DETERMINANTS OF THE ADOPTION OF TECHNOLOGICAL INNOVATIONS IN ORGANIZATIONS

BY

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CERTIFICATE OF ORIGINALITY

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Abstract

The effects of the determinants of innovation have been criticized as being inconsistent across studies, confounding the predictive powers of the determinants. This study, to explain the inconsistency from a conceptual viewpoint, posits that the attitude of decision makers has a mediating and moderating role in the intention to adopt technological innovations. This study focuses on the empirical tests conducted on online retailing. Data collected from 109 different organizations indicates that, through the attitude, the perceived relative advantage and compatibility of adopting an innovation have indirect effects on the intention to adopt the innovation. Moreover, the results indicate that the attitude moderates the relationship between firm size and the intention to adopt the innovation. In particular, no relationship between firm size and adoption intention is found for firms where the attitude of the decision makers is less positive; but a relationship exists for the firms where the attitude of the decision makers is more positive.

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CHAPTER ONE INTRODUCTION

1. Introduction of the Chapter

The purpose of this study is to find out the determinants of the intention to adopt technological innovations in organizations. This chapter presents the overall rationale of the research. First, the theoretical background of innovation theories is addressed. Innovation theories provide the theoretical foundation for studying innovation; however, the research findings have been criticized as inconsistent across studies. Second, the business background of online transactions is addressed. Online transaction, with a surprising growth worldwide in recent years, is recognized as one of the major technological innovations altering business models in the information age. Third, research problems and objectives are stated in order to tackle unresolved issues. Lastly, the structure of this dissertation is highlighted.

1.1. Theoretical Background of the Research

1.1.1. Theories of Innovation

Theories of innovation have been widely recognized in studies of the adoption of innovations (e.g., Davis et al., 1989; Down and Mohr, 1976; Moore and Benbasat, 1991; Rogers, 1983; Tornatzky and Klein, 1982). In the past decade, theories of innovation have been widely used to investigate the adoption of technologies (e.g., Attewell, 1992; Chau and Tam, 1997; Frambach and Schillewaert, 2002; Grover and Goslar, 1993; Iacovou and Benbasat, 1995; Thong 1999; Waarts, et al., 2002). Moore and Benbasat (1991) developed different sets of instruments to measure the perceptions of the adopters towards adopting

innovations, i.e. Perceived Characteristics of Innovation (PCI), based on the research of Rogers (1983). Davis et al. 's (1989) Technology Acceptance Model (TAM) is the adaptation of the Theory of Reasoned Action (TRA) which is a widely used model in social psychology that explains the determinants of intended behaviors in terms of the relations among beliefs, attitudes, subjective norms, and behavioral intentions (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975). In sum, innovation theories have provided a fundamental base for investigating adoptions of technological innovations. In fact, technologies seem the most representative innovations. Rogers (1983) even used "innovation" and "technology" as synonyms in his classic book of innovation diffusions.

1.1.2. The Problematic Issue in Past Innovation Studies

Although theories of innovation provide the theoretical foundation, the research findings have been criticized as inconsistent across studies. The determinants of innovations that are found to be important for innovations in one study can be found to be completely unimportant in another study (Downs and Mohr, 1976). Without explicit explanations, such inconsistent findings lead to inconclusive results in innovation research. Other critiques, have pointed out this problematic issue (e.g., Roger, 1983; Wolfe, 1994). In fact, some of the inconsistent findings in innovation research seem unreasonable and beyond interpretation (Downs and Mohr, 1976). Simply explaining the inconsistencies by pointing to sampling biases, measuring errors, or low research generalizability across studies cannot contribute to the establishment of a more general theory of innovation. There is a need to research into the determinant-innovation relationship.

1.2. Business Background of the Research

Online transactions, with a surprising growth worldwide in recent years, are recognized as one of the major technological innovations altering business models in the information age. Lever (2001) indicates that the projected value of global e-commerce is expected to rise up to US$5 trillion in 2005 from US$354 billion in 2000. According to a survey of the New York Times, about 42% of top manufacturers or vendors in different industries, such as IBM, Pioneer Electronics, Cisco System and Nike have taken part in online direct-to-consumer transactions (Chiang et al., 2002). However, not every business would likely to or able to adopt online retailing. The manufacturing sector is one of the example. Manufacturers who establish online retailing enabling direct-to-consumer transactions may bypass their middlemen in supply chain, i.e., disintermediation (Bailey and Bakos**,** 1997; Benjamin and Wigand, 1995). While a total disintermediation seems unrealistic (Jallat and Capek, 2001), the technology does induce potential threat to physical middlemen that leads to channel conflict, an overall disagreement of working partnership in distribution channels/supply chains (Anderson and Narus, 1984). Apart from manufacturing firms, some firms from wholesaling, trading or service firms also face different levels of channel conflict caused by online sale, according to the different marketing channels. In other words, not every organization would like to or is able to establish online retailing, which could incur costly harmonization with internal operations and external networks. While many research studies adoption of online retailing from the buyer perspective, fewer of them provide empirical analysis from the seller perspective.

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1.3. Research Problem and Research Objectives

The main research question of the study is what are the determinants of intention to adopt technological innovations in organizations? The objectives of the research are three-fold:

1) to conduct a review of studies of technological innovations to highlight and explain some of the inconsistent finding. A new conceptual explanation of the inconsistencies is provided (i.e., the mediating and new moderating effects of the attitude towards adoption of innovation).

2) to posit a conceptual framework of the intention to adopt technological innovations with respect to the mediating effect and moderating effect.

3) to conduct empirical analysis on the effects of the proposed framework in order to establish the determinants of intention to adopt online retailing.

1.4. Structure of the Dissertation

Chapter one presents the rationale of this research. Chapter Two provides a critique of innovation theories, from which major arguments and theoretical foundations of the research will be derived. Specifically, a review is conducted on the (in)consistent findings of effects of the determinants across studies. Potential reasons for the (in)consistencies will be highlighted. Based on this, a more conceptual explanation of the inconsistencies will be derived, i.e., the mediating and the new moderating effect. In Chapter Three, the conceptual framework is

proposed based on the literature review. Chapter Four addresses the research design in this study. Chapter Five empirically tests the proposed conceptual framework. Chapter Six discusses the findings. The contributions, limitations and future research directions will be discussed in Chapter Seven.

CHAPTER TWO LITERATURE REVIEW

2. Introduction of the Chapter

This chapter will be divided into two major sections: 1) the general literature review; and 2) the critique of innovation research. General definitions, typologies, adoption stages and determinants of innovation will be addressed in the first section. The second section will be the critique of innovation research with respect to the past inconsistent findings. Potential explanations for the (in)consistencies of research results will be provided.

2.1. Definition of Innovation

Innovation refers to ideas, practices, or objects that are perceived as new (Rogers, 1983). The "newness" may not be measured by absolute but the perceived new experiences of the potential adopters (Thong, 1999; Zaltman, 1973). Various innovation typologies can confuse what particular studies are actually addressing. (Garcia and Calantone, 2002; Gopalakrishnan and Damanpour, 1997).

2.2. Innovation Typology

There are many different types of innovations such as really-new, administrative, radical, technical, incremental, and discontinuous, product and process related (Damanpour, 1991; Garcia and Calantone, 2002; Gopalakrishnan and Damanpour, 1997; and Wolfe, 1994). Garcia and Calantone (2002) provided a comprehensive literature review from multiple disciplines to reveal some recognized definitions of innovation typologies. For example,

incremental was defined as adding radical new features to improve upon an existing innovation (Rothwell and Gardiner,1988); while radical/discontinuous innovation referred to innovations that sweep away a large portion of organizations' existing investments (Utterback, 1996). The typology can also be classified by the perspective of product newness to the world, firm lines and markets (Kleinschmidt and Cooper, 1991). Garcia and Calantone's (2002) review highlighted the above definitions and typologies to provided four dimensions (i.e., macro-level, micro-level, marketing and technological perspective) which can be the basis to identify technological innovations. The perspective of macro-level referred to an innovation which is new to the world, markets or industries; while the one of micro-level referred to an innovation which is new to firms or customers. The marketing perspective regards new marketplaces or market-skills requested; while the technological one focuses on shifts of science embedded. Gopalakrisham and Damanpour (1997) highlighted some of the innovation typologies in a comparative way: 1) product versus process innovation; 2) radical (discontinuous) versus incremental (continuous) innovation; 3) technical (technological) versus administrative innovation. In fact, there have been two general criteria to identify an innovation typology, i.e., primary and secondary (Downs and Mohr, 1976). Primary innovation typology classifies an innovation by its inherent features without referencing to situations that the innovation distinguish itself from other innovations; the secondary one classifies an innovation by subjective attributes of the innovation which will be various to different percipients (Downs and Mohr, 1976; and Jeans, 1966).

Among the various typologies, the adoption of technological innovations of organizations have been one of the major concerns in research. Organizational innovations, parallel to the generic definition, are defined as adopting the ideas or behaviors that are new to the adopting

firms (Daft, 1978). Advance technologies especially the Information Technology (IT) are widely recognized as innovations to organizations (Waarts et al., 2002; and Thong, 1999). This research focuses on online retailing, which are believed as the major technological innovation changing the business model in the world.

Online retailing is recognized as a technological innovation (Wang, 2001). It involves physical or digital product/service transactions through the Internet, providing an additional direct-to-consumer channel which engages material, information and cash exchange among participants. The basic computing equipments or software of online retailing include File Transfer Protocol (FTP), web browser, HTML code editor, point of sale program, shipping software and other electronic warehouse and fund transferring systems. Apart from the technological issue, the adoption of online retailing involves considerations in operations and channel partnerships of organizations.

Compatible internal operations facilitate the adoption of online retailing. For example, establishing this electronic direct-to-consumer outlet, manufacturers have to pick up parts of intermediary functions which were originally performed by their channel partners. These intermediary functions include a) aggregation: aggregating individual and small order demand into batch favorable to mass productions and economy of scale (Bailey and Bakos, 1997); b) bulk breaking: buying products in bulk and reselling them in smaller quantities favorable to buying patterns of markets; and c) transaction supporting: facilitating the transaction by holding inventory, offering assortment, delivering product, handling payment, and other customer services. In order to efficiently pick up these functions, manufacturers have to practice some operation systems such as mass customization, Just-In-Time, or

postponement to maintain the efficiency of productions. Besides manufacturers, other types of firms have to modify their operations in order to synthesize the online-offline issues. For example, retailers may need to reorganize their product catalogs to make them sensible in online sale. In sum, different organization types come cross different levels of modification in operations for adopting online retailing.

The external channel partnership is another critical issue, too. It is impossible for manufacturers to internalize all of the intermediary functions mentioned above, and to sell by the electronic channel merely. Dell Computer may be a rare successful case to bypass middlemen. Thus, most of the manufacturers who plan to adopt online retailing have to collaborate with their existing channel partners for product distributions. IBM demonstrates such new channel partnerships by the hybrid go-to-market model (Gandolfo and Padelletti, 1999). In the hybrid models, direct selling and channel selling should be strategically rearranged and shared in the whole process of order fulfillments according to different types of products. However, this bricks and mortar retailing can create collaborations but also conflicts. Channel conflict refers to disagreements among channel partners (Anderson and Narus, 1984). The experience, expertise and customer information earned by the electronic channels may offer the manufacturers more channel powers that diminish the roles of the physical intermediaries. The middlemen, therefore, may perform retaliation or unsupportive behaviors against the adoption of online retailing of manufacturers. Apart from manufacturers, other types of firms such as wholesalers and trading companies also face different degrees of the conflict caused by online sales, according to different lengths and layouts in various supply chains.

Establishment of online retailing requires comprehensive competence. However, it does not mean the infeasibility of online retailing that more and more companies have demonstrated the new business models engaging in electronic channels. The objective of this research aims at finding out the determinants of intention to the technological innovation in organizations, by applying the innovation theories. The part below addresses the relevant concepts in the innovation theories.

2.3. Stages of Innovation Adoption

Adoption of innovations can be divided into initiation stage and implementation stage. An initiation stage refers to considerations of adopting or rejecting an innovation with respect to the awareness and assessment of the innovation. It involves a cognitive and affective process in which potential adopters seek information-evaluation knowledge of the innovation and come up with an attitude towards that innovation leading the decision choices (Rogers, 1983). According to Rogers (1983), an implementation stage begins after an adoption decision has been once made. At the stage, a firm concerns the issue of how to fully use the innovation in target areas. It involves the actual usage, social reinforcement and ends up with its institutionalization.

2.3.1. Initiation Stage

The first sub-stage of the initiation stage is the knowledge stage (Rogers, 1983). At this stage, the existence and basic understanding of an innovation are known. There are three types of knowledge: the awareness knowledge, how-to knowledge and principles knowledge.

The awareness knowledge of an innovation can be determined by needs. A need, which is a state of dissatisfaction, induces someone to seek innovation. On the another hand, innovation can also create needs. Once an innovation is aware, the following question is what the innovation is. The awareness knowledge motivates the how-to knowledge regarding to the necessary information to use an innovation properly. Potential adopters seek the general know-how of the innovation, while an adequate level of the knowledge gives rise the principles, which consists of the information dealing with the specific functions of the innovation. The cognitive activities at the stage have direct influence on the affective function of the persuasion stage. Potential adopters tend to evaluate the information gained and anticipate the future situation of using the innovation. The evaluations come up with positive or negative feelings about the innovation, which have major impacts on the adoption decisions. The decision stage occurs in which activities will lead to choice to adopt or reject an innovation. According to Rogers, adoption is a decision to make full use of an innovation as best course of action available; while rejection is a decision not to adopt the innovation. In fact, there are two types of rejection, which are the active rejection and passive rejection. Active rejection refers to potential adopters who have considered the adoption but decide not to adopt finally; the passive rejection refers to those who never really considering adopt the innovation.

2.3.2. Implementation Stage

The implementation stage is another major stage of innovation adoption apart from the initiation (Gopalakrishnan and Damanpour, 1996). Implementation begins at which an innovation is put into use begins after a real decision of adoption is made. The

implementation stage usually follows the decision unless it is held up by some reasons. The conceptualization of the innovation in mental evaluation turn into actual behaviors at this stage. The end of the implementation of an innovation depends on its nature, but normally occurs at the point which the innovation becomes an institutionalized and regularized part of the adopting party. An innovation is no longer a new idea after it changes to a routine. In fact, such institutionalization of an innovation will only occur if the innovation is confirmed after it has been implemented. It refers to confirmation stage at which reinforcement is required for the adoption. At the stage, the implementation carries on if dissonance of the adoption occurs but is resolved. Otherwise, the implementation would be terminated.

2.4. Determinants of Innovation

Past innovation research provided wide-scope determinants of innovation including the organizational factors, managerial factors, competitive factors, network factors, social system factors and the perceived features of an innovation itself have been treated as the determinants (e.g., Kimberly and Evanisko, 1981; Tornatzky and Fleischer, 1982; Gatigon and Robertson, 1989, Rogers, 1983 and Moore and Benbasat, 1991). Their research findings contribute to the establishment of the innovation theories. In many recent research, the theories have been often used to study IT such as Electronic Data Interchange (EDI), Enterprise Resource Planning (ERP), and Open Systems (OS), providing a well conceptual base for further research (e.g., Thong, 1999; Teo et al., 2003; Premkumar et al., 1994; Frambach and Schillewaert, 2002; Attewell, 1992; Iacovou, 1995; Chau and Tam,1997; Grover and Goslar, 1993). The literature established a fundamental framework of the innovation determinants, which includes the four main directions a) Perceived characteristics

of innovation (PCI), b) Characteristics of environment, c) Characteristics of organization and d) Characteristics of top management.

2.4.1. Perceived Characteristics of Innovation (PCI)

The perceived characteristics of innovation (PCI) are one of the most predictive determinants of innovative behavior. PCI are perceptions of adopting an innovation that affect the intention to adopt that innovation (Moore and Benbasat, 1991; Roger, 1983). The development of PCI combines various efforts in innovation research. Through an extensive review of the literature, Tomatzky and Klein (1982) put forward twenty-five characteristics of innovations. Rogers (1983, 1995) narrowed those factors down to five, namely relative advantage, compatibility, complexity, trialability, and observability. In addition to Rogers' works, Moore and Benbasat (1991) developed sets of applicable scales to measure the nature of these perceptions of innovation to ensure their theoretical generalizability. They pointed out that PCI can apply across different research settings, and help establish general theories. Since different potential adopters perceive the intrinsic characteristics of an innovation in different ways, their responses to the innovation will be different. Thus, these perceptions will be more relevant and predictive of innovative behavior across different contexts.

PCI seem close to part of the concepts in the famous technology acceptance model (TAM) posited by Davis et al. in 1989. For example, the perceived relative advantage, and perceived complexity in PCI are the similar ideas to the perceived usefulness and perceived ease of use in TAM respectively. PCI have been widely used in research of organizational levels while and TAM has been widely used in individual levels. In fact, an organization

itself does not have the perception, which is reflected by individuals, especially the top managers of in a firm. In fact, Fishbein and Ajzen's (1975) theory of reasoned action (TRA) is the more original theory positing the influence of perceptions/beliefs[1] on behaviors. The paragraphs below will address the relevant parts of the theory before the discussion of other determinants.

