

**END USER COMPUTING SUCCESS FACTORS IN SMALL FIRMS**

A Case Study and Survey  
of Factors Affecting EUC Success in Small Firms  
in New Zealand

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## **ABSTRACT**

End User Computing is becoming an increasingly important activity in small firms. This thesis reports results of an empirical investigation of the factors influencing End User Computing Success in small businesses. The study proposed a conceptual model which was based on the Technology Acceptance Model (TAM) theory. Another important contribution of this study was that it extended previous research by testing a subset of the TAM in a new context, i.e. small firms. The development and testing of the research model involved: (1) a pilot case study, (2) a cross-case analysis of eight firms, and (3) a national survey of 596 computer users. Partial Least Squares was the data analysis technique used to analyse the survey data. The results of the study indicated that management support, external support, perceived ease of use, and perceived usefulness had direct positive effects on EUC success in small firms. Smaller but significant effects were also found for internal support, internal training, and external training on EUC success. Overall, the results of the study provided strong support for the TAM theory in a small firm context. Suggestions for future research and implications for small firm managers, external sources of assistance, and educational institutions were discussed.

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## CHAPTER 1 - INTRODUCTION AND RESEARCH STRATEGY

### 1 INTRODUCTION

The increasing importance and proliferation of microcomputers and end user computing (EUC) represents a significant development in the information systems (IS) field (Amoroso and Cheney, 1991; Davis, 1989; DeLone, 1988; Igarria, 1993; Lee, 1986; Rivard and Huff,

1988). Most large organisations continue to invest heavily in computers for their employees, but only since the introduction of microcomputers and user friendly EUC software has the impact been significant on small firms (Cragg and King, 1993).

Previous research suggests that there is a relationship between organisational size and computer usage characteristics (DeLone, 1981, 1988; Ein-Dor and Segev, 1978; Raymond, 1985, 1990a). Small businesses suffer from resource poverty (Welsh and White, 1981), a condition characterised by severe constraints on financial resources, a lack of trained personnel, and a short-range management perspective imposed by a volatile competitive environment. As a result, in terms of EUC, small firms are likely to face problems which are different from those faced by larger organisations (Raymond, 1985, 1990b).

Although many studies have investigated EUC in large organizations, there has been very little research into EUC issues in the small business environment (Raymond, 1990b). According to Raymond (1990b), an important research direction for EUC would be to identify the factors contributing to the success of EUC in small firms. Raymond (1990b) stresses that it is important to determine whether or not EUC success factors that have been identified in large organizations are relevant in a small firm context. In addition, the author suggests that the potential influence of the external environment (e.g., vendors, consultants, and educational institutions) on EUC success in small firms should be investigated. Since small firms have a more difficult time attracting and retaining skilled IS staff (due to their small size, limited number of senior positions, and fewer alternative career paths), it is likely that small businesses would be more dependent on external IS expertise.

For this study, an end user is defined as anyone who uses a computer for work related purposes. However, the main focus of this study was on the optional use of computers by knowledge workers, who include professionals and managers but exclude clerical/secretarial staff. According to Davis (1989), an important dimension of EUC success which is relevant to both large and small firms, is the acceptance or usage of computer technology. A better understanding of the factors

that influence usage is important to ensure that the use of computers is managed effectively.

Thompson, et al. (1991) suggest that when computer use is optional, having access to the technology does not ensure that it will be used, or used effectively. Similarly, Lee (1986) points out that the relationship between the availability of computer technology and its use by knowledge workers has not been investigated. To gain a better understanding of factors that influence the use of computers, researchers have recently adapted the Technology Acceptance Model (TAM) (Davis, et al., 1989) theory. Several other models have been developed to investigate the factors affecting the user acceptance aspect of EUC success (Amoroso and Cheney, 1991; DeLone, 1988; Fuerst and Cheney, 1982; Igbaria, 1990, 1993; Raymond, 1985).

The primary objective of this study is to gain a more complete understanding of the factors affecting EUC success in small businesses. In particular, the purpose of this research is to develop and empirically test a conceptual model of EUC success in small firms. Another important contribution of this study is that it extends previous research by testing a subset of the TAM (Davis, et al., 1989) in a new context, i.e. small businesses. The TAM predicts that acceptance of technology is influenced by external variables (e.g. training and support), perceived ease of use, and perceived usefulness.

A better understanding of the factors influencing EUC success could contribute to small firms becoming more competitive through successful EUC activity. Since small firms are very vulnerable to any failure in their computing activities, it is valuable to determine the relative impact of various individual, technical, and organisational factors on EUC success. This study will be of special interest to small firm managers. In order to plan and manage EUC activities, managers must have an adequate knowledge of their users. The results of the study will also be of interest to end users who want to improve their use of computers and to researchers investigating EUC.

This thesis reports the results of an empirical investigation of EUC success in the new context of small businesses. This Chapter presents the research questions (Section 1.1), the research context (Section 1.2), the research strategy (Section 1.3) and the thesis structure (Section 1.4).

## 1.1 THE RESEARCH QUESTIONS

This study was designed to examine the factors affecting EUC success in small firms. Based on the Final Research Model (Chapter 4), four primary research questions were addressed:

- (1) What is the impact of intra-organisational factors on EUC success in small firms?
- (2) What is the impact of extra-organisational factors on EUC success in small firms?
- (3) What is the impact of perceived ease of use and perceived usefulness on EUC success in small firms?
- (4) Do perceived ease of use and perceived usefulness mediate the effects of external variables on EUC success in small firms?

## 1.2 THE RESEARCH CONTEXT

Small businesses play a key role in the New Zealand economy (Bollard, 1984, 1988). According to Hamilton and English (1993), small firms are the most common form of business in New Zealand. The authors define a small business to be any firm employing fewer than 10 people. In 1990, according to New Zealand business patterns, there were 150,120 enterprises of all sizes operating in New Zealand and 90% of these had fewer than 10 employees (Hamilton and English, 1993); the manufacturing sector alone had 13,457 businesses with fewer than 10 employees. Therefore, the results of this study, which concentrates on small firms, will be of interest to a majority of New Zealand businesses.

Bollard (1988) defined the maximum size for a small manufacturing firm in New Zealand to be under 50 employees. The author defined firms with fewer than twenty employees as very small firms. In order to ensure a large enough sample size of computer users, this study only included small firms with between 20 and 100 employees in the manufacturing and engineering industry sectors. Chapter 3 provides a more detailed discussion of the site selection criteria.

Since very few investigations have focused on small businesses, the results of this investigation are an important contribution to the small business literature. Furthermore, very little is known about the role of computers and EUC in small firms. Thus, the findings of this study are an important contribution to the IS literature.

### 1.3 THE RESEARCH STRATEGY

Figure 1.1 presents the research strategy used in this research. The primary objective of the study was to develop and empirically test a model of the factors influencing the success of EUC in small firms. The study unit of analysis was the individual end user.

The study involved three main efforts:

- (1) Based on a preliminary review of the literature, an Initial Research Model (Zinatelli, 1993) was developed and used as a guide in the case study data collection.
- (2) Based on the results of the case study research, a Revised Research Model was developed.
- (3) Based on the Revised Research Model and a thorough review of the literature, a Final Research Model (Chapter 4) was developed and empirically tested. The Final Research Model is based on the TAM (Davis, et al., 1989) theory.

Two main methods of data collection were used in the study:

Case Studies: Which were used to gain a better understanding of EUC in small firms and to identify potentially important factors influencing EUC success.

A Survey: Which was used to collect data to empirically test the Final Research Model.

The strategy guiding the research involved the following ten steps:

- (1) A preliminary review of the EUC literature was conducted and an Initial Research Model (Chapter 3) was developed.
- (2) An in-depth exploratory pilot case study was conducted to gain a better understanding of the nature of EUC in small firms.
- (3) An exploratory/explanatory cross-case analysis involving eight companies was conducted to identify important factors influencing EUC success. A Revised Research Model was developed (Chapter 3).
- (4) A thorough review of the relevant literature was completed.
- (5) A Final Research Model (Chapter 4), which was based on the case studies and the literature review, was developed.
- (6) A survey instrument was designed to capture data necessary to measure the variables

in the Final Research Model.

- (7) Data was collected, collated, coded, cleaned, entered, and described.
- (8) Data analysis using Partial Least Squares (PLS), which is a structural equation modeling technique, was conducted.
- (9) Results of the analyses were interpreted and reported.
- (10) The study findings were summarized and future directions for research and implications were suggested.

#### **1.4 THE THESIS STRUCTURE**

A summary of each of the chapters in this thesis follows:

- |                  |  |
|------------------|--|
| <u>Chapter 1</u> | Highlights the need for a better understanding of the factors influencing EUC success in small firms. Research questions are identified and the research context is described. The overall research design is then presented. Figure 1.1 depicts the thesis structure. |
| <u>Chapter 2</u> | Reviews areas of relevant prior research from the literature, providing a summary of the current state of understanding of EUC success in small firms.   |
| <u>Chapter 3</u> | Describes the preliminary case studies and related findings.   |
| <u>Chapter 4</u> | Presents a conceptual model of EUC success in small firms along with related research hypotheses.  |
| <u>Chapter 5</u> | Presents the survey research design and methodology used to accomplish the objectives of the thesis. The operationalisation of constructs in the research model is discussed.  |
| <u>Chapter 6</u> | Presents a discussion of the data analysis techniques used, an assessment of the measurement model, and an evaluation of the structural model.   |
| <u>Chapter 7</u> | Presents an interpretation of the findings based on the survey results, case study results, and literature review.   |
| <u>Chapter 8</u> | Discusses the limitations of the study and implications for future research. Implications for small firm managers, consultants, vendors, and educational institutions are also described.  |

## 1.5 PUBLISHED AND SUBMITTED WORK

The following publications and presentations have been prepared during the course of my PhD research:

### Journal Papers

1. Zinatelli, N. (1993) End User Computing Success in Small Firms: A Research Model, *New Zealand Journal of Computing*, Vol 4, No 2, pp 41-46.
2. Zinatelli, N. and Cavaye, A. (1994) Case Study Research in Information Systems: Strategies for Success and Pitfalls to Avoid, Forthcoming in the *New Zealand Journal of Computing*.
3. Cragg, P. and Zinatelli, N. The Evolution of Information Systems in Small Firms (submitted to international journal February 1993).

### Conference Papers

1. Cragg, P. and Zinatelli, N. (1993) Applying the Future Today - Dream On!, In: *The 13th New Zealand Computer Society Conference Proceedings; August 18-20, 1993, Auckland*, Vol. 2, (Ed: Hosking, J.G.) New Zealand Computer Society, Inc., Wellington, pp 376-386.
2. Zinatelli, N. (1993) End User Computing Success Factors in a Small Firm Context, *International Conference on Information Systems Doctoral Consortium*, Orlando, Florida, USA.
3. Zinatelli, N. (1992) End User Computing Success in Small Firms: A Research Model, *New Zealand Computer Science Research Students' Conference Proceedings*, pp 319-326, Hamilton.
4. Zinatelli, N. and Cavaye, A. (1993) Case Study Research in Information Systems: Strategies for Success and Pitfalls to Avoid, *New Zealand Informatics Workshops'93*, pp 57-65, Auckland.
5. Zinatelli, N. and Cragg, P. (1994) Factors Influencing EUC Sophistication and Success in Small Firms (submitted to Conference April 1994).

### Work in Preparation:

1. Zinatelli, N. and Cragg, P. An Empirical Investigation of Factors Influencing EUC Sophistication and Success in Small Firms.
2. Zinatelli, N. and Cragg, P. Usage Patterns of End User Computing in Small Firms.

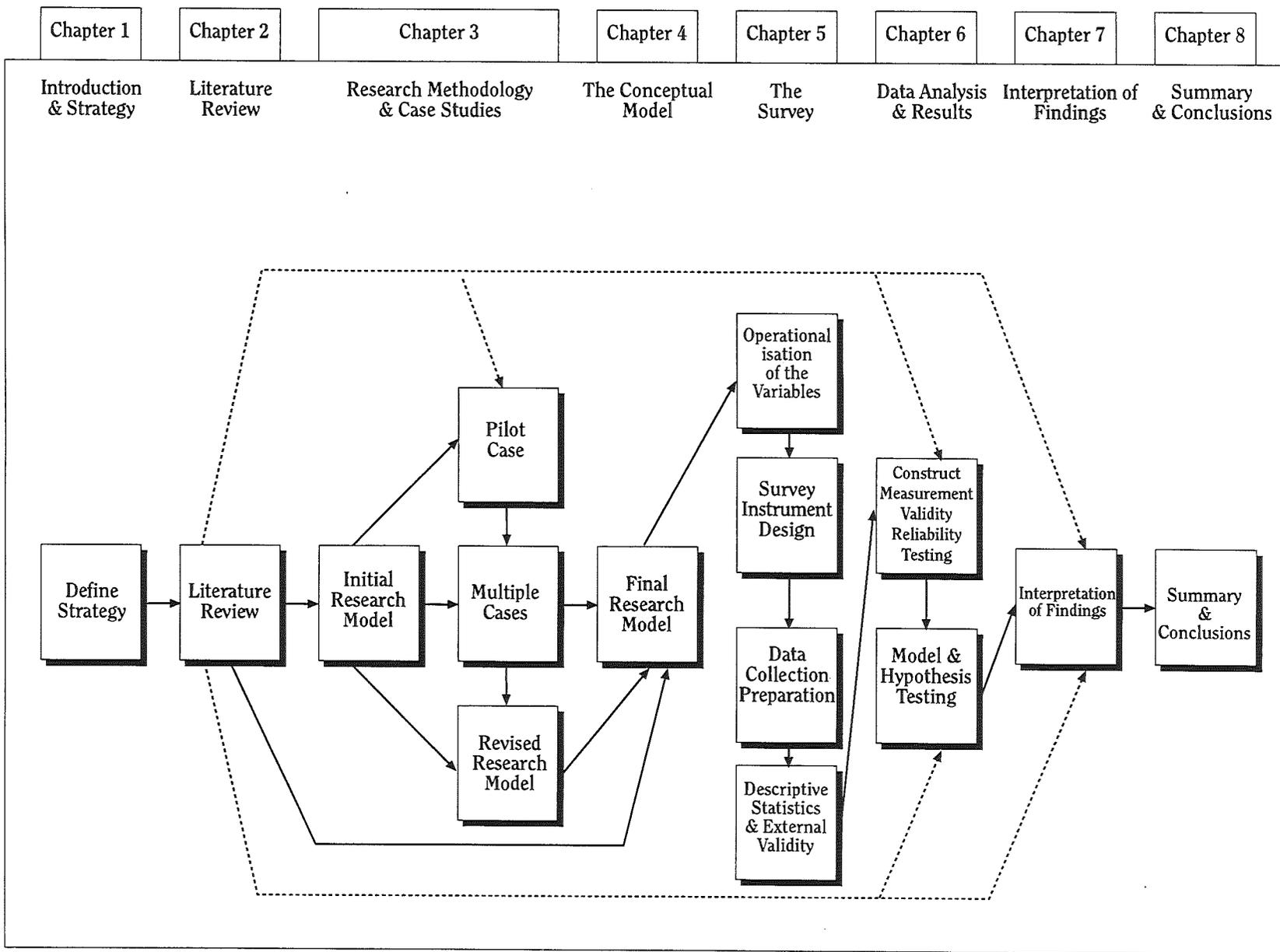


Figure 1.1 The Thesis Structure and Research Strategy



## **CHAPTER 2 - LITERATURE REVIEW**

### **2 LITERATURE REVIEW**

This chapter reviews the theoretical and empirical literature relevant to the study. The literature review has five main objectives:

- (1) To clarify the definition of EUC.
- (2) To identify key variables which could potentially influence EUC success in small firms.
- (3) To introduce theory which usefully relates the key variables identified.
- (4) To serve as a source of explanation of phenomena observed in model and hypothesis testing.
- (5) To position the current study relative to previous and ongoing research in the Information Systems (IS) field.

