



The adoption of techno-relationship innovations

A framework for electronic customer relationship management

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Abstract

Purpose – The purpose of this paper is to develop a comprehensive research framework for understanding the adoption of techno-relationship innovations. The second purpose is to examine the factors influencing the adoption of electronic customer relationship management (eCRM) applications.

Design/methodology/approach – Existing adoption models were discussed and merged. Twenty potential determinant factors were proposed and a survey was conducted using a self-administered questionnaire. Data were collected from 508 manufacturing small and medium manufacturing enterprises (SMEs) in Thailand. Hypotheses were tested using discriminant analysis.

Findings – The research framework was validated. Seventeen factors have the ability to discriminate between eCRM adopters and non-adopters. However, multivariate statistical analysis suggests that 12 factors have acceptable discriminate power and should be given priority. The top five influential factors are compatibility, industry pressure, customer pressure, subjective norm, and attitude.

Research limitations/implications – The study proposes a comprehensive research model for examining the adoption of techno-relationship innovations. The model covers 20 factors from individual, technological, organisational, and environmental contexts. The empirical investigation is based on an Asian perspective but the research model is equally applicable in other countries.

Practical implications – The findings offer guidance to government/private agencies and technology suppliers who wish to encourage the adoption of the application of eCRM and its relevant components among manufacturing SMEs.

Originality/value – The concept of techno-relationship innovation is introduced. The study suggests an inclusive way to understand factors influencing the adoption of techno-relationship innovations.

Keywords Customer relations, Thailand, Small to medium-sized enterprises, Electronic commerce, Technology led strategy

Paper type Research paper

1. Introduction

Information technology (IT) plays a significant role in business manoeuvres nowadays. Business competition has been affected by the progression of IT (Porter and Millar, 1985). Firms have developed a number of IT-related innovations in order to outperform their rivals. The proper adoption of IT innovations can improve a firm's performance and eventually lead to competitive advantage. As suggested, customer relationship is seen to be a key factor in determining the success or failure of business. Companies who focus on their customers' needs and wants are in a better position to achieve long-term success than those who do not (Jaworski and Kohli, 1993; Kotler, 2000; Levitt, 1960; Webster, 1988). This is evident from a number of empirical studies



demonstrating that being a customer-oriented firm relates positively to business performance (Baker and Sinkula, 1999; Matsuno and Mentzer, 2000; Narver and Slater, 1990). From a marketing perspective, IT plays an important role in enabling a firm to manage its relationships with customers more efficiently and effectively. In many cases, satisfied customers are less likely to switch to competitors, making it difficult for competitors to enter the market or gain market share (Buchanan and Gilles, 1990).

While there is an extensive body of literature on IT innovation adoption and implementation, there is scant research on the adoption of IT innovation aimed specifically at performing relationship marketing tasks. In addition, the existing adoption models are fragmented and provide incomplete explanations of the occurrence of innovation adoption. To date, the studies employing adoption models have included a variety of variables to explain the phenomena, resulting in inconsistency in the naming, grouping, and boundaries of the variables. This leads to confusion for government/private agencies and technology suppliers attempting to promote the adoption of these IT-related innovations. There is a lack of comprehensive framework which covers all aspects of potential factors which may influence a firm's adoption decision. The absence of such a research domain forms the basis of the present study.

In this study, the term "techno-relationship innovation" is proposed and defined as a technology-related idea, process, method, product, or service that is intended to perform relationship marketing tasks and which is perceived as new to an individual or a firm. Depending upon how it is perceived and used, a techno-relationship innovation can be a self-service machine, an SMS alert service, a web site, a cell phone, a newsletter, an email system, a blog, a specific software solution, promotional campaigns, etc. The essential issue is that it needs to be perceived as new and that it has the ability to perform a relationship marketing function.

The study's principal aim is to develop a comprehensive research framework for understanding the adoption of techno-relationship innovations. This is achieved by consolidating adoption models and the multitude of factors in the literature regarding the adoption and use of IT innovations. The second aim is to empirically validate the research framework within a specific techno-relationship innovation of an electronic customer relationship management (eCRM) application. It is expected that the outcomes would provide insightful guidance to government and private agencies that want to promote the adoption of eCRM applications, especially marketing managers who work for technology vendors.

The paper is organised as follows. The following section provides the theoretical background for developing a conceptual research framework. A research model is drawn and clear definitions of potential factors are given. Next, research hypotheses are developed for empirical investigation. The research methodology, data analysis, and results are presented. Then, the research findings and implications are discussed. The study's limitations and suggestions for further research are also provided.

2. A conceptual framework

Research on the adoption of innovations has been conducted for a variety of business aspects using a variety of theoretical frameworks. This research stream covers many types of businesses and industries at individual and organisational level. Consequently, there is a diversity of terminologies used in this research stream. Broad terminology commonly found in the literature includes information system (IS),

IT, information and communication technology (ICT), and management of information system (MIS). These terms are not clearly distinct from each other. They are connected to technology and sometimes substituted and used interchangeably. They all share a basic notion about using some forms of technology to manage information for a specific purpose. Thus, it could be said that the studies related to IS, IT, ICT, and MIS adoption are applicable to the present study. The term IT is a common term and even used in a broad way to describe a collection of several practices in IS, ICT, and MIS. Then, this study uses the term IT in this broadest concept.

Based on the literature, widely used theoretical constructs include the technology acceptance model (TAM) (Davis, 1989; Davis *et al.*, 1989; Venkatesh and Davis, 1996), the theory of planned behaviour (TPB) (Ajzen, 1991; Mathieson, 1991; Taylor and Todd, 1995), the social cognitive theory (SCT) (Compeau and Higgins, 1995; Compeau *et al.*, 1999; Hill *et al.*, 1987), and the diffusion of innovation (DOI) (Moore and Benbasat, 1991; Rogers, 1962). These studies offer valuable insight into the cognitive, affective, and behavioural reactions of individuals to technology, and also into the factors that influence their reactions. It appears that the TAM, TPB, SCT, and DOI have been extensively employed for examining the factors affecting decisions to adopt several technological innovations, whether it is IS, IT, ICT, or MIS. It could be argued that there is no one single model which is superior to any other. Each model has its strengths and weaknesses. It is apparent that there are similarities and differences in the theoretical constructs of the four models. In fact, the four models share several common characteristics that overlap each other. The present study applies these four models and consolidates them into a single research framework.

2.1 The conjunction of the four adoption models

The TAM, TPB, SCT, and DOI are similar in that they tend to predict and explain individuals' behaviour toward technological innovation (e.g. adopting, implementing, using). However, these models are inconsistent in the focused context and terminology used in their theoretical constructs. In other words, in each model, behaviour is determined by a set of beliefs toward particular innovation and a set of affective responses to that behaviour. The beliefs and affective responses are demonstrated by perceived usefulness and perceived ease of use in TAM; by attitude, subjective norm, and perceived behavioural control in TPB; by self-efficacy, affect, anxiety, and outcome expectations in SCT; and by the perceived characteristics of innovation in DOI. These factors are typically used as independent variables that influence technology adoption either positively or negatively. It can be argued that some factors are similar and thus, they are merged into a single factor to reduce repetition. Some factors are renamed and some terminologies are used as they are.

2.1.1 Attitude. In the TPB model, an attitude is defined as "an individual's positive or negative feelings (evaluative affect) about performing the target behaviour" (Fishbein and Ajzen, 1975, p. 216). In other words, if the outcome of behaviour is mentally evaluated to benefit the individual, he/she may intend to perform that behaviour, but if it is evaluated to be disadvantageous, he/she may decide not to perform the particular behaviour. The two constructs of the SCT model, affect and anxiety, can be merged into this construct since affect represents the positive side while anxiety reflects the negative side of an individual's feeling. Based on the SCT model proposed by Compeau and Higgins (1995), affect refers to an individual's liking for a particular behaviour whereas

anxiety evokes anxious or emotion reactions toward performing a particular behaviour. These meanings correspond and can be seen as a subset of attitude. Thus, affect and anxiety in SCT model are merged with attitude in TPB model. The terminology of attitude is thus used as the overall descriptor in this study.

2.1.2 Perceived advantage. This construct is a combination of perceived usefulness in TAM, outcome expectation in SCT, and relative advantage in DOI. Perceived usefulness refers to “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989, p. 320) whilst outcome expectation is “the perceived likely consequences of using computer” (Compeau *et al.*, 1999, p. 147). Relative advantage refers to “the degree to which an innovation is perceived as better than the idea it supersedes” (Rogers 2003, p. 229). From these definitions, it is clear that they all emphasize the advantages accrued from adopting technology. Thus, it could be argued that they are compatible and can be categorised in one single construct. The terminology of perceived advantage is thus applied and defined as the degree of advantage which a techno-relationship innovation is perceived to contribute to the users, either at individual or organisational level.