TRA is a widely recognized theory explaining determinants of intentioned behaviors in social psychology. According to TRA, performance of a behavior is affected by behavioral intention (BI) to perform the behavior. Behavior intention is influenced by Attitude (A) towards performing the behavior, and the attitude itself is a function of salient beliefs (B). Subjective norm is also another joint determinant of the behavioral intention. In overall, beliefs are the fundamental elements in the theory that serve as a basic determinant of other values. Beliefs influence behavior intention through the attitude.

In TRA, a belief associates with an object to some attributes. It is defined as the subjective probability of a consequence by performing the target behavior. In other words, a belief is the perceived characteristics of a specific behavior and its influence. The two words, i.e., belief and perception will be used interchangeably in this study. An attitude refers to the totally favorable or unfavorable evaluation of the salient beliefs about performing a behavior. Not all of the beliefs have equal importance setting up attitudes that only a relative small number of beliefs play major roles. They are the salient beliefs which can be changed time by time and replaced by new values. Attitude is an evaluative or affective effect learned over time. Behavioral intention is defined as the subjective probability of performing a behavior. According to TRA, attitude is an overall evaluative affect of the belief and conative

component of intention which mediates the belief and intention. The conceptual relationship among belief, attitude and intention will be the theoretical ground in the critique in later sections. Before we discuss the critique, the other determinants of innovation should be highlighted first.

2.4.2. Characteristics of Organization

The organizational characteristics have determinant roles in adoption of innovations. The characteristic includes organizational structure, slack and size. Rogers (1983) discussed and provided the definitions of these factors. Centralization and formalization are two of the basic structure of firms. According to Rogers, centralization is the degree to which power and control in a system are concentrated in the hands of relatively few individuals; while formalization refers to the degree to which an organization emphasizes following rules and procedures in the role performance of its members. Generally speaking, the highly centralized and formalized organization would hinder the initiation of innovation due to the fact that innovative ideas may be restricted by the few dominant leaders and discouraged by some strict rules. Nevertheless, once an innovation is decided to be adopted, such organizational structures can facilitate the implementation of the innovation because of the top-down and regularized coordination. Organizational slack refers to the degree of uncommitted resources available to an organization. Available resources can generally make a firm more willing to adopt innovation while motivation exits. Firm size, which can reflect the total resource, slack, and structure of organizations, are another well known determinant to innovation adoption. However, the effects of firm size on the adoption seem inconsistent across studies. While some studies have found that larger firms have a higher rate of adoption of innovations (e.g., Germain and Droge, 1995; Lind et al., 1989; Thong, 1999; Zmud, 1982), others do not

indicate the existence of such a relationship (e.g., Boeker and Huo, 1998; Brandyberry, 2003; InduShobba and Peter, 1999; Grover and Goslar, 1993).

2.4.3. Characteristics of Environment

External environment plays critical roles in organizational innovation. The impacts of competitors and trading partners are probably the most influential factors (e.g., Waarts et al., 2002; Srinivasan et al, 2002; and Teo et al., 2003).

The adoption of innovations among the rivalries appears to raise the likelihood of the adoption of a firm. It is because capabilities of non-adopters in the areas enabled by the innovations might be perceived to be lower or actually lower than those of adopters. Under a rival pressure, firms tend to be more responsive and cautious about the actions of competitors. In other word, the greater the extent of the adoption in a sector, the greater chance of a firm would adopt the innovation in that sector; the chance would be higher when a firm perceives the successful adoption of its competitors (Teo et al., 2003).

Apart from the competitors, trading partners are other influential parties of organizational innovation. Influence of the trading partners (e.g., supplier and customer) would be greater in a high degree of vertical dependence, in which there are inter-locking relationships among the partner firms (Gatignon and Robertson, 1989). The inter-dependence in operations and strategy drive a firm to adopt a particular innovation if its supplier or buyer has adopted the innovation. For example, the extent of adoption of Financial Electronic Data Interchange (FEDI) among the trading partners would positively relate to an organization’s adoption.

(Teo et al., 2003). When dominant customers or suppliers have adopted a particular technology, a firm may follow the adoption to show the partnership and fitness of business.

2.4.4. Characteristics of Top Management

Innovativeness of leaders in can directly affect the decision of adopting an innovation. A leadership can be generally categorized by the formality of leaders, i.e., opinion leaders or formal leaders. Rogers (1983) highlighted that the influence of opinion leaders refers to the degree to which an individual is able to influence other individuals' attitudes or overt behavior informally in a desired way with relative frequency. It is an informal leadership. Formal leaders (e.g., top managements) who have authorized powers from their formal position and status are also influential to innovation in organizations. The supports of top management teams are critical to the adoption of innovation since senior managers are usually in the position mobilizing the necessary assets and resource for adopting the innovation (Srinivasan et al., 2002). If top managers advocate to an innovation, the middle/junior managers and other subordinates would contribute more in the innovation. Thong (1999) pointed out that the CEOs' knowledge on particular innovation can also raise the chance of the adoption of the innovation. In sum, the decision of innovation adoption can be dominated by both of the formal and informal leaders.

2.5. Critiques of Innovation Research

2.5.1. The Inconsistent Findings in Past Innovation Research

The past research findings have been criticized as inconsistent across studies. The determinants of innovations that are found to be important for innovations in one study can

be found to be completely unimportant in another study (Downs and Mohr, 1976). Without explicit explanations, such inconsistent findings lead to inconclusive results in innovation research. Other critiques have pointed out this problematic issue (e.g., Roger, 1983; Wolfe, 1994). In fact, some of the inconsistent findings in innovation research seem unreasonable and beyond interpretation (Downs and Mohr, 1976).

2.5.2. Clear Picture of the (In)consistent Findings

Although past research has yielded important insights on inconsistent findings, they should not lead us to overlook the inconsistent findings. In fact, a clear picture of the unstable research results should be drawn with the research designs used in the studies. When a study is conducted specifically to some unique research design, it is likely that the results of the study can only be compared with those of other studies using a similar design. There have been some innovation studies in the past that have limited their investigation to particular types of organizations, such as personal computing firms (e.g., Boeker and Huo, 1998), hospitals (e.g., Kimberly and Evanisko, 1981), and schools (e.g., Daft, 1978). When the results are compared across these studies with unique organizational types, it is reasonable that the determinants can have inconsistent effects on the innovation. With regard to inconsistent findings that caused by the uniqueness of research designs, the findings themselves may not reflect the real inconsistency of the research results; rather, they indicate the low generalizability of a study with a unique design. Therefore, a clear picture of the consistent and inconsistent effects of determinants can only be shown when similar research designs are used across studies.

Three important research designs often used in innovation research were highlighted in this review to show up the problem of (in)consistency. They are: the innovation typology, the stage of adoption of the innovation, and the organizational context (Damanpour, 1991; Downs and Mohr, 1976; Wolfe, 1994). The details will be presented in the methods of the review.

2.5.3. Methods of the Review

The primary focus of the literature review was on studies in areas of organizational innovation. The literature search was based on a number of international electronic databases such as EBSCO (Business Source Premier), ScienceDirect, and Emerald. Only published journal articles were included in this literature review. Excluded were books, theses, and literature other than journal articles. The search was mostly based on the descriptors of "innovation adoption," "innovation diffusion," "organization," and so forth in abstracts and keywords. A wide range of journals about organizations and innovations were included, such as The Journal of Product Innovation Management, MIS Quarterly, European Journal of Innovation Management, Information Systems Research, The Journal of High Technology Management Research, Journal Business Research, Information and Management, Journal of Marketing, Management Science, and the Journal of Management Information Systems. Manual selections were also examined for additional studies to make the review more comprehensive. It is unlikely that the review is exhaustive, but it is comprehensive in terms of the four general directions of innovation determinants, i.e., the perceived characteristics of an innovation, the characteristics of an organization, the characteristics of the environment and characteristics of top management.

The review was conducted under the following criteria with regard to the above-mentioned three research designs, i.e., innovation typology, the stage of adoption of an innovation and the organizational context, in order to show up the (in)consistent findings.

(a) Innovation Typology

The review included studies concerning technological innovations, while excluding studies of other types of innovation. As discussed, the effects of innovation determinants can be very different on various types of innovations. By contrast, the determinants should have similar effects on the same type of innovation. The innovation typology was therefore controlled for technological innovations to show up the inconsistent effects of determinants (if any) with respect to a single type of innovation. In fact, technology has been recognized as being the most representative of innovation (Rogers, 1983). There are two criteria, i.e., primary and secondary, to classify an innovation as technological. The primary innovation typology classifies an innovation by its inherent features without reference to situation, i.e., the technology distinguishes itself from other types of innovations; the secondary innovation typology classifies an innovation by the subjective attributes of the innovation, which will differ according to the percipient (Downs and Mohr, 1976; and Jeans, 1966). Tables 2a, 2b, and 2c (column seven) show the criterion for the innovation typology used.

(b) Adoption Stage of Innovation

In the review, the effects of the determinants refer to the initiation (not to the implementation) stage of the innovation. The adoption of an innovation can be basically divided into two stages: the stages of initiation and of implementation (Gopalakrishnan and

Damanpour, 1996). An organization considers whether adopt or reject an innovation based on its awareness, attitude, and other evaluations of the innovation in the stage of initiation. In other words, the initial stage refers to the intention to adopt an innovation. In the stage of implementation, organizations are concerned about how to fully use the innovation in the targeted areas. Some determinants favorable to one stage can be unfavorable to another (e.g., a high degree of formalization in a firm tends to facilitate the implementation but impede the initiation of an innovation. To better depict the (in)consistent effects of determinants, the review focuses on the initiation stage (see column five of Tables 2a, 2b, and 2c). This stage is a concern since it relates to the intention to adopt an innovation. For studies that aggregate the stages in single dependent variables or use binary measures of adoption, it is impossible for us to distinguish the effects of the stage of initiation from that of implementation. These studies are also included.

(c) Organizational Context

Organizational context refers to the types of industrial sectors or business natures selected in the samples of the studies. The review included studies with samples across organizational types. For studies specific to particular firm types, such as manufacturing sectors (Brandyberry, 2003), personal computing firms (Boeker and Huo, 1998), and hospitals (Hausman and Stock, 2003), the differential effects of the determinants may merely be due to the uniqueness of the contexts. In fact, it is common for recent studies on innovation to be conducted across different types of organizations in order to increase the generalizability of the study (see column six in Tables 2a, 2b, and 2c). In order to show up the (in)consistent findings, the review included studies across different types of organizations, and excluded studies with specific contexts.

Innovation Determinant		Study	Determinant-Innovation Relation	Research Design		
				Innovation Stage	Organizational Context	Criterion of Innovation Typology
Perceived Characteristics of Innovation (PCI)	Perceived Relative Advantages	Thong (1999)	Significant	Initiation	Cross- organizational types	Primary
		Waarts, van Everdingen and Hillegersberg (2002)	Significant	Initiation	Cross -organizational types	Primary
		Premkumar, Ramamurthy and Nilakanta (1994)	Significant	Initiation	Cross -organizational types	Primary
		Kuan and Chau (2001)	Significant	Binary measure: Adopter or non-adopter	Cross -organizational types	Primary
	Perceived Compatibility	Premkumar, Ramamurthy and Nilakanta (1994)	Significant	Initiation	Cross -organizational types	Primary
		Thong (1999)	Significant	Initiation	Cross -organizational types	Primary
		Chau and Tam (1997)	Significant	Binary measure: Adopter or non-adopter	Cross -organizational types	Primary
	Perceived Complexity	Thong (1999)	Significant	Initiation	Cross- organizational types	Primary
		Premkumar, Ramamurthy and Nilakanta (1994)	Insignificant	Initiation	Cross -organizational types	Primary

Table 2a. The Effects of Perceived Characteristics of Innovation

Innovation Determinant		Study	Determinant-Innovation Relation	Research Design		
				Innovation Stage	Organizational Context	Criterion of Innovation Typology
Characteristics of Organizations	Firm Size	Zmud (1982)	Significant	Initiation	Cross -organizational types	Primary
		Grover and Goslar (1993)	Insignificant	Initiation	Cross -organizational types	Primary
		Thong (1999)	Significant	Initiation	Cross- organizational types	Primary
		InduShobba and Peter (1999)	Insignificant	Aggregated stages	Cross -organizational types	Primary
		Germain and Droge (1995)	Significant	Binary measure: Adopter or non-adopter	Cross –organizational types	Primary
	Centralization and/or Formalization	Chau and Tam (1997)	Insignificant	Initiation	Cross -organizational types	Primary
		Grover and Goslar (1993)	Insignificant	Initiation	Cross -organizational types	Primary
		Gatignon and Robertson (1989)	Insignificant	Binary measure: Adopter or non-adopter	Cross -organizational types	Primary
	Resource Competence	Thong (1999)	Insignificant	Initiation	Cross- organizational types	Primary
		Chau and Tam (1997)	Insignificant	Initiation	Cross -organizational types	Primary
		Waarts, van Everdingen and Hillegersberg (2002)	Significant	Initiation	Cross -organizational types	Primary
		Grover and Goslar (1993)	Insignificant	Initiation	Cross -organizational types	Primary

Table 2b. The Effects of Characteristics of Organization

Innovation Determinant		Study	Determinant-Innovation Relation	Research Design		
				Innovation Stage	Organizational Context	Criterion of Innovation Typology
Characteristics of Environments	Influence of Competition	Waarts, van Everdingen and Hillegersberg (2002)	Significant	Initiation	Cross -organizational types	Primary
		Teo, Wei and Benbasat (2003)	Significant	Initiation	Cross -organizational types	Primary
		Thong (1999)	Insignificant	Initiation	Cross- organizational types	Primary
		InduShobba and Duchessi (1999)	Significant	Binary measure: Adopter or non-adopter	Cross -organizational types	Primary
		Kuan and Chau (2001)	Insignificant	Binary measure: Adopter or non-adopter	Cross- organizational types	Primary
	Influence of Partner Firms	Teo, Wei and Benbasat (2003)	Significant	Initiation	Cross -organizational types	Primary
		Gatignon and Robertson (1989)	Significant	Binary measure: Adopter or non-adopter	Cross -organizational types	Primary
		Waarts, van Everdingen and Hillegersberg (2002)	Significant	Initiation	Cross- organizational types	Primary
Characteristics of Top Management	Innovativeness	Thong (1999)	Significant	Initiation	Cross- organizational types	Primary

Table 2c. The Effects of Characteristics of Environment and Top Management

2.5.4. Review Results

In order to better depict the (in)consistent effects, the review only includes studies using the research designs above. Among these designs, inconsistent research findings refer to the innovation determinants which have significant effects on innovation adoption in one study but have insignificant effects in another study; while consistent findings refer to the determinants which have steady significant effects across studies (see column four of Tables 2a, 2b, and 2c).

PCI have more stable effects across the studies than the other determinants (see Table 2a in column four). For the perceived relative advantages, all of the studies in the review found the determinant significant. Also, for the perceived compatibility, all of the findings are significant. The findings of PCI are similar with the findings of the extensive meta-analysis conducted by Tornatzky and Kein in 1982. They found the ten most common innovation characteristics studied by researchers, and three out of the ten variables namely, relatively advantage, compatibility and complexity, were found consistently significant in different studies. For the perceived complexity, relatively fewer studies in the review have used the determinant. In other words, it appears that the findings of perceived relative advantage and compatibility are quite consistent across studies in the review. The perceived nature of the determinants makes their effects general to different studies. Since different potential adopters perceive the intrinsic characteristics of an innovation in different ways, their responses to the innovation would be different. Thus, these perceptions will be more relevant

and predictive to innovations across contexts. The perceived characteristics help establish general theories (Moore and Benbasat, 1991).

Comparing with PCI, more unstable effects occur in other determinants in characteristics of organization and characteristics of environment. As shown by column four of Tables 2b and 2c, inconsistent effects of firm size are found. No significant effects were found for centralization and/or formalization. For resource competence, some potential inconsistent effects are still presented; while for the influence of competition, inconsistent findings are shown in column four. Only one study and determinant of characteristics of top management had been selected in the review due to the selective requirements of the three research designs (see Table 2c). It is insufficient for us to draw conclusion on this determinant. In sum, the results of the review show that the PCI appear the more predictive and stable determinants than the others.

2.5.5. Explanation of the Inconsistent Effects

The causes of the unstable findings in the review go beyond some past explanations. It has been suggested in previous studies that the two problematic research designs, i.e. the aggregated innovation stage and secondary innovation typology, can cause the determinants to have unstable effects (Downs and Mohr 1976; Fichman, 2001). As has been discussed, some determinants of innovation can have positive effects on one stage while having negative effects on another stage. When a study aggregates different stages in a single dependent variable, the positive and negative effects could offset each other and produce unstable

findings (Downs and Mohr 1976). Also, according to Downs and Mohr (1976), the secondary innovation typology can produce unstable findings since, when an innovation typology is classified by secondary attributes, different organizations and even different departments in a firm may classify an innovation differently according to their own understandings of that innovation. However, as shown in the review, almost all of the studies have not used the two problematic designs. Thus, there should be other reasons for the inconsistent effects.