This Chapter is organised to achieve the above objectives. Section 2.1 reviews the literature relevant to the clarification of the definition of EUC. Section 2.2 reviews literature relevant to small firm organisational characteristics. Section 2.3 reviews previous research on computing in small firms. Section 2.4 reviews the literature examining the problem of measuring IS and EUC success. Section 2.5 reviews literature relevant to the identification of the factors influencing EUC success in both large and small firms. Section 2.6 reviews prior research on theories of behaviour prediction. Section 2.7 presents a summary of the Chapter.

#### **2.1 DEFINING END USER COMPUTING**

Many IS researchers would agree that EUC is one of the most important developments in the IS field in the last decade. However, the term EUC has been used to represent many different types of computer use and there is very little consensus regarding the definition of EUC. Therefore, before presenting a review of the relevant literature, the meaning of the term EUC will be discussed and the definition of EUC used in this study will be presented.

Not surprisingly, the definition of EUC has changed as new technologies have been introduced, as users have become more sophisticated, and as the needs of users have changed. As a result, there is much confusion in the literature surrounding the term EUC. According to Wagner (1990), there is a strong need for researchers to provide clear

definitions of EUC to avoid confusion and misunderstanding which can occur when a single term is used to represent many different computer concepts. Furthermore, it is difficult to compare results of various studies and build a cumulative knowledge of EUC if definitions are not clearly stated and if consistent definitions are not used.

### **2.1.1 End User Classifications**

Based on the results of studies of EUC in large firms, several different classifications of end users have been developed (Cotterman and Kumar, 1989; Mclean, 1979; Rivard and Huff, 1985; Rockart and Flannery, 1983). However, the most widely accepted and useful classification of end users was introduced by Rockart and Flannery (1983). In their study, the authors identified six distinct classes of end users who differed significantly from each other with respect to their computer skills, computer usage, application focus, education and training requirements, and support required. Schiffman, et al. (1992) also reported that types of end users differ significantly with respect to computer usage. A brief description of each end user classification (Rockart and Flannery, 1983) follows:

- (a) *Nonprogramming end users* primarily using limited menu-driven environments.
- (b) *Command-level users* accessing data on their own terms using report generators and fourth generation languages.
- (c) *End user programmers* using both command and procedural languages directly for their own personal information needs.
- (d) *Functional support personnel* supporting other end users within their functional group.
- (e) *EUC support personnel*, often in an Information Centre (IC), supporting end users and developing software for other end users.
- (f) *DP programmers* developing programs in EUC languages.

### **2.1.2 Defining EUC in Large Firms**

Several studies have adopted narrow definitions of EUC based on various end user classifications. For example, Rivard and Huff (1988) included only command level, end user programmers, and functional support personnel (Rockart and Flannery, 1983) in their study. Similarly, Amoroso (1986) and Amoroso and Cheney (1991) studied users who

developed applications regularly for their own use.

In contrast, several studies of EUC in large firms have adopted a broad definition of EUC. For example, Igarria (1990) and Igarria and Nachman (1990) define EUC as including anyone who uses a microcomputer or computers in general. Similarly, Doll and Torkzadeh (1988) provide a definition which includes as users all employees except the IS staff who directly interact with computer applications. Brancheau and Wetherbe (1990) and Thompson (1991) include all knowledge workers who use computers on an optional basis. In recent studies, the term EUC has been replaced by the term “user acceptance of computer technology” (Adams, et al., 1992; Davis, 1989; Davis, et al. (1989); Igarria, 1993, Igarria and Baroudi, 1994). Section 2.6 provides an explanation for the use of this new term.

### **2.1.3 Defining EUC in Small Firms**

Raymond (1987a) and Abdul-Gader (1992) used broad definitions of EUC in a their studies. In Raymond’s (1987a) investigation of the presence of EUC in small firms, the author defined EUC as any individual computing activity that is not directly related to organisational systems usage. In addition, the author described examples of sophisticated end-users who used a personal computer for professional reasons including, user-developed applications, spreadsheets for analysis and budgeting, and word processing. Similarly, Abdul-Gader (1992) defined EUC as the ability of professional staff and managers to directly fulfil their computing needs.

Raymond and Bergeron (1992) defined EUC as the capability of users to have direct control over their computing needs. The authors proposed that many of the EUC applications developed on personal computers, using spreadsheet or database packages, are a specialised type of EUC referred to as Personal Decision Support System (Snitkin and King, 1986). In their study, Raymond and Bergeron (1992) included users of microcomputer applications developed with a spreadsheet or database package; all of the users were first or second-level managers in the accounting, finance, sales, and production functions.

In his paper on the foundations and directions for research in EUC in small firms, Raymond (1990b) suggested that researchers should determine exactly what constitutes EUC as opposed to organisational computing, by using the various end user classifications proposed

by IS researchers. The author stated that command level users and end user programmers (Rockart and Flannery, 1983) are the EUC activity of interest in the context of small firms; however, no justification for this definition was provided.

The Rockart and Flannery (1983) end user classification was used by Montazemi (1988) and Abdul-Gader (1992). Montazemi (1988), in his study of the factors affecting information satisfaction in small firms, used the classification to determine the level of end user computer literacy. Similarly, Abdul-Gader (1992) used the classification to determine end user literacy in his study of EUC in a developing nation.

Although the Rockart and Flannery (1983) classification of end users is commonly used in EUC studies, it is based on results from large firms. In a small firm context, the end user classifications of functional support personnel, EUC support personnel, and DP programmers are not entirely relevant. This is primarily due to the fact that small firms typically do not have the resources to justify having ICs and/or DP Programmers and the EUC support role is often on an informal basis. Thus, for studies of EUC in small firms, end user classifications based on large firm studies are not necessarily appropriate.

#### **2.1.4 Defining EUC in The Current Study**

Consistent with other studies of EUC in both large and small firms, this study adopts a broad definition of EUC. In this study, EUC involves the optional use of computers by professionals and managers (i.e. knowledge workers) for work-related purposes. Computer professionals and clerical/secretarial staff are not included in this definition since their use of computers is typically mandatory.

## **2.2 SMALL FIRM ORGANISATIONAL CHARACTERISTICS**

According to Cooley, et al. (1987), it is an oversimplification to assume that the computing environment of small firms is equivalent to that of large firms. If small firms are to benefit from the full potential of computers, then an understanding must be developed of the factors affecting the success of IS in small firms. Martin (1989) suggests there is a need to identify those special characteristics of small firm computer experience which contrast with the experience of larger firms. Delone (1981; 1988) found that firm size does make a difference on how firms manage their computer resources because small firms face different

computer related opportunities and problems.

In the IS field, several studies have attempted to identify the organisational differences between large and small firms and the effects of these differences on computerisation (Cheney, et al., 1986; Ein-Dor and Segev, 1978; Raymond, 1984; 1990a). Raymond (1985) states that small firms have their own unique qualities in terms of their environment, structure, psycho-sociological climate, management, and IS usage. In addition, Raymond (1984) concludes that the characteristics of small firms which can affect IS are: centralization of structure, insufficiency of resources for IS, and the fact that the extra-organisational environment cannot be controlled.

In a recent paper on the foundations and directions for research on EUC, Raymond (1990b) proposed that different characteristics of small firms should be examined in order to determine their potential impact on EUC in small firms. Raymond (1984; 1990b) suggests that the following four categories of small firm characteristics could potentially affect EUC: organisational, decisional, psycho-sociological, and information systems. Raymond (1987a) concludes that it is important to investigate the relationship between the success of EUC and the organisational and IS contexts of small firms.

According to Thong, et al. (1993), small firms lag behind larger firms in the use of IT due to the characteristic problem of resource poverty. Resource poverty results from small firms operating in a highly competitive environment, suffering financial constraints, lacking professional expertise, and being susceptible to external forces. Resource poverty, coupled with a short-range management perspective imposed by a volatile competitive environment (Welsh and White, 1981), implies that small firms face greater risks in IS implementation. Small firm managers tend to choose the lowest cost IS and underestimate the amount of time and effort required for IS implementation.

### **2.3 COMPUTING IN SMALL FIRMS**

Studies of computing in small firms have examined the specific EUC issue as well as investigating the general role of computers in small firms. A review of these two research areas is presented.

### **2.3.1 EUC in Small Firms**

Several recent studies have looked specifically at various aspects of EUC in small businesses. Raymond (1987a) attempted to identify factors which could explain why some small firms engage in EUC while others do not. He reported that firms in which EUC was present were larger in size and more decentralized. In addition, firms engaging in EUC had invested more in hardware resources, they had a less autonomous information system function, and they had more decision support applications.

Montazemi (1987; 1988) examined the characteristics of end users in small firms and found that the level of end user computer literacy was low and end users had difficulty developing complex applications. In a more recent study, Raymond and Bergeron (1992) concluded that small business managers who developed their own spreadsheet-based analysis applications experienced higher levels of decision-making satisfaction. Cragg and King (1993) investigated the growth of EUC in six small firms over a five year period and found that very little growth in EUC had occurred in most of the firms.

Cragg and Zinatelli (1993) examined changes that had occurred with respect to EUC in eighteen small firms over an eight year period. The results of the study revealed that most users were non-programming users (Rockart and Flannery, 1983) who primarily worked with menu-based application packages. Low EUC literacy was identified as a main area of concern for small firm computing. The authors concluded that there is considerable scope for greater use and better management of computer technology in small firms.

### **2.3.2 The Role of Computers in Small Firms**

Substantial potential for research contributions lies in the study of the role of computers in small firms (Cooley, et al., 1987). According to Farhoomand and Hrycyk (1985), personal computers proliferated in small firms due to affordable and user-friendly hardware and software tools. However, small firms are limited in their use of computers in that computers are primarily used to support accounting applications (Baker, 1987; Cragg, 1984; 1986; Farhoomand and Hrycyk, 1985; Heikkila, et al., 1991; Kagan, et al., 1990; Massey, 1986; Martin, 1989; Nickell and Seado, 1986; Raymond and Magnenat-Thalmann, 1982; Cragg and Zinatelli, 1993). Thus, in small firms, computers have a large impact at the operational level, but not at the managerial decision-making level.

Several researchers have highlighted the strong need for small firms to use computers not only for accounting applications but also for other important areas such as marketing, production, forecasting, and decision support (Cragg, 1986; Massey, 1986; Nickell and Seado, 1986; Raymond, 1987b; 1989; 1992). In a recent study, Raymond and Pare (1992) found that small firms have started to use computers to support areas other than accounting. The results of the latter study show that small firms are increasing investments in information technology (IT) with the goals of improving productivity and making more effective use of computers.

Various studies have investigated factors that influence small firm computing. Top manager involvement and computer literacy have been identified as having a strong influence on small firm computing (Baker, 1987; Cragg and King, 1993; Delone, 1988; Malone, 1985; Cragg and Zinatelli, 1993). Several studies suggest that the role of the external environment has an important influence on computing in small firms (Baker, 1987; Kole, 1983; Lees and Lees, 1987; Martin, 1989; Raymond, 1990a; 1990b; Zinatelli and Cragg, 1994).

Several researchers have conducted empirical studies to identify factors that contribute to the success of IS in small firms (Delone, 1988; Gable, 1991a; Raymond, 1985; 1988; 1989; Soh, et al., 1992; Yap, et al., 1992; Thong, et al., 1993). For example, these studies have identified internal and external support, top management support, experience, and training as factors contributing to the success of IS in small firms.

## **2.4 MEASURES OF IS and EUC SUCCESS**

Appropriate measures are needed in order to assess the success of EUC. This section reviews the literature on IS success and EUC success measures. A distinction is made between IS success and EUC success; IS success is an organisational computing success measure whereas EUC success is an individual computing success measure. Measures of EUC and IS success used in previous small firm studies are discussed.

### **2.4.1 A Comparison of IS and EUC Success Measures**

Although measures of IS success are related to measures of EUC success, researchers have developed and modified various instruments to reflect the important differences between

these two measures of success. Since there is no consensus on the measure of IS success (DeLone and McLean, 1992) or EUC success, researchers must choose the most appropriate instruments to use. For example, DeLone and McLean (1992) identified six main categories of IS success: system quality, information quality, utilization, user information satisfaction (UIS), individual impact, and organizational impact. The author concluded that the six categories of success measures clearly indicate that IS success is a multidimensional construct and that it should be measured as such.

Measures of IS success are related to measures of EUC success in that researchers have typically modified IS success measures to be suitable for end user developed applications. For example, Doll and Torkzadeh (1988) argued that measures of UIS developed for traditional IS environments may no longer be appropriate for an end user environment where users directly interact with the application software. The authors proposed that UIS instruments have not been designed or validated for measuring EUC satisfaction because they focus on general satisfaction rather than on a specific application. As a result, the UIS instruments omit aspects important to EUC such as ease of use.