2.1.3 Perceived easiness. The perceived easiness construct is derived from the concept of perceived ease of use in TAM, complexity in DOI, and perceived behavioural control in TPB. For the first two constructs, Davis (1989, p. 320) defines perceived ease of use as “the degree to which a person believes that using a particular system would be free of effort”. Complexity refers to “the degree to which an innovation is perceived as difficult to understand and use” (Rogers 2003, p. 257). Both constructs deal with the effort to learn and use new technology. Perceived ease of use and complexity also involve an individual’s perception, but on the opposite end of the scale. This is to say the higher a person perceives ease of use, the lower he/she perceives complexity of use, and vice versa. Based on this explanation, both constructs can be combined into one single construct.

The perceived behavioural control construct refers to “the perceived ease or difficulty of performing the behaviour” (Ajzen, 1991, p. 188). In other words, perceived behavioural control is the capability that a person thinks he/she has in performing a particular behaviour, which, in this study, refers to adopting a techno-relationship innovation. It could be argued that this definition underlies the construct of perceived ease of use and complexity. Consequently, perceived behavioural control is merged with the above two constructs. The present study uses the term perceived easiness for this construct and refers to the degree to which a techno-relationship innovation is perceived as being simple to learn and use.

2.1.4 Subjective norm. The subsequent development of the TAM model included the subjective norm construct, which is consistent with the TPB model. There is no doubt this construct matches well between the two models. Subjective norm is defined as “a person’s perception that most people who are important to him/her think he/she should or should not perform the behaviour in question” (Fishbein and Ajzen, 1975, p. 302). In other words, any individual’s behaviour is also influenced by other people surrounding him/her. These people can be friends, classmates, family, relatives, parents, colleagues, leaders, celebrities, and so forth. Therefore, the term subjective norm is retained in this study.

The remaining constructs, self-efficacy, compatibility, observability, and trialability are rather distinct from each other. Thus, they are utilised separately. In this step,

there are eight constructs to be used in the research framework. The next step looks at previous adoption research. Additional factors are retrieved and added to the research framework.

2.2 The conjunction of pertinent influencing factors

As shown in previous studies, the adoption models are typically employed together with some supplementary factors. Even though the adoption models are powerful in explaining the circumstances of technology adoption, most of their constructs focus on the context of individual and technology. Earlier research shows that other contexts can also influence the technology adoption, the same as they do with individual and technological contexts.

The widely referenced pertinent factors affecting the adoption of technological innovation are found in the seminal work of Tornatzky and Klein (1982), who reviewed 75 innovation studies and identified the ten most frequently used factors in literature. Subsequently, Tornatzky and Fleischer (1990) conceptualised that the context of technology adoption consists of three aspects: technological, organisational, and environmental. Their study is known as the technology-organisation-environment framework. This framework has been reported to have a consistent relationship with adoption behaviour (Carayannis and Turner, 2006; Jeon *et al.*, 2006; Kuan and Chau, 2001; Venkatesh *et al.*, 2003). Nevertheless, the three-context framework may have some limitations, since the characteristics of a manager or policy maker are not included in the framework. An individual's personal characteristics might affect his/her adoption decision as well.

Considering this limitation, Thong (1999) expands Tornatzky and Fleischer's (1990) framework by adding individual characteristics and advises four characteristics that could influence technology adoption decision. The four characteristics are:

- (1) management characteristics;
- (2) technological characteristics;
- (3) organisational characteristics; and
- (4) environmental characteristics.

These four contexts appear to cover all potential aspects when examining factors influencing an adoption decision. Thus, this framework serves as a foundation in developing a conceptual framework for the present study.

The eight constructs discussed earlier are now categorised into either individual context or technological context. The individual context includes attitude, subjective norm, and self-efficacy. The technological context consists of perceived advantage, perceived easiness, compatibility, observability, and trialability. Other pertinent factors are added and categorised as described below.

2.2.1 Individual context. Besides, the constructs of attitude, subjective norm, and self-efficacy, two more constructs are integrated in this context: innovativeness and technological experience. The construct of innovativeness has been used to examine the adoption of several technological innovations such as IT (Thong, 1999; Thong and Yap, 1995), e-commerce (Al-Qirim, 2005; Wymer and Regan, 2005), and internet technologies (Lee, 2004). Innovativeness is seen as one of the major characteristics in driving the firm. In business competition, it has been found that some executives are

keen to take risks adopting new technology whereas some are hesitant to try out such technology. Different levels of this individual characteristic can affect how the technology is adopted. So, this construct is included in the research framework under individual context.

For the technological experience construct, a number of studies indicate that prior experience influences subsequent behaviour either positively or negatively (Beck and Ajzen, 1991; Bagozzi *et al.*, 1992; Kim and Malhotra, 2005). Generally speaking, an individual is likely to adopt new technology without difficulty if he/she has prior experience in or with that technology. For instance, those who are familiar with computers will be interested and can see the difference in the amount of data storage among floppy disks, compact disks, digital versatile disks, and universal serial bus flash drives, whereas those who have never used computer and do not know the capacity of each data storage device will not. If an inexperienced individual is willing to use the data storage device, he/she needs to seek more information and possibly rely on advice from other people. Consequently, it can be said that experienced and inexperienced individuals have different ways of dealing with technology. Therefore, this construct can be seen as a determinant factor and it is thus included in the research framework under individual context.

2.2.2 Technological context. The five constructs retrieved from the four adoption models are placed within this context. The five constructs are perceived advantage, perceived easiness, compatibility, observability, and trialability. The present study proposes a new theoretical construct namely “perceived relationship marketing functionality” since the conceptual framework is for understanding the adoption of techno-relationship innovation and there is a lack of empirical evidence that addresses the link between perceived capable relationship marketing tasks and the adoption of a particular technology. “perceived relationship marketing functionality” is placed under technological context. Generally speaking, there are three major tasks in the relationship marketing perspective:

- (1) establishing or acquiring new customers;
- (2) enhancing customer relationships; and
- (3) maintaining or retaining customers.

These three critical tasks serve as the theoretical foundation for this construct.

2.2.3 Organisational context. The constructs in the organisational context are related to demographic information. In general, demographic information refers to characteristics of an individual or firm in terms of age, income, education, occupation, size, turnover, revenue, location, etc. In the studies related to the adoption of technology, the firm’s characteristics are also widely examined. The main factors that are incorporated in this organisational context include firm size, the availability of financial resources, knowledge and expertise in a particular technology, and business experience (Al-Qirim, 2005; Chwelos *et al.*, 2001; Dholakia and Kshetri, 2004; Grandon and Pearson, 2004; Jeon *et al.*, 2006; Kuan and Chau, 2001; Lee, 2004; Lertwongsatien and Wongpinunwatana, 2003; Mehrtens *et al.*, 2001; Michandani and Motwani, 2001; Premkumar and Roberts, 1999; Seyal *et al.*, 2004; Thong, 1999). Four constructs are suggested under organisational context: size, financial resource, technological expertise, and business experience.

2.2.4 Environmental context. This context is also referred to as external factors. Most constructs in this context relate to psychographic information that considers an individual's lifestyles, perceptions, behaviours, interests, and values. Prior studies concerning the adoption of technology typically draw attention to the perceptions of the executives or the person in charge relating to external factors. There are two major external factors extensively examined in this research stream: external pressure and external support. External pressure refers to any kind of pressure that might affect an adoption decision such as competitive pressure, customer pressure, and industry pressure. External support is the support from other firms that might affect an adoption decision such as support from government/private agencies and technology suppliers. A number of studies have demonstrated the association between these factors and an adoption decision (Al-Qirim, 2005; Chwelos *et al.*, 2001; Dholakia and Kshetri, 2004; Grandon and Pearson, 2004; Jeon *et al.*, 2006; Kuan and Chau, 2001; Lee, 2004; Lertwongsatien and Wongpinunwatana, 2003; Mehtens *et al.*, 2001; Michandani and Motwani, 2001; Premkumar and Roberts, 1999; Seyal *et al.*, 2004; Thong, 1999). In this study, five constructs are considered for environmental context: competitive pressure, customer pressure, industry pressure, governmental encouragement, and external support.

Inclusively, the present study proposes 20 potential determinant factors in four contexts for understanding the adoption of techno-relationship innovations. A definition of each potential determinant factor is provided in Table I. In addition, a schematic model is drawn in Figure 1 to clarify the linkage between the four contexts and the adoption of techno-relationship innovation. In a broader perspective, individual and organisational factors are viewed as internal forces while technological and environmental factors are seen as external forces.

3. An empirical investigation

The eCRM application, representing techno-relationship innovation, is chosen for empirical investigation in the context of small and medium manufacturing enterprises (SMEs). It can be said that the concept of eCRM is in the early stage of expansion. In a broader sense, eCRM is a subfield of CRM. The obvious distinction is that CRM application normally focuses on conventional business setting while eCRM application takes full advantage of internet technology and is used in the electronic marketplace. Since eCRM is relatively new in the research community, the term has been used interchangeably with conventional CRM in recent studies. The eCRM is seen as a part of a comprehensive CRM strategy and implementation. It covers much more than customer service for web site visitors (Fleischer, 2001).