The cross-organizational types can be one of the candidates. It is suggested that the influence of organizational contexts should be considered since an innovation determinant may have different effects on the adoption of innovations in different types of organizations. Neglecting the differences would confound the predictive powers of the determinants. The organizational types can be effective moderators (Damanpour, 1991). Wolfe (1994) pointed out that some determinants, especially those of organizational characteristics (e.g., firm size) have homogeneity within rather than across organizational types and contexts. Mixing up the contexts can produce misleading research findings in one study and, eventually, unstable findings across studies. As shown in Tables 2a, 2b, and 2c (column six), most of the studies in the review used the cross-organizational types, which can be one reason for the inconsistencies. The argument further supports the consistent findings of PCI in the review. Moore and Benbasat (1991) argued that PCI help establish general theories across contexts. However, some of other determinants (e.g., firm size) may not be across organizational contexts and types. To resolve the problem, some studies distinguish types of organizations by limiting the scope of research to particular types of firms such as those in manufacturing sectors (Brandyberry, 2003), personal computing firms (Boeker and Huo, 1998), and

hospitals (Hausman and Stock, 2003). However, this design reduces the generalizabilty of the studies, which makes different research results incomparable and becomes a barrier against the accumulation of knowledge (Wolfe, 1994). Therefore, based on the stable and predictive effects of PCI, this research posits a mediating and moderating effect in predicting the adoption of innovations. In particular, the moderating effect can distinguish organizations, which can explain the inconsistent findings from a conceptual point of view.

2.6. Mediating and Moderating Effect of Attitude towards Adopting Innovation

2.6.1 Mediating Effect of Attitude

The mediating effects of attitude towards innovation should be discussed firstly in order to address the moderating effects. As found in the literature review in Tables 2a, 2b, and 2c, PCI are the stable predictors of initiation of innovation. As discussed, the initiation stage refers to the intention to adopt innovation. These perceived characteristics of an innovation reflect the beliefs held by decision-makers about the attributes of an innovation, such as whether it is beneficial and/or appropriate to the firm. These perceptions/beliefs[1] are likely to influence the overall attitude of decision-makers towards adopting that innovation; and that attitude is likely to affect the intention to adopt the innovation. In other words, attitude mediates the relation between perception and behavioral intention. This argument of the relationship among one's perceptions, attitudes, and behavioral intention is in line with that of a famous behavioral model, i.e., Theory of Reason Action (TRA) by Fishbein and Ajzen, 1975. As posited by TRA, through attitude, beliefs about performing a behavior indirectly affect behavioral intention. This refers to the favorable or unfavorable evaluative effect of the

perceived characteristics of performing the target behavior. A firm itself cannot have perceptions, attitudes, and intentions. These values are held by individuals, especially the decision-makers in the company. In other words, for example, when an innovation is perceived as an advantage for a company, such a perception will lead to a positive attitude towards the innovation and is likely to raise the intention to adopt it. We can add "attitude towards adopting an innovation" as a mediator between "PCI" and "intention to adopt" (Figure. 2.1.).

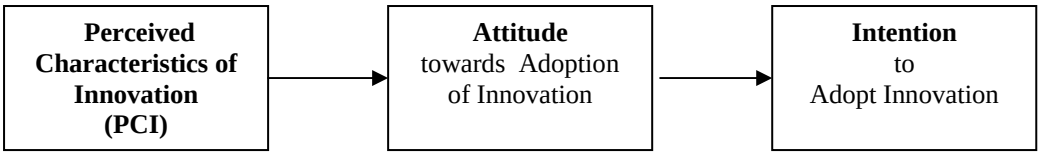

Figure 2.1: The Mediating Effect of the Attitude

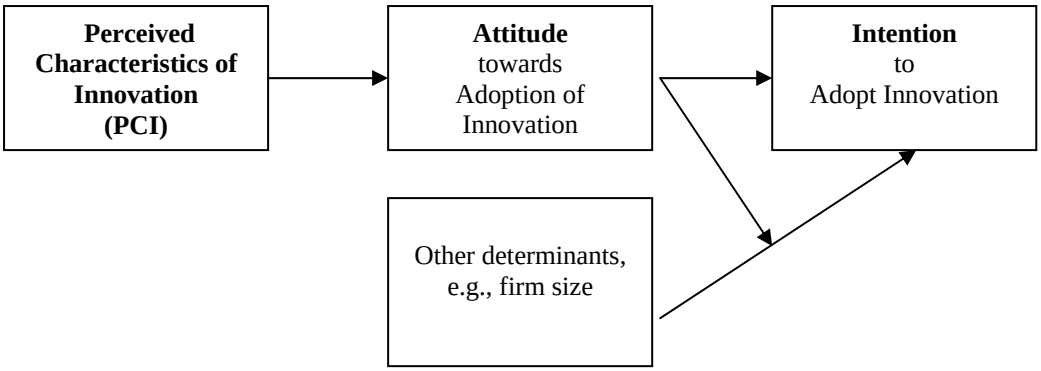

Figure 2.2: The Moderating Effect of the Attitude

2.6.2 Moderating Effect of Attitude

2.6.2.1. Conceptual Explanation of the Inconsistent Findings

Apart from the mediating effect, the attitude can moderate the relationship between the other determinants and the intention to adopt innovation (Figure 2.2). We take one of the inconsistent determinants, e.g. firm size, as example. As shown in Table 2b (Column four), some studies have found that larger firms have more of an intention to adopt technological innovations; while others did not. Both sides can be correct while attitude is treated as a moderating variable in the relationship between firm size and the intention to adopt. According to TRA, attitude refers to the totally favorable or unfavorable evaluation of the perceptions about performing a behavior. This means that the evaluation of whether to adopt an innovation will be based on the perceptions of adopting the innovation, For example, a decision maker will still have a less positive attitude toward adopting an innovation after his or her evaluation that the innovation is expected to be compatible but not beneficial to the company. A negative attitude will be held when the innovation is not expected to be compatible as well as beneficial; while a positive attitude will be held when the innovation is believed to bring relative advantage and fit well with the current system. Once a positive or negative attitude is held towards adopting an innovation, this tends to have contingent effects on the intention to adopt the innovation, i.e., a moderating effect. A bigger firm would still have little intention to adopt an innovation if a negative attitude towards the innovation is held; while a smaller firm would still be eager to adopt an innovation if a positive attitude is held. In other words, the relationship between firm size and the intention to adopt the innovation is contingent upon the attitude towards adopting the innovation. In that sense,

attitude can be a more general measure to distinguish between organizations (e.g., between those with a higher attitude and those with a lower attitude) when attitude is treated as a moderating variable. Differential effects for firm size may be reasonably found due to the contingent effect. The determinant may have no effects on innovation for firms with a lower attitude; but may have positive effects for firms with a higher attitude. This moderating effect can be applied to the other determinants. The relationship between the determinants of an innovation and its adoption can be strongly contingent upon the contexts reflected by the moderator. When the moderating effects of attitude are considered, the differential ("inconsistent") effects of the determinants of innovation become explicable. In sum, the perceptions of adopting an innovation affect the intention to adopt that innovation through the attitude towards its adoption, i.e., the mediator effect. The attitude can also reflect a firm's overall evaluation of the innovation with respect to organizational context. Such an attitude can moderate the effect of other determinants on the intention to adopt, and provides a conceptual explanation for the "inconsistent" effect of determinants.

2.7. Implications for Building Research Frameworks of Innovation Studies

The review has the following implications for establishing research frameworks on the adoption of innovations.

First, as shown by the literature review, it has been a common practice for researchers to conduct studies using samples across types of firms, i.e., cross-organizational types. This design definitely increases the generalizability of a study, which contributes to the

accumulation of knowledge in innovation research. However, the design can potentially confound the predictive powers of the determinants of an innovation so that further research needs to be conducted.

Second, moderating effects should be built into research frameworks, especially for studies to be conducted across organizational types. Effective moderators can be a more general measure to distinguish organizational contexts. The relationship between the determinants of an innovation and its adoption can be strongly contingent upon the contexts reflected by the moderators. The theoretical importance of interactions in innovation research was recommended by Downs and Mohr in 1976. However, it seems that the effect has been neglected in past studies.

Third, the review supports Moore and Benbasat's (1991) argument that the perceived measures of PCI help establish general theories across research settings. Therefore, it is highly recommended that these perceived characteristics be used to establish the more predictive and general research frameworks in innovation studies.

Fourth, as shown by the wisdom of researchers, innovation studies have usually been controlled for innovation typology, e.g., technological innovation. Also, different stages of innovation, e.g., the stages of initiation and implementation, should not be aggregately measured in single dependent variables. As discussed, the two research designs can produce misleading research results.

2.8. Chapter Summary

The chapter has provided a critical review on innovation theories with respect to the typologies, stages and determinants of innovations. It is suggested that results of innovation research have been inconsistent across studies. However, a clear picture of the those consistent and inconsistent effects of the determinants can only be shown when similar research designs are used across studies. Three important research designs often used in innovation research were controlled in this review to show up the problem of (in)consistency. They are: the innovation typology, the stage of adoption of the innovation, and the organizational context. It appears that PCI are the more stable determinants than the others in the review. Potential reasons for the consistency and inconsistent effects of the determinants have been provided. Aggregated organizational contexts seem the stronger explanations for the inconsistencies than the aggregated stages and innovation typologies. A new conceptual relationship among the determinants, i.e., the mediating and moderating effect of attitude has been proposed to explain the inconsistent findings in a more conceptual viewpoint. The important insights gained from the review are the implications for establishing research frameworks of innovation, which provide the skeleton of the proposed conceptual framework in this study. The next chapter presents the framework in details.

1. Perceptions and beliefs refer to the perceived characteristics of innovation adoption. Two words are used interchangeably in this study..

CHAPTER THREE CONCEPTAUL FRAMEWORK

3. Introduction of the Chapter

This chapter presents the conceptual framework (Figure 3.1), regarding the determinants of adoption of technological innovations in organizations. Based on the insights gained from the literature review in Chapter Two, the framework consists of the four general directions of innovation determinants namely: 1) Perceived Characteristics of Innovation (PCI), 2) Environmental Characteristics, 3) Organizational Characteristics, and 4) Top Management Characteristics. The mediating and moderating effects of attitude are posited in this study. It is posited that PCI have indirect effects on the intention to adopt technological innovations through attitude, i.e., mediating effects. Attitude also moderates the relationship between the determinants and the intention to adopt. The dependent variable is the intention to adopt the technological innovation. Online retailing is chosen as the class of the innovation.

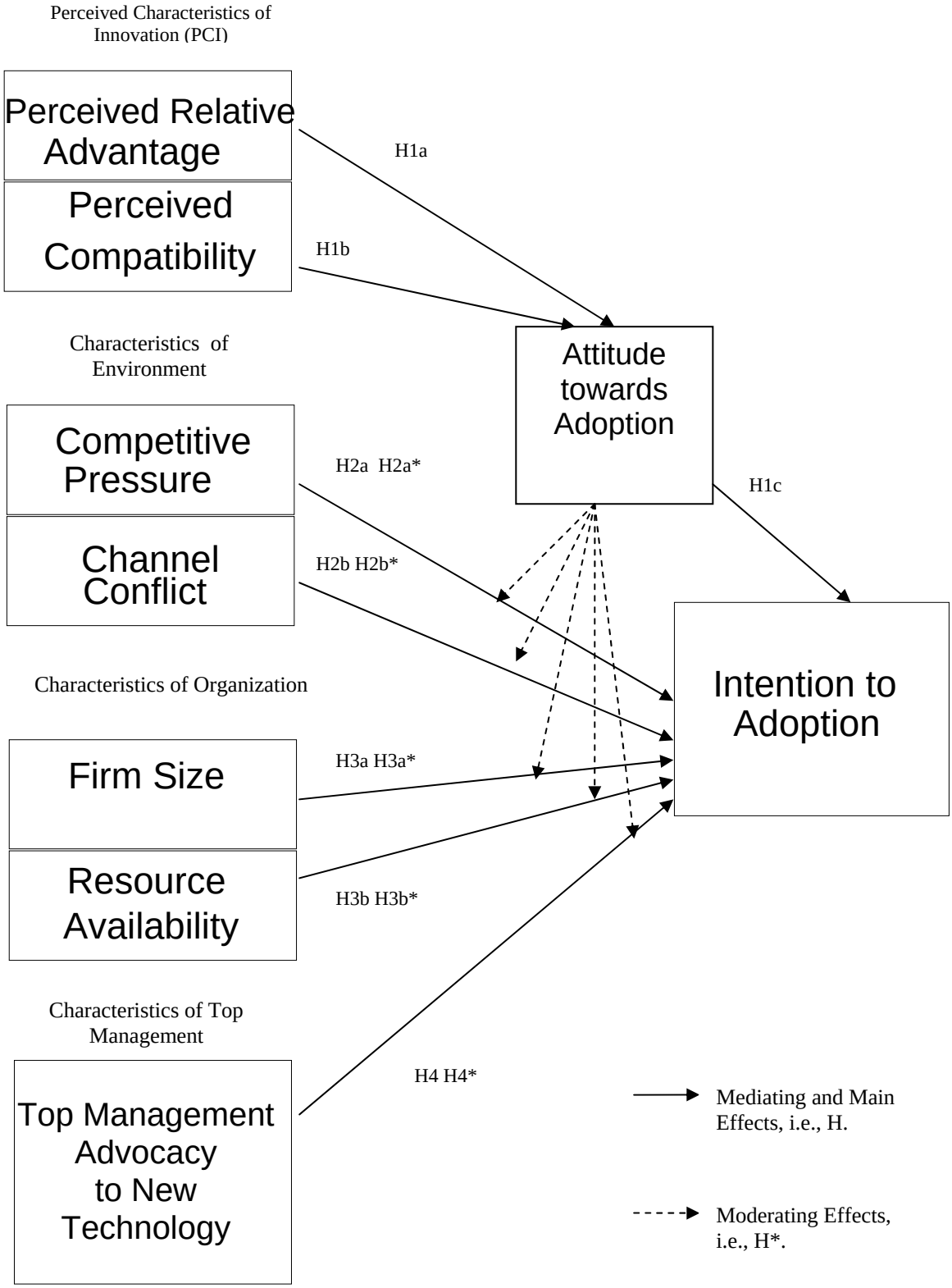

Figure 3.1: The Research Framework of Online Retailing Adoption

3.1. Adoption Intention of Online Retailing

Two common dimensions in measuring organizational innovations are a) the degree to which the initiation of an innovation is contemplated and b) the degree to which an implemented innovation is diffused (Fichman, 2001). The former measurement indicates the extent to which a firm intends to adopt, i.e., initiate, the innovation; while the letter indicates the extent to which a firm implements the innovation within the organization. As discussed before, the factors affecting the initiation of an innovation could be different from its implementation, so that mixing up factors in a dependent variable can lead to misleading results. This study focuses on the former measurement in order to find the determinants of the intention of organizations to adopt, i.e., initiate, an innovation. The class of the technological innovation is the online retailing.

3.2. Perceived Characteristics of Innovation

3.2.1. Perceived Relative Advantage

Rogers (1983) defined relative advantage as the degree to which an innovation is perceived as being better than the idea it supersedes. It is reasonable to believe that an decision of adopting or rejecting an innovation will be based on the benefits that the organization could be expected to reap from the innovation. Online retailing, which allows transactions to be conducted directly between sellers and buyers, can substitute for, or complement traditional market channels. The expected benefits of establishing online retailing include: cost reductions by technology-enabled efficiencies, disintermediation and

other Click-and-Mortar synchronizations; image improvements by raises of goodwill to organizations; valve enhancements by personalization and customization; market extensions by dealing with customers beyond physical outlets (Steinfield et al., 2002; Bakos, 1998; Benjamin and Wigand, 1995).

As these advantages are perceived relative to contexts, these perceptions of the relative advantage involved would differ depending on different types of organizations and contexts in which they operate. According to TRA (Fishbein and Ajzen, 1975), perceptions of performing a behavior positively associate with the attitude towards performing the behavior, i.e., the evaluative effects. Thus, the greater the perceived relative advantages to be obtained by adopting the innovation are, the more positive the attitude will be towards its adoption. Hence:

H1a: Perceived relative advantage is positively related to the attitude towards adopting online retailing.

3.2.2. Perceived Compatibility

Compatibility is the degree to which an innovation is perceived as consistent with existing values, past experience, and needs of potential adopters (Rogers, 1983). It has been found in previous studies that higher perceived consistency positively relates to the intention to adopt innovations such as EDI (Premkumar, 1994); Information Systems (Thong, 1999) and Open systems (Chau and Tam, 1997). It is more likely that organizations will adopt new things if these fit well with their overall integrity.