The Doll and Torkzadeh (1988) study distinguishes between UIS and an end user's satisfaction with a specific application. The authors define EUC satisfaction as the attitude towards a specific computer application by someone who interacts with the application directly. In contrast, UIS instruments, such as the Ives, et al. (1983) instrument, measure general user satisfaction with IS staff and services, information products, and user involvement rather than satisfaction with a specific application. According to Doll and Torkzadeh (1988), most end users would not be able to evaluate these UIS activities and thus several IS staff and service items in the UIS instruments are less appropriate in an end user environment.

#### **2.4.2 Measures of EUC Success from an Individual Perspective**

Many approaches have been used to measure the success of EUC in organisations. However, EUC satisfaction (Baroudi and Orlikowski, 1988; Doll and Torkzadeh, 1988; Ives, et al., 1983) and application utilisation (Amoroso, 1986; Amoroso and Cheney, 1991; 1992; Ein-Dor and Segev, 1991) are the two most widely used surrogate measures of EUC success.

Other surrogate measures of EUC success include decision-making satisfaction (Raymond

and Bergeron, 1992; Sanders and Courtney, 1985), perceived effectiveness (Igarria, 1990) and perceived individual impact (Blili, 1992). More recently, measures of the quality of end user developed applications have been developed (Amoroso and Cheney, 1992; Rivard, et al., 1993). A brief summary of the most widely used and most recently developed EUC success measures follows.

#### i. User Information Satisfaction

Delone and McLean (1992) state that UIS is the most widely used measure of IS success due to a number of reasons. A major factor is that satisfaction has a high degree of face validity; it is hard to deny the success of a system which is liked by its users. In addition, the development of the Bailey and Pearson instrument (1983) and its derivatives has provided a reliable tool for measuring satisfaction and for making comparisons among studies. Finally, most of the other measures are either conceptually weak or empirically difficult to obtain. In terms of EUC success, Cheney, et al. (1986) propose that UIS is a good measure of EUC success since several instruments have been developed and validated to measure UIS.

Bailey and Pearson (1983) defined (UIS) as a multidimensional attitude on the part of the user toward different aspects of an IS. Similarly, Ives, et al. (1983) described UIS as the perceived effectiveness of an information system. In terms of EUC satisfaction, three measurement instruments have been used in previous studies: (1) the Doll and Torkzadeh (1988) EUC satisfaction measure, (2) a modified version of the Ives, et al. (1983) IOB instrument, and (3) a modified version of the Baroudi and Orlikowski (1988) instrument. The Doll and Torkzadeh (1988) instrument has been described as a more valid measure of EUC success than the IOB instrument (Amoroso and Cheney, 1991).

Doll and Torkzadeh (1988) define EUC satisfaction as the attitude towards a specific computer application by an individual who interacts with the application directly. The specific EUC satisfaction components included in their instrument are: content, format, accuracy, ease of use, and timeliness of an application. The Doll and Torkzadeh (1988) instrument was developed specifically for end user developed applications and has also been used in a small firm context (Abdul-Gader, 1992). The other two EUC satisfaction instruments were originally developed as measures of IS success and were modified to

better suit the end user development environment.

### ii. Application Utilisation

Utilisation of an information system is one of the most frequently reported measures of IS success (Delone and McLean, 1992). Some studies have measured actual use through objective measures using hardware monitors. Other studies adopted a subjective or perceived measure of use by questioning users about their use of an IS. Delone and McLean (1992) argue that usage, whether actual or perceived, is a useful measure of IS success only when such use is voluntary. Cheney, et al. (1986) propose that unless use is mandatory, an end user will utilise EUC facilities only when they are perceived to be of value to the user. Thus, the authors recommend application utilisation as a surrogate measure of EUC success.

However, Amoroso and Cheney (1992) state that unlike the situation for UIS, standard utilisation measures still have not been developed. As a result, there have been problems with previous studies attempting to measure application utilisation. One such problem was that single-item measures have been used when a multi-dimensional construct was being assessed. To overcome this problem, two dimensions of utilisation were considered in their instrument: (1) task characteristics and (2) intended versus actual utilisation patterns. Some of the specific usage categories included in their instrument are: planning, budgeting, decision-making, and report generation. Amoroso and Cheney (1992) stress the importance of a good measure of utilisation; such a measure will enable managers to justify expenditures on IT which end users continue to demand.

### iii. Perceived Individual Impact

According to Delone and McLean (1992), of all the measures of IS success, individual impact is probably the most difficult to define in an unambiguous fashion. This difficulty is due to the fact that impact could be related to a number of different measures such as impact on performance, understanding, decision-making, and user activity.

Blili's (1992) study on managerial EUC in large firms included perceived individual impact as one measure of EUC success. The perceived impact measure in this study focused on the impacts of EUC on managerial performance, productivity, and job satisfaction. Blili's (1992) impact measure related very closely with both UIS and utilisation measures.

#### iv. User Developed Application Quality

Amoroso and Cheney (1992) suggest that researchers focus on the quality dimension of end user developed applications, where quality is defined as the degree to which an application attains its goals from the perspective of the user. The authors recommend that the combination of end user computing satisfaction and application utilisation be used as a surrogate measure of EUC success. Rivard, et al. (1993) developed a new measure to assess the quality of user-developed applications. The measure defines quality as a construct consisting of eight dimensions: reliability, effectiveness, portability, economy, user-friendliness, understandability, verifiability, and maintainability. The authors propose that the measure is readily usable by end users and that it can help users better assess their own applications.

#### **2.4.3 EUC Success from an Organisational Perspective**

Cheney, et al. (1986) suggest that organisational performance and decision effectiveness are difficult EUC success measures to use due to the numerous intervening environmental variables that tend to influence them. Furthermore, DeLone and McLean (1992) state that IS researchers have tended to avoid organizational impact measures (except in laboratory studies) because of the difficulty of isolating the effect of the IS effort from other effects which influence organisational performance. Despite these difficulties, several IS field studies and case studies have chosen various organisational performance measures such as cost reduction, revenue generation, and productivity gains.

Several large firm studies have attempted to measure EUC success from an organisational perspective (Bergeron, et al., 1993; Rivard and Huff, 1984; 1987). EUC success from an IS department perspective has been investigated in several empirical studies. For example, Rivard and Huff (1984) found that IS managers are primarily interested in being able to demonstrate that the applications developed by users are of tangible benefit to the organisation and that the users themselves were satisfied with the EUC services made available to them from the IS department.

However, Rivard (1987) found that successful implementation of EUC has two sometimes conflicting dimensions: end user computing satisfaction and the ability of IS management to demonstrate that tangible benefits result from such user activities. The author concludes

that the conflict may be avoided by better planning the evaluation of EUC and by making users responsible for demonstrating the tangible benefits of their EUC activities.

In a more recent study, Bergeron, et al.(1993) investigated the importance of EUC success criteria from an IS department perspective. The results show that, in order of decreasing importance for organisations, EUC success is related to the following five criteria: (1) organisational effectiveness, (2) user appreciation, (3) quality of EUC applications, (4) efficiency of EUC applications, and (5) adequacy of EUC applications. Thus, the results of the study demonstrate that the measure of EUC success from an IS department perspective is a useful measure in a large firm context. However, since most small firms do not have IS departments, this measure of EUC success is not appropriate for small firms.

#### **2.4.4 Measures of EUC and IS Success in Small Firms**

Raymond (1987c) proposed that since the impact of IS on organisational effectiveness is difficult to measure, user satisfaction measures provide the most useful assessments of IS success in small firms. UIS has been the most widely used measure of IS success in small firms (Montazemi, 1988; Raymond, 1985; 1990a; Soh, et al., 1992; Thong, et al., 1993; Yap, et al., 1992). Raymond (1985) stressed that it is important to note that the UIS measure relates to the IS in its entirety rather than to a specific application.

Montazemi (1988) and Raymond (1985) used a modified version of the Bailey and Pearson (1983) instrument to measure UIS. Raymond (1987c) later addressed the question of measuring user satisfaction in the context of small firms by adapting and validating the Pearson and Bailey (1979) and IOB (1983) UIS instruments to small firms. Raymond's (1987c) instrument has become the most widely used UIS instrument in studies of small firm computing (Raymond, 1990a; Soh, et al., 1992; Thong, et al., 1993; Yap, et al., 1992).

Other measures of small firm IS success include usage (Delone, 1988; Raymond, 1985; 1990a; Soh, et al., 1992), organisational impact (DeLone, 1988; Thong, et al., 1993), and project and economic success (Soh, et al., 1992). Although IS success has been investigated in a small firm context, very few studies have looked specifically at EUC success in small firms. Two recent studies have looked at EUC satisfaction and decision-making satisfaction in small firms (Abdul-Gader, 1992; Bergeron, et al., 1993).

## **2.5 FACTORS INFLUENCING EUC SUCCESS IN BOTH SMALL AND LARGE FIRMS**

Raymond (1990b) suggests that the main motivation in identifying EUC success factors is that changes can then be induced in organisational, technical, and individual variables in order to create a more favourable environment for EUC. The author stresses that changes can only be made when these variables are partially or fully controllable. In their study of the benefits and risks of EUC, Alavi and Weiss (1986) state that an important issue is to determine how to induce these changes in order to create an effective EUC environment. The authors caution that changes must be made in a controlled manner so that individual and organisational benefits are maximised and risks are minimised.

Based on the work of Ein-Dor and Segev (1978), Cheney, et al. (1986) summarized a conceptual scheme for relating organisational context variables and EUC success. The scheme categorises independent variables into three types: (1) uncontrollable, (2) partially controllable, and (3) fully controllable. Cheney, et al. (1986) conclude that an analysis of the partially and fully controllable variables will aid in the design of a controlled environment within which EUC will succeed.

The fact that there are differences between small and large firm computing provides the basis for identifying partially and fully controllable IS and EUC success factors in small firms (DeLone, 1981; 1988; Ein-Dor and Segev, 1978; 1982; Raymond, 1985). For example, DeLone (1983) grouped success factors into three categories: (1) fixed, (2) semi-fixed, and (3) controllable. IS experience is an example of a fixed or uncontrollable factor. Semi-fixed factors include vendor knowledge of the small client's business, personnel acceptance of IS system, hardware and software characteristics, top management knowledge of computers, and type of computer services used. Controllable factors were also identified, such as top management involvement with computers, level of external software support, level of firm sponsored IS training, relative spending on software and people versus hardware, and level of IS planning.

The next two sections provide a review of the literature on partially and fully controllable factors that could potentially influence EUC success in small firms. Both intra-organisational and extra-organisational factors are considered; however, the main focus of the review is on internal and external support. These two factors have been identified in

the literature as having a strong influence on EUC success in large firms and a potentially strong effect on EUC success in small firms.

### **2.5.1 Extra-Organisational Factors Influencing EUC Success**

In his review of survey research in the study of IS, Kraemer (1989) stated that survey research has not dealt with the external environment and that survey researchers tend to draw the boundaries of their investigations at the organization. This lack of investigation of the external environment is also true of the small firm computing literature. However, several researchers have stressed the importance of investigating the influence of the extra-organisational environment on small firm computing.

For example, Raymond (1984) proposed that one characteristic of small firms which can affect IS is the uncontrollability of the extra-organisational situation. The author suggested that a greater dependency on the extra-organisational situation can manifest itself by the absence of specialised IS personnel and by inadequate hardware and software support from vendors. Similarly, Turner (1982) stated that small firms typically acquire a greater proportion of their IS resources externally than they develop internally and the absence of internal resources can be a detriment to IS success. In more recent studies, Raymond (1990a; 1990b) recommended that the uncertainty of the extra-organisational environment in relation to IS and EUC success in small firms should be studied more thoroughly.

The following sections present a review of the literature on external IS and EUC support for small firms. A distinction is made between IS support (organisational computing support) and EUC support (individual computing support). Studies investigating vendor support, consultant support, and government incentives for both IS and EUC in small firms are reviewed.

#### **i. External IS Support for Small Firms**

IS researchers have found that small firms lack computer experience and do not have sufficient internal IS expertise (Cragg and King, 1993; Delone, 1981; 1988; Gable, 1991b; Lees, 1987; Lees and Lees, 1987; Raymond, 1989). As a result, small firms often need to rely on external IS experts to assist in IS implementation. Gable (1991a) stated that small firms have a more difficult time attracting and retaining skilled IS staff and are thus more

dependent on external expertise. Raymond (1987b) concluded that smaller firms tend to be much more dependent on external resources and expertise in terms of systems development, operation, and maintenance. Thus, the level of external IS support has a more direct impact on UIS in small firms in comparison with large firms.

Thong, et al. (1993) investigated the impact of external IS support on small firm computing and found that high quality external IS expertise is critical to the success of IS. In addition, the study findings indicate that external IS expertise is even more critical than top management support. Thus, the authors recommend that more efforts be directed at selecting and engaging high quality external consultants and vendors for small firm IS implementation.

By engaging high quality external support, many potentially serious problems could be avoided by small firms. However, Yap, et al. (1992) concluded that the use of external support is not without problems. Lack of commitment to implementation success and lack of expertise are common problems associated with external support. In addition, Martin (1989) identified problems that arose from the dependence of small firms on software houses or other IS suppliers. One such problem was that often the IS supplier was itself a small business; in a volatile market, there was a significant risk that the supplier could cease to trade, leaving the purchaser with an investment in IS which could not be maintained or developed.

Various types of external support are needed in order to meet the growing needs of small firm computing. Montazemi (1987) concluded that a set of guidelines is needed to help small firms in policy planning and choice of IS. Since small firms have minimal financial capability to hire internal analysts, the author suggested that this can be achieved through an external IS bureau staffed with IS specialists knowledgeable about small firm needs and constraints. In addition, there is a growing need for educational institutions to offer in-depth IS programmes developed specifically for small firms. Cragg and King (1993) emphasised that vendors, consultants, and accountants could play a greater role in helping small firms review their current systems, develop IT plans, and educate and train personnel.