The present study elucidates the scope of eCRM by applying the definition proposed by Lee-Kelley *et al.* (2003, p. 24). The eCRM is defined as:

[...] the marketing activities, tools, and techniques, delivered over the internet (using technologies such as web sites and e-mail, data-capture, warehousing, and mining) with a specific aim to locate, build and improve long-term customer relationships to enhance their individual potential.

From a marketing perspective, eCRM can be seen as a marketing tool that comes in the form of a software application and is used to manage customer relationships over the internet. In more detail, the firm can utilise eCRM application as a strategy to learn more about customers' needs and behaviours in order to strengthen relationships with them.

Determinant factors	Definition
<i>Individual context</i>	
Attitude (based on TPB, SCT)	An individual's positive or negative feelings (evaluative affect) about performing the target behaviour (Fishbein and Ajzen, 1975, p. 216)
Subjective norm (based on TAM2, TPB)	A person's perception that most people who are important to him/her think he/she should or should not perform the behaviour in question (Fishbein and Ajzen, 1975, p. 302)
Self-efficacy (based on SCT)	An individual's beliefs about his or her capabilities to use techno-relationship innovation to accomplish a particular job or task (Compeau and Higgins, 1995, p. 192)
Innovativeness	A willingness to introduce newness and novelty through experimentation and creative processes aimed at developing new products and services, as well as new process (Dess and Lumpkin, 2005, p. 148)
Technology experience	The period of time an individual has been using the technology in question
<i>Technological context</i>	
Perceived advantage (based on TAM, SCT, DOI)	The degree of advantage in which a techno-relationship innovation is perceived to contribute to the users either at individual or organisational level (Compeau <i>et al.</i> , 1999; Davis, 1989; Rogers, 2003)
Perceived easiness (based on TAM, TPB, DOI)	The degree to which a techno-relationship innovation is perceived as being simple to learn and use (Ajzen, 1991; Davis, 1989; Rogers, 2003)
Compatibility (based on DOI)	The degree to which a techno-relationship innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters (Rogers, 2003, p. 240)
Observability (based on DOI)	The degree to which the availability of the techno-relationship innovation is visible to others (Rogers, 2003, p. 258)
Trialability (based on DOI)	The degree to which a techno-relationship innovation may be experimented with on a limited basis (Rogers, 2003, p. 258)
Perceived relationship marketing functionality	The degree to which a techno-relationship innovation is perceived as a marketing tool in performing relationship marketing tasks (Grönroos, 1990; Kalakota and Robinson, 2001)
<i>Organisational context</i>	
Size	The extent of a firm measured by a number of dimensions such as number of employees, total capital investment, and annual sales
Financial resources	The availability of financial resources to adopt and maintain a techno-relationship innovation
Technological expertise	The availability of technical staff or consultants in dealing with a techno-relationship innovation
Business experience	The period of time a firm has been in the business
<i>Environmental context</i>	
Competitive pressure	The intensity level of competition that makes a feeling of being underperformed to a firm
Customer pressure	The behaviour and demand of customers that force a firm to adopt a techno-relationship innovation in order to keep and satisfy customers

(continued)

Table I.
Definition of potential determinant factors

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Determinant factors	Definition
Industry pressure	The overall trend and direction of operational practices that force a firm to adopt a techno-relationship innovation in order to survive in the business or remain its competitive advantages
Governmental encouragement	The policies, initiatives, agencies, and everything that organised by government to facilitate the rate of adopting a techno-relationship innovation and relevant components
External support	The availability of support from technology vendors for successfully implementing and using a techno-relationship innovation

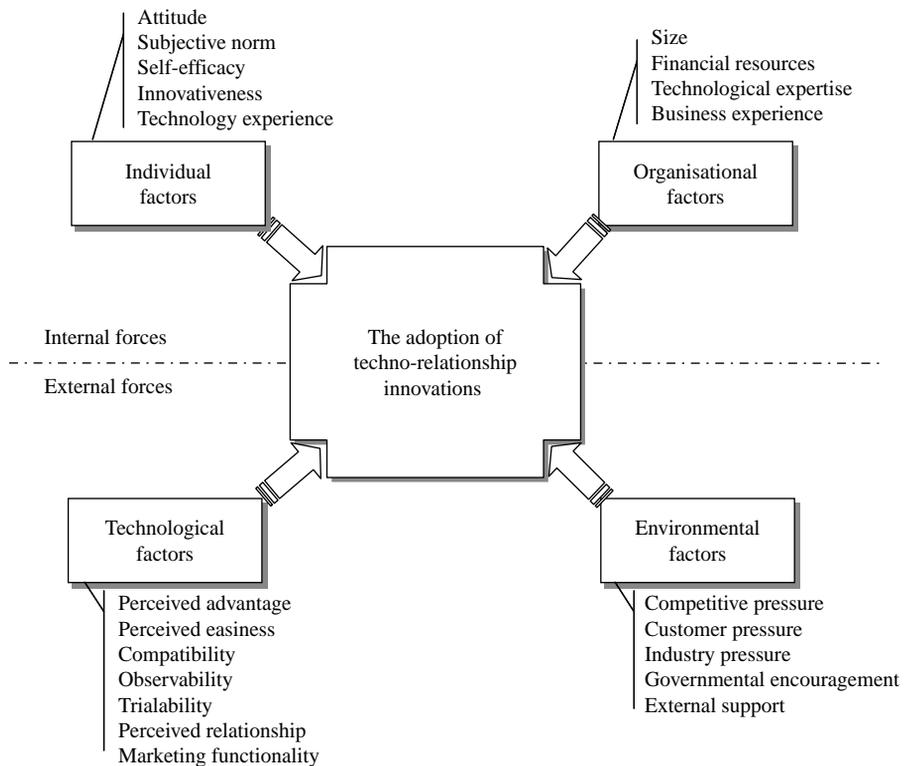


Figure 1.
A schematic model of a conceptual framework

3.1 Types and benefits of eCRM application

In general, there are two main types of eCRM application; operational and analytical eCRM applications (Dyche, 2001). Operational eCRM is generally concerned with the customer contact points, both from customers to firm and from firm to customers. It is known as a “front office” system. Examples of operational eCRM include site customisation, cross-sell/up-sell capability, loyalty program, automatic email response system, and automatic service system. Analytical eCRM is generally concerned with the use of technology or software to process large amounts of customer data. This data

provides reliable information that the company can use to analyse its customers' behaviour. It is known as a "back office" system. Examples of analytical eCRM are analytical report system, sales recording system, sales trend and forecast report system, and customer profile/segmentation system.

There are many technological components to eCRM application but initially viewing eCRM in technological terms is a mistake. The better way to look at it is viewing eCRM as a strategic process that will help a firm to better understand customers' needs and how the firm can meet those needs, which eventually enhances and maintains good relationships with the customers. This strategy depends on bringing together diverse information about customers and market trends so a firm can sell and market products/services more effectively. The eCRM application is expected to perform the said job for the firm. In fact, eCRM is not only about software and IT. It is about aligning business processes with customer strategies to build customer loyalty and increase profits over time. These processes are supported by technology and software (Rigby *et al.*, 2002). By utilising eCRM application properly, a number of benefits can be anticipated (Chen and Chen, 2004; Fjermestad and Romano, 2003; Wu and Wu, 2005). This study extensively reviews the potential benefits of adopting eCRM referenced in various sources, and proposes that there are three perspectives on eCRM benefits:

(1) *Strategic benefits:*

- gain and maintain competitive advantage;
- provide tools to efficiently analyse and understand customer requirements; and
- identify new/added selling opportunities.

(2) *Customer service benefits:*

- increased customer satisfaction;
- increased customer loyalty; and
- increased customer retention rate.

(3) *Productivity benefits:*

- increased revenue and profitability;
- increased employee productivity; and
- overall, cost reduction.

In this study, eCRM application is seen as a techno-relationship innovation which provides several benefits to firms of all sizes. Nonetheless, it appears that existing studies examining the adoption of techno-relationship innovations focus on large firms while little attention is given to SMEs (Jayachandran *et al.*, 2005; Rebolledo *et al.*, 2005). This results in insufficient knowledge in predicting and explaining the behaviours of SMEs regarding the adoption of techno-relationship innovation, specifically eCRM applications. Since SMEs can also benefit from adopting eCRM, there is less understanding of what factors and how many factors influence the SMEs' adoption decision. The shortage of this research domain leads to the necessity to conduct a research in the context of SMEs.

3.2 Context of SMEs

SMEs are the major driving forces contributing to economic development. They are considered as the backbone of economic activity since the diversity of SMEs generates enormous employment opportunities to the community in which they operate. SMEs constitute the dominant form of business organisation in all countries worldwide, accounting for over 95 per cent and up to 99 per cent of the business population depending on the country (OECD, 2005).

In a broader perspective, SMEs can be categorised into three sectors: manufacturing, service, and trading (wholesale and retail). In particular, manufacturing SMEs are concerned with production processes, collecting raw materials, and making finished products, whereas trading SMEs are intermediaries transferring products to other firms or end customers. In contrast, service SMEs provide various types of services to individuals and organisations. In general, SMEs in different sectors differ in several aspects and require different kinds of strategic planning. The present study is more interested in the manufacturing sector and it is therefore chosen for empirical investigation.