Compatibility could involve the concepts of internal and external fitness. Internal compatibility refers to the perceived consistency between adopting online retailing and existing operations. Manufacturing sectors demonstrate typical examples. Manufacturers enjoy economy of scale from mass productions since their intermediaries take roles in aggregating inventories and customer orders (Bailey and Bakos, 1997). To build up online retailing (direct-to-consumer channels), manufacturers may cope with the more frequent but smaller order sizes, which may be unfavorable to the efficiencies in mass productions. Therefore, concepts in Operations Management (OM) and Supply Chain Management (SCM) such as Postponement, Mass Customization and Just-In-Time are employed to make mass production systems compatible to direct orders with reasonable production and inventory costs. However, it is unlikely that the concepts will be practical to all manufacturers. In fact, apart from manufacturing firms, it is reasonable for each type of organizations to consider whether online retailing fits to the internal aspects such as product suitability, existing marketing strategies and other business settings.

Apart from the internal operations, external compatibility is critical, too. Online retailing, as an electronic direct-to-consumers channel, can bypass parts of the intermediaries due to lower transaction costs. The pros and cons of “disintermediation” have attracted much research attention (e.g., Bailey and Bakos, 1997; Benjamin and Wigand, 1995; and Jallat and Capek, 2001). Disintermediation can be the source of channel conflict between firms and their middlemen (Anderson and Narus, 1984; and Webb, 2002). Serious channel conflict, in fact, is an incompatibility that can be a barrier to the adoption of online retailing. Apart from

channel conflict, the fitness of other external aspects is also an important consideration for online retailing adoption, such as buyer behaviors (e.g., quantity per purchase, seasonal buying and tendency towards home shopping) and market structures (e.g., geography, density and size).

These perceived compatibility of adopting online retailing will be different according to various organizational types and contexts. Based on TRA, the higher compatibility of adopting online retailing is perceived, the higher the attitude of adopting the innovation will be. Hence:

H1b: Perceived compatibility is positively related to the attitude towards adopting online retailing.

Attitude, defined as positive or negative evaluations about performing the target behavior, will determine the intention to carrying out that behavior (Fishbein and Ajzen, 1975). Intention can be viewed as a conative component of the affective nature of attitude. Therefore, a positive attitude is likely to increase the willingness to adopt the innovation. Hence:

H1c: The attitude towards adopting online retailing is positively related to the intention to its adoption.

The above propositions combine to form a mediating effect among the perception, attitude and intention. PCI, as the perceptions, are likely to influence the overall attitude

towards adopting online retailing; and that attitude is likely to affect the intention of adoption. This argument is parallel to TRA that perceptions of a performing behavior indirectly affect the behavioral intention through the attitude, referred to as a positive or negative evaluation about performing the target behavior. Hence:

H1d: The attitude towards adopting online retailing mediates the relationship between the perceptions and adoption intention.

3.3. Environment Characteristics

3.3.1. Competitive Pressure

Firms tend to be more responsive and cautious about competitors' actions (Gatignon and Robertson, 1989). It is generally suggested that competitive pressure is influential to innovation adoptions (Gatignon and Robertson, 1989; Teo et al., 2003; Warrts, 2002;).

Competitive pressure is likely to make a firm more innovative in general; however, the real intention of adopting an innovation will be contingent upon the attitude towards that innovation, i.e., the moderating effect. According to argument of the moderating effect in Chapter Two (details in section 2.6.2.), the attitude is the total evaluation of adopting an innovation based on the perceptions of adopting the innovation, such as whether the innovation is perceived to bring additional advantages and be compatible with the existing systems. Once a positive or negative attitude is held towards adopting an innovation, it tends to have a contingent effect on the intention to adopt the innovation. Under competitive

pressure, the adopting intention of an innovation would be higher if the innovation is evaluated as a competitive advantage and fitting well with the strategies and operations of orgaizations, i.e., a positive attitude. An negative attitude, on the contrary, will decrease the intention even in the competitive environment. The adoption of online retailing seem to go along with the same logic. Therefore, increasing numbers, extents and successful cases of competitors adopting online retailing would generally increase a firm's adoption intention. However, the actual adoption intention will be contingent upon the positive (negative) attitude towards adopting online retailing of the firm. Hence:

H2a: Competitive pressure is positively related to the intention to adopt online retailing.

H2a*: The relationships between competitive pressure and adoption intention will be stronger in organizations with a positive attitude towards the adoption.

3.3.2. Channel Conflict

Channel conflict is one of the critical barriers to establishing online retailing. Channel conflict refers to the frequency, intensity, and duration of disagreements between a firm and its channel partners or intermediaries (Anderson and Narus, 1984). Online retailing could be a source of channel conflict. The direct-to-consumers channel could diminish the role of intermediaries in marketing channels due to the lower transaction costs of electronic activities (Bailey and Bakos, 1997; and Benjamin and Wigand, 1995). Although a complete disintermediation seems to be unrealistic, the potential threats would induce retaliation from

marketing channels in the form of unsupportive behaviors or even the boycotting of brands, which can constrain an organization from adopting online retailing.

However, different types of firms encounter different levels of channel conflict. For example, manufacturers tend to face more resistance than retailers. Manufactures are generally farther away from the markets so that they rely more on their distribution channels. When the firms set up online channels to end users, they become part of the competitions for their partners. Besides, product-firms tend to have more considerations in direct-selling than service-firms, such as product deliveries, market contacts and after sale services. When a product -firm tries to internalize such functions, the potential threat to its dealers may induce conflict. Generally speaking, organizations that suffer from less (more) channel conflict would be more likely (less likely) to adopt online retailing. Hence:

H2b: Channel conflict is negatively related to the intention to adopt online retailing.

According to the arguments with regard to moderating effect, the real intention to adopt online retailing will be contingent upon the attitude towards the innovation adoption. The positive evaluation of online retailing will increase the likelihood of a firm adopting the technology even considering the possibility of channel conflict. Hence:

H2b*: The relationships between channel conflict and adoption intention will be weaker in organizations with a positive attitude towards the adoption.

3.4. Organization Characteristics

3.4.1. Firm size

It is generally suggested that larger firms are more inclined to adopt innovations, especially technological innovations (Lind et al., 1989; Thong, 1999; and Yao et al., 2002). Bigger businesses and operations seem have more slack resources in terms of capital, assets, and expertise as well as larger production outputs, spreading out the investment in innovations. However, Grover and Goslar (1993) have argued that business magnitude is not relevant because, when motivation exists, small businesses are still eager to employ new technologies. This inconclusive finding is in fact partially attributed to the same result of omitting the moderating effect (details in Section 2.6.2.); i.e., the attitude towards the innovation. With regard to online retailing, larger firms generally have more tangible assets (e.g., capital) and intangible assets (e.g., brands) to build up online retailing. However, the real intention to adopt online retailing may be contingent upon by the attitude towards online retailing. A bigger firm will still have a low likelihood to adopt an innovation if a negative attitude towards the innovation is held by decision makers; while a high intention would occur under a positive attitude. Hence:

H3a : Firm size is positively related to the intention to adopt online retailing.

H3a*: The relationships between firm size and adoption intention will be stronger in organizations with a positive attitude towards the adoption.

3.4.2. Resource Availability

Computerized operations are likely to facilitate an organization to adopt online retailing. Online retailing can involve electronic sale interfaces on the Internet, and integrated warehousing systems in back offices. IT resource, such as bar code systems, automatic inventory replenishment systems, electronic fund-transferring systems, and technical personnel can well prepare organizations to adopt the innovation. Thus, firms which have the infrastructures and manpower for online retailing are more ready to the adoption. Still, parallel to the argument concerning the moderating effect, the real intention of firms to adopt online retailing are likely to be moderated by the attitude towards online retailing. Hence:

H3b: The availability of resources is positively related to the intention to adopt online retailing.

H3b*: The relationships between resource availability and adoption intention will be stronger in organizations with a positive attitude towards the adoption.

3.5. Characteristics of Top Management

3.5.1. Top Management's Advocacy to New Technology

Leaders can be generally divided into authority leaders, i.e., top management who have formal powers and opinion leaders, i.e., individuals who have informal influence on other attitudes or behaviors. The top managers will directly affect the adoption of innovations

since authorities are usually in a position to make such decisions (Thong, 1999). If top management is advocate to new technologies, it is more likely that the firm will adopt more relevant innovations. This logic can apply to the adoption of online retailing because top management is critical of creating the necessary resources and climates. Innovative top management seems more ready to accept newness, which eventually leads to a higher adoption intention in organization level. Again, according to the argument concerning the moderating effect, the relationship can be contingent upon the attitude. Hence:

H4: The advocacy of top management to new technologies is positively related to the intention to adopt online retailing.

H4*: The relationships between top management advocacy and adoption intention will be stronger in organizations with a positive attitude towards the adoption.

3.6. Chapter Summary

The framework consists of the four directions of innovation determinants to predict the intention to adopt online retailing of organizations. New theoretical relationships among the determinants have been posited. Attitude towards the adoption is posited as the mediator variable between PCI and the intention, and as the moderator variable in the relationship

between other determinants and the adoption intention. The next chapter will present the details of the research design used in the framework.

CHAPTER FOUR RESEARCH METHODOLOGY

4. Introduction of the Chapter

This chapter addresses the research strategies and methods used in this study. Based on the critiques in Chapter Two, a number of aspects are addressed to provide a valid research design: the typology of innovation; the stage of innovation, and the organizational context. They give a fundamental scope of the research. With respect to the instruments, operationalization of the variables will be highlighted. Validation of the instrument are examined by reliability and validity tests. Reliability or internal consistency of the items will be examined by Cronbach's alpha; while the validity will be evaluated in terms of content validity and construct validity, i.e., convergent and discriminant validity. Two phrases of pilot study are carried out to ensure the content and face validity. Principal component analysis is used to test the convergent and discriminant validity. The data collection method and the sample profile will be presented. Finally, the methods of the data analysis are introduced.

4.1. Overall Research Design

This research empirically tests the proposed framework concerning the determinants of adoption of online retailing in organizations. The research design was controlled or addressed by the three major aspects below, based on the insights gained from the critique in Chapter Two.

- *The typology of innovation*
- *The stage of innovation*
- *The organizational context*

4.1.1. Typology of Innovation

The critique in Chapter Two addresses the issue that a determinant may have different impacts on different innovation types (Wolfe, 1994), so that the innovation typology should be distinguished in a study to ensure valid results (Damanpour, 1991). The innovation typology of this study is therefore based on primary attribute of the innovation itself (online retailing) ensuring an objective instead of subjective classification in order to avoid the problem of aggregating innovations by secondary attributes (Downs and Mohr, 1976). When multiple innovations are aggregated to a class, average scores of the effects of the determinants on these innovations may confuse the predictive powers of the determinants. The innovation typology, therefore, is based on the primary attributes of the online retailing itself. The online retailing is defined as establishing an online shop which allows direct-to-consumer transaction. It should involve physical or digital product/service transactions

through the Internet, providing additional direct-to-market channel which engages at least material, information and cash exchange among participants.

4.1.2. Stage of Innovation

Also, based on the insights gained from the critique, innovation stages should be separated rather than aggregated in one dependent variable. The stage of innovation can be basically divided into initiation and implementation stage (Gopalakrishnan and Damanpour, 1997). Factors (e.g., small business magnitude or formal structure) which help implement an innovation may hinder its initiation. The positive and negative effects of these factors would offset each other that provide meaningless implication when the adoption is measured by items in both of the stages (Downs and Mohr, 1976). Therefore, the particular stage of adoption, i.e., initiation, is selected in this research to avoid such the problem.

4.1.3. Organizational Context

As shown by Tables 2a, 2b and 2c, it is a common practice for research to use samples across organizational types to raise research generalizability. The samples in this research include manufacturing, wholesaling, retailing, transporting and business services sectors. The moderating effects have been used in the framework to establish the more predictive determinants of the innovation with respect to the sampling methods.

4.2. Operationalization of Instrument

Measurement of the variables was based on developed instruments as much as possible while refinements and additional items were made when necessary. All of the items were on seven-point Likert-type scales ranging from strongly disagree (1) to strongly agree (7).

Perceived-Relative-Advantage and Perceived-Compatibility were measured by the items adapted from Moore and Benbasat (1991) and SAR government's annual survey on IT usage and penetration (Census and Statistics Department 2002). The items measure the perceptions of usefulness and appropriateness of using the innovation. Different parties would have different perceptions on the primary attributes of an innovation that, for instance, firm "A" thinks it is useful; while firm "B" thinks not. Thus, the perceived attributes will be used. Furthermore, the perceived attributes should not be based on the perceptions of the innovation itself but perceptions of using the innovation. Someone may dislike a technology itself but nevertheless believe that using the technology will bring advantages. Five items of Competitive-Pressure was adapted from Wang (2001) and Srinivasan et al. (2002). Channel-Conflict was measured by three items adapted from Scovotti (2000). Resource-Availability was measured by four items modified from Kuan and Chau's perception-based model (2001). Top-Management-Advocacy was measured by four items developed by Srinivasan et al. (2002). Firm-Size was measured by number of employees, a common measure used by researchers on studies of innovation adoption (e.g., Thong, 1999; Zmud, 1982). The numbers of employee were subjected to a logarithmic transformation in order to reduce variance of those highly skewed values. Attitude-towards-Adoption is measured with three items adapted

from Jackson et al. (1997). Modifications were made to those items in the sense of organizational perspective. Intention-to-Adoption is measured by three items adapted from Teo et al. (2003), which was originally developed by Azjen and Fishbein (1980). These items include actions (contemplating to adopt, likely to adopt), subject (online retailing), context (organization), timing (in the near future) which are critical element for innovation adoption (Te et al., 2003). Tables 4-1 and 4-2 show the details of the items. As the measures were based on developed instruments, their goodness was ensured by previous works. Re-assessments are still positive for their validations. Their reliability and validity tests were tested.

4.3. Validation of the Instrument

4.3.1. Reliability: Internal Consistency

Reliability or inter-item consistency should be accessed to ensure consistent measures across sets of items. The consistencies were examined by calculating Cronbach's alpha coefficient for those multipoint-scaled items.

Table 4-3 shows the alpha values in column two. A number of recommended alpha levels were provided by representative studies (see Peterson, 1994 p. 382). For example, according to Murphy and Davidshofer (1988), alpha values are in unacceptable level (below 0.6), low level (0.7), moderate level (0.8 – 0.9) and high level (above 0.9). Nunnally (1978) pointed out that the acceptable alpha level for preliminary research is 0.7; and for basic research is 0.8.

As shown in Table 4-3, good reliabilities were demonstrated. The alpha values ranging from 0.90 to 0.97 are higher than the threshold value of 0.8.

Constructs name	Items
Perceived Relative Advantage	Regarding our business nature, adopting online selling:
	1. increases our business opportunities.
	2. enhances our competitiveness.
	3. improves our customer services.
	4. adds value for our customers.
	5. improves our goodwill.
Perceived Compatibility	Adopting online selling fit well with/ well compatible to:
	1. our product/service nature.
	2. our firm's selling strategy.
	3. the way our firm likes to sell.
	4. our firm's operations.
Attitude towards Adoption	1. Adopting online selling in the near future is recognized as a good idea in our firm.
	2. We take a positive attitude towards adopting online selling in the near future.
	3. We think adopting online selling in our firm in the near future is reasonable.
Competitive Pressure	1. Our firm is now facing active competition in the area of online business.
	2. Our competitors have begun to actively offer online services.
	3. The leading firms in this industry are active in establishing online business.
	4. If our firm does not undertake online business, we may lose edge over competitors.
	5. Being ahead of our competitors' online business capability is a key factor in our online business initiative.

Table 4-1: The Measuring Items of the Construct

Constructs name	Items
Channel Conflict	1. Online selling negatively affects the relationships between our firm and our marketing partners (e.g., middlemen, agents, or dealers).
	2. The relationship between our firm and marketing partners (e.g., middlemen, agents, or dealers) is prone to conflict due to our firm's online selling.
	3. There is risk of retaliation by current marketing partners (e.g., middlemen, agents, or dealers) if our firm sells online.
Resource Availability	1. Our firm possesses advanced IT systems.
	2. Our firm provides good IT support to employees.
	3. Our firm has competent IT staff.
	4. Our firm has capable resources to develop IT in our business
Top Management Advocacy to New Technology	1. Top management keeps telling subordinates that this firm must gear up now to meet changing technology trends.
	2. Top management makes an effort to convince subordinates of the benefits of new technology.
	3. Top management encourages subordinates to develop and implement new technology.
	4. Top management is frequently the most enthusiastic party of adopting new technology.
Intention to Adoption	1. Our firm is likely to adopt online selling in the near future.
	2. Our firm plans to adopt online selling in the near future.
	3. It is our intention to develop online selling in the near future.