Raymond (1987b) stated that limited intra-organisational and extra-organisational resources

prevent small firms from having their own IS development staff. Since lack of support causes the majority of problems in small firm computing, the author concluded that a possible solution would be to increase the level of EUC in small firms. An increased level of EUC would enable small firms to be less dependent on external sources of support.

Previous studies have investigated the influence of several external sources of assistance on computing in small firms including: (1) vendor support, (2) consultant support, and (3) government incentives.

### ***Vendor Support***

Small firms are very reliant on advice and support from vendors (Cragg and King, 1993). Typically, the duties of a vendor include providing computer hardware and software packages, technical support, and training of users. Empirical studies have revealed the important influence vendor effectiveness has on IS success in small firms. Yap, et al. (1992) found that IS success is positively associated with the level of vendor support given to small firms. Since small firms rely on vendors to propose IS alternatives and to provide after sales service and training, the authors stress that it is important to consider the commitment and ability of vendors during the vendor selection process. Similarly, Thong, et al. (1993) concluded that the level of IS effectiveness is higher in firms with a high level of vendor effectiveness.

The lack of vendor impartiality could also cause potential problems for small firm computing (Thong, et al., 1993). For example, vendors may recommend products in which they have a vested interest but which may not suit the requirements of small firms. The small firms would be coerced into modifying their requirements to suit the products offered by the vendors and settle for a less effective IS. This problem is exacerbated by the fact that small firms have less influence over computer vendors and as such are often less well-served (Delone, 1988).

Raymond (1989) highlighted another problem with the support provided to small firms by vendors. The author concluded that vendors of application software are only beginning to offer products and services that support production, management, and marketing in small firms. This is due to the fact that vendors prefer to concentrate on the more profitable and still vast market of the initial computerization of small firms through packaged basic

accounting software. Raymond (1989) recommended that firms that want to go beyond this initial stage of computerisation will have to depend on a variety of sources including vendors, internal computer personnel, and above all managers themselves, by means of EUC.

### ***Consultant Support***

According to Simon (1990), engaging external consultants versus employing full time staff in small firms eliminates:

- (1) the need to maintain expensive internal IS staff when the IS implementation is completed and maintenance is needed infrequently
- (2) the need to provide expensive on-going professional training for the internal staff to keep up with new technology
- (3) the difficulties in engaging qualified internal IS staff due to limited career advancement prospects in small firms

Gable (1991a) argued that small firms should be involved in consultant engagement. However, there are many risks associated with engaging a consultant and many small firms choose not to pursue this approach. Some of these risks and negative factors are: perceived prohibitive costs of consultants, fear of admitting failure, getting the wrong consultant, competitive vulnerability, and shortage of time to deal with consultants. Despite these risks, the use of external consultants may provide much needed expertise to help small firms in project management and software selection (Kole, 1983).

Empirical studies have revealed the important influence which consultant effectiveness has on IS success in small firms. Yap, et al. (1992) found that, in small firms with consultants, IS was positively associated with consultant effectiveness. In addition, Thong, et al. (1993) concluded that the level of IS effectiveness is higher in firms with effective consultants as compared to those with a low level of consultant effectiveness. Similarly, Soh, et al. (1992) found that computerisation success is positively associated with the capability and experience of the consultant.

However, several IS researchers have highlighted the potential negative effects of engaging a consultant. Lees (1987) found that consultants have negative effects on user satisfaction

and usage due to decreased top management involvement in companies that engage consultants, and the consultant's inadequate experience and abilities. Soh, et al. (1992) concluded that computer projects of small firms with consultants are less likely to be completed on time and within budget as compared to those without consultants. To avoid these potential problems, Senn and Gibson (1981) recommended engaging a consultant who has technical expertise as well as knowledge of small firm operations.

Gable (1991a) found that small firms often overestimate the impact of consultant and vendor support in achieving successful computer system selection and implementation. The author proposed that for consultant engagement to be successful, the process must be viewed as being directed toward the achievement of specific organisational results where the client accepts responsibility for the direction of the process. The results of the study revealed that client involvement is integral to project success and frequently lacking due to misconceptions of small firms regarding their role in the consultative process. Gable (1991a) recommended that small firms: (1) assess client and consultant compatibility, (2) identify and address specific organizational goals, and (3) accommodate evolving project objectives. The author stressed that engaging a consultant does not guarantee successful computerisation and that there is a need for pro-active top management involvement even when a consultant is engaged.

### ***Government Incentives***

Government incentives are an external factor that could potentially influence the success of EUC in small firms (Yap, et al., 1993; Yong, and Keng, 1991). Yap, et al. (1993) conducted a study which examined the impact of a government incentive programme on small firm computerisation in Singapore. The government program was developed to encourage and assist small firms to become more competitive through the use of IT. The main finding of Yap, et al.'s (1993) study was that participation in the government program did not result in more effective IS. However, there was evidence to show that government incentives, including subsidies, low interest loans, seminars, and technical expertise had a positive influence on small firm computing. For example, government incentives lower the barriers to computerisation and make computerisation more attractive to small firms which lack financial resources and technical expertise.

## ii. External EUC Support

One factor which is critical to the success of EUC in large firms is the technical support provided by an Information Centre (IC) or IS function (Brancheau, et al., 1985; Magal, et al., 1988). Since large firms rely primarily on ICs for EUC support, the impact of external sources of EUC support on EUC success is not very strong. For example, Amoroso (1986) found that vendor support was not significantly related to the satisfaction of end users. In addition, vendor-based training was perceived as inadequate; 61% of the users received no training from the vendor community. End users also claimed that policies relative to obtaining vendor support and closing vendor contracts were either not known or not helpful. However, vendor support did have a substantial impact on utilisation measures.

Since lack of resources and technical sophistication would preclude the creation of an IC in small firms, the influence of external EUC support is potentially much greater. Raymond (1990b) suggested that small businesses would look more to external sources of EUC support such as small business consulting centres operated by government agencies, universities, or computer vendors. Thus, the availability and quality of this extra-organisational support could be considered as a more relevant determinant of EUC success in small firms.

Although an internal IC may not be well-suited to small firms, the concept of an external IC to meet the needs of small firms was introduced by Raymond (1987a). Raymond (1990b) later proposed that an external IC could be used to increase EUC success by facilitating the implementation, usage, and management of EUC in small firms. The author stressed that not only is it important to determine whether adapting the IC concept to small firms would be opportune, but it is also important to determine how the external IC might be created. Raymond (1990b) suggested inter-firm cooperation, community centres operated by a university or governmental agency, and walk-in centres operated by consultants or vendors as possible external ICs.

In his investigation of the sources of support that were utilised by end users in large firms, Bowman, et al. (1993) found that support from outside associates was preferred over support from consultants or vendors. This result is not surprising since the most important criteria when users chose help included immediate availability, proximity of source, and cost of

### **2.5.2 Intra-Organisational Factors Influencing EUC Success**

This section reviews the literature on the influence of intra-organisational factors, including EUC support and top management support, on EUC success in both large and small firms.

#### **i. Internal EUC Support**

The importance of EUC support to the success of EUC has been highlighted in many studies of EUC in large firms. An IC is typically set up to provide EUC support for users in large firms and these ICs are critical to the success of EUC (Magal, et al., 1988).

Igbaria (1990) reported that EUC support was found to have two separate dimensions: (1) application development support which includes the presence of an IC and the availability of development assistance and (2) management support which includes top management encouragement, allocation of resources, and IS staff support. The results of the study indicated that both management support and IC support had positive effects on EUC effectiveness. Similarly, Igbaria and Nachman (1990) found that greater availability and accessibility of hardware and software resources were significantly related to overall end user satisfaction. The results of Amoroso's (1986) study showed that EUC support had a positive impact on both EUC satisfaction and utilisation.

Rivard and Huff (1988) concluded that the greater the user satisfaction with the EUC support provided by the firm, the greater the overall user satisfaction with EUC. However, the authors stated that in organisations where EUC is immature, it may be supported informally via personal contacts between users and individuals in the DP departments or between experienced and novice users. Similarly, Bowman, et al. (1993) found that other users and manuals accompanying the software were the two most important types of assistance sought by users. These two sources were rated by users as more important than other sources of support including purchased books, computing centres, help screens, and external support. According to Raymond (1990b), since the IS function is at its early stages in most small firms, it is likely that EUC is also at its early stages and is probably supported informally.

Abdul-Gader (1992) and Montazemi (1988) investigated the influence of the presence of systems analysts on EUC success in small firms. The results indicated that EUC success is positively influenced by the number of systems analysts present in small firms.

## ii Top Management Support

Previous studies have established the importance of top management support in ensuring IS success in small firms. For example, Delone (1988) found that CEO knowledge of computers and active involvement in the computerisation efforts was the strongest influencing factor on IS success. Yap, et al. (1992) concluded that IS success is positively associated with the level of CEO support.

Thong, et al. (1993) investigated the relative importance of top management support and external IS expertise on IS success. The findings of the study revealed that while top management support is essential for IS success in small firms, high quality external IS expertise is even more critical. Top management may provide the resources needed for the project but it is the external experts who will implement the systems. The authors conclude that top management involvement, interaction, and support is a necessary but not sufficient factor for successful IS implementation.

Although top management support is often prescribed as critical for IS success, few studies have attempted to determine what type of executive support is likely or appropriate. Jarvenpaa and Ives (1991) noted that hands-on management in IS projects might be much more important in a small firm where the CEO commonly makes most key decisions and is perhaps the only individual who can link IT to corporate objectives and strategy. The authors distinguish CEO participation (which entails the CEO investing some of his/her time on IT related matters) and executive involvement (the CEO does not need to take a hands-on role in managing IT but rather only needs to view IT as contributing to the firm's success). The study concluded that CEO support generally takes the form of involvement rather than active participation and that involvement is an effective means of support.

## **2.6 THEORIES OF BEHAVIOUR PREDICTION**

In the past, much of the EUC success literature was descriptive and did not have a strong theoretical base. However, more recent efforts have drawn on theories from referent disciplines to help predict and explain EUC success. In particular, IS researchers have recently adopted two behaviour intention models as theoretical foundations for research on the factors influencing user acceptance of computer technology: (1) Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA) and (2) Davis, et al. (1989)'s Technology Acceptance

Model (TAM). These two theories are reviewed briefly in the paragraphs which follow.

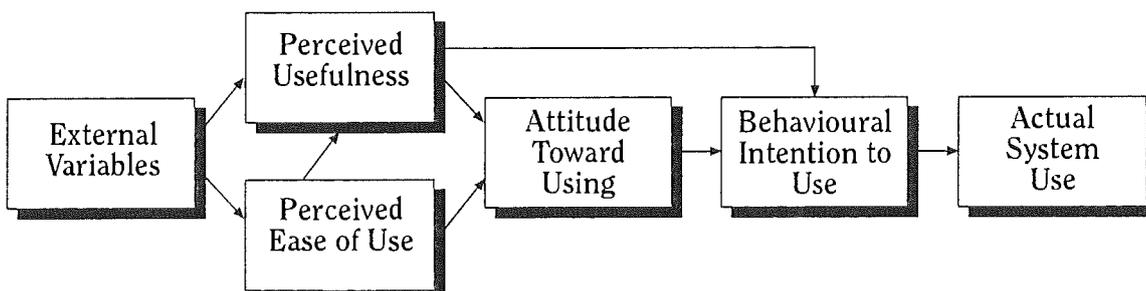
One of the most widely adopted and tested theories of behaviour is the TRA proposed by Fishbein and Ajzen (1975). TRA is a well-researched behaviour intention model from social psychology that has been successful in predicting behaviour across a wide variety of disciplines. Thus, according to Davis, et al. (1989), TRA should be appropriate for studying the determinants of computer usage in the IS field. Since computer usage is one of the most commonly used measures of EUC success, the TRA model should also be appropriate for studying the factors influencing EUC success.

Despite the acceptance of the TRA (1975) in the psychological literature, the theory is very general and not specific to the IS context. A more recently developed theory, TAM (Davis, et al., 1989), is based on TRA and is specifically developed for modeling user acceptance of computer technology.

According to Davis, et al. (1989), the goal of TAM is to “provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behaviour across a broad range of EUC technologies and user populations, while at the same time being both parsimonious and theoretically justified” (p. 985).

Figure 2.1 shows the TAM theory. TAM proposes that two main beliefs: perceived usefulness and perceived ease of use, are fundamental determinants of user acceptance of computer technology (Davis, et al., 1989). In particular, the model predicts that perceived usefulness is influenced by perceived ease of use and that both of these constructs predict attitude. Based on the TAM, attitude towards use and perceived usefulness, influence behavioural intention which in turn predicts actual usage.

**FIGURE 2.1 The Technology Acceptance Model (TAM)**



The empirical investigations that have been conducted suggest that the TAM predicts intention fairly well. For example, Davis (1989) reported that perceived ease of use and perceived usefulness were significantly correlated with use of an office automation package, a text editor, and two graphics packages. Davis, et al. (1989) found that TAM successfully predicted use of a word processing package.

An additional primary goal of the TAM is to provide a basis for investigating the impact of external factors on internal beliefs, attitudes, and intentions. Despite this primary goal, Davis, et al. (1989) focused their research primarily on the determinants of usage rather than on the external variables affecting the determinants. More recent studies (Adams, et al., 1992; Igbaria and Baroudi, 1994; and Mathieson, 1991) have investigated the impacts of external factors on technology acceptance.

Although both the TAM and TRA models predicted intentions and usage satisfactorily (Davis, et al., 1989), the TAM was found to be much simpler, easier to use, and a more powerful model of the determinants of computer usage (Igbaria, 1993). This is not surprising since the TAM was developed specifically for predicting computer usage behaviour. For these reasons, the TAM was selected as the theoretical grounding for this study.

## **2.7 CHAPTER SUMMARY**

This Chapter reviewed a selection of literature relevant to the study. The literature review was organised into the following sections: (1) the definition of EUC, (2) small firm organisational characteristics, (3) small firm computing, (4) measuring IS and EUC success, (5) factors influencing EUC success in both large and small firms, and (6) theories of behaviour prediction. Although there is a lack of research on EUC in small firms, the importance of identifying the factors influencing EUC success in small firms was highlighted. Chapter 3 follows from these observations and relates findings of preliminary case studies aimed at investigating the influence of various factors on EUC success in small firms.