An SME is defined by a number of dimensions which vary from country to country. The scope of manufacturing SMEs used in this study is consistent with the formal definition and classification proposed by the Ministry of Industry, Thailand, where the sample was drawn. The criteria of being manufacturing SMEs in this study refer to the number of employees and total registered capital. A small manufacturing enterprise should have fewer than 50 employees and registered capital less than 50 million Baht (approximately 1.7 million US\$), while a medium manufacturing enterprise should have between 51 and 200 employees and registered capital between 50 and 200 million Baht (approximately 1.7-6.3 million US\$).

It is expected that eCRM has potential for SMEs and can lead to sustainable competitive advantages in the e-marketplace. However, it is not clear whether or not SMEs are aware of this particular technology. Also, their attitude and willingness to adopt eCRM are inadequately understood. What factors are important and unimportant to them when they decide to adopt eCRM applications have not been well examined. This inadequate knowledge makes it difficult for government/private agencies and technology suppliers in encouraging SMEs to use eCRM applications and to participate in the e-marketplace. Thus, the research framework developed in Figure 1 is applied for empirically investigating the eCRM adoption among manufacturing SMEs.

3.3 Formulating hypotheses

Regarding the research framework in Figure 1, the general hypothesis is that the adoption of techno-relationship innovation depends on a combination of individual, organisational, technological, and environmental factors. The operational research hypotheses can be formulated based on each factor in each context. In case of eCRM application, the present study focuses on the adoption from firm perspectives. Then, the hypotheses are developed in accordance with the research framework and based on prior studies in the domain of technology adoption specifically in the context of SMEs. The terms “adoption” and “implementation” are in many instances conceptually similar and sometimes used interchangeably. It should be noted that “adoption” in this study, however, refers to accepting and obtaining a specific techno-relationship innovation while “implementation” typically means sequential phases of using

a specific techno-relationship innovation. The present study merely pays attention to the adoption process, not the implementation process.

Most business activities of SMEs typically rely on a few dominant persons inside the firm. These persons can be executives at various levels in the firm. It can be said that their conceptual beliefs have an effect on the adoption decision of the entire firm. There are five potential determinant factors under individual context. So, five hypotheses are formulated. It should be noted that the technology experience factor in this study refers to internet experience since eCRM application is a computer application operating on the internet:

- H1.* Executive's attitude towards eCRM has an effect on the adoption of eCRM application.
- H2.* Executive's subjective norm has an effect on the adoption of eCRM application.
- H3.* Executive's self-efficacy has an effect on the adoption of eCRM application.
- H4.* Executive's innovativeness has an effect on the adoption of eCRM application.
- H5.* Executive's internet experience has an effect on the adoption of eCRM application.

In technological context, there are six potential determinant factors. These factors are consistently found to have a significant effect on the adoption of several innovations. So, similar results are expected in the case of eCRM adoption as well. Six hypotheses are formulated as follows:

- H6.* Perceived advantage has an effect on the adoption of eCRM application.
- H7.* Perceived easiness has an effect on the adoption of eCRM application.
- H8.* Compatibility has an effect on the adoption of eCRM application.
- H9.* Observability has an effect on the adoption of eCRM application.
- H10.* Trialability has an effect on the adoption of eCRM application.
- H11.* Perceived relationship marketing functionality has an effect on the adoption of eCRM application.

The organisational context refers to the readiness of a firm to deal with techno-relationship innovations. Previous studies have demonstrated the association between organisational readiness and the level of technology adoption (Chwelos *et al.*, 2001; Kuan and Chau, 2001; Thong, 1999; Venkatesh *et al.*, 2003). Four possible determinant factors are identified within this context: size, financial resource, technological expertise, and business experience. It should be noted that size can be measured by various dimensions. Prior studies typically employ only one dimension in measuring a firm's size. This might restrict the interpretation of the findings. To gain more insight about this construct, the present study measures the firm's size in two dimensions, number of employees and total capital investment. Thus, this context contains two sub-hypotheses and three main hypotheses:

H12a. Firm's size in regard to number of employees has an effect on the adoption of eCRM application.

H12b. Firm's size in regard to total capital investment has an effect on the adoption of eCRM application.

H13. Financial resource has an effect on the adoption of eCRM application.

H14. Technological expertise has an effect on the adoption of eCRM application.

H15. Business experience has an effect on the adoption of eCRM application.

Environmental context refers to influences from external factors surrounding the firm. These factors are normally beyond the control of the firm and in some way influence the operation of business either positively or negatively. Environmental factors have been widely examined in previous studies and found to be significantly associated with the decision to adopt technology. The present study identifies two broad external factors, external pressure and external support. External pressure covers three potential determinant factors: competitive pressure, customer pressure, and industry pressure. External support consists of two potential determinant factors: governmental encouragement and external support. Five hypotheses are developed as follows:

H16. Competitive pressure has an effect on the adoption of eCRM application.

H17. Customer pressure has an effect on the adoption of eCRM application.

H18. Industry pressure has an effect on the adoption of eCRM application.

H19. Governmental encouragement has an effect on the adoption of eCRM application.

H20. External support has an effect on the adoption of eCRM application.

4. Methodology

A survey research strategy was employed to examine whether the proposed determinant factors are able to discriminate between eCRM adopters and non-adopters. The self-administered questionnaire was developed and the data were collected from manufacturing SMEs in Thailand.

4.1 Instrument development

A survey questionnaire was developed and a pilot test was conducted using 30 manufacturing SMEs. 23 questionnaires were returned within two weeks making a 76 per cent response rate. Six out of 23 respondents were interviewed over the telephone to refine the wording, meaning, understanding, and formatting of the questionnaire. Adjustments were made based on the feedback from the respondents. Moreover, the internal consistency reliability method was conducted to verify the reliability of the measurement scales used in the questionnaire. Some items were dropped to increase the reliability of the scale. The coefficient score of Cronbach's α for the modified scales are relatively high and over 0.70 across all scales. The final questionnaire consisted of the following major sections:

- (1) Demographic information (gender, age, education level, and management position).
- (2) Basic information (industry type, presence of company web site, the time period of the company web site, and presence of eCRM applications).
- (3) Multi-item scale measuring the determinant factors in four contexts (Appendix 2):
 - *Individual context*: internet experience was measured by the number of years that the respondent has been using the internet. Attitude, subjective norm, self-efficacy, and innovativeness were measured by using a seven-point Likert scale from (1) strongly disagree to (7) strongly agree.
 - *Technological context*: all constructs were measured by using a seven-point Likert scale from (1) strongly disagree to (7) strongly agree.
 - *Organisational context*: size was measured by the number of employees and the total capital investment. Business experience was measured by the number of years that the firm has been in business. Financial resource and technological expertise were measured by using a seven-point Likert scale from (1) strongly disagree to (7) strongly agree.
 - *Environmental context*: all constructs were measured by using a seven-point Likert scale from (1) strongly disagree to (7) strongly agree.

4.2 Data collection

The data were gathered from manufacturing SMEs in Thailand. This country plays a significant role in the South East Asia (SEA) region in terms of economic growth, social development, political stability, and international contract agreements. The country is rich in natural resources and has the potential to be one of the major resource suppliers in the world market. The economy is growing and the government is motivating the country to be the business hub of SEA. Within the country, all firms are exposed to the same business environment conditions, no matter where they are located. This fact indicates that the selected sample may be seen as being representative of the firm population, which will provide reliability in terms of generalisability from the results. Then, from this study, it can be argued that the data collected from manufacturing SMEs are representative for all manufacturing SMEs in Thailand.

The data collection process was carried out in four steps. First, the list of manufacturing SMEs from the database of the Office of Small and Medium Enterprises Promotion (OSMEP), an official government agency that provides updated list of enterprises in the whole country covering service, trading, and manufacturing sectors, was selected as a sampling frame. Second, a sample of 800 manufacturing SMEs was drawn using a systematic sampling technique. Third, a package containing a covering letter, a questionnaire, and a postage-paid reply envelope was sent asking the executive of the firm to fill out the questionnaire. There were 296 questionnaires received within two weeks, i.e. a response rate of 37.0 per cent.

Lastly, to increase the representative level of the sample, a reminder letter together with a new questionnaire was sent to those who did not return the initial questionnaire. A further 227 questionnaires were returned within two weeks, increasing the response rate to 65.38 per cent. However, 15 responses were excluded due to incomplete questionnaires or because the firms did not meet the qualifications for being a manufacturing SME in this study. The remaining usable 508 respondents are deemed

sufficient for data analysis and large enough to be representative of the manufacturing SMEs.

5. Data analysis and results

5.1 Evaluation of non-response bias

The non-response bias was evaluated by comparing the early responses and late responses regarding demographic data (gender, age, education level, and management position). Early responses were defined as those who completed and returned the questionnaires within two weeks of the initial mailing while late responses refer to those who returned questionnaires within two weeks of the reminder mail. A Pearson χ^2 test was calculated and no significant difference was found in terms of gender ($\chi^2 = 0.156$, $p = 0.693$), age ($\chi^2 = 8.007$, $p = 0.091$), education level ($\chi^2 = 1.144$, $p = 0.766$), or management position ($\chi^2 = 1.227$, $p = 0.542$). The analysis of response bias is summarized in Table II. The analysis suggests no response bias in this study; if any, it is not considered to be significant.