Table 4-2: The Measuring Items of the Construct

Variables	Alpha Value	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Perceived Relative Advantage	0.95								
R.ADV1			0.58						
R.ADV2			0.69						
R.ADV3			0.70						
R.ADV4			0.81						
R.ADV5			0.79						
Perceived Compatibility	0.97								
COMPAT1				0.73					
COMPAT2				0.73					
COMPAT3				0.78					
COMPAT4				0.75					
Attitude towards Adoption	0.96								
ATT0001								0.76	
ATT0002								0.83	
ATT0003								0.68	
Competitive Pressure	0.94								
COMPETI1		0.83							
COMPETI2		0.82							
COMPETI3		0.84							
COMPETI4		0.81							
COMPETI5		0.68							
Channel Conflict	0.90								
CHANNEL1									0.88
CHANNEL2									0.93
CHANNEL3									0.93
Resource Availability	0.92								
IT1					0.85				
IT2					0.89				
IT3					0.86				
IT4					0.75				
Top MGT Advocacy	0.95								
T.MGT1				0.82					
T.MGT2				0.86					
T.MGT3				0.88					
T.MGT4				0.88					
Intention to Adoption	0.96								
INTENTI1							0.86		
INTENTI2							0.83		
INTENTI3							0.78		
Cumulative % of variance explained		42.980	61.505	69.394	75.938	79.530	82.806	85.569	87.759

a. Rotation method: Equamax
b. The factor loadings below 0.5 are suppressed

Table 4-3: Construct (Convergent and Discriminant) Validity and Reliability

4.3.2. Content Validity: First and Second Pilot Study

Validity of the measurements should be evaluated to see whether they are measuring the ideas intended to measure. Pilot study took place to ensure the content and face validity that appropriate items were used to measure relevant concepts. Two pilot studies were conducted. In the first one, a preliminary questionnaire containing the research items was developed and sent to above 20 DBA and MSc students in the evening classes of The Hong Kong Polytechnic University. Most of the participants are in managerial positions in their organizations. Telephone interviews were carried out to get some of their feedbacks on the appropriateness of wordings and contents.

In the second stage of the pilot study, a refined questionnaire was sent to three directors or top executives in three different representative companies. One of them is the executive of communication and distribution sector of IBM (China/H.K.); another one is the director of IBM's business partner; the last one is a managing director of a certified accounting firm. IBM is one of the most successful computing vendors adopting the online retailing world-wide. The participation of the IBM's executive in the pilot study is very representative for this study. Also, since adopting online retailing can affect a firm's sale /channel strategy and partnership, the feedback from the director of IBM's business partner is very meaningful especially for the matter of channel conflict. Beside these, the participation of the managing director of the accounting firm provided important insights from the perspective of business service regarding online selling. Face-to-face interview, telephone interview or email contact were conducted with them to ensure the content and face validity of the questionnaire items. Final refinements were made by those feedbacks and other logical reasoning.

In the whole process of the pilot study, the refinements were based on two major concerns. First, the statements should express meanings they are supposed to be. Some wordings or concepts understood in academic context may be strange in business fields. It is important to verify whether the informants correctly interpret the original meanings of those questions or not. Modifications were therefore made to those words which could create potential confusions. For examples, a phrase, i.e., "Regarding your business nature", was explicitly added to the question items of "Perceived Relative Advantage" in order to ensure the context-specific ratings. The ratings can be misleading if the informants mark the scales simply by their general impression of adopting online retailing rather than by considering specifically to their business contexts. Also, the two heading questions of Perceived-Relative-Advantage and Perceived-Compatibility were revised. I used "*do you think* adoption of online selling brings advantage to (fits well with) your firm?" instead of "*does* adoption of online selling brings advantage to (fit well with) your firm?" As the constructs are in perceived nature, the revised tone is more appropriate for asking informants' perception of adopting the innovation. The original one may mislead people to think the questions are asking evaluations after the adoption so that some of the targeted firms, which have not adopted the innovation, may omit the question. Beside these, some words were modified after the pilot studies. For example, "channel partners" instead of "channel members" was finally used because "partners" is a better word leading the managers to think about the interest conflicts and relationship in their supply chains. Also, the terms, e.g., agents and dealers, were kept since they are customs in business. The second concern is that the contents of the question items should be applicable and relevant to real business in local context. For example, one question of Perceived-Relative-Advantage was deleted, i.e., Adopting online selling reduces cost of our firm. It was suggested that local firms adopt online retailing for business opportunities and goodwill

rather than cost saving. The question which seems irrelevant in local context was deleted in the final version of the questionnaire.

4.3.3. Construct Validity

Construct validity was assessed by convergent and discriminant validity. Convergent validity is ensured if the items measuring the same concept cluster to form a single construct; discriminant validity is ensured when two variables are predicted to be uncorrelated, and the scores obtained by measuring them are empirically found so. Principal component analysis was commonly used to examine the construct validity for adapted instruments in innovation studies (e.g., Thong, 1999; Premkumar, 1994). In fact, it is critical to empirically distinguish those constructs, which are close concepts in human mind. Table 4-3 shows that sufficient convergent validity was found in all of the multi-items. The loadings of items measuring the same construct were greater than the cut off point of 0.5 recommended by Nunnally (1978). It was indicated that items measuring the same construct really clustered together to form a single construct. Beside the convergent validity, the results of discriminant validity are shown in Table 4-3. As a general rule, eight factors were extracted according to stable plateau of the scree plot with eignvalues in Y-axis and number of remained factors in X-axis (Figure 4.1). Kaiser (1960) recommended retaining all factors with eignvalues greater than 1. Jolliffe (1972; and 1986) pointed out that Kaiser's criterion can be too strict and suggested remaining factors with eignvalue greater than 0.7. Beside these, scree plot is another widely used criterion to extract the number of factors (Ngai and Cheng, 1997). The factor extraction was based on the scree plot. As shown by the curve in Figure 4.1, there was a first drop after one factor; second drop after three factors; third drop after five factors; the curve began to tail off after eight factors. It was indicated that eight factors should be remained. Suppressing the

factor loadings below 0.5, Table 4-3 shows no problem of the cross loadings that items measuring the same concepts were loaded on their associated factors stronger than other factors. In other words, the items measuring different constructs were really discriminated from each others after eight factors were extracted. The discriminant validity was therefore ensured. The convergent and discriminant validity ensured the validation of the instruments.

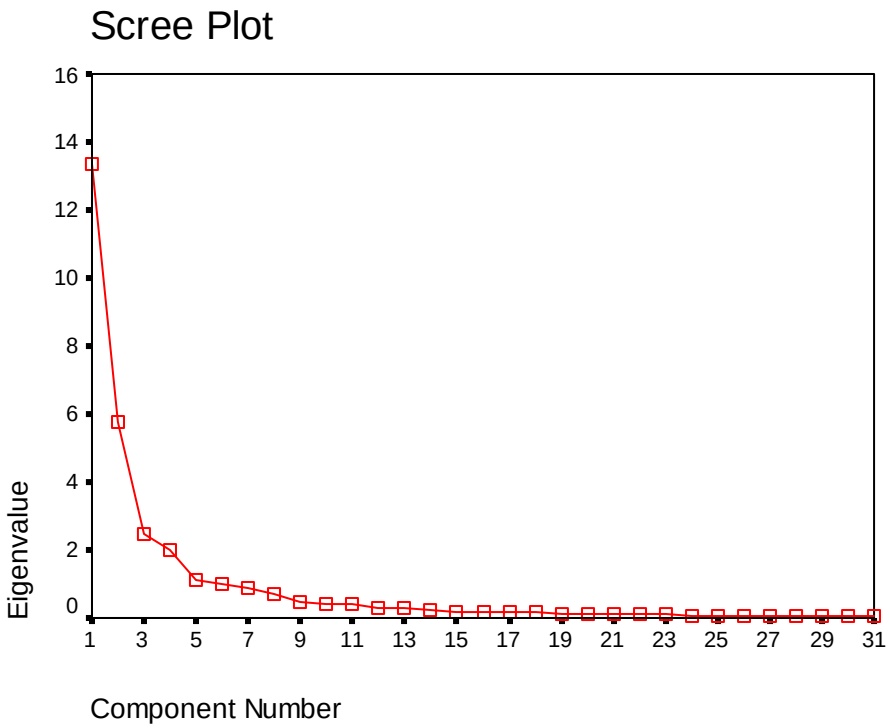

Figure 4.1: Scree Plot

4.4. Data Collection and the Sample Characteristic

A detailed questionnaire with the various variables and measuring items was developed (see Appendix A). Refinements were carefully made in the process of the pilot study mentioned in the previous part. Two thousand and two hundred questionnaires were sent out to different companies. The database of the companies was obtained from Census and Statistics Department (C&SD), which was the key survey frame. The official database is the

most representative frame in local that provides the Hong Kong Standard Industrial Classification (HSIC). HSIC, compiled by the C&SD been serving as a standard framework for the statistical classification of economic units into different industry classes. It is generally used by the department in various surveys and statistical systems and in the publication of statistics. The frame is collected and updated by the official survey of C&SD. It makes the database more representative than other business associations' directories which are collected by voluntary participation in activities. The database is systemically stratified by industrial sectors and firm sizes, and C&SD provided stratified random sample by computer. In order to enhance the generalizability of the study, the sample drawn from the frame covered a range of sectors including the wholesaling, retailing, manufacturing, and other business services. Questionnaires were sent out in April 2004 and reminder cards (see Appendix B) were sent after 4 weeks. The cross - industries sample, which was used by many other famous research of innovation, enhances the research generalizability (e.g., Chau and Tam, 1997; Teo et al., 2003 and Thong, 1999).

Total 152 questionnaires were returned. Follow up calls were made for those responses which were not fully completed, and resulting 140 useful questionnaires. The total response rate is above 6.9%. According to Siu's (1996) study on the response behaviors of Chinese owners/managers in Hong Kong, the reported response rates are from 6.8% to 11.6%. Thus, response rate of this study should be considered acceptable. Among the respondents, 49 (35%) of them are in manufacturing; 45 (32.1%) are wholesaling and retailing; 45 (32.1%) of them are in business service sectors and 1 (0.7%) of them had not reported. It is indicated that although the response rate is not very high, the respondents are representative since they are evenly distributed over the sample. Beside these, 109 of the companies have not yet adopted

the online selling; while 31 of them have already adopted. Only the response from non-adopting firms were included in the data analyses in order to have predictive value on adoption intention. It is also can avoid the problem of correlating today's variables with yesterday's innovativeness. The top managers or CEOs were chosen to be the key informants for the firms according to the guidelines suggested by Huber and Power (1985) for research with single informant per organization. 86% of the responses are completed by the companies' CEOs, directors, owners or managers themselves. The remaining responses (14%) were completed by other organizational member who were believed to be knowledgeable to the questions. Non-response bias was examined by comparing the response between those from the normal mailing period (around initial four weeks) and those not. Around 104 (74%) of them belongs to the first group; while around 36 (26%) of them belong to the second group. T-tests were conducted to evaluated the significant differences between the two groups in terms of the firms' characteristics (the annual revenue) and responses to the question items. No significant difference was found in terms of the annual revenue (t = 0.1, p = .921) and most of question items (see appendix C). The above analysis suggests that non-response biases should not be serious.

4.5. Data Analysis Methods

The data analysis are split into two major tests: 1) main effect and mediating effect test 2) and the moderating effect test, which were handled separately by using SPSS. The first test for mediating effect is assessed by the three-step procedure suggested by Baron and Kenny (1986); and the second one for moderating effect is tested by Hierarchical Moderated Regression (Cohen et al., 2003).

4.5.1. Test of Mediating Effect and Main Effect

The mediator variable, called an intervening or process variable, is divided into two categories in term of its effect i.e., complete and partial mediation (Baron and Kenny, 1986). According to Baron and Kenny, complete mediation is defined as the case in which an independent (a predictor) variable no longer affects a dependent (criterion) variable after the mediator variable is intervening relation. Partial mediation is defined as the case in which the effects of an independent variable on a dependent variable are reduced (still have some effects) after the mediator variable are controlled.

Baron and Kenny's three step procedure is used to assess the mediating effect. First, the independent variables should be significantly related to the mediator variable. Second, the independent variables should be significantly related to the dependent variable. Third the mediator variable should be related to the dependent variables with the independent variables entered in the equation. The independent variables should be controlled in step 3 for establishing the mediation. If these conditions hold in the three steps, partial mediation is initially found. If the significant beta weights between the independent variables and the dependent variable found in step 2 are become non-significant in step 3, complete mediation is initially found. The formal significance of the mediating effect refers to the reductions in the effect of the independent variables on the dependent variable. The amount of reduction may not be definitely proven by either change in variance explained or inferential statistic e.g., p-value. The mediating effect should be divided by its standard error. The mediating effect is significant if the Z-score calculated is small than 1.96 (two tails) with a significant

level p< .05. The test of mediating effect include the hypothesis 1a-1d. The main effects of other independent variables on the dependent variables will be tested by the multiple regression analysis in the same model, which includes the hypothesis 2a, 2b, 3a, 3b and 4. The mediating effect and main effects are in the same model.

4.5.2. Test of the Moderating Effect

Moderator variable has been defined as the variable which systematically modifies either the form and/or strength of the relationship between an independent (predictor) variable and a dependent (criterion) variable. Moderator variable can be categorized as three types according to their relationships with the independent and dependent variables (Subhash et al., 1981). A homologizer refers to a moderator which does not interact with the independent variable and not relate to both of the independent and dependent variable; a purer moderator refers to the case which the moderator interacts with the independent variable but not relates to the independent variable and dependent variable; a quasi moderator refers to the case which the moderator interacts with the independent variable meanwhile relates to the independent and dependent variable. The case of quasi moderator is very common in the social science research.

Hierarchical regression analysis (Cohen et al., 2003) is used to test the moderating effect. The variables are entered into the regression equation in block-wises. The control variables are entered into the first block. Next, the other independent variables are entered into second block. Then, the moderator variable is entered into the third block. Finally, the interaction terms (independent variable x moderator) are entered into the last block. The centering

procedure suggested by Aiken and West (1991) is used to recode the independent and moderator variables. The moderating effect is significantly found if the interaction terms are significant and explained a significant incremental portion of variance when entered in the last block. To explore the nature of the significant interaction term, partial correlation between the independent and dependent variable are computed separately by the moderator. The effect of the interaction is graphically plotted at mean and one upper and lower standard deviation. The test of the moderating effect includes the hypothesis 2a*, 2b*, 3a*, 3b*, and 4*. In order to depict a clear picture of the data analysis, Tables 4-4 and 4-5 summarize the relevant variables and hypothesis, and testing procedures of the two major tests

4.6. Chapter Summary

The research strategies and designs in this study are addressed in three directions based on the critiques in Chapter Two. First, primary criteria, i.e., online retailing itself, is applied to classify the innovation typology. Second, the adoption stage of innovation is focused on initiation stage. Third, cross-organizational context is used for increasing the research generalizability. The moderating effect of the attitude towards innovation adoption is a more general measure to distinguish the organizations. With respect to the instruments, operationalization of the variables were adapted from *developed instruments* as much as possible while refinements and additional items have been made when necessary. Internal consistency of the items, content validity and construct validity, i.e., convergent and discriminant validity, have been examined by relevant tests that sufficient reliability and validly have been shown. The data collection methods have been presented. Finally, the two major tests of data analysis have been introduced. Tables 4-4 and 4-5 show the details.

Test	***Variable***	***Testing Procedure***	***Hypothesis***
Mediation and Main Effects	*Independent Variable (IV):* • *Perceived relative advantage.* • *Perceived compatibility* • *Competitive pressure* • *Channel conflict* • *Firm size* • *Resource availability* • *Top MGT advocacy to new technology* *Mediator Variable (Me):* • *Attitude towards adoption* *Dependent Variable (DV):* • *Intention to adoption*	*Mediating Effect* *Baron and Kenny's (1986) three-step procedure:* *1) Regress Me on IVs* *2) Regress Dv on IVs* *3) Regress Me on DV with IVs included* *Evaluation of the steps:* *1) Partial Mediation: the 3 steps are significantly found.* *2) Complete Mediation: the 3 steps are significant found, and the significant β of IVs in step 2 become non-significant in step 3.* *3) The reductions in the effect of IVs on DV are divided by their standard error respectively, and should provide the Z-score <1.96* *Remark:* *Significant level* (p <.05)	*H1a: Perceived relative advantage is positively related to the attitude towards adopting online retailing* *H1b: Perceived compatibility is positively related to the attitude towards adopting online retailing* *H1c: The attitude towards adopting online retailing is positively related to the intention to adopt online retailing* *H1d: The attitude towards adopting online retailing mediates the relation between the perceptions and adoption intention*
		Main Effects *Since the main effects and the mediating effects are in the same mode, the main effects have been tested in step 1 of the test of the mediation i.e., Regress DV on IVs.*	*Main Effects* *H2a: Competitive pressure is positively related to the intention to adopt online retailing* *H2b: Channel conflict is negatively related to the intention to adopt online retailing* *H3a: Firm size is positively related to the intention to adopt online retailing* *H3b: The availability of resources is positively related to the intention to adopt online retailing* *H4: The advocacy of top management to new technologies is positively related to the intention to adopt online retailing*

Table 4-4: The Test of Mediating Effect and Main Effects

Test	***Variable***	***Testing Procedure***	***Hypothesis***
Moderation	*Control Variable:* • *Perceived relative advantage.* • *Perceived compatibility* *Independent Variable (IVs):* • *Competitive pressure* • *Channel conflict* • *Firm size* • *Resource availability* • *Top MGT advocacy to new Technology* *Moderator Variable (Mo):* • *Attitude towards adoption* *Dependent Variable (DV)* • *Intention to adoption*	*Hierarchical Moderated Regression (Cohen et al., 2003) The variables are entered by four blocks (Models):* • *Block one: Control variables* • *Block two: Independent variables* • *Block three: Moderator variable* • *Block four: Interaction terms (IVs*Mo)* *Evaluation of the steps:* *Moderating effects are found when the* β *of the interaction terms are significant, and* ΔR^2 in last block is significant. *Remarks:* • *The IVs and Mo are centered by the procedures suggested by Aiken and West (1991).* • *Significant level (* p <.05)	*H2a*: The relationships between competitive pressure and adoption intention will be stronger in organizations with a positive attitude towards the adoption* *H2b*: The relationships between channel conflict and adoption intention will be weaker in organizations with a positive attitude towards the adoption* *H3a*: The relationships between firm size and adoption intention will be stronger in organizations with a positive attitude towards the adoption* *H3b*: The relationships between resource availability and adoption intention will be stronger in organizations with a positive attitude towards the adoption* *H4*: The relationship between top MGT advocacy and adoption intention will be stronger in organizations with a positive attitude towards the adoption*

Table 4-5: The Test of the Moderating effect

CHAPTER FIVE DATA ANALYSIS

5. Introduction of the Chapter

The data analysis will be split into two major tests: 1) the test of main effects & mediating effects and 2) the test of moderating effects. The two tests in the theoretical framework will be tested separately. Baron and Kenny's three step procedure will be used to assess the mediating effect. The reducing effect of the initial predictor variables on the criterion variable will be examined. Hierarchical regression analysis (Cohen et al., 2003) will be used to test the moderating effect. The variables will be entered in four blocks. A moderating effect is found if an interaction term is significantly found and explained a significant incremental portion of variance when entered in the last block. Partial correlation test will also be conducted to explore the nature of the moderating effect. First, the general descriptive statistics and multicollinearity of the variables will be presented. Second, the mediating effect will be tested. Third, the moderating effect will be tested. Lastly, the power test will be addressed.