## **CHAPTER 3 - RESEARCH METHODOLOGY AND THE CASE STUDIES**

### **3 RESEARCH METHODOLOGY**

This chapter introduces the combined qualitative and quantitative research approach that was used for this study. A combined case study and survey research strategy was used in the development of three research models: (1) the Initial Research Model, (2) the Revised Research Model, and (3) the Final Research Model. In this chapter, the first two research models are presented and the case study research approach used in the development of the Revised Research Model is described. Results based on the case studies are also discussed. The Final Research Model is described in Chapter 4 and the survey research method used to test the generalisability of the model is described in Chapter 5.

#### **3.1 THE COMBINED QUALITATIVE AND QUANTITATIVE RESEARCH APPROACH**

For this study, two commonly used research methodologies in organisational studies were considered: (1) a case study research approach which emphasises qualitative data and (2) a survey approach which emphasises statistical inference. Both approaches are used in IS research and both methods have strengths and weaknesses. For example, one weakness of the survey approach is that it provides only a snapshot of the situation at a certain point in time and little information on the underlying meaning of the data can be obtained (Galliers, 1992). In contrast, the case study approach seeks to understand the underlying meaning of the data, but the conclusions based on a small number of case studies may not be generalisable.

According to Gable (1992b), the relative strengths and weaknesses of case study and survey research methods complement each other and the case for combining both qualitative and quantitative methods is strong. In Gable's (1992b) study, case studies were used to gain an understanding of the problem domain and to build a theoretical model. Survey research was then used to test the generalisability of the theory resulting from the case study research.

Kaplan and Douchon (1988) support this view of combining the two research methods; the authors suggest that a combined approach introduces both testability and context into the research and increases the robustness of the results. The authors conclude that there is a need for a variety of approaches in the study of IS because no single method can provide

the richness that IS as a discipline needs for further advancement.

A combined qualitative and quantitative research approach was chosen as the most appropriate method of investigation for this study (Zinatelli and Cavaye, 1994). A case study research strategy was chosen for the first phase of data collection and a positivist approach to conducting case study research was used (Eisenhardt, 1989; Galliers, 1992; Lee, 1989; Yin, 1989a). According to Benbasat, et al. (1987), the qualitative method of case study research is particularly appropriate for studying phenomena that are not supported by a strong theoretical base. In addition, Yin (1989b) suggests that case studies in IS are an appropriate research strategy when the objective is to study contemporary events in their natural settings and when it is not necessary to control behavioural events. Since all of these conditions are true for EUC in small firms, case studies were used for the preliminary investigation. The survey research method was used in the second phase of data collection to test the generalisability of the theory resulting from the case studies.

The combined case study and survey research design involved the development of three research models:

#### i. The Initial Research Model

An Initial Research Model (Figure 3.1) which was based on a preliminary review of the literature was developed. The purpose of this preliminary model was to identify the relevant factors which could potentially influence EUC success in small firms (Zinatelli, 1993), and to guide the case study data collection. This positivist approach to case study research has been recommended by several authors (Eisenhardt, 1989; Lee, 1989; Yin, 1989a) and is the dominant approach to case study research in IS (Benbasat, et al., 1987; Cavaye, 1994, Yin, 1989b).

#### ii. The Revised Research Model

The case studies were then used to strengthen the Initial Research Model (Section 3.3). Based on an analysis of the case study results, a Revised Research Model (Figure 3.2) was developed.

#### iii. The Final Research Model

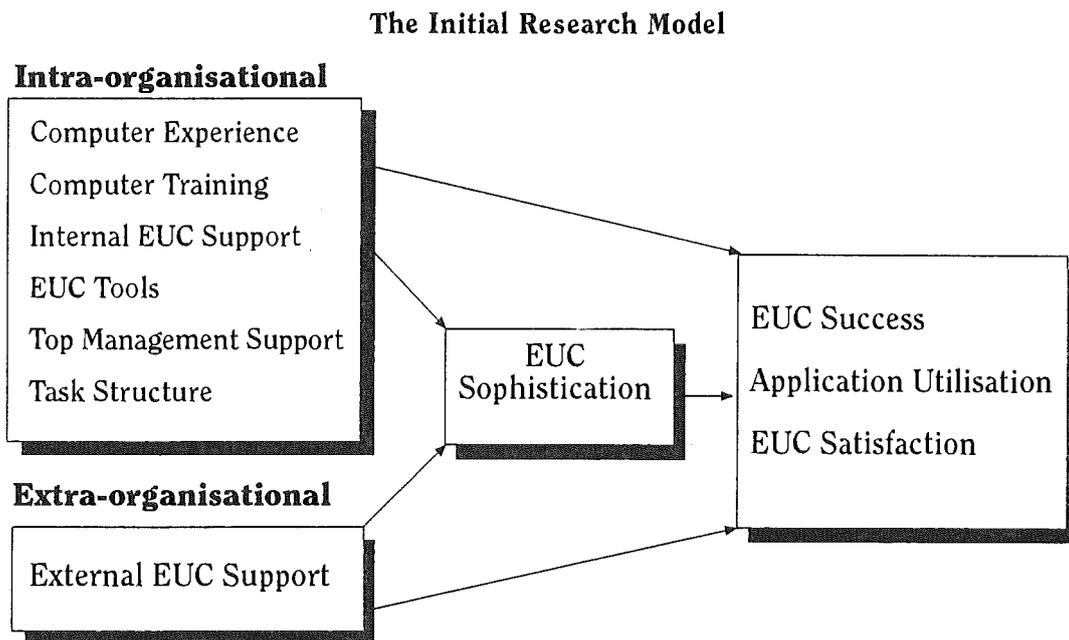
A more thorough literature review was completed (Chapter 2) and a Final Research Model was developed (Chapter 4). In order to test the generalisability of the final research model,

a second phase of data collection involving survey research methods was conducted (Chapter 5). Both the Initial Research Model (Figure 3.1) and the Revised Research Model (Figure 3.2) are discussed in this chapter.

### 3.2 THE INITIAL RESEARCH MODEL

Figure 3.1 presents the Initial Research Model (Zinatelli, 1993), which was based on a preliminary review of the literature. This model was used to guide the case study data collection.

**Figure 3.1 EUC Success in Small Firms**



The relationships between the independent and dependent variables are presented in Figure 3.1; the variables and their related hypotheses are discussed in Section 3.2.1. Based on a preliminary literature review, which is presented in Section 3.2.2, the research model identifies six intra-organisational factors and one extra-organisational factor associated with EUC success in small firms. The six intra-organisational factors include: (1) computer training, (2) computer experience, (3) internal EUC support, (4) EUC tools, (5) top management support, and (6) task structure. The primary extra-organisational factor is external EUC support. In addition, the model identifies the potential influence of EUC sophistication (Blili, 1992; Marcolin, et al., 1992; 1993) on EUC success.

### 3.2.1 Initial Research Questions

Three initial research questions were investigated:

- (1) What intra-organisational factors influence EUC success in small firms?
- (2) What extra-organisational factors influence EUC success in small firms?
- (3) Does EUC sophistication mediate the effect of intra-organisational and extra-organisational factors on EUC success in small firms?

According to the research model, seven independent variables were expected to affect EUC success in small firms. In addition, EUC sophistication was expected to affect EUC success. Much of the previous research on EUC in large firms has focused on identifying factors influencing EUC success (Abdul-Gader, 1992; Amoroso, 1986; Amoroso and Cheney 1991; Blili, 1992; Igbaria, 1990; Igbaria, et al., 1989; Igbaria and Zviran, 1991; Rivard and Huff, 1988) and more recently EUC sophistication (Blili, 1992; Marcolin, et al., 1992; 1993).

### 3.2.2 Initial Hypotheses

Based on a preliminary review of the literature, eight initial research hypotheses were formulated. This section discusses the variables introduced in the Initial Research Model (Figure 3.1) and their related research hypotheses.

#### i. Computer Experience

Amoroso (1986) reported that end user information satisfaction and application utilisation will increase when end users have a high degree of computer experience. Igbaria (1990) also found that computer experience is positively related to EUC effectiveness. In their study of microcomputer usage, Igbaria, et. al., (1989) concluded that people with stronger computer experience use microcomputers more often. In terms of EUC in small firms, Montazemi (1988) reported that end user literacy generates higher user satisfaction.

#### **Hypothesis 1**

The degree of EUC sophistication and success in small firms will increase when end users have a high degree of computer experience.

### ii. Computer Training

Igbaria (1990) concluded that training was positively related to EUC effectiveness. Igbaria, et al., (1989) also reported that users who attended more training courses tended to use more varied and sophisticated applications more often and for a greater number of hours per day. Raymond (1988) conducted a study of the attitudes and computer usage patterns of small business managers with and without formal computer education and training. He concluded that training promotes greater understanding, more frequent use, and more diverse use of applications. Raymond and Bergeron (1992) found that microcomputer training had a significant effect on the decision-making satisfaction (Sanders and Courtney, 1985) of small firm managers who developed their own applications.

### **Hypothesis 2**

The degree of EUC sophistication and success in small firms will increase when end users have a high degree of computer training.

### iii. Internal EUC Support

The importance of internal EUC support to the success of end user developed applications has been highlighted in many studies of EUC in large firms. EUC support involves providing end users with training, development support, guidance in the selection of hardware and software tools, data availability, and system access (Amoroso, 1986). In large organisations, an Information Centre (IC) is usually set up to provide EUC support for its end users; these ICs are critical to the success of EUC (Magal, et al., 1988).

Amoroso (1986) found that end user information satisfaction and application utilisation will increase when users have greater EUC support. Amoroso and Cheney (1991) concluded that perceived EUC support directly impacted on end user information satisfaction. Rivard and Huff (1988) reported that user satisfaction with data processing support was most closely and positively related to overall satisfaction with end user developed applications. Igbaria (1990) discovered a direct positive relationship between IC support and EUC effectiveness.

### **Hypothesis 3**

The degree of EUC sophistication and success in small firms will increase when quality internal EUC support is available to end users.

#### iv. EUC Tools

EUC tools include hardware and software tools that enable end users to develop applications to support their own personal business needs. End user access to quality hardware and software tools is critical to the success of end user developed applications. Amoroso (1986) described quality software as being accessible, user-friendly, powerful, flexible, and effectively supported by its vendor.

Amoroso (1986) and Amoroso and Cheney (1991) concluded that end user information satisfaction will increase when quality end user tools are made readily available to users. Rivard and Huff (1988) discovered that user perception of friendliness of software tools was positively related to overall satisfaction.

#### **Hypothesis 4**

The degree of EUC sophistication and success in small firms will increase when quality EUC tools are available to end users.

#### v. Top Management Support

Igbaria (1990) found that top management support, including encouragement and commitment to the allocation of resources, was positively related to the effectiveness of EUC in large firms. Abdul-Gader (1992) concluded that top management involvement with computers had a positive influence on EUC success.

In terms of small firm computing, the primary finding of DeLone's (1988) study was that the successful use of IS was strongly linked to CEO knowledge of computers and active involvement in the computerization efforts. Yap, et al., (1992) also found a positive correlation between IS success and CEO support, which included CEO attendance in IS meetings and CEO involvement in decision-making and feasibility studies. Raymond (1985) concluded that IS success will increase in small firms that have a high ranking IS function. In terms of financial support from top management, Yap, et al., (1992) found a positive correlation between IS success and sufficiency of financial resources allocated for IS implementation.

### **Hypothesis 5**

The degree of EUC sophistication and success in small firms will increase when top management support for EUC exists.

#### vi. Task Structure

Igbaria (1990) found that task structure, which is the extent to which tasks have clearly defined procedures, is positively related to computer usage, user satisfaction, and perceived changes in users' jobs. The results of Igbaria's study also show that task variety is inversely related to the

effectiveness of EUC. Raymond and Bergeron (1992) concluded that a personal decision support system will be more successful when the user has a higher level of task autonomy.

### **Hypothesis 6**

The degree of EUC sophistication and success in small firms will increase when end users' tasks are highly structured.

#### vii. External EUC Support

Raymond (1990b) proposed that the availability and quality of external EUC support could be considered a more relevant EUC success factor in a small firm context. Although very few studies have looked specifically at external EUC support for small firms, Yap, et al., (1992) were one of the first to empirically investigate external expertise as an IS success factor in small firms.

In the latter study, external expertise consisted of consultant and vendor support. The study reported that over half of the businesses hired consultants and the results of the study showed that IS success is positively associated with the consultant effectiveness during IS implementation. The quality of the consultant, in terms of experience, capability, and effectiveness during feasibility studies, was reported to be extremely important. Yap, et al. (1992), also reported that IS success is positively associated with the level of vendor support given to small firms; vendor support included hardware and software support, training, and documentation. These findings highlight the important role that external expertise plays in the computerization of small firms (Kole, 1983).

**Hypothesis 7**

The degree of EUC sophistication and success in small firms will increase when quality external EUC support is available to end users.

viii. EUC Sophistication

Recent studies have investigated the topic of EUC sophistication (Blili, 1992; Marcolin, et al., 1992; 1993). For example, Marcolin et al. (1992; 1993) developed an instrument for measuring EUC sophistication which in broad terms is defined as how capable and well-prepared an individual is for conducting EUC activities. The authors identified and investigated three dimensions of EUC sophistication: breadth, depth, and finesse. The authors concluded that although the basic instrument is valid, further testing and application of the EUC sophistication instrument will better clarify the measure. Blili (1992) investigated EUC sophistication in his study of EUC in large organisations. The measure used by Blili (1992) included utilisation and application sophistication to determine EUC sophistication levels.

Marcolin, et al. (1992) suggest that if higher levels of EUC sophistication are better for organisations, then it would be valuable to determine the relative impact of various individual, technical, and organisational factors on achieving high EUC sophistication levels.

**Hypothesis 8**

The degree of EUC success in small firms will increase when end users have a high degree of EUC sophistication.

ix. EUC Success

Since appropriate instruments for measuring user information satisfaction (Baroudi and Orlikowski, 1988; Doll and Torkzadeh, 1988; Ives, et al., 1983) and application utilisation (Amoroso, 1986; Amoroso and Cheney, 1991, 1992) were already in existence, the case studies were used to explore a potentially new and important measure of EUC success, i.e. perceived impact (Blili, 1992; DeLone and McLean, 1992).