5.2 Analysis of measurement model

The measurement model was evaluated for reliability, convergent validity and discriminant validity. The analysis was done in two steps. First, factor analysis was used to analyse the convergent validity and discriminant validity of all items measuring proposed determinant factors in four contexts. Convergent validity is confirmed if the items load strongly on their associated factors (loading exceed 0.50). Discriminant validity is demonstrated if each item loads more strongly on its associated factor than on other factors. The items that did not load strongly on the intended factors were dropped for subsequent analysis. Second, internal consistency reliability was employed by computing the coefficient score for Cronbach's α . As a rule of thumb, a Cronbach's α above 0.70 is considered good and acceptable for most research (Nunnally, 1978).

The scale's validity was assessed based on the four contexts. There were five constructs in individual context, four constructs in organisational context, five constructs in environmental context, and six constructs in technological context. The factor analysis used principal component in order to extract the maximum variance from the items. The outcome was rotated using the Varimax rotation criterion.

Table III shows the results of factor analysis for individual, organisational, and environmental contexts. Five factors were extracted under individual context which collectively explained 79.39 per cent of the total variance. Four factors were extracted under organisational context which collectively explained 91.79 per cent of the total variance. For environmental context, the constructs were divided into two groups,

	χ^2	df	p
Early responses ($n = 287$)			
Late responses ($n = 221$)			
Gender	0.156	1	0.693
Age	8.007	4	0.091
Education level	1.144	3	0.766
Management position	1.227	2	0.542

Table II.
Results of non-response
biases analysis

	<i>Component</i>						
	1	2	3	4	5		
<i>Individual context</i>							
ATTD2	0.874	0.197	0.022	0.223	0.024		
ATTD1	0.844	0.141	0.138	0.215	0.078		
ATTD3	0.813	0.191	-0.043	0.285	0.140		
INNO4	0.240	0.820	-0.020	-0.067	0.015		
INNO3	0.313	0.815	0.089	-0.025	0.037		
INNO2	0.020	0.782	0.266	0.174	0.044		
INNO1	0.006	0.654	0.186	0.174	0.402		
SELF2	0.024	0.096	0.893	-0.024	0.202		
SELF3	0.078	0.171	0.827	-0.001	-0.166		
SELF1	0.012	0.100	0.798	0.060	0.339		
SUBN2	0.364	0.050	-0.041	0.880	0.024		
SUBN1	0.503	0.091	0.081	0.765	-0.103		
INEX	0.156	0.146	0.190	-0.069	0.874		
<i>Organisational context</i>							
FINA1	0.932	0.135	0.305	0.078			
FINA2	0.923	0.178	0.314	0.052			
SIZE1	0.056	0.902	0.133	0.156			
SIZE2	0.227	0.877	0.021	0.141			
TECX1	0.295	0.052	0.910	-0.072			
TECX2	0.549	0.162	0.708	-0.050			
BUEX	0.069	0.240	-0.082	0.965			
<i>Environmental context</i>							
INDP1	0.884	0.329	0.237	GOVE2	0.937	0.037	
INDP2	0.838	0.414	0.230	GOVE1	0.842	0.378	
CUSP1	0.311	0.878	0.254	EXSP1	0.070	0.950	
CUSP2	0.421	0.841	0.174	EXSP2	0.563	0.696	
COPP1	0.248	0.231	0.940				

Notes: ATTD, attitude; INNO, innovativeness; SELF, self-efficacy; SUBN, subjective norm; INEX, internet experience; FINA, financial resources; SIZE, size; TECX, technological expertise; BUEX, business experience; INDP, industry pressure; CUSP, customer pressure; COPP, competitive pressure; GOVE, governmental encouragement; EXSP, external support

Table III.
Construct validity analysis for individual, organisational, and environmental contexts

one group relating to any kind of external pressure while the other group related to any kind of external support. Three factors were extracted for external pressure but one item in the competitive pressure construct did not load on the intended factor. That item was dropped and the analysis was recalculated, explaining 94.33 per cent of the total variance. For the external support group, two factors were extracted which collectively explained 86 per cent of the total variance. The results in Table III show that all items have loading value exceeding 0.50 on their associated factors and load more strongly on their associated factor than on others. Thus, convergent and discriminant validity were demonstrated.

For technological context, six factors were extracted. However, one item in the construct of perceived relationship marketing functionality did not load on the intended factor, indicating possible invalidity of the item. After removing this invalid

item, the recalculated six factors explained 82.38 per cent of the total variance. Table IV shows that all items have loading value exceeding 0.50 on their associated factors and load more strongly on their associated factor than on others. Thus, convergent and discriminant validity of the constructs under technological context were demonstrated as well.

Following the convergent and discriminant validity, the reliability of the constructs was assessed by computing coefficient score for Cronbach's α . Table V shows that the α values range from 0.73 to 0.99, which is considered high and above the recommended value of 0.70 (Nunnally, 1978). Consequently, the reliability and validity of the measurement model were demonstrated providing strong indication for subsequent analysis.

5.3 Demographics and descriptive statistics

Results indicate that the majority of the respondents were male (53.9 per cent), holding the top management position in the company (51.6 per cent). Most respondents were well-educated, with 64.6 per cent having bachelor degrees and 25.0 per cent having master degrees. The respondent age was dispersed, ranging from under 31 to over 60. In addition, the proportion of industry type was well-suited and comparable with the sampling frame retrieved from OSMEP's database. The majority belonged to industry type 5 (40.2 per cent). These companies are manufacturers of wood, paper, wooden products, gasoline, metallic products, rubber, plastic, glass, cement, ceramic, chemical

Technological context	Component					
	1	2	3	4	5	6
PADV7	0.846	0.236	0.125	0.060	0.162	- 0.157
PADV8	0.841	0.129	0.118	0.014	0.040	0.008
PADV6	0.828	0.096	0.135	0.148	0.123	0.186
PADV4	0.818	0.136	0.106	0.147	0.129	0.130
PADV3	0.805	0.114	0.142	0.096	0.215	0.269
PADV5	0.775	- 0.021	0.261	0.035	0.114	0.213
PADV2	0.740	0.188	0.189	0.235	0.075	0.198
PADV1	0.726	0.049	0.335	0.125	0.117	0.234
PADV9	0.714	0.256	0.349	0.123	0.009	- 0.102
PESS2	0.159	0.881	0.115	0.132	0.176	0.123
PESS3	0.289	0.811	0.140	0.178	0.155	- 0.096
PESS1	0.107	0.810	0.292	0.178	0.081	0.154
COPA2	0.321	0.190	0.844	0.196	0.069	0.052
COPA3	0.256	0.193	0.797	0.041	0.136	0.307
COPA1	0.373	0.241	0.790	0.249	- 0.025	- 0.059
OBSV2	0.089	0.084	0.097	0.938	0.069	0.025
OBSV3	0.042	0.295	0.167	0.801	- 0.060	0.231
OBSV1	0.356	0.132	0.142	0.793	0.155	0.009
TRAL2	0.183	0.114	0.106	0.054	0.922	0.085
TRAL1	0.210	0.220	0.017	0.074	0.900	0.024
PRMF2	0.579	0.171	0.197	0.184	0.094	0.664
PRMF3	0.590	0.116	0.180	0.267	0.130	0.636

Table IV.
Construct validity
analysis for technological
context

Notes: PADV, perceived advantage; PESS, perceived easiness; COPA, compatibility; OBSV, observability; TRAL, trialability; PRMF, perceived relationship marketing functionality

Table V.
Reliability analysis

Construct	Cronbach's α
<i>Individual context</i>	
Attitude	0.894
Subjective norm	0.882
Self-efficacy	0.822
Innovativeness	0.810
Internet experience	Single item
<i>Technological context</i>	
Perceived advantage	0.950
Perceived easiness	0.889
Compatibility	0.909
Observability	0.873
Trialability	0.906
Perceived relationship marketing functionality	0.938
<i>Organisational context</i>	
Size	0.808
Financial resources	0.993
Technological expertise	0.827
Business experience	Single item
<i>Environmental context</i>	
Competitive pressure	Single item
Customer pressure	0.910
Industry pressure	0.930
Governmental encouragement	0.824
External support	0.733

products, printing, and publishing. Results also showed that 93.3 per cent of respondents had been using the internet and 57.3 per cent of the companies indicated that a company web site was already in place. Regarding the adoption of eCRM application, 79.7 per cent of the companies did not have eCRM application and this group was classified as eCRM non-adopters while the eCRM adopters accounted for 20.3 per cent Table VI highlights the demographic information characterizing the sample of the study.