5.1. Descriptive Statistic and Multicollinearity of the Variables

Table 5-1 shows the general descriptive statistic and correlation among the variables which the values are the average score of the relevant items. The significant coefficients of correlation shows reasonable relationship among the variables. For example, Intention-to-Adoption is correlated to the Perceived-Relative-Advantage (r = .68***), Perceived-Compatibility (r = .69***), Attitude-towards-Adoption (r = .70***), Competitive-Pressure (r = .61***) and Top-Management-Advocacy (r = .25**). The Perceived-Relative-Advantage

and Perceived-Compatibility are correlated to the Attitude-towards-Adoption (r = .79*** and .79*** respectively). Competitive-Pressure is correlated to the two perceptions (r = .56*** and .68*** respectively) and the attitude (r = .60***), too. Top-Management-Advocacy and Firm-Size are correlated to IT-Availability (r = .69*** and .32** respectively).

Variable	M	SD	VIF	1	2	3	4	5	6	7	8	9
1. Perceived Relative Advantage	3.780	1.532	3.371	/								
2. Perceived Compatibility	2.832	1.349	3.592	.79***	/							
3. Attitude towards Adoption	3.352	1.531	3.404	.79***	.79***	/						
4. Competitive Pressure	2.624	1.354	1.779	.56***	.63***	.60***	/					
5. Channel Conflict	3.034	1.448	1.077	.15	.22*	.19*	.18	/				
6. Resource Availability	4.151	1.436	2.114	-.03	-.05	-.007	.07	.09	/			
7. Top MGT Advocacy	4.294	1.418	2.013	.17	.10	.14	.18	.11	.69***	/		
8. Firm Size	4.805	1.915	1.124	.01	-.03	-.003	.06	-.04	.32**	.19	/	
9. Intention to Adoption	2.725	1.413	n/a	.68***	.69***	.70***	.61***	.15	.11	.25**	.10	/

* p <.05. ** p <.01. *** p < .001.

Table 5-1: Intercorrelation Matrix and Descriptive Statistics

Although it is common to see certain degree of correlations exist among the independent variables in social science research, the problem of multicollinearity should be detected. The multicollineraity was assessed by the variance inflation factor (VIF). As seen from Table 5-1 (column four), there are no problematic mutliconllinearity of note, since all of the VIF values are much lower than threshold value of 10 (Hair et al, 1998).

5.2. Test of Main Effects and Mediating effect

As discussed in Chapter Four, Baron and Kenny's three step procedure is used to assess the mediating effect. In step 1, I regressed the mediator (Attitude-towards-Adoption) on the independent variables (Table 5-2). It was indicated that the beta weights of Perceived-Relative-Advantage (β=.44***) and Perceived-Compatibility (β=.37***) were significant for the mediator (Attitude-towards-Adoption). The results show strong supports for Hypothesis 1a and 1b that the higher the perceived relative advantage and compatibility of online retailing, the higher attitude towards the adoption will be. Thus, the first requirement for the mediating effect was met since the independent variables are significant related to the mediator.

Variable	F	df	Adjusted R^2	β
Mediator: Attitude towards Adoption	33.999***	7	.69	
Perceived Relative Advantage				.44***
Perceived Compatibility				.37***
Competitive Pressure				.12
Channel Conflict				.02
IT Resource Availability				.02
Top MGT Advocacy				.005
Firm Size				-.01

* p <.05. ** p <.01. *** p < .001.

Table 5-2: Mediator Regressed on Independent Variable (Step 1 of the Mediator Test)

I regressed the dependent variable on the independent variables in step 2. Table 5-3 shows that the beta weights of Perceived-Relative-Advantage (β =.31**), Perceived-Compatibility (β =.30*) and Competitive-Pressure (β =.23**) are significant for the Intention-to-Adoption. The results indicated that the second requirement for the mediating effect is satisfied for those significant beta weights of Perceived-Relative-Advantage and Perceived-Compatibility since the two independent variables are significantly related to the dependent variable. Besides these, Hypothesis 2a was supported that the main effect between Competitive-Pressure and Intention-to-Adoption was significantly found.

Variable	F	df	Adjusted R^2	β
Dep. Var. : Intention to Adoption	19.622***	7	.55	
Perceived Relative Advantage				.31**
Perceived Compatibility				30*
Competitive Pressure				.23**
Channel Conflict				-.10
Resource Availability				.05
Top MGT Advocacy				.08
Firm Size				.06

Note. Dep. Var. = Dependent Variable

* p <.05. ** p <.01. *** p < .001.

Table 5-3: Dependent Variable Regressed on Independent Variables (Step 2 of the Mediator Test)

In step 3, I regressed the dependent variable on the mediator with the independent variables included. It is shown by Table 5-4 that the beta weight (β=.27*) of the mediator (Attitude-towards-Adoption) was significant for the Intention-to-Adoption. While comparing

the R-squares between Tables 5-3 and 5-4, it is indicated that Attitude-towards-Adoption contributes significant incremental change of R-square (0.57-0.55=0.02) in additional to all other predictor variables are entered. The Attitude-towards-Adoption explains significant portion of variance of the Intention-to-Adoption. The result provides a support for Hypothesis 1c that the attitude towards adopting online retailing is positively related to the adoption intention. It shows that the third requirement for the mediation was satisfied since the mediator variable is significantly related to the dependent variable with the independent variables entered.

Variable	F	df	Adjusted R^2	β
Dep. Var. : Intention to Adoption	18.593***	8	.57	
Perceived Relative Advantage				.19
Perceived Compatibility				.20
Competitive Pressure				.20
Channel Conflict				-.02
IT Resource Availability				.04
Top MGT Advocacy				.08
Firm Size				.06
Mediator: Attitude towards Adoption				.27*

Note. Dep. Var. = Dependent Variable

* p <.05. ** p <.01. *** p < .001.

Table 5-4: Dependent Variable Regressed on Mediators with Independent Variables Included (Step 3 of the Mediator Test)

Examining the three requirements, we can determine whether a partial or complete mediation is found. Table 5-4 shows that the beta weights of Perceived- Relative-Advantage and Perceived-Compatibility which are significant in step 2 (β =.31** and β =.30* respectively) were decreased and became non-significant in step 3 (β = .19 and β = .20 respectively). The statistical significance of the mediated effects i.e., the reduction in the effect of independent variables on dependent variable were assessed by dividing them by their standard error respectively, and provided the Z-score of the values. According to Goodman's (1960) equation, the mediated effects were significant (Z = 2.14 (>1.96) and 2.01 (>1.96), respectively). It was indicated that complete mediations were found and providing strong support for Hypothesis 1d. Thus, the attitude towards adopting online retailing mediates the relation between the perceptions (perceived relative advantage and compatibility) and intention of its adoption.

In sum, the complete mediating effects were presented for Perceived-Relative-Advantage and Perceived-Compatibility ➔ Attitude-towards-Adoption ➔ Intention-to-Adoption. Also, a main effect was found between the Competitive-Pressure and Intention-to-Adoption. That means, Hypothesis 1a, 1b, 1c, 1d, and 2a were supported; while Hypothesis 2b, 3a, 3b and 4 were not supported. The implication will be discussed in the next chapter. Figure 5.1 graphically shows the significant findings in the mediating effect and main effect.

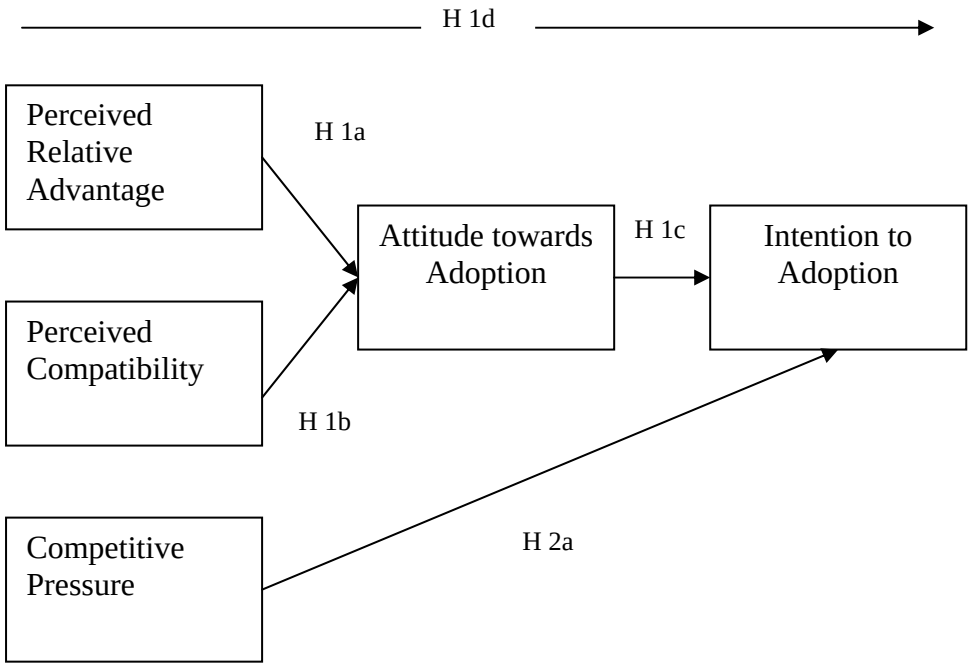

Figure 5.1: The Significant Findings of the Mediating Effect and Main effect

5.3. Test of Moderating Effect

Hierarchical regression analysis (Cohen al at., 2003) was used to test the moderating effect. The variables were entered into the regression equation in block-wises. The control variables (Perceive-Relative-Advantage and Perceived-Compatibility) were entered into the first block. These two variables were treated as control variable in this test as they are widely accepted by innovation research for explaining significant variance in intention to adopt innovation. Next, the other independent variables were entered into second block. Then, the moderator (Attitude-towards-Adoption) was entered into the third block. Finally, the interaction terms (independent variable x moderator) were entered into the last block. The centering procedure suggested by Aiken and West (1991) was used to recode the independent and moderator variables.

Table 5-5 shows the results of the hierarchical moderator regression. The result of model 1, 2 and 3 were parallel to those significant results of the mediator test. As expected, in model 1, the two control variables (Perceived-Relative-Advantage, β =.37** and Perceived-Compatibility, β =.39***) were significantly related to the Intention-to-Adoption. In model 2, the independent variable (Competitive-Pressure, β =.23**) was also significant related to the dependant variable. In model 3, the moderator (Attitude-towards-Adoption, β =.27*) was significantly related to the dependent variable.

Variables	Model 1	Model 2	Model 3	Model 4
Step 1: Control variable				
Perceived Relative Advantage	.37**	.31**	.19	.19
Perceived Compatibility	.39***	.30*	.20	.24*
Step 2: Independent variable				
Competitive Pressure		.23**	.20*	.20*
Channel Conflict		-.01	-.02	-.03
IT Availability		.05	.04	.04
Top MGT Advocacy		.08	.08	.10
Firm Size		.06	.06	.14*
Step 3: Moderator variable				
Attitude towards Adoption			.27*	.24*
Step 4: Interaction terms				
Attitude* Competitive Pressure				-.02
Attitude* Channel Conflict				-.06
Attitude* IT Availability				.05
Attitude* Top MGT Advocacy				.009
Attitude* Firm Size				.21**
R^2	.52	.58	.60	.64
Adjusted R^2	.51	.55	.57	.60
F	56.71***	19.62***	18.59***	13.168***
ΔR^2		.06*	.02*	.05*

* p <.05. ** p <.01. *** p < .001.

Table 5-5: Hierarchical Regression Analysis of Moderator Test for Intention to Adoption

In Model 4 of Table 5-5, the interaction term (Attitude-towards-Adoption*Firm-Size, β =.21**) was significant and explained a significant incremental portion of variance (ΔR^2 = .05*) when entered last after the other interaction terms were entered into the equation. It was indicated that the Hypothesis 3a* was supported that "Firm Size - Intention to Adopt" relation will be stronger for the firm with higher attitude towards the adoption. No significant results were found for the other four interaction terms that Hypotheses 2a*, 2b*, 3b* and 4* were not supported. To explore the nature of the significant interaction term, partial correlation between "Firm Size – Intention to Adopt" relation was computed separately for firm with higher attitude and lower attitude while controlling for the control variables. The high and low attitudes were divided by the cut-off point of 3.5 in the seven-point scale. It was found that Firm-Size was not significantly correlated to Intention-to-Adoption for firms with lower attitude (r = -.05, not significant); while Firm-Size was significantly correlated to Intention-to-Adoption (r = .29, $p < .05$) for high attitude firms. Figure 5.2 graphically reveals the effect by plotting the interaction between the Firm-Size and Attitude-towards-Adoption at mean (i.e., medium) as well as one standard deviation above (i.e., high) and below (i.e., low) in predicting adoption intention. Figure 5.2 indicates that adoption intention is greater where the attitude is positive than where it is negative at all levels of firm size. The effect is greater when the size of the firm increases. The greatest intention occurs when both firm size and attitude are high.

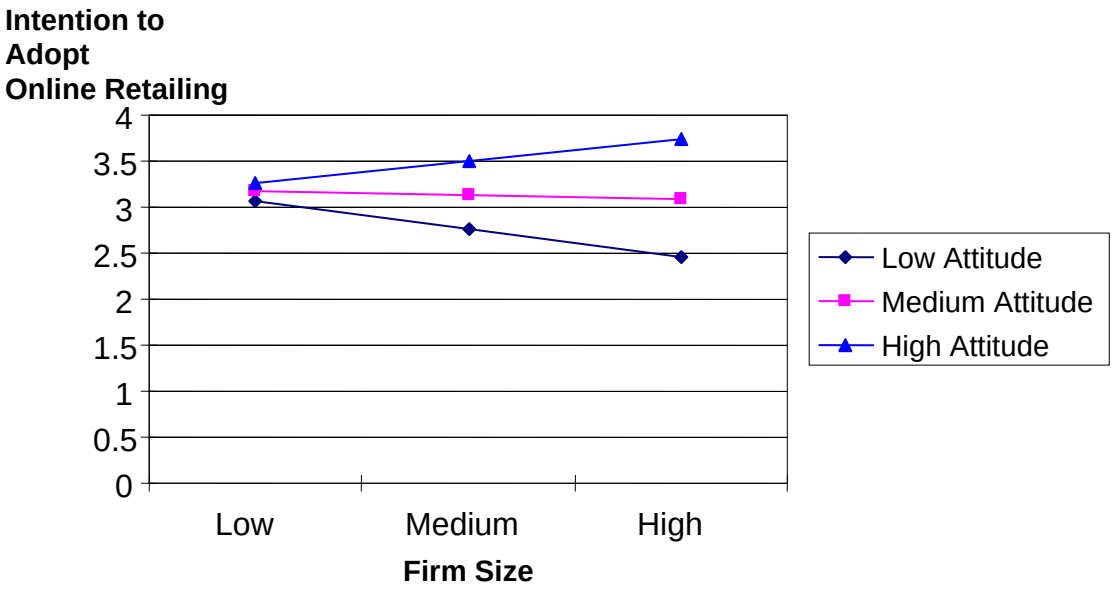

Figure 5.2: The Interaction of Firm size and Attitude towards Adoption in Predicting the Intention to Adopt Online Retailing

According to Cohen's (1988) calculation of effect sizes and the categories (0.02 = small, 0.15 = medium, and 0.35 = large), the effect size of the interaction term (f^2 = 0.14) was near to medium level. The calculation of the effect size (f^2) in the model as well as the power test are addressed in next part.