### **3.3 THE CASE STUDY RESEARCH APPROACH**

A case study research approach was used to investigate the factors identified in the Initial Research Model (Figure 3.1) as having a potential influence on EUC success in small firms. In addition, the case studies were used to identify new success factors and to gain a better understanding of the relationships in the model. This section discusses: (1) case study research, (2) case study research in IS, (3) the case study design, (4) the case study stages, and (5) the case study results.

#### **3.3.1 Case Study Research**

The case study approach is a research method which emphasizes in-depth understanding and qualitative analysis. Thus, case studies are an appropriate research strategy when a “how” or “why” question is being asked about a current set of events in their natural setting, and when no experimental controls are involved (Yin, 1989a; 1989b). According to Eisenhardt (1989), case research can be used to: (1) provide description, (2) test theory, and (3) generate theory.

Generalisation is a problem for case study research because the techniques used rarely yield precise descriptive statements about a large population (Babbie, 1989). However, the goal of case study research is not to enable researchers to make scientific generalisations. Instead, case studies are used by researchers to gain an in-depth understanding of social phenomena in their natural settings. Thus, insight and understanding are the main goals of case study research.

Case studies are particularly appropriate for studying research phenomena that are not supported by a strong theoretical base (Benbasat et al, 1987). Typically, case study researchers have little a priori knowledge of what the variables of interest will be and how they will be measured. However, some researchers do identify critical variables and conceptual research frameworks before conducting case studies (Miles and Huberman, 1984).

The amount of prior theorising and empirical research completed before entering the field will determine data collection strategies. Case studies can involve data collection from either single or multiple cases, and numerous levels of data analysis (Yin, 1989a). Typically,

data are collected from a small number of organisations through methods such as interviews, observations, archives, and questionnaires; the data may be qualitative, quantitative, or both.

### **3.3.2 Case Study Research in IS**

In a study of IS research approaches Orlikowski and Baroudi (1991) found that nearly 50% of all empirical IS research published between 1983 and 1988 was survey research, whilst another 27% was based on laboratory experiments. Experimental and quantitative strategies prevail in IS studies, but that does not mean that those strategies are necessarily the best and most appropriate for studying IS topics. In fact there is evidence of a growing interest in case study research methods in IS (Benbasat, et al., 1987; Gable, 1992a; Kaplan and Duchon, 1988; Lee, 1989).

In their study of the case research strategy in IS, Benbasat, et al. (1987) highlight three main factors supporting the case study methodology as an appropriate IS research strategy. First, case studies enable researchers to study IS in a natural setting, to learn about state-of-the-art technologies, and to generate theories from practice. The authors state that case studies are well-suited to IS research because interest in the IS field has shifted to organisational rather than technical issues. Second, through case studies, researchers gain a better understanding of the nature and complexity of processes taking place in organisations. Third, since new research topics emerge each year in the rapidly changing field of IS, valuable insights into new areas of investigation can be gained through the use of case study research.

To investigate the nature and quality of case study research in IS, Benbasat, et al. (1987) surveyed several journals and conference proceedings for a 5 year period between 1981 and 1985. The authors identified a number of problems that were common to most of the case research studies in their sample. All of the problems were related to the following methodological issues: (i) no clear statement of rationale for single versus multiple cases, (ii) no clear statement of research objectives, (iii) no clear statement of case site selection criteria, (iv) no clear statement of data collection methods, (v) infrequent use of multiple methods of data collection. The authors conclude that overcoming these problems with case study research will enable IS researchers to better contribute to theory building

processes. Furthermore, in order to maintain credibility, IS researchers using a case study approach should not attempt to generalise to a larger population from a small scale study (Babbie, 1989).

### 3.3.3 The Case Study Design

The overall case study design for this study includes a single, exploratory, in-depth pilot case study followed by a more explanatory, cross-case analysis of eight firms (Gable, 1992a; Yin, 1989a). Table 3.1 presents details of the case study design.

**Table 3.1 Case Study Design**

<b>Characteristic</b>	<b>Pilot Study</b>	<b>Multiple Cases</b>
<b>Number of Cases</b>	One	Eight
<b>Unit of Analysis</b>	End Users	End Users
<b>Study Objectives</b>	Exploration and Description	Explanation and Description
<b>Dependent Variable</b>	EUC Sophistication and Success	EUC Sophistication and Success
<b>Method of Analysis</b>	Description	Pattern Matching (Yin, 1989a)

Yin (1989a) states that single case studies are appropriate when (1) the case represents a critical case in testing a well-formulated theory; (2) the case is an extreme or unique event; or (3) the case serves a revelatory purpose. In this study, the single pilot case study served a revelatory purpose in that it was used to identify potentially important factors influencing EUC success. These factors were then further investigated in the eight case studies.

According to Eisenhardt (1989), multiple case designs are appropriate when the intent of the research is description, theory testing, or theory building. In this study, multiple cases were used to strengthen the Initial Research Model (See Figure 3.1); thus, theory building was an important objective of the multiple case studies.

Table 3.1 indicates characteristics of the pilot study and the multiple-case studies. The pilot case study was exploratory and descriptive. The multiple case study had the objective of explaining the relationships between the independent and dependent variables depicted in the preliminary model.

### 3.3.4 Case Study Stages

This section describes the four stages of data collection used to conduct the case study research.

Stage 1: Develop case study protocol.

Stage 2: Conduct pilot case study.

Stage 3: Conduct multiple case studies.

Stage 4: Develop a revised research model.

#### Stage 1: Develop Case Study Protocol

Yin (1989a) states that having a case study protocol is essential if a multiple case design is being used. A case study protocol, which is a data collection instrument, is intended to increase the reliability of case study research. Since multiple case studies require cross-case comparisons, some standardisation of instruments is necessary for comparative analysis (Lee, 1989).

For this study, an initial case study protocol, which consisted of a list of open-ended questions, was developed and used for the pilot case study. The initial protocol questions were defined by the variables identified in the literature and consisted of a list of general questions relating to potential individual, organisational, and technical factors that influence EUC sophistication and success in small firms.

Based on an analysis of the pilot case study, a revised protocol in the form of a summary table of the potential factors of interest was created. This table was used as an interview guide to ensure that parallel information was collected at different sites for cross-site analysis purposes.

#### Stage 2: Conduct Pilot Case Study

A single, exploratory, in-depth pilot case study was conducted. The purpose of the pilot study was to refine data collection plans and to provide insight into the basic issues being studied. The investigation was much broader and less focused than the multiple case study data collection plan.

### Stage 3: Conduct Multiple Case Studies

#### *(a) Site Selection Criteria*

The study was conducted in Christchurch, New Zealand. A multiple-case study design consisting of 8 small firms was developed. The organisations in this phase of data collection met the criteria listed in Table 3.2:

**Table 3.2 Characteristics of Case Study Firms**

(i)	Listed in the New Zealand Business Who's Who 1993 directory.
(ii)	Involved with End User Computing.
(iii)	Included in the manufacturing sector.
(iv)	Small manufacturing firms with under 50 employees (Bollard, 1988).
(v)	Independent (i.e. not a subsidiary).

#### *(b) Site Selection Processes*

Marshall and Rossman (1989), suggest that the ideal site for a qualitative research project is one in which entry is possible and in which there is a high probability that a mix of many of the processes, people, and interactions that may be part of a research question will be present. Furthermore, Eisenhardt (1989) and Pettigrew (1989) suggest selecting cases that are polar types, are extreme situations, have high experience levels, have transparently observable phenomena of interest, and are likely to replicate or extend emergent theory.

In this study, an attempt was made to investigate a variety of firms by selecting cases that had the following characteristics:

- i. Involved in the main manufacturing areas in the Canterbury region: these areas included engineering, clothing, furniture, and plastics.
- ii. Different sizes within the New Zealand small manufacturing firm definition (Bollard, 1988).
- iii. Involved with internal EUC support or external EUC support or both.
- iv. Different levels of computer experience.
- v. Well-established and more recently established.

In case study research, the entire sample is not selected at the beginning of the study (Marshall and Rossman, 1989). Rather, sampling is part of an ongoing process of development of hypotheses and the search for negative cases that will disprove those hypotheses. Thus, results from each case study were used in the selection of the next site.

*(c) Data Collection and Analysis Procedures*

An interview guide was constructed to investigate the initial research model. The interviews consisted primarily of open-ended questions. Most of the data was collected from face-to-face interviews with one or more of the following individuals in each firm:

- (1) A top manager.
- (2) The individual responsible for computers.
- (3) All command level users and end user programmers (Rockart and Flannery, 1983).

In some firms, one person fitted all three categories. In other firms, several different people were interviewed. In total, 19 people from 8 different companies were interviewed. Only 13 of the people interviewed were either command level or end user programmers. Included in the sample were 8 top managers, 3 of whom were not computer users.

Since it was important to make certain that respondents' comments and perceptions were accurately recorded, all interviews were tape-recorded and transcribed. An attempt was made to observe and collect any relevant supporting materials such as end user-generated applications and reports, training certificates, and company information.

In order to analyse the qualitative data, several approaches were used. Various authors have outlined specific techniques for conducting data collection and analysis concurrently (Lofland and Lofland, 1984; Glaser, 1978; Miles and Huberman, 1984). Many of these techniques, including tabular displays, coding techniques, and memo writing were used to analyze and present the qualitative data in this study.

Furthermore, according to Lofland and Lofland (1984), researchers sometimes regard data collection to be one phase of their work and analysis another. However, in case study research, there is a constant overlap between data collection and analysis. For this study, the responses to the interview questions resulted in the identification of new factors that could potentially influence EUC sophistication and success. These new factors were then probed for in the remainder of the cases; data from previous cases were also analysed to further investigate the new factors (Miles and Huberman, 1984; Reich and Benbasat, 1990).

#### Stage 4: Develop Revised Research Model

Based on the case study results, the Revised Research Model (Figure 3.2) was developed.

### 3.4 THE CASE STUDY RESULTS

This section presents the results of the cross-case analysis. User and company characteristics are described in Section 3.4.1. Section 3.4.2 discusses the initial hypotheses and introduces new hypotheses that emerged from the case study data.

#### 3.4.1 User and Company Characteristics

This section discusses the characteristics of the participating companies and users in the eight case studies. Table 3.3 contains information on the companies and end users included in the sample. The results are based on the data collected from eight case studies (referred to as firms A, B, etc.). All firms had between 20 to 50 employees, with the exception of one firm which had 12 employees. Bollard (1988) defines small manufacturing firms as having fewer than 50 employees and very small firms as those having fewer than 20 employees. Several other very small firms were contacted but were not included in the sample because of their limited use of computers.

**Table 3.3 Characteristics of Companies and End Users in the Sample**

Characteristic	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H
Year of Establishment	1988	1950	1980	1970	1963	1905	1918	1945
Number of Employees	40	30	47	30	40	12	50	40
Product Type	Engineering	Plastics	Shoes	Plastics	Furniture	Clothing	Furniture	Plaster
Number of End Users	2	2	1	2	1	1	2	2
Functional Role of EUC Specialist	Managing Director	Managing Director	Technical Manager	Accountant	Marketing Manager	Managing Director	Accountant	Assistant Production Manager
End User Type	End user programmer /support	End user programmer /support	End user programmer /support	Command level/support	Command level	Command level	Command level/support	Command level

#### i. End User Type

The Rockart and Flannery (1983) classification of end users was initially used to identify different types of end users in the case study firms. Only command-level and end user programmers were included in the study. Nonprogramming end users existed in most firms but were not included in this phase of the study.

The end user classifications of functional support personnel, EUC support personnel, and DP programmers, which are based on results from large firms, are not entirely appropriate in a small firm context. For example, small firms do not have the resources to justify having Information Centres and DP Programmers.

Therefore, a more appropriate classification for end users in small firms was needed. In this study, four main types of end users were identified as shown in Table 3.3:

- (a) *Command level users.*
- (b) *Command level/support users who provide EUC support for other users.*
- (c) *End user programmers.*
- (d) *End user programmers/support who provide EUC support for other users.*

#### ii. End Users and The EUC Specialist

Very little EUC existed in the firms. As shown in Table 3.3, each firm had at most two end users. The case studies revealed that one individual in each firm was clearly the most knowledgeable user of computer resources. The common characteristics of this individual, who is referred to as the EUC Specialist, are shown in Table 3.4.

**Table 3.4 Characteristics of the EUC Specialist**

- |       |  |
|-------|--|
| (i)   | Most active and influential with respect to computers.                 |
| (ii)  | Most experienced with computers.                                       |
| (iii) | Responsible for managing computer resources.                           |
| (iv)  | Responsible for providing internal computer support in some cases.     |
| (v)   | Involved with developing applications for use by others in some cases. |
| (vi)  | Either a top manager, manager, or accountant.                          |

Although the exact nature of the role differed from firm to firm, the primary functional role of the EUC Specialist was either as manager or accountant; none of the firms employed a full-time EUC Specialist. As shown in Table 3.3, the managing directors in three of the eight firms were identified as the EUC specialists. Three of the other EUC specialists held managerial roles and two were company accountants.

The case studies revealed that in each firm the EUC Specialist was the most active and influential computer user. Since more than 50% of the EUC Specialists were in managerial roles, the EUC sophistication and success of these end users in particular could have a

significant organisational impact (Bergeron, et al., 1993) on these firms. Therefore, the main focus of the case study data analysis is on factors influencing the EUC success of the EUC Specialists.

### iii. EUC Sophistication

The case studies revealed that the following four dimensions of EUC sophistication were relevant in small firms:

- (a) *Breadth* of software tools being used.
- (b) *Finesse* which included self-sufficiency and user ability to learn new things (Marcolin, et al., 1992; 1993).
- (c) *Application utilization* (Bili, 1992).
- (d) *End user type* (Rockart and Flannery, 1983).

Therefore, a combination of these four dimensions was identified as an appropriate EUC Sophistication measure for this study. The EUC specialists (referred to as Users A, B, C, etc.) in Table 3.5 are ranked in order of highest to lowest EUC sophistication. User A was the most sophisticated end user because this individual ranked highly on all four dimensions. User H was the least sophisticated end user and had low rankings in all four dimensions.