5.4 Discriminant analysis

The multivariate statistical technique of discriminant analysis was utilised for two purposes. First was to test the hypotheses and second was to identify the degree of importance of determinant factors in differentiating between eCRM adopters and non-adopters. The dependent variable, adoption of eCRM, was a dichotomous variable measured by yes (adopter) and no (non-adopter). Twenty proposed determinant factors were used as independent variables and entered simultaneously in the discriminant function. Multicollinearity was assessed and not found among independent variables.

The results in Table VII indicate the reliability of the discriminant function. Wilks' Λ value was used to test if the discriminant function was statistically significant. The results showed high statistical significance ($p < 0.000$) and indicated that there was a statistical difference between the two groups. Further analysis looked at the predictive capability (hit ratio) of the function. In this study, the proportional chance criterion without using discriminant function is 67.7 per cent $[(103/508)^2 + (405/508)^2] = 0.6766$. The results showed that the overall predictive ability of the discriminant function was

MIP 27,3		<i>n</i>	Percentage
398	<i>Gender</i>		
	Male	274	53.9
	Female	234	46.1
	<i>Age</i>		
	< 31	105	20.7
	31-40	191	37.6
	41-50	126	24.8
	51-60	73	14.4
	> 60	13	2.6
	<i>Education level</i>		
	High school	20	3.9
	Vocational/diploma	33	6.5
	Bachelor	328	64.6
	Master	127	25.0
	<i>Management position</i>		
	Top management	262	51.6
	Middle management	129	25.4
	Lower management	117	23.0
	<i>Industry type^a</i>		
	Type 1	122	24.0
	Type 2	104	20.5
	Type 3	32	6.3
	Type 4	33	6.5
	Type 5	204	40.2
	Type 6	13	2.6
	<i>Use of internet</i>		
	Yes	474	93.3
No	34	6.7	
<i>Availability of company website</i>			
Yes	291	57.3	
No	217	42.7	
<i>Availability of eCRM application</i>			
Yes	103	20.3	
No	405	79.7	

Table VI.
Demographic and general
information

Note: ^aFor detail of each industry type, see Appendix 1

<i>Wilks' Λ</i>			<i>Predicted group membership</i>		
<i>Test of function(s)</i>	<i>Wilks' Λ</i>	<i>Sig.</i>	<i>Adopters</i>	<i>Non-adopters</i>	<i>Total</i>
1	0.686	0.000			
<i>Classification result</i>					
Original group	Count	<i>eCRM adoption</i>			
		Adopters	86	17	103
	Non-adopter	78	327	405	
	Percentage	Adopters	83.5	16.5	100
	Non-adopter	19.3	80.7	100	

Table VII.
Reliability of
discriminant function

Note: 81.3 per cent of original grouped cases correctly classified

able to classify 81.3 per cent of the cases correctly assuming homogeneity of the covariance matrices. It is clearly demonstrated that the hit ratio is higher than the proportional chance criterion, thereby demonstrating the high validity of the discriminant function.

The hypotheses were assessed by comparing group means. Table VIII shows the group means, standard deviations, and the tests for equality of the group means. It can be seen from the univariate *F* value that most factors were highly statistically significant ($p < 0.05$) and likely to be good predictors. There are three factors (self-efficacy, trialability, and size) that were not statistically significant between adopters and non-adopters. The results suggested that all hypotheses except *H3*, *H10*, *H12a*, and *H12b* are supported. The hypothesis testing is summarized in Table IX.

From the discriminant analysis, it can be seen which variable was more important than the others. Further analysis looked at the discriminate power of each determinant factor in predicting group membership. Table X shows the rank of importance of all proposed determinant factors from the most to the least important. The results were similar to the hypothesis testing, confirming that self-efficacy, trialability, and size factors were not important in differentiating between eCRM adopters and non-adopters.

Determinant factors	eCRM adopters (<i>n</i> = 103)		eCRM non-adopters (<i>n</i> = 405)		Test of equality of group means		
	<i>M</i>	SD	<i>M</i>	SD	Wilks' Λ	<i>F</i> value	Sig.
Attitude	6.04	1.088	4.97	1.210	0.883	67.143	0.000*
Subjective norm	5.48	1.333	4.13	1.407	0.869	76.476	0.000*
Self-efficacy	4.30	1.853	4.21	1.350	0.999	0.306	0.580
Innovativeness	5.24	1.278	4.81	0.992	0.974	13.732	0.000*
Internet experience	3.44	0.904	3.13	1.209	0.989	5.779	0.017*
Perceived advantage	5.46	0.928	4.71	0.989	0.914	47.597	0.000*
Perceived easiness	4.92	1.152	4.35	1.030	0.954	24.363	0.000*
Compatibility	5.50	0.938	4.15	1.083	0.791	133.906	0.000*
Observability	5.06	1.293	4.06	1.331	0.914	47.428	0.000*
Trialability	5.17	1.535	5.08	1.377	0.999	0.341	0.560
Perceived relationship marketing functionality	5.68	1.225	4.76	1.245	0.917	45.764	0.000*
Size1 (no. of employees)	2.47	1.571	2.40	1.631	1.000	0.158	0.691
Size2 (capital investment)	2.12	1.536	1.96	1.522	0.998	0.887	0.347
Financial resources	4.80	1.773	4.04	1.419	0.960	20.829	0.000*
Technological expertise	4.53	1.593	3.46	1.534	0.928	39.222	0.000*
Business experience	2.61	1.497	3.05	1.611	0.988	6.375	0.012*
Competitive pressure	5.46	1.187	4.81	1.397	0.961	20.480	0.000*
Customer pressure	5.11	0.951	3.78	1.244	0.833	101.315	0.000*
Industry pressure	5.49	1.186	3.98	1.264	0.808	120.432	0.000*
Governmental encouragement	5.12	1.442	4.73	1.414	0.988	6.331	0.012*
External support	5.49	1.456	4.46	1.090	0.890	62.667	0.000*

Table VIII.
Group means statistics
using discriminant
analysis

Notes: *F*-test with statistical confidence level of 95 per cent; * $p < 0.05$

Hypotheses	Determinant factors	Resulted
<i>Individual context</i>		
H1	Attitude	Supported
H2	Subjective norm	Supported
H3	Self-efficacy	Not supported
H4	Innovativeness	Supported
H5	Internet experience	Supported
<i>Technological context</i>		
H6	Perceived advantage	Supported
H7	Perceived easiness	Supported
H8	Compatibility	Supported
H9	Observability	Supported
H10	Trialability	Not supported
H11	Perceived relationship marketing functionality	Supported
<i>Organisational context</i>		
H12a	Size1 (no. of employees)	Not supported
H12b	Size2 (capital investment)	Not supported
H13	Financial resources	Supported
H14	Technological expertise	Supported
H15	Business experience	Supported
<i>Environmental context</i>		
H16	Competitive pressure	Supported
H17	Customer pressure	Supported
H18	Industry pressure	Supported
H19	Governmental encouragement	Supported
H20	External support	Supported

Table IX.
Summary of hypothesis
testing

Determinant factors	Function
Compatibility	0.761
Industry pressure	0.721
Customer pressure	0.662
Subjective norm	0.575
Attitude	0.539
External support	0.520
Perceived advantage	0.453
Observability	0.453
Perceived relationship marketing functionality	0.445
Technological expertise	0.412
Perceived easiness	0.324
Financial resources	0.300
Competitive pressure	0.297
Innovativeness	0.244
Business experience	-0.166
Governmental encouragement	0.165
Internet experience	0.158
Size2 (capital investment)	0.062
Trialability	0.038
Self-efficacy	0.036
Size1 (no. of employees)	0.026

Table X.
Discriminate power

Moreover, by using a cut-off level of 0.3 as recommended by Hair *et al.* (2003), all factors with a loading value below 0.3 were considered to have a low level of discriminate power. Five additional factors (competitive pressure, innovativeness, business experience, governmental encouragement, and internet experience) were below the cut-off value and considered to have low discriminate power. The remaining twelve factors were above the cut-off value and seem to be good determinant factors in differentiating between eCRM adopters and non-adopters. The next section discusses the findings of the study.

6. Discussion

The findings reveal that the proportion of eCRM adopters was relatively low. Approximately, 20.3 per cent of the respondents already adopted eCRM applications. So, there is ample room to increase the adoption rate among manufacturing SMEs in Thailand. The governmental and private agencies who want to encourage the adoption and use of eCRM application need to pay attention to the effect of each factor identified in this study.

6.1 *The influence of individual factors*

All factors except self-efficacy played a significant role in differentiating eCRM adopters and non-adopters. The findings reveal that the respondents tended to follow the recommendations of those who were important to them in combination with their own judgement to evaluate the eCRM application. From the analysis, the subjective norm factor was slightly more important than the attitude factor since the former was ranked no. 1 and the latter was ranked no. 2 in this context. The finding for self-efficacy was considered to be surprising. The level of self-efficacy of the firm's executives was not an indicator in predicting the likelihood of eCRM adoption. This could be because the eCRM application generally involves many persons in many departments inside a firm. The higher or lower self-efficacy of the executives is not crucial for an adoption decision because they may not be the users of eCRM application. Realising the potential advantages of having eCRM application might be sufficient for them to adopt eCRM applications.