5.4. The Power Analysis of the Hierarchical Moderated Regression

Since four of five interaction terms were found insignificant, power analysis is critical in testing moderating effects for the insignificant interaction terms. Tests of hypothesis may be suffered by Type II error that true alternative hypotheses may be falsely rejected. The chance of the error can be reduced by sufficient power. According to Cohen et al. (2003), the effect sizes (f^2) is one of the most critical elements to determine the power. The effect size refers to

the ratio of portion of variance explained by the source to the anticipated error variance, which can be shown by the following equation.

$$f^2 = \frac{R^2_{Y \cdot A,B} - R^2_{Y \cdot A}}{1 - R^2_{Y \cdot A,B}}$$

From the hand calculation of the above equation, the effect size of the hierarchical moderator test: f^2= 0.05/1-0.64 = 0.14 (medium effect size according to Cohen's categories). I used the well-known computing software (G-power) to calculate the power level in post hoc mode by entering the effect size, alpha level, total sample size and number of predictors in the set of source. The value was above 0.8, the generally recommended power level (Cohen, 1988).

5.5. Chapter Summary

The chapter has conducted the two major tests: 1) main effect & mediating effect tests and 2) moderating effect test. It have been found that Attitude-towards-Adoption completely mediates the relationship between PCI (Perceived-Relative-Advantage and Perceived-Compatibility) and Intention-to-Adoption. Also, a main effect was found for the relationship between the Competitive-Pressure and Intention-to-Adoption. Also, one of the interaction terms has been found significant. It has been found that Attitude-towards-Adoption has a medium moderating effect, i.e., medium effect size, in the relationship between the Firm - size and Intention- to-Adopt. The nature of the moderating effect has been explored by the

partial correlation test. In particular, no relationship between firm size and adoption intention is found for firms where the attitude of the decision makers is less positive; but a relationship exists for the firms where the attitude of the decision makers is more positive.

CHAPTER SIX DISCUSSIONS

6. Introduction of the Chapter

Research findings on the determinants of innovation in organizations have been criticized as unstable across studies. Some of the inconsistent findings seem unreasonable and beyond interpretation (Downs and Mohr, 1976; Rogers, 1983; Wolfe, 1994). There are typical examples of the effects of firm size on the adoption of innovations. Explaining the inconsistent findings only by pointing to measuring errors, sampling biases or matters of the generalizability of research cannot help establish a more general theory of innovation. To determine the real relationships between the determinants and the adoption of innovations, the research posits and examines the mediating and moderating effect of the attitude of decision makers in predicting the intention to adopt technological innovations. Specifically, the study focuses on the adoption of online retailing. The research findings of the mediating role of attitude are in line with those of previous research studies, e.g., TRA. Based on this, this study extends the theory and determine the moderating effect of the attitude, which can explain the inconsistent effects of firm size. This provides a starting point for future studies to take into greater account the factors of mediation and moderation in determinant-innovation relations.

6.1. Mediating Effect and Main Effects

Perceived relative advantage and perceived compatibility have strongly positive effects on the intention to adopt online retailing. The findings are in line with Rogers'(1983 and

1995) arguments of and other innovation research that perceptions of adopting innovation explicitly influence its adoption intention. When an innovation is perceived as being better than the idea it supersedes, and bringing further advantages to a firm, it will be very likely to be adopted. Online retailing can be useful for improving organization image, extending customer markets and adding customer values. The more of these relative advantages are perceived, the higher the intention to adopt the innovation will be. Also, when the innovation is perceived as compatible to existing values, experience, and needs of a firm, it will be more likely to be adopted. For online retailing, decision makers have to consider their internal operation systems as well as external market channel to determine whether the innovation fits well with their circumstances or not. For example, the small or individual order sizes received online may be unfavorable to some mass production systems in terms of economy of scale; the direct online selling to end-user may threaten the middlemen and cause channel conflict; it may be unsuitable to sell fast moving products (e.g., soft drinks) online in a high density market (e.g., Hong Kong). Organizations perceived more compatibilities of online retailing will have higher adoption intention. In sum, it is empirically supported that perceptions of adopting an innovation have initially direct effects on the adoption intention of the innovation.

The research results further support that attitude towards innovation adoption completely mediates the perception-intention relationship. Through the attitude of decision makers, perceived relative advantage and compatibility of adopting the innovation have indirect effects on adoption intention. The two perceptions are positively associated with the attitude, and their direct effects on the adoption intention are dropped after the attitude is added into the relationship. The full mediation indicates that the attitude of decision makers can be the favorable or unfavorable evaluation of adopting an innovation, and this determines the

intention to adopt the innovation. In other words, decision makers will evaluate the adoption of an innovation based on such perceptions such as whether the innovation will bring additional advantages and, at the same time, be compatible with the current systems. The evaluation will result in a positive or negative attitude towards the adoption, and eventually affect the intention to adopt that innovation.

Competitive pressure was found directly influential to the intention to adopt. Organizations are reactive to their competitors. A rival environment makes the responses more quickly. It is suggested that firms will be more receptive to innovations in a more competitive environment (Gatignon and Robertson, 1989). The intensity of competitions can be attributed to the level of industrial concentration, price intensity, demand uncertainty and communication openness. In sum, firms under high competitive pressure have higher intention to adopt innovations (Teo et al., 2003; Warrts, 2002). This research confirms the argument for online retailing which can be a competitive weapon in a rival environment.

The relationship between channel conflict and intention to adopt online retailing is not supported. The direct-to-consumers channel enabled by online retailing could diminish the role of intermediaries in marketing channels**,** and the potential threats would induce channel conflict constraining an organization from adopting online retailing. However, the direct effect is not significantly found in the data analysis. The relationship may be suppressed by some variables such as relative channel powers. For example, when a manufacturer possesses a higher level of channel power due to its product brand (i.e., the firm has the coercive power if its middlemen rely on the product brand), the manufacturer may still be able to establish the online channel even though disagreements occur in some of its intermediaries. Besides,

the conflicts could be resolved by authorized agreements such as setting lower prices for a same model in physical outlets than those being offered on the web; restricting range of products offered online; and critically involving intermediaries in the overall order-fulfillment process.

The main effect of top management advocacy to new technologies, resource availability and firm size on the adoption intention are not found. It seems that the advocacy of top management to technology has no major influence on intention to adopt online retailing. With respect to the significant findings of perceived relative advantage, perceived compatibility and competitive pressure, it seems that performance, benefit, suitability and competitive advantage are more important factors of technological innovation than the advocacy itself in Hong Kong business. There is also no relation between resource availability and the adoption intention. It appears that resource availability has no influence on the intention, but does not mean that resource is not important. It is hard to believe that a firm lack both of current and future capabilities such as staff, capitals and equipments will still be eager to adopt technological innovations. It seems that the current availability of resources will not affect the intention to adopt innovation if it is not difficult to make or buy the resource in the near future. The adoption of online retailing demonstrates such case. The findings of this research may provide a theoretical explanation to the annual survey of the Census and Statistics Department on IT usage and penetration in 2002 (p.76) in which the costs of employing IT personnel (4.9%), procuring/developing software (6.7%) and procuring/maintaining computer equipments (8.7%) are relatively minor reasons against firms intending to sell by electronic means, in comparison with other major reasons such as popularity in industry (43.1%) and business benefits (38.7%). Respondents can choose more than one reasons in the survey.

When the costs to obtain the resources in the near future are not high, the available resource in hand tends to be a less necessary consideration of adopting the innovation.

Firm size has no main effect on intention to adopt the innovation. The determinant is one of the most inconsistent findings. However, a more meaningful result was found after the moderating effect was considered. The next section presents the implication of the interaction, which can explain some of the inconsistencies.

6.2. Moderating Effect

Research results support that the relationships between firm size and intention to adopt are contingent upon the attitude toward the innovation adoption, i.e., the moderating role of attitude. The contingency has been explicitly presented by the differential effects of firm size. Initially, no direct effect of firm size on adoption intention was found; while the interaction between firm size and attitude was found to be significantly related to the intention to adopt. Furthermore, no relation between firm size and adoption intention was found for firms where the attitude of the decision makers was less positive; but a relationship exists for the firms where the attitude of the decision makers was more positive. For firms with a negative attitude, firm size has no effect on the adoption of an innovation. Thus, large firms have no more intention to adopt than small firms. For organizations with a more positive attitude towards the innovation, bigger firms are more likely to adopt it. Thus, firm size has a positive effect on the adoption of innovations. In sum, a larger firm tends to have more capability in terms of capital, human resources, and the ability to mass produce, to adopt a technological

innovation. However, these capabilities would only give rise to the intention to adopt the technology when a positive attitude is held by decision makers toward the innovation.

The moderating effect provides a conceptual explanation of the inconsistent effects of firm size on innovation. While some studies have found that larger firms are more likely to adopt technological innovations, others have not found the existence of such a relationship. In fact, the differential findings may indicate some moderating variables in the relationship between firm size and the intention to adopt, rather than unstable research results. The results found that firm size has no effect on the intention to adopt for all types of firm, and for firms with a less positive attitude towards the innovation; but has a positive effect for firms with a more positive attitude. Rather than being inconsistent, these findings show the moderating effects of the attitude held by decision makers. In other words, the impact of firm size on the intention to adopt an innovation may be contingent upon the attitude. The differential effects can be conceptually explicated after the moderating role of attitude is taken into account. The findings empirically provide a starting point for future studies to take moderator variables into greater consideration, i.e., interactions in the research framework of innovation studies. Although the theoretical importance of interactions in innovation research was raised by Downs and Mohr in 1976, it seems that the effect was often neglected in previous studies. More of the effective moderator variables should be found in future research on innovations to establish a more general theory of innovations. This research is one such theoretical and empirical attempt.

It is interesting that the interaction terms of competitive pressure are not found. It seems that the attitude does not moderate the relationship between competitive pressure and

adoption intention. However, it is found that the competitive pressure does have direct effect on the adoption intention. It is also reasonably supposed that competitive pressure can have influence on the attitude, too. The concept of pressure, in fact, tends to be an intangible beliefs on some behaviors. In other words, it can be also a perception of performing or not performing a behavior. If we treat competitive pressure as a perception of innovative behavior, the determinant can be renamed as “perceived competitive pressure”. It can be the third perception other than perceived relative advantage and compatibility, which affects the attitude. Thus, the conceptual relationship among competitive pressure, attitude and adoption intention can be a mediation instead of moderation.

For channel conflict, attitude is not found as the moderator for the relationship between the variable and the dependent variable. Other potential moderator variables was provided. The interactions between the attitude and resource availability as well as top management advocacy to technology are not found. There may be other effective moderator variables in the relations.

6.3. Chapter Summary

In this study, the moderating and mediating effects of attitude towards innovation have been examined on the relations between a number of innovation determinants and intention to adopt online retailing of organizations. The attitude moderates the relationship between firm size and the intention. Larger firms tend to be more capable to adopt a technological innovation. However, these capabilities would only give rise to the intention to adopt the technology when a positive attitude is held by decision makers toward the innovation. The

moderating effect provides a conceptual explanation for the differential effects of firm size on the intention to adopt innovation, which have been recognized as inconsistent findings in innovation research. The results also support that the attitude mediates the relations between perceived relative advantage, perceived compatibility of the innovation and the adoption intention. The two perceptions have indirect effects on the adoption intention through the attitude. Beside these, high competitive pressure would make a firm more willing to adopt the innovation. Current resource availability may not be absolutely necessary for the adoption of online retailing when it is not difficult to obtain the resource in the near future. Generally speaking, it seems that performance, benefit, suitability and competitive advantage are more important factors affecting adoption of online retailing than the advocacy to new technology in Hong Kong business.

CHAPTER SEVEN RESEARCH IMPLICATIONS AND CONCLUSION

7. Introduction of the Chapter

The major research problem of this study is to find out the determinants of the intention to adopt technological innovations in organizations. This research summarizes and explains some of the inconsistent findings on recent technological innovation studies. A number of implications for establishing research frameworks of innovation studies are derived according to the insights gained from the review. A conceptual framework of adopting online retailing is proposed. The determinants are comprised of four comprehensive aspects: 1) perceived characteristics of innovation, 2) environmental characteristics, 3) organizational characteristics and 4) top management characteristics. This chapter presents the theoretical contribution and managerial implications of the study, and the research limitations are discussed. Then, the future directions of research are addressed. Finally, the conclusion will be drawn.

7.1. Theoretical Contribution

The research empirically found the mediating and moderating effects, which can enrich the innovation theories. For the mediating effect, it is indicated that perception of adopting technological innovations has an indirect effect on the intention to adopt the innovation through the attitude towards the innovation adoption. Furthermore, a moderating effect of the

attitude are found. It appears that not all of the larger firms would have higher intention to adopt the technological innovation; rather, only those larger firms where decision makers have positive attitude toward the innovation adoption would have such higher innovative intention than small firms.

7.1.1. Analysis of Moderation Model (Interactions)

Downs and Mohr (1976) recommended that interactions among variables be used in innovation research. However, it seems that the effects have often been neglected in past studies. This research provides an attempt to consider the moderating effects in innovation research. Future studies should consider more of the moderator variables.

7.1.2. The Conceptual Explanation for the Past Inconsistent Findings

The moderating effect potentially provides a new theoretical interactions among past innovation determinants meanwhile a conceptual explanation for the past inconsistent findings. As discussed, the differential effects of firm size on adoption intention would be conceptually explainable after the moderating effect of attitude has been taken into account. This conceptual relationship can be a potential explanation for other inconsistent findings of effects of innovation determinants. More moderating effects can be investigated consolidating the theory. In sum, the research makes contributions by adding the moderating effect of the attitude to innovation theories.

7.1.3. Application of the Mediation Model to Online Transaction

The findings of the mediating effect confirm the famous theories of reasoned action (Fishbein and Ajzen, 1975). The research makes contributions by applying the mediation model to investigate organizations' adoption of online transactions.

7.1.4. The Critical Review on the Recent Innovation Research

A literature review is conducted to highlight the inconsistent finding of different determinants. It depicts a clear picture of the inconsistencies with the research designs (i.e., the innovation typology, innovation stage and organizational context). From the review, a number of implications are derived for establishing frameworks in innovation research. The review generally provides the overview of the stable findings (e.g., PCI) and unstable findings (e.g., organizational characteristics) in the determinant – innovation relations. Based on the classic innovation research and critiques of the inconsistencies, potential reasons are provided.

7.2. Managerial Implications

The amazing growth of online transactions has drawn great commercial attention in various industries. However, while there are abundant studies of online shopping from customer perspectives, few studies provide empirical investigation from the view of sellers. Figuring out the major determinants of adopting online retailing is useful for managers to evaluate internal (e.g., potential advantage, fitness, and resource competence) and external factors (e.g., competitive pressure) of their firms for online decisions. It is found that the

relative advantage (e.g., firm's goodwill and competitiveness), and compatibility (e.g., product nature, marketing strategies and type of operations) are the most important considerations. These critical dimensions provide a roadmap for managers to evaluate their organizational contexts while considering whether the adoption of online transactions is favorable or not. Also, competitive pressure is the another major factor. The popularity of the innovation in rivalries should be another concern for managerial decisions. Resource availability, on the another hand, seems not a necessary prerequisite for the adoption. It is suggested that developing and procuring costs of the staff and equipment of online retailing may not be a major consideration for managers. Therefore, decision makers should not overlook the barriers of resource availability in the online decisions. Channel conflict induced by online direct selling still seems a potential threat for organizations. However, it is believed that the conflict can be resolved by agreements among the business partners. Agreements include the pricing strategies, selection of product catalogs, and authorized intermediary involvements in the order fulfillment processes between the online and physical markets. All of the issues provide insights for managers to position their organizations in the development of online retailings.

7.3. Limitations of the Research

The findings of the study have the following limitations which should be recognized.

1) The question items were filled by single informants per organizations. Potential response bias can be induced by some subjective values of the individual who cannot exactly represent the whole organization. With respect to the issue, CEOs, directors or top managers

were chosen as the key informant according to the guidelines suggested by Huber and Power (1985) for research with single informants per organizations. These informants were believed to answer the questions in organizational perspectives due to their positions and the explicit firm-level wordings in the questionnaires.

2) This research focus on particular stage of innovation, i.e., initiation. However, organizational behaviors change over time, especially in the implementation stage of the innovation. Multiple stages can be carried out to paint a dynamic picture of the innovation diffusion and actual usage given that potential problem of the aggregations across the stages mentioned is carefully handled. Also, the research framework focuses on adoption of online retailing. The classification of the innovation typology is based on the primary innovation attributes by which online retailing distinguishes itself from other type of innovations. It provides an objective and confirmed classification but, meanwhile, limits the generalizability of the study. The classification of innovation typology can be extended to more general concepts by using some subjective criteria.