**Table 3.5 EUC Sophistication**

Dimension	User A	User B	User C	User D	User E	User F	User G	User H
<b>Breadth</b>	high	high	high	med	med	med	low	low
<b>Finesse</b>	high	high	high	med	high	med	med	low
<b>Utilization</b>	high	high	low	high	high	high	high	low
<b>End User Type</b>	End User Programmer/ support	End User Programmer/ support	End User Programmer/ support	Command level/support	Command level	Command level	Command level/support	Command level
<b>EUC Sophistication</b>	<i>high</i>	<i>high</i>	<i>high</i>	<i>moderate</i>	<i>moderate</i>	<i>moderate</i>	<i>low</i>	<i>low</i>

#### (a) *Breadth of Software Tools*

Table 3.6 illustrates the breadth of EUC software usage; this dimension showed considerable variation amongst users. All of the users had experience with word processors and spreadsheets. Menu-driven packages were also used by a majority of users. However, only Users B, C, D, and E had experience with database packages. Programming languages were even less popular; Users A, B, and C had limited experience with programming

languages. Other software tools such as electronic mail, presentation packages, graphics packages, and flowchart tools were utilized by Users A, B, and E.

**Table 3.6 Breadth of EUC Software Tools**

Software	User A	User B	User C	User D	User E	User F	User G	User H
Word processor	yes							
Spreadsheet	yes							
Database	no	yes	yes	yes	yes	no	no	no
Programming Languages	yes	yes	yes	no	no	no	no	no
Menu-Driven Packages	yes	yes	no	yes	yes	yes	yes	no
Others	yes	yes	yes	yes	yes	no	no	no

*(b) Finesse*

Users A, B, C, and E were highly self-sufficient in that they were self-taught users and believed that “learning by doing” was the most enjoyable and satisfying way to learn. In addition, these users had very little EUC training and support; however, they were able to learn various EUC tools and programming languages. This fact illustrates their strong abilities to learn new concepts and applications. Thus, these users were given a high finesse rating.

Although Users D, F, and G were primarily self-taught, they had received some form of support or training from a vendor or consultant and were given moderate finesse level ratings. User H was assigned a low finesse rating; this person had taken a polytechnic (college) course in spreadsheets but was limited to what he had learned in the course.

*(c) Application Utilisation*

With the exception of Users C and H, all of the EUC specialists used computers on a daily basis for at least 50% of their work hours. Since User C developed applications primarily for use by others in the company, his utilisation was quite low. User H was a relatively new user and planned to increase his utilisation as he developed future applications to support his work.

*(d) End User Type*

Users A, B, and C were identified as end user programmer/support types and Users D, and G

were command level/support types. Therefore, the majority of EUC Specialists provided training, support, and software development for other end users in their firms.

#### iv. EUC Success

Table 3.7 summarizes the most common responses to open-ended questions relating to perceived impact in order of most common to least common responses. Many of these aspects of perceived impact were investigated in Blili's (1992) study of managerial EUC.

**Table 3.7 Perceived Impact of EUC**

1.	Saves time
2.	Provides better access to information
3.	Improves personal productivity
4.	Eliminates repetitive tasks
5.	Leads to better decisions
6.	Provides better information
7.	Reduces staff
8.	Saves money
9.	Improves accuracy
10.	Allows better control of business
11.	Makes life easier
12.	Leads to more efficient company
13.	Supports better customer service
14.	Allows better documentation
15.	Enhances professionalism

In this study, each EUC Specialist was assigned a perceived impact level rating which was based on the number of impact factors identified by each individual. Responses from Users A and B indicated high levels of perceived impact in that a large number of impact factors were identified by these two users. Users D, E, and F experienced moderate levels of perceived impact. User C reported low levels of perceived impact since he developed applications for use by others in the firm. Users G and H also indicated low levels of perceived impact.

#### **3.4.2 Discussion of the Case Study Results**

This section discusses the relationships in the Initial Research Model (Figure 3.1) and the related hypotheses. New factors and hypotheses which emerged from the case study investigation are also introduced.

##### i. The Relationship Between EUC Sophistication and Success

Table 3.8 shows that the two users who had the highest EUC sophistication levels (Users A

and B) also had the highest perceived impact levels. Users G and H, who had the lowest sophistication levels, also had the lowest perceived impact levels. Moderate sophistication levels and perceived impact levels were also closely matched. Therefore, the case studies suggest that EUC sophistication had a positive influence on EUC success.

**Table 3.8 End User Sophistication and Success**

Variable	User A	User B	User C	User D	User E	User F	User G	User H
EUC Sophistication	high	high	high	moderate	moderate	moderate	low	low
EUC Success	high	high	low	moderate	moderate	moderate	low	low

ii. The Relationship between Intra-organisational Factors and EUC sophistication and EUC success.

In this study, three main categories of intra-organisational factors were investigated: (1) individual, (2) technical, and (3) organisational. Results relating to factors within each of the three categories are discussed below.

**Individual Factors**

Three of the individual factors investigated in this study were identified in the literature and relate to the initial research hypotheses. These factors include: computer experience (Hypothesis 1), computer training (Hypothesis 2), and task structure (Hypothesis 6). Other individual factors, which emerged from the case study data as having an influence on EUC sophistication and success, include: high interest in EUC, lack of time, outside work time invested, and education. The influence of these factors is described as either positive or negative in Table 3.9.

**Table 3.9 Individual Factors Influencing EUC Sophistication and Success**

Factor	Influence	User A	User B	User C	User D	User E	User F	User G	User H
Computer Experience (years)	positive	20	5	10	5	8	10	12	2
Lack of Computer Training	negative	yes	yes	yes	yes	yes	yes	yes	yes
Interest	positive	high	high	high	high	high	high	high	high
Lack of time	negative	yes	yes	yes	yes	yes	yes	yes	yes
Outside Work Time	positive	high	high	high	high	high	moderate	moderate	moderate
Education	positive	degree	non-degree	non-degree	degree	degree	degree	degree	non-degree
Task Structure	none	low	low	low	low	low	low	high	low

*(a) Computer Experience (Hypothesis 1)*

Computer experience level had a positive effect on EUC sophistication and success as indicated by the fact that, in comparison with other users in each firm, the EUC Specialists in all eight firms had the most computer experience. With the exception of User H, all of the EUC Specialists had at least 5 years of computer experience.

*(b) Lack of Computer Training (Hypothesis 2)*

Lack of computer training had a negative influence on EUC sophistication and success. In general, users had no training on end user tools such as spreadsheets and databases. One exception was User G who had attended a 20 hour polytechnic course on spreadsheet use. Many of the users complained about having great difficulties and expressed frustration at not being able to accomplish desired tasks on the computer. Users were frustrated with wasting time in their attempts to understand applications and stated that they would often give up on particular tasks.

Most EUC Specialists were interested in getting formal computer training but for a variety of reasons had not done so. For example, User B attempted to take a database course at a polytechnic but the course was cancelled due to low enrolments. Other users complained about lack of time and money which prevented them from attending training courses. Users A and E were very sceptical of the usefulness of computer training courses and did not perceive a need for formal training.

Training on standard software packages (for example accounting packages) was more common amongst EUC Specialists. Users D, F, and G received vendor or consultant training on accounting software. For many of the users (Users A, D, E, F, and G), their only formal computer training was a limited exposure to a programming language as part of their general university education. All of these users commented on the importance and usefulness of this formal computer training in initiating them into the use of computers.

*(c) High Interest in EUC (New Hypothesis)*

High interest in computers had a positive influence on EUC sophistication and success. All of the EUC Specialists were highly enthusiastic and motivated computer users. Users described computers as being interesting, enjoyable, helpful, intriguing, fascinating, and

challenging. Amoroso and Cheney (1991) reported similar results in that users who were highly motivated in developing applications had higher application utilization rates.

*(d) Lack of Time (New Hypothesis)*

Lack of time available for EUC had a negative influence on EUC sophistication and success. This influence is not surprising since the primary functional role of the EUC Specialist was either as manager or accountant. Users complained about not having enough time during business hours to become more competent computer users. EUC specialists could see the potential use of computers to support many new tasks; however, they lacked the time required to learn new software tools and to develop applications to support more of their tasks.

*(e) Outside Work Time (New Hypothesis)*

Outside work time invested on computers had a positive influence on EUC sophistication and success. All of the EUC Specialists invested considerable time outside normal work hours on developing their self-taught computer skills. Users A, B, C, D, and E described their computer learning experiences as being intensive self-study during evenings and on weekends over a period of several years. Users F, G, and H, who had lower levels of EUC sophistication and success, invested outside work time in computers but did so to a lesser extent.

*(f) Education (New Hypothesis)*

Education had a positive influence on EUC sophistication and success for EUC Specialists with University degrees (Users A, D, E, F, G). Although these users had minimal exposure to computers and programming languages at University, all of them commented on the value of that exposure in giving them some background in computing and as an important influence on their computing ability. The users also identified their university education as providing them with the ability to "learn how to learn" which lead them to become self-taught computer users. Users B, C, and H had no exposure to computers prior to job-related computer use.

*(g) Task Structure (Hypothesis 6)*

Task structure did not have a positive influence on EUC sophistication and success. Thus, the case studies revealed unexpected findings. Since six of the EUC Specialists held managerial positions, computers were used primarily to support unstructured managerial tasks. Raymond and Bergeron (1992) reported similar findings in their study of managerial EUC.

Users D and G, in their role as accountants, performed structured tasks using accounting packages. However, User D was also involved with many unstructured tasks in that he developed applications for use by other end users in his firm.

**Technical Factors**

The two technical factors investigated in this study were identified in the literature and relate to the initial research hypotheses. These factors are linked to EUC tools and internal EUC support.

*(a) EUC Tools (Hypothesis 4)*

The availability of quality EUC tools had a positive influence on EUC sophistication and success. All of the EUC Specialists had personal computers in their offices, with the exception of User G who had to share his computer with another staff member. Since all of the users were the most influential and active computer users in their respective firms, their current hardware and software needs were being met. In addition, the fact that six of the EUC Specialists held managerial positions meant that they had active involvement in any computer-related purchase decisions.

*(b) Lack of Internal EUC Support (Hypothesis 3)*

Lack of internal EUC support had a negative influence on EUC sophistication and success. There was very little internal EUC Support available to any of the EUC Specialists. Users A and G were the only users to have access to internal EUC support. Due to the nature of their product, User A employed full-time programmers who provided him with limited EUC support. In addition, User A would occasionally obtain help with spreadsheets from the company accountant. Firm G had recently established a computer sales division with two full-time staff who provided User G with limited EUC support.

### Organisational Factors

Top management support, which was one of the organisational factors investigated in this study, was identified in the literature and relates to the initial research hypotheses. Other factors that emerged from the case study data as having an influence on EUC sophistication and success include: lack of EUC planning and financial constraints. The influence of these factors is described as either positive or negative in Table 3.10.

**Table 3.10 Organisational Factors Influencing EUC Sophistication and Success**

Factor	Influence	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H
Top Management Support	positive	high	high	high	low	high	high	high	low
Lack of EUC Planning	negative	yes							
Financial Constraints	negative	no	yes						

#### (a) Top Management Support (Hypothesis 5)

Top management support, in terms of commitment to allocation of resources and top management involvement had a positive influence on EUC sophistication and success. Top managers in firms A, B, C, E, F, and G stressed the importance of computers and stated that although small firm computing requires a strong financial commitment, the overall benefits outweighed the costs. On the other hand, top managers in firms D and H were very negative about computers and complained about the extremely high costs associated with computers. As a result, Users in firms D and H had some difficulty in obtaining financial support for their EUC efforts.

The case studies revealed that top management involvement with computers could be classified into three main categories ranging from high to low involvement:

- (i) *Centralized*: The top manager is the EUC Specialist in the firm and makes all of the decisions regarding computers with very little involvement of other staff. The top managers in Firms B, and F had centralized involvement roles.
- (ii) *Participatory*: The top manager is a direct computer user and closely involves other end users in selection and implementation decisions. Participatory involvement was the style of top managers in Firms A, E, and G.

- (iii) *Delegator*: The top manager knows very little about computers and delegates to other staff. Decisions are made based on knowledge and expertise of other staff. The top manager is involved in a managerial, overseeing capacity. Top managers in Firms C, D, and H had never used a computer and delegated this function to the EUC Specialist.

Higher levels of top management involvement, including centralized and participatory involvement, had a positive influence on EUC sophistication and success in five of the eight firms. Firms C, D, and H had top managers who were delegators; lack of interest in computers and low involvement of top managers in these three firms resulted in a negative influence on the EUC sophistication and success of Users C, D, and H.

*(b) Lack of EUC Planning (New Hypothesis)*

Lack of EUC planning had a negative influence on EUC sophistication and success. None of the firms did any formal EUC planning. Top managers described their allocation of resources and computer planning as being very informal and ad hoc. In many firms, resources were only allocated to computers if the firm was having a strong financial year and if there were funds left over after other higher priority items had been financed. As a result, EUC Specialists did not do any formal planning but instead requested new hardware and software on an as-needed basis.

EUC Specialists did not perceive a need for formal planning for application development, EUC training, and hardware and software maintenance and purchases. These activities were only carried out if EUC Specialists had time remaining after completing their primary functional duties. Thus, lack of planning for EUC activities contributed to the perceived lack of time available to perform these tasks.

*(c) Financial Constraints (New Hypothesis)*

Financial constraints had a negative influence on EUC sophistication and success. The following negative influences, which were apparent in most firms, were a direct result of small firm financial constraints:

- (i) *Lack of Internal EUC Support*: None of the firms employed a full-time computer professional since having an internal EUC Specialist was seen as a cheaper alternative.

- (ii) *Lack of External EUC Support:* The main source of EUC support was informal help from friends (Table 3.11).
- (iii) *Lack of New Application Development:* In many firms, EUC Specialists did not have time available for new application development; firms did not get outside help because they could not afford it.
- (iv) *Lack of EUC Budget Plans:* Allocation of financial resources to computers was dependent on whether the firm had a strong financial year.
- (v) *Used Equipment Purchases:* Used hardware and software were purchased by two of the firms from friends or acquaintances.

### Extra-organisational Factors

Two main extra-organisational factors influenced EUC sophistication and success: (1) quality of external EUC support which had a positive influence and (2) lack of external EUC support which had a negative influence. Each factor is discussed below. Table 3.11 shows the positive or negative influence of the five main types of external EUC support available to small firms.

**Table 3.11 External EUC Support**

Support Type	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H
Vendor	yes (+)	yes (-)	yes (-)	yes (+)	yes (+)	yes (+)		
Consultant			yes (-)		yes (+)		yes (+)	
Friends		yes (+)						
Polytechnic		yes (-)						yes (+)
Computer Club			yes (+)					

#### (a) Quality of External EUC Support (Hypothesis 7)

Quality external EUC support had a positive influence on EUC sophistication and success. The influence of each of the five types of external EUC support is discussed below.

#### Vendors

Vendors primarily provided quality support for software packages and hardware. Users A, D, E, and F obtained useful knowledge from vendors and were very satisfied with the vendor support they had received. However, Users B and C had negative experiences with their vendors and as a result were very sceptical of outside help.

### Consultants

Very few firms employed consultants. Users E and G were very positive about the consultant support they had received. On the other hand, User C had very bad experiences in dealing with his consultant. He felt that he had wasted a lot of time and money on consultant fees and that the quality of the consultant support was extremely poor.

### Friends and Acquaintances

With the exception of User A, the main source of EUC support for EUC Specialists was from friends and acquaintances. Users obtained help from friends and acquaintances in order to save costs and because of the trust they had in the quality of support from people known to them on a personal basis.

### Polytechnic

User A was the only EUC Specialist to complete a 20 hour polytechnic course on spreadsheets. The polytechnic course had a very positive influence on the EUC sophistication and success of User A and he was planning to enrol in future polytechnic courses. User B had enrolled in a polytechnic course on databases. However, due to low enrolments the course was cancelled.

### Computer Club

User C was actively involved in a computer club and obtained most of his EUC support through his involvement with the club.

### *(b) Lack of External EUC Support (New Hypothesis)*

Lack of external EUC support had a negative influence on EUC sophistication and success. Firms received very little external EUC support for tools such as spreadsheets, databases, fourth generation languages, and programming languages. In general, support for standard software packages, such as accounting and integrated manufacturing packages, was available from vendors, but support for more advanced EUC tools was very limited. As a result, the only form of support for these tools was informal help from friends and acquaintances.

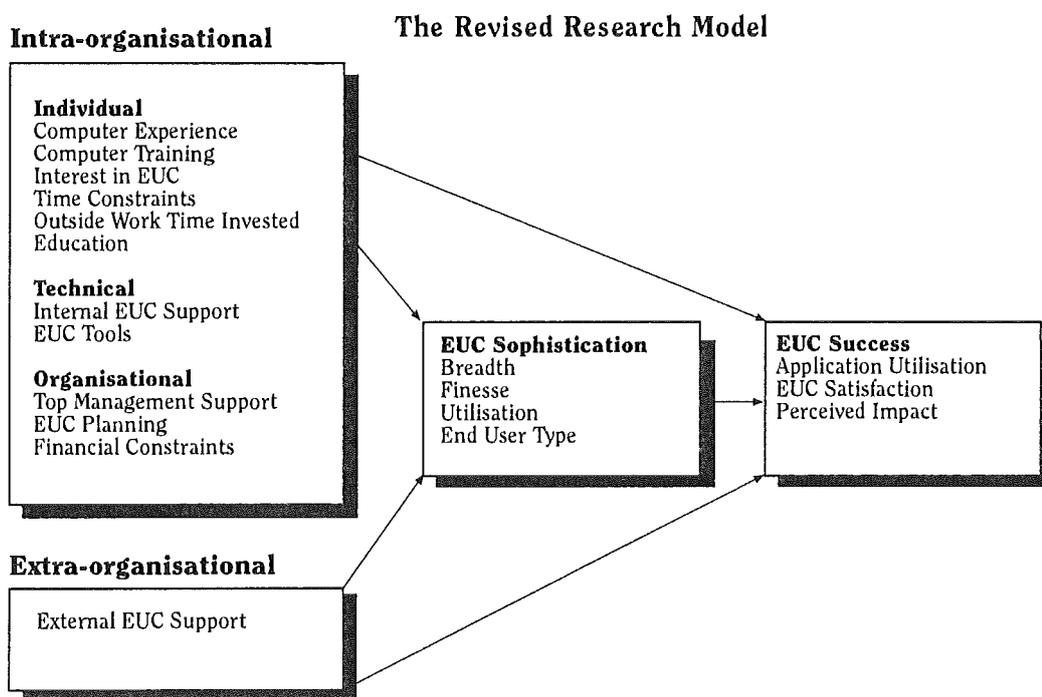
Important sources of external EUC support for small firms included outside associates and organisations. For many small firms, outside associates were the only external sources of EUC support. Vendors and consultants typically provided support for standard accounting packages and most users had some form of computer training through either a high school, polytechnic, or university. One user made use of his active involvement with a computer club as his main source of EUC support.

The case studies revealed that there were three main reasons why firms obtained very little external EUC support: (i) high costs of external support; (ii) lack of trust in external support and training; and (iii) low awareness of external EUC support services

### 3.5 THE REVISED RESEARCH MODEL

Figure 3.2 presents the Revised Research Model, which is based on an analysis of the case study results. This model explains the primary factors influencing EUC sophistication and success in small firms.

**Figure 3.2 EUC Success in Small Firms**



The Revised Research Model (Figure 3.2) includes several intra-organisational factors that emerged from the case study data and that were not included in the Initial Research Model (Figure 3.1). These new factors include: interest in EUC, time constraints, outside work time invested, education, EUC planning, and financial constraints.

The results of the case studies highlight the important influence of both intra-organisational and extra-organisational factors on EUC sophistication and success. Since very few studies have investigated the influence of the extra-organisational environment on EUC success, this finding is particularly important.

Following the case studies, a more thorough review of the literature was conducted. Relevant theories were reviewed and empirical support for many of the variables and relationships in The Revised Research Model was found. In particular, the TAM (Davis, et al., 1989) theory was identified as an appropriate theoretical grounding for this research (Chapter 4). Strong empirical support was found for the influence of key variables including internal support, internal training, top management support, external support, and external training on EUC success (Chapter 4).

These key variables were selected for more rigorous study on the basis that (1) they have received significant prior attention in related literature, (2) they were perceived to be the most influential variables, and (3) their operationalisation was more straightforward. The other variables which were identified in The Revised Research Model (Figure 3.2) were in many cases related to one of the key variables. For example, in some studies, top management support included financial support for EUC tools and EUC planning (Abdul-Gader, 1992; Blili, 1992). In addition, EUC sophistication has been used as an EUC success measure (Blili, 1992).

The Final Research Model (Figure 4.1), which is based on: (1) The Revised Research Model (Figure 3.2), (2) the TAM theory (Davis, et al., 1989), and (3) strong empirical support from the literature, is presented in Chapter 4. To test the generalisability of the Final Research model (Figure 4.1), a quantitative survey research approach was used (Chapter 5).

### **3.6 SUMMARY OF CASE STUDY FINDINGS**

This section presents a summary of the main findings resulting from the case study research. A more detailed discussion of the case study results and conclusions is provided in Chapter 8. The results of the case studies revealed both positive and negative influences of individual, technical, organisational, and external factors on EUC sophistication and success. Although

some factors, such as high interest in EUC and top management support, were identified as having a positive influence on EUC in most of the firms, many negative influences were identified. Factors such as lack of computer training and planning, as well as financial and time constraints, had a negative influence on EUC sophistication and success. In addition, the results of the case studies indicated a positive relationship between EUC sophistication and success.

The results of the case studies illustrate considerable variability in EUC sophistication and success levels in small firms. Many EUC Specialists were capable of very advanced EUC; others were limited to the use of only one or two EUC tools. The results identified specific topics in need of further research, including factors that influence EUC in different organisational and cultural contexts and measures of EUC sophistication and success that are appropriate in a small firm context.

### **3.7 CHAPTER SUMMARY**

This Chapter introduced the combined qualitative and quantitative research approach that was used for this study. A combined case study and survey research strategy was used in the development of three research models: (1) the Initial Research Model, (2) the Revised Research Model, and (3) the Final Research Model. In this chapter, the first two research models were presented and the case study research approach used in the development of the Revised Research Model was described. Results and conclusions based on the case studies were also discussed. In Chapter 4, the Revised Research Model (Figure 3.2) is further developed through the identification of variables appropriate to the research context and the survey methodology.

## **CHAPTER 4 - THE CONCEPTUAL MODEL AND RESEARCH HYPOTHESES**

### **4 THE CONCEPTUAL MODEL**

This Chapter presents the Final Research Model (Figure 4.1), which is an enhanced version of the Revised Research Model (Chapter 3). For clarity, the research questions are restated (Section 4.1). This Chapter proposes a model of the factors influencing EUC success in small firms and provides a set of four main hypotheses for empirical study. The primary objective of all study activity described up to this point in the thesis has been model development, which involved: (1) the Initial Research Model, (2) the case studies, (3) the Revised Research Model, and (4) a thorough review of the literature. The literature has been drawn upon throughout model development to identify directly relevant factors.

The primary objective of this Chapter is to organise the factors identified into a coherent Final Research Model. The theoretical grounding for this model comes from the TAM (Davis, et al., 1989) theory, which was discussed in Chapter 2. The Chapter proceeds as follows. Section 4.1 discusses the development of the Final Research model. The research hypotheses derived from the model and their related constructs are presented in Section 4.2. The Chapter summary is presented in Section 4.3.

#### **4.1 THE FINAL RESEARCH MODEL**

This study was designed to examine the factors affecting EUC success in small firms. As stated previously, four primary research questions were addressed:

- (1) What is the impact of intra-organisational factors on EUC success in small firms?
- (2) What is the impact of extra-organisational factors on EUC success in small firms?
- (3) What is the impact of perceived ease of use and perceived usefulness on EUC success in small firms?
- (4) Do perceived ease of use and perceived usefulness mediate the effects of external variables on EUC success in small firms?

Figure 4.1 presents the conceptual model of EUC success in small firms. The Final Research Model was developed based on the TAM (Davis et al., 1989), the case study results (Chapter 3), and a review of relevant literature (Chapter 2). The theoretical grounding for this

research comes from the work of Davis (1989) and Davis, et al. (1989), and the external variables in the model were identified based on the case study results (Figure 3.2) and the small firm computing literature (Cragg and King, 1993; DeLone, 1988; Montazemi, 1988; Raymond, 1985; 1990b; Soh, et al., 1992; Yap, et al., 1992).

In this study, the TAM (Davis, et al., 1989) has been adapted to the context of EUC in small firms and is tested within a small business context. Two modifications to the theory were made in order to test the model in a small business environment. First, since external factors have been identified as important predictors of computer usage and user information satisfaction in small firms (Cragg and King, 1993; DeLone, 1988; Montazemi, 1988; Raymond, 1985; 1990b; Soh, et al., 1992; Yap, et al., 1992), intra-organisational and extra-organisational factors were included.

Second, the behavioural intention construct was excluded from the analysis because of the strong support for Fishbein and Ajzen's (1975) proposition that intentions and behaviour are related. In addition, Adams, et al. (1992) replicated Davis, et al.'s (1989) study and excluded intentions from their model. Furthermore, due to the strong focus on actual EUC success in this study, behavioral intention was excluded from the model.

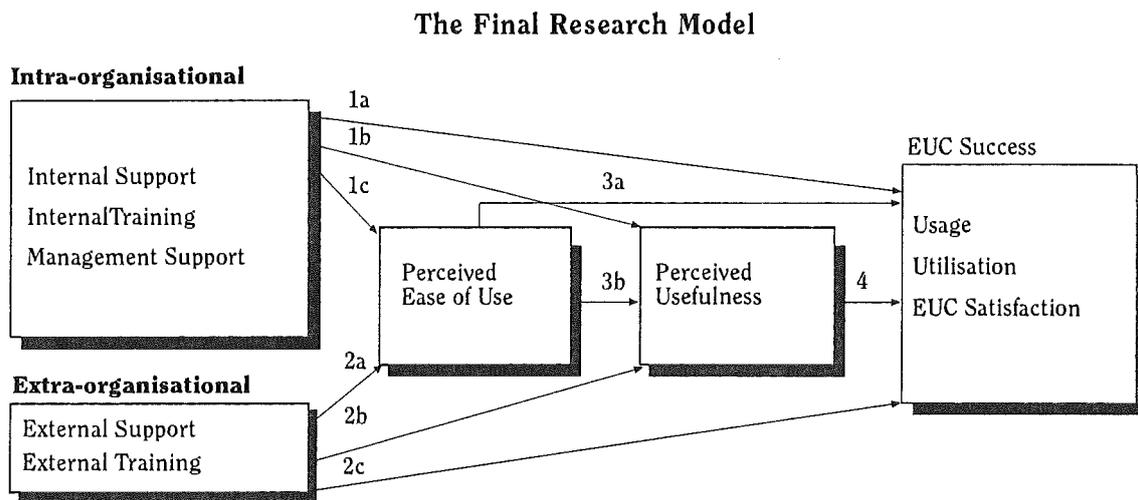
Several aspects of the Davis, et al. (1989) study that limit the generalisability of their results are addressed in this investigation. For example, Davis, et al. (1989) tested their model using full-time MBA students, who are not completely representative of the entire population of managers and professionals. Furthermore, the authors studied only one system (a word processing package) rather than computer applications in general. Finally, although the work of Davis, et al. (1989) provided insights into the determinants of user acceptance of computer technology, their research focused entirely on the determinants of usage rather than on the external factors (e.g. training and user support) affecting these determinants.

In summary, the Final Research Model (Figure 4.1) is based on: (1) The Revised Research Model (Figure 3.2), (2) the TAM (Davis, et al., 1989) theory, and (3) strong empirical support from the literature (Section 4.2). The Final Research Model (Figure 4.1) includes the following variables as directly and/or indirectly affecting EUC success in small firms: (1)

intra-organisational factors including internal support, internal training, and management support, (2) extra-organisational factors including external support and external training, (3) perceived ease of use, and (4) perceived usefulness.

The Final Research Model differs significantly from the Revised Research Model (Chapter 3) in that it incorporates the TAM (Davis, et al., 1989) and only includes a subset of the intra-organisational and extra-organisational factors that were previously identified by the case study research. In addition, EUC sophistication was included as a measure of EUC success in the Final Research Model rather than as a mediating variable (Blili, 1992). The literature review provided strong support for these changes which lead to an enhanced research model (Section 