For innovativeness and internet experience factors, although statistically significant, the discriminant analysis suggested that they had less discriminate power in predicting group membership. From this point, it can be argued that they have some effect on the decision to adopt eCRM application but less than subjective norm and attitude factors. In sum, two out of five factors in this context are essential factors influencing the eCRM adoption.

6.2 *The influence of technological factors*

The findings in this context were consistent with previous similar studies (Moore and Benbasat, 1991; Venkatesh and Davis, 2000; Yi *et al.*, 2006). In this study, all factors except trialability were considered good determinant factors in differentiating eCRM adopters and non-adopters. Five out of six factors were statistically significant on univariate *F* test and were loaded above minimum standard value on discriminant function. Ranked from most to least important, they were compatibility, perceived advantage, observability, perceived relationship marketing functionality, and

perceived easiness. The findings suggest that eCRM adopters are more heavily influenced by these technological factors.

The trialability factor had no effect on the decision to adopt eCRM application. It can be explained that both adopter and non-adopter groups have an equivalent chance of trying out eCRM application, no matter whether eCRM application would be adopted or not. The analysis also shows that the mean values for both adopter and non-adopter groups were relatively high. This implies that both groups were well aware about trialability before making decisions. They were permitted to use the application on a trial basis for long enough to see what the application could do. Although this factor was found to have no difference between the adopter and the non-adopter group, this does not necessarily mean that it has no influence at all. In fact, trying a demo version is a common practice in the computer software industry. Most prospects typically ask for a demo version because they want to test and evaluate the software for a while before making a decision. Since eCRM application is computer software, it is therefore necessary to provide a demo version to all prospects.

6.3 The influence of organisational factors

In this context, the availability of financial resource and technological expertise were considered as good determinant factors in differentiating eCRM adopters and non-adopters. The adopter group tended to have more financial capability and technical staff than the non-adopter group. This indicates that organisational readiness has a strong effect on the decision to adopt new technology. For the business experience factor, the findings suggested that it had a negative effect on the adoption of eCRM application. It was the only factor in this study that had a negative effect on the adoption decision. This finding reflected that eCRM adopters tended to be younger firms than non-adopters. However, the discriminant analysis showed less discriminate power for this factor, suggesting that it was less important when compared to other factors.

The analysis for size factor was unanticipated. It appears that the size in both dimensions had no effect on the adoption of eCRM application. The discriminant analysis revealed that there was no statistical difference in size between the eCRM adopter and non-adopter groups. Nonetheless, the mean values for the eCRM adopter group in both dimensions were slightly larger than the mean values for the non-adopter group. The explanation is that the distribution of the sample was imbalanced. Regarding the number of employees, the largest group was the firms which have 25 employees or less (46.5 per cent). The second and third groups were far from the first group; 21.9 per cent have between 151 and 200 employees and 16.3 per cent have between 26 and 50 employees. Likewise, in term of total capital investment, the proportion of the sample's distribution was also unequal. Most firms (64.6 per cent) have total capital investment of 25 million Baht or less. These figures indicate that the firms in the sample have similar size in both dimensions. Thus, it could be argued that the imbalance of the sample distribution led to insignificant results for evaluating the size factor.

The insignificance of the size factor requires further research to validate the finding in this study. However, as recommended in previous studies, the common constraints seen in SMEs are limited financial resources, lack of in-house IT expertise, and a short-range management perspective (Delone, 1988; Lees, 1987). These constraints are still valid as long as the business practices are dominated by capitalism. Larger firms with more money available always have more potential and advantages over smaller firms.

Therefore, it is suggested that the size of the firm should not be completely ignored. In the case of encouraging eCRM adoption, the size factor might be used in initially segmenting the group of SMEs before emphasizing other relevant factors.

6.4 The influence of environmental factors

All environmental factors in this study were found to be statistically highly significant. The perception of eCRM adopters was higher than non-adopters in every factor. Nevertheless, competitive pressure and governmental encouragement showed less discriminate power in discriminant analysis, meaning that they had some effect on an adoption decision but lower predictive capability than the other three factors, which had discriminate value above the threshold value. The rank of importance was industry pressure, customer pressure, and external support. In more details, the industry pressure and customer pressure appeared to be crucial factors since they were ranked very highly within this context and also among all factors.

6.5 The overall consequences of the determinant factors

The data analysis indicated that 17 out of 20 factors could be seen as determinant factors in the adoption of eCRM application in manufacturing SMEs. These 17 factors were able to differentiate between eCRM adopters and non-adopters. However, when emphasizing what factors most influence the adoption decision, the results suggested that 12 out of the 17 factors had discriminate values above the standard threshold value and these 12 factors, then, were considered good determinant factors that should be given priority.

Table XI shows the rank of influential factors based on each context as well as overall. From the 12 influencing factors, it appears that most influential factors are external factors. There are eight external factors (technological and environmental factors) while the other four factors are internal factors (individual and organisational factors). The external factors are typically beyond the control of manufacturing SMEs. These findings are beneficial to both government/private agencies and technology suppliers who want to increase the adoption rate of eCRM application among manufacturing SMEs. The vital assignment for achievement is establishing awareness of those external influential factors in the minds of the executives of manufacturing SMEs. For internal influential factors, the two individual factors tend to be more important than the two organisational factors. Thus, it is suggested that the two individual factors should be given attention in collaboration with other external influencing factors while the two organisational factors should be initially used in segmenting SMEs who have the potential of being eCRM adopters.

Notwithstanding, in encouraging the adoption of techno-relationship innovation, all factors in the four contexts are important to some extent and they should be prioritised based on their influence. In the case of eCRM application, the five most influential factors came from technological, environmental, and individual contexts. The sequence of significance was compatibility, industry pressure, customer pressure, subjective norm, and attitude.

The overall results showed that compatibility plays the most significant role, suggesting that if a newly developed techno-relationship innovation (eCRM application in this study) is compatible with current working conditions of the firm, it is more likely that the firm will adopt such techno-relationship innovation. In addition,

Factors	Rank of importance
Overall factors	<ol style="list-style-type: none"> 1. Compatibility 2. Industry pressure 3. Customer pressure 4. Subjective norm 5. Attitude 6. External support 7. Perceived advantage 8. Observability 9. Perceived relationship marketing functionality 10. Technological expertise 11. Perceived easiness 12. Financial resources
Individual factors	<ol style="list-style-type: none"> 1. Subjective norm 2. Attitude
Technological factors	<ol style="list-style-type: none"> 1. Compatibility 2. Perceived advantage 3. Observability 4. Perceived relationship marketing functionality 5. Perceived easiness
Organisational factors	<ol style="list-style-type: none"> 1. Technological expertise 2. Financial resource
Environmental factors	<ol style="list-style-type: none"> 1. Industry pressure 2. Customer pressure 3. External support

Table XI.
The rank of influential factors

the customers' requirements and the industry's overall business practices appeared to dictate whether a firm adopted or did not adopt a particular techno-relationship innovation. This indicates that awareness of external pressures had a certain effect on the adoption decision. Any effort that focuses on increasing the level of this awareness can facilitate an increased adoption rate. Furthermore, subjective norm and attitude factors were crucial individual factors affecting the firm's adoption decision. These findings infer that manufacturing SMEs tended to follow suggestions from credible people in their field more than their own judgement.

7. Conclusions and implications

Generally speaking, customer behaviour changes over time. It is suggested that a firm who correctly anticipates upcoming customer behaviours and trends will be well prepared to prevail and prosper in the long run. Nowadays, several information technologies have been introduced which enable a firm to more easily build and sustain competitive advantage. Given that the adoption of eCRM application is expected to sustain long-term customer relationships, the number of adopters among SMEs as shown in this study is considerably low. This study has examined and pointed out what factors and how many factors should be taken into consideration. The five most influential factors are compatibility, industry pressure, customer pressure, subjective norm, and attitude. Furthermore, since the analysis is based on manufacturing SMEs in the Kingdom of Thailand, it can be said that the findings specifically benefit Thai government/private agencies and technology suppliers who want to encourage the

adoption of eCRM application. Where the existing literature supports the results (as in the instance of this research), inductive generalisation enables the transferability of findings. Thus, the findings of this study may also transfer to other countries that have a similar setting to Thailand.

7.1 Theoretical implications

The existing adoption models focus on specific aspects, leading to an incomplete explanation of the phenomena. An inclusive model that is able to explain the phenomena in all possible aspects is lacking. This leads to the theoretical contribution of this study.

The first theoretical implication is that this study expands marketing theory by integrating four adoption models, resulting in eight potential determinant factors. A number of previous studies are reviewed to identify other relevant factors. Twelve additional potential determinant factors are specified, adding up to 20 potential determinant factors. All 20 factors are given clear definition and classified into one of four contexts: individual, technological, organisational, and environmental. A comprehensive research framework is drawn representing the association between the adoption of techno-relationship innovation and determinant factors. The study suggests 20 potential determinant factors involved in the adoption of techno-relationship innovation.