3) The research does not include the cultural factors among countries. Since the research was conducted in Hong Kong, it may limit the generalizability of the findings to the organizations in the similar institutional context. In fact, Hong Kong as an international metropolis in which Eastern and Western corporate cultures are influential to organizations may improve the generalizability. However, it is suggested that concern be made to the differential effects of cultural factors on innovations while comparing the results to organizations other than Asia- pacific regions. Future study can extent the research by adding such cultural factors to the framework.

7.4. Future Directions of Research

The discussion of the research findings and limitations provide some directions for future research.

The research results support the mediating effect of attitude in the relation between perception, and intention of adopting innovation. A number of theoretical extensions can be based on the mediation model. First, there are some other potential dimensions of the perceptions other than perceived relative advantage and compatibility. As discussed, (perceived) competitive pressure may be one of the candidates. The concept of pressure can be an intangible value of performing or not performing a behavior, which can be influential to attitude towards the behavior. In fact, the findings of this research has already found the initial effect of the competitive pressure on adoption intention. Future studies can further test if there is any significantly drop of the effect after the attitude is entered into the relation given that the competitive pressure is a predictor variable of attitude. If the initial effect drops, it is very likely that perceived competitive pressure becomes the one of the perceived characteristics of innovation in the mediation model. Other potential dimensions of perception include the perceived trialability and observability suggested by previous innovation research. Future studies can base on these candidates to develop new measuring instruments and constructs.

Another potential extension of the mediation model is the actual usage of innovation. The dependent variable of the research regards only the intention to adopt innovation. It is believed that higher intention predicts higher actual usage. However, it cannot guarantee the

actual adoption of the innovation. It is a research gap for future studies to find out other determinants of the actual adoption. Also, further mediating and moderating effect can be found in the intention-usage relation.

The research also supports a moderating effect of the attitude. It provides a starting point for future research to consider more interactions in innovation research. The insignificant interaction terms found in this research may indicate some other moderator variables behind, which can provide other three-way interactions on the basis of the attitude.

The research choose a less aggregated research design in innovation typology and diffusion stage according to Downs and Mohr's (1976) recommendations. The specific research design increases the internal validity of the framework but limit the research generalizability. For the innovation stage, the cross sectional investigation in the research addresses the innovation in a particular period. In fact, organizational behaviors change over time, especially in the implementation stage of the innovation. Longitudinal studies can be carried out to paint a dynamic picture of the innovation diffusion in multiple stages. Studying the same innovations in multiple periods of time avoids the potential problem of aggregating the measuring items of multiple stages in one study. The selection of determinants may be different in different periods. In fact, researchers can purposely use same determinants (e.g., organizational formalization/centralization) which are believed to have differential effects in different diffusion stages of to see the change of the effects. Such longitudinal studies can be a more meaningful picture of the innovation diffusion. For the innovation typology, the classification can be extended to more general concepts by using some subjective criteria. Wolfe (1994, p. 419) summarized a list of innovation attributes which can be used to make a

more general classification of innovation. It is suggested that different nature of innovation typologies (e.g., technological and administrative innovation) should be addressed. Those innovation attributes can provide a general research for a more global understanding of innovation. Meaningful comparison between the research of different innovation types can be made while innovation attributes are explicitly defined in the studies.

7.5. Conclusion of the Research

The well-known innovation theories provide the theoretical foundation for investigating adoption of technological innovation. However, the research findings of the effects of innovation determinants have been criticized as inconsistent across studies, which confuse predictive powers of the determinants. It is indicated that more research insights be added into the theories.

This research has potentially significant implications for studies of technological innovations. This research contributes to an understanding of mediating and moderating roles of the attitude of decision makers in predicting the intention to adopt technological innovations. The results indicate that attitude mediates the relationship between perception and the intention to adopt an innovation. Attitude is the totally favorable or unfavorable perception about adopting an innovation; and determines the intention to adopt that innovation. Furthermore, attitude, as the evaluative effect, moderates the relationship between firm size and the intention to adopt. In other words, the effects of firm size tend to be contingent upon attitude. This provides a potentially conceptual explanation for the inconsistent effects of determinants in innovation research. This research empirically

provides a starting point for future studies to take into consideration more moderators in the determinant-innovation relations to establish a more predictive and general theory of innovation.

Appendix A

English Version of the Cover Letter and Questionnaire

SURVEY ON ORGANIZATION'S INTENTION OF ADOPTING ONLINE SELLING

Dear Entrepreneurs,

We are conducting a study of the innovative behavior of organizations with respect to online sales. Online transactions, with a surprising growth worldwide in the past decade, are recognized as one of the major innovations altering business models. The objective of this research is to help entrepreneurs identify business opportunities and position their company in the e-business. We are pleased to invite you to participate in this survey and send you a useful summary of the results after analysis. Your company has been carefully chosen, and your response is very important to the research. Your information will be kept confidential.

Please note the points in completing the questionnaire

Definition of the major term. Online selling is defined as selling products, services or information to consumers through the Internet and receiving online or offline payments.

Informants. The questionnaire should be completed by top management members e.g. the CEO, GM, or marketing managers, etc.

Return date. Please return your completed questionnaire in the self-addressed and pre-paid envelope before 31 March 2004.

For enquiry or assistance in completing this questionnaires, please contact Mr. March TO at 2766 /9577

Yours sincerely

Mr. March TO
Project Planner

Dr. Eric NGAI
Asso. Professor, Chief Supervisor.

SURVEY ON ORGANIZATION'S INTENTION OF ADOPTING ONLINE SELLING

CONFIDENTIAL

Please note the points in completing the questionnaire

Definition of the major term. Online selling is defined as selling products, services or information to consumers through the Internet and receiving online or offline payments.

Informants. The questionnaire should be completed by top management members e.g. the CEO, GM, or marketing managers, etc.

Return date. Please return your completed questionnaire in the self-addressed and pre-paid envelope before 23rd April 2004.

For enquiry or assistance in completing this questionnaires, please contact Mr. March TO at 2766 /9577

PART A: Company Profile

1. Please *tick* ONE box below which best indicates your major business nature.

❑Manufacturing (Please specify major products: _____)
❑Wholesaling, retailing or import/export trades (Please specify major products:_____ _____)
❑Transport, storage or communications: _____)
❑Business Services (Please specify major services: _____)
❑Others (Please specify: _____)

2. Please tick the box(es) to indicate your firm's current Internet usage/application.

❑Internet connection
❑Electronic mail
❑Web page or Website only
❑Provision of products, services or information through the Internet free of charge.
❑Online Selling i.e. Selling products, services or information to consumers through the Internet and receiving online or offline payments.

3. Annual business revenue of your company: HK$_____

4. Total number of employees in your company: _____

5. Major market(s) of your company:_____

6. Location of your company's parent company or head quarters:_____(e.g. HK, USA, UK)

PART B: Your Firm's View of Adopting Online Selling i.e. selling products, services or information to consumer through the Internet (Please rate the following statement on a seven-point scale i.e. from 1=strongly disagree to 7=strongly agree by circling the most appropriate number).

I. Regarding your business nature, do you think adoption of online selling (i.e. selling products, services or information through the Internet) brings advantages to your firm?

Regarding our business nature:	**Strongly Disagree**						**Strongly Agree**
1. Adopting online selling increases our business opportunities.	1	2	3	4	5	6	7
2. Adopting online selling enhances our competitiveness.	1	2	3	4	5	6	7
3. Adopting online selling improves our customer services.	1	2	3	4	5	6	7
4. Adopting online selling adds value for our customers	1	2	3	4	5	6	7
5. Adopting online selling improves our goodwill.	1	2	3	4	5	6	7

II. Do you think adoption of online selling (i.e. selling products, services or information to consumer through the Internet) fits well with your firm?

	Strongly Disagree						**Strongly Agree**
6. Adopting online selling fits well with our product/service nature.	1	2	3	4	5	6	7
7. Adopting online selling fits well with our firm's selling strategy.	1	2	3	4	5	6	7
8. Adopting online selling fits well with the way our firm likes to sell.	1	2	3	4	5	6	7
9. Adopting online selling is well compatible with our firm's operations.	1	2	3	4	5	6	7

III. What is the top management's overall attitude toward adoption of online selling i.e. selling products, services or information through the Internet ?

	Strongly Disagree						**Strongly Agree**
10. Adopting online selling in the near future is recognized as a good idea in our firm.	1	2	3	4	5	6	7
11. We take a positive attitude toward adopting online selling in the near future.	1	2	3	4	5	6	7
12. We think adopting online selling in our firm in the near future is reasonable.	1	2	3	4	5	6	7

IV. What is the business environment of your firm?

	Strongly Disagree						**Strongly Agree**
13. Our firm is now facing active competition in the area of online business.	1	2	3	4	5	6	7
14. Our competitors have begun to actively offer online services.	1	2	3	4	5	6	7
15. The leading firms in this industry are active in establishing online business.	1	2	3	4	5	6	7
16. If our firm does not undertake online business, we may lose edge over competitors.	1	2	3	4	5	6	7
17. Being ahead of our competitors' online business capability is a key factor in our online business initiative.	1	2	3	4	5	6	7
18. Online selling negatively affects the relationships between our firm and our marketing partners (e.g. middlemen, agents, or dealers).	1	2	3	4	5	6	7
19. The relationship between our firm and marketing partners (e.g. middlemen, agents, or dealers) is prone to conflict due to our firm's online selling.	1	2	3	4	5	6	7
20. There is risk of retaliation by current marketing partners (e.g. middlemen, agents, or dealers) if our firm sells online.	1	2	3	4	5	6	7

V. How ready is your firm's resources and top management support for IT development?

	Strongly Disagree						Strongly Agree
21. Our firm possesses advanced IT systems.	1	2	3	4	5	6	7
22. Our firm provides good IT support to employees.	1	2	3	4	5	6	7
23. Our firm has competent IT staff.	1	2	3	4	5	6	7
24. Our firm has capable resources to develop IT in our business.	1	2	3	4	5	6	7
25. Top management keeps telling subordinates that this firm must gear up now to meet changing technology trends.	1	2	3	4	5	6	7
26. Top management makes an effort to convince subordinates of the benefits of new technology.	1	2	3	4	5	6	7
27. Top management encourage subordinates to develop and implement new technology.	1	2	3	4	5	6	7
28. Top management is frequently the most enthusiastic party of adopting new technology.	1	2	3	4	5	6	7
29. Top management is adventurous to adopt technology.	1	2	3	4	5	6	7
30. Top management believes that the higher financial risks of adopting technology are worth the higher rewards.	1	2	3	4	5	6	7

VI. What is your firm's plan to adopt online selling i.e. selling products, services or information through the Internet? **(Please go to Part C if your firm <u>has already adopted</u> online selling.)**

	Strongly Disagree						Strongly Agree
31. Our firm is likely to adopt online selling in the near future.	1	2	3	4	5	6	7
32. Our firm plans to adopt online selling in the near future.	1	2	3	4	5	6	7
33. It is our intention to develop online selling in the near future.	1	2	3	4	5	6	7

PART C: Personal Profile (Strictly Confidential)

1. Your gender:

- ❑ Male
- ❑ Female

2. Your age:

❑ 20-25 ❑ 26-30 ❑ 31-35 ❑ 36 or above

3. Please choose ONE box representing your position in your firm.

- ❑ Owner / CEO /Director
- ❑ Manager
  - ❑ General Manager
  - ❑ Marketing Manager
  - ❑ IT Manager
  - ❑ Other Manager
- ❑ Others (Please specify: _____)

Thank you for participating in this research. To express our appreciation, we will be pleased to send you an executive summary of this *survey*. Please either provide your contact information below or simply send a business card to us, together with this completed questionnaire.

Contact person: _____
Phone number: _____Email:_____
Company name: _____
Company address: _____

Thank you again for your participation in this study! Please return your completed questionnaire in the reply envelope provided to:

Department of Management and Marketing
The Hong Kong Polytechnic University
Attn: Mr. March TO

Appendix B

English Version of the Reminder Card

Dear Director/Manager,
Re: Reminder of Survey on Intention of Online Selling Adoption

About four weeks ago, a questionnaire seeking your opinion about adoption of online selling was mailed to you. The objective of this project is to help entrepreneurs identify business opportunities and position their company in the e-business. We would like to send you a useful summary of the results after analyses.

If you have already completed and returned the questionnaire to us, please accept our sincere thanks. If not, we would be grateful if you can do so today. Your opinion is very important to the survey.

If you did not receive a questionnaire, or if it was misplaced, please contact Mr. March TO at 9577 / 2766- . We are pleased to mail you another one today. Thank you for your participation. We look forward to your valuable insights.

Appendix C

Result of the Test of Non-Response Bias

Group Statistics

	Reponse Bias	N	Mean	Std. Deviation	Std. Error Mean
Perceived relative advantage	Normal mailing period	104	4.2673	1.70336	.16703
	Out of normal mailing period	36	4.2389	1.63310	.27218
Perceived compatability	Normal mailing period	104	3.4567	1.74303	.17092
	Out of normal mailing period	36	3.4236	1.74828	.29138
Attitude	Normal mailing period	103	3.9288	1.76547	.17396
	Out of normal mailing period	36	3.8519	1.97033	.32839
Competitive pressure	Normal mailing period	104	3.1654	1.70013	.16671
	Out of normal mailing period	36	3.4056	1.79299	.29883
Channel conflict	Normal mailing period	103	3.0097	1.40297	.13824
	Out of normal mailing period	36	3.2130	1.56175	.26029
IT Availability	Normal mailing period	104	4.3774	1.52169	.14921
	Out of normal mailing period	36	4.8056	1.47613	.24602
T.MGT's advocacy	Normal mailing period	104	4.6130	1.47342	.14448
	Out of normal mailing period	36	4.5903	1.41188	.23531
Firm size	Normal mailing period	104	4.7379	1.66933	.16369
	Out of normal mailing period	35	6.0259	2.13687	.36120
Intention	Normal mailing period	82	2.8049	1.45528	.16071
	Out of normal mailing period	27	2.4815	1.27210	.24482
Annual revenue	Normal mailing period	88	333.7966	1015.66152	108.26988
	Out of normal mailing period	17	309.0000	287.39694	69.70400

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Perceived relative advantage	Equal variances assumed	.069	.794	.087	138	.931	.0284	.32599	-.61617	.67300
	Equal variances not assumed			.089	63.275	.929	.0284	.31935	-.60969	.66653
Perceived compatability	Equal variances assumed	.003	.960	.098	138	.922	.0331	.33731	-.63385	.70009
	Equal variances not assumed			.098	60.784	.922	.0331	.33781	-.64242	.70866
Attitude	Equal variances assumed	1.796	.182	.218	137	.827	.0770	.35238	-.61985	.77375
	Equal variances not assumed			.207	55.889	.837	.0770	.37162	-.66752	.82142
Competitive pressure	Equal variances assumed	.431	.513	-.720	138	.473	-.2402	.33341	-.89941	.41907
	Equal variances not assumed			-.702	58.258	.486	-.2402	.34219	-.92507	.44473
Channel conflict	Equal variances assumed	1.199	.276	-.726	137	.469	-.2033	.27981	-.75656	.35005
	Equal variances not assumed			-.690	56.000	.493	-.2033	.29472	-.79366	.38715
IT Availability	Equal variances assumed	.519	.472	-1.466	138	.145	-.4282	.29204	-1.00561	.14931
	Equal variances not assumed			-1.488	62.607	.142	-.4282	.28774	-1.00322	.14691
T.MGT's advocacy	Equal variances assumed	.422	.517	.081	138	.936	.0227	.28195	-.53480	.58020
	Equal variances not assumed			.082	63.306	.935	.0227	.27613	-.52904	.57445
Firm size	Equal variances assumed	1.678	.197	-3.668	137	.000	-1.2880	.35111	-1.98234	-.59374
	Equal variances not assumed			-3.248	48.722	.002	-1.2880	.39656	-2.08507	-.49101
Intention	Equal variances assumed	.883	.349	1.032	107	.305	.3234	.31351	-.29810	.94489
	Equal variances not assumed			1.104	50.241	.275	.3234	.29285	-.26474	.91154
Annual revenue	Equal variances assumed	.684	.410	.100	103	.921	24.7966	249.11113	-469.257	518.84976
	Equal variances not assumed			.193	89.997	.848	24.7966	128.76729	-231.022	280.61539

Appendix D

The Manuscripts Derived from the Thesis and Submitted to the Academic Journals

TO, M. L. and NGAI, E. W. T. Firm Size and Adoption of Technological Innovations: The Moderating Role of Decision Makers' Attitude. Journal of Business Research. (2005)

TO, M. L. and NGAI, E. W. T. Determinants of Technological Innovation Adoption: A Critical Review and a Research Agenda. Creativity and Innovation Management. (2005)

TO, M. L. and NGAI, E. W. T. The Mediating and Moderating Roles of Decision-Makers' Attitude in the Adoption of Technological Innovations Journal of Asia-Pacific Journal of Management. (2005)

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