Second, the proposed comprehensive research framework is empirically tested with eCRM application in the context of manufacturing SMEs. The findings provide evidence supporting the validity and reliability of the framework. Most determinant factors in the framework are able to differentiate between eCRM adopters and non-adopters. The importance ranking of determinant factors is also possible. Therefore, the comprehensive research framework can be used as a research tool in examining determinant factors in the decision to adopt other techno-relationship innovations as well.

7.2 Practical implications

The study has several practical implications. First, the findings offer guidance to government/private agencies and technology suppliers, especially those who attempt to encourage the adoption and use of eCRM application among manufacturing SMEs. Since the adoption rate is rather low, there is ample room to boost the adoption rate. The study identifies determinant factors that affect the adoption decision. In the case of eCRM adoption, 17 determinant factors have the ability to distinguish between adopters and non-adopters. However, multivariate statistical analysis advises that 12 out of those 17 are considered good determinant factors and should be given priority. The implication is that encouraging this type of techno-relationship innovation successfully requires a thorough understanding of the importance of each determinant factor.

Because the findings in this study are based on Thai manufacturing SMEs, they cannot be generalised to SMEs in other countries. The effects of determinant factors are analysed from an Asian perspective. Thus, the interpretation and utilisation of the research findings should be thoroughly scrutinised. Nevertheless, and confirmed in literature relating to other adoption models, it can be argued that the developed research framework is applicable for examining factors influencing SMEs' adoption

decision in other economies and cultural contexts, even though the outcomes might be found somewhat variant to this study.

Second, eCRM application is a complex application requiring cautious deliberation. The application typically concerns several units inside the firm and consequently all relevant units should be well aware and informed about the adoption. Otherwise, the application might not function as expected. For SMEs, investing in a new techno-relationship innovation can be crucial and highly risky. Although eCRM has enormous potentials for SMEs, it is not “a magic bullet” for SMEs. Business competition nowadays is complicated and requires quick response. The eCRM itself cannot promise business success. Rather, it should be adopted in collaboration with other business strategies. In particular, adopting eCRM application without properly understanding how it works might disappoint adopting firms and lead to a negative image for eCRM application. Thus, the implication here is that prospective eCRM adopters should be provided sufficient and clear information from firms who are promoting eCRM applications.

8. Limitations and suggestions for further research

Although the findings reveal interesting insights about the determinant factors affecting the adoption of techno-relationship innovation, some limitations must be addressed.

First, the eCRM application is the only techno-relationship innovation examined in the study. The findings are applicable only to eCRM application and its relevant components but not to all techno-relationship innovations. It is probable that the adoption of other techno-relationship innovations may reveal different results. So, further research investigating other techno-relationship innovations is needed.

Second, the study focuses only on the adoption decision using cross-sectional data collection but not on how eCRM is implemented. A longitudinal study on the implementation issue is recommended to facilitate understanding eCRM implementation in manufacturing SMEs. In addition, the terms “adoption” and “implementation” are sometimes used interchangeably. The “adoption” in this study, however, refers to accepting and obtaining something while “implementation” typically means sequential phases of using something. Further research looking at the effect of determinant factors on each phase is suggested.

Third, although the sample is sufficient for being representative of manufacturing SMEs, it was drawn from Thai manufacturing SMEs. This selectivity restricts the ability to generalise the results since industry infrastructure differs from country to country. The results can only represent manufacturing SMEs in Thailand and other countries that have similar industry infrastructure. Hence, further comparative research is needed to replicate the results found in this study.

Finally, manufacturing SMEs are the main focus in the study. Other business sectors may exhibit different forms of behaviour. It would be interesting to examine eCRM adoption in other sectors such as service SMEs and trading SMEs to see if differences exist. Consequently, the results presented in this study should be interpreted in light of these limitations.

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Further reading

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Appendix 1. Industry type

- Type 1.* Manufacturing of food products, prepared food, beverages, alcoholic beverages, dairy products, oil, animal fat products, tobacco, and other edible products.
- Type 2.* Manufacturing of machinery, vehicles, office accessories, medical instruments, electronic, and computing equipment.
- Type 3.* Manufacturing of knitting, spinning, weaving, and finishing of textiles, carpets, rope, and nets.
- Type 4.* Manufacturing of wearing apparel, hats, clothing accessories, dressing, and dyeing of fur for apparel.
- Type 5.* Manufacturing of wood, paper, wood products, gasoline, metallic products, rubber, plastic, glass, cement, ceramics, chemical products, printing, and publishing.
- Type 6.* Manufacturing of leather products, tanning and dyeing leather, luggage, bags, and footwear.

Appendix 2. List of measurement items by construct

Individual context

Attitude based on (Harrison *et al.*, 1997):

- (1) I believe that adopting eCRM to my firm is a wise decision.
- (2) I believe that adopting eCRM is helpful to my firm's business.
- (3) I believe that eCRM applications are effective marketing tools in the e-marketplace.

Subjective norm based on (Venkatesh and Davis, 2000):

- (1) People who are important to me think that I should use eCRM applications.
- (2) People who influence my behaviour think that I should use eCRM applications.

Self-efficacy based on (Compeau *et al.*, 1999).

I could complete the job using the computer application [...]:

- (1) [...] if there was no one around to tell me what to do as I go.
- (2) [...] if I had only the software manuals for reference.
- (3) [...] if I had seen someone else using it before trying it myself.

- (4) [...] if I could call someone for help if I got stuck. *
- (5) [...] if I had used similar applications before this one to do the same job. *

Note: *these items were excluded during instrument pre-test process.

Innovativeness based on (Al-Qirim, 2005; Thong and Yap, 1995):

- (1) I often risk doing things differently.
- (2) I usually have fresh perspectives on old problems.
- (3) I have original ideas.
- (4) I would sooner create something new than improve something existing.

Technological context

Perceived advantage newly developed scale and based on (Moore and Benbasat, 1991).

Using an eCRM application enables my firm to ...:

- (1) [...] gain and maintain competitive advantage.
- (2) [...] analyse customer requirements more efficiently.
- (3) [...] identify new selling opportunities.
- (4) [...] increase customer satisfaction.
- (5) [...] increase customer loyalty.
- (6) [...] increase customer retention rate.
- (7) [...] increase revenue and profitability.
- (8) [...] increase employee productivity.
- (9) [...] reduce overall cost.

Perceived easiness based on (Moore and Benbasat, 1991):

- (1) I believe that an eCRM application is easy to use.
- (2) Learning to operate an eCRM application is easy for me.
- (3) I believe that it is easy to get an eCRM application to do what I want it to do.

Compatibility based on (Karahanna *et al.*, 1999; Moore and Benbasat, 1991):

- (1) Using an eCRM application is compatible with most aspects of the firm's work.
- (2) Using an eCRM application fits with the firm's work style.
- (3) I think that using an eCRM application fits well with the way I like to work.

Observability newly developed scale and based on (Moore and Benbasat, 1991):

- (1) I have noticed that eCRM applications are being used by other firms.
- (2) I am aware of the existence of eCRM applications in the market.
- (3) I know where to get eCRM applications.

Trialability based on (Moore and Benbasat, 1991):

- (1) Before deciding whether to adopt an eCRM application, I am able to properly try it out.
- (2) I am permitted to use an eCRM application on a trial basis long enough to see what it can do.

Perceived relationship marketing functionality newly developed scale.

I believe that eCRM application is a marketing tool used to [...]:

- (1) [...] acquire new customers.*
- (2) [...] enhance customer relationships.
- (3) [...] retain customers.

Note: *the item was excluded during the data analysis.

Organisational context

Financial resources newly developed scale and based on (Grandon and Pearson, 2004):

- (1) My firm has the financial resources to adopt an eCRM application.
- (2) My firm has the financial resources to maintain an eCRM application.

Technological expertise newly developed scale and based on (Grandon and Pearson, 2004):

- (1) My firm has the technical staff to keep up eCRM applications.
- (2) My firm is able to find consultants who are skilful in eCRM applications.

Environmental context

Competitive pressure newly developed scale and based on (Grandon and Pearson, 2004):

- (1) Competition is a factor in my decision to adopt eCRM applications.
- (2) I know that my competing rivals already use eCRM applications.*

Note: *the item was excluded during the data analysis.

Customer pressure newly developed scale:

- (1) Customers' requirements indicate that a company needs to have eCRM applications.
- (2) Customers' behaviours indicate that a company needs to have eCRM applications.

Industry pressure based on (Grandon and Pearson, 2004; Premkumar and Roberts, 1999):

- (1) The overall operational practices in my industry pressure me to adopt eCRM applications.
- (2) It is a strategic necessity to use eCRM applications to compete in my industry.

Governmental encouragement newly developed scale:

- (1) I know that the government has policies and initiatives encouraging companies to adopt internet technologies.
- (2) I am aware of the existence of governmental agencies providing services toward internet/e-business/e-commerce adoption.

External support newly developed scale and based on (Al-Qirim, 2005):

- (1) The availability of support from technology vendors is a factor in my decision to adopt eCRM applications.
- (2) I know there are technology vendors, who provide technical advice and support for eCRM adoption.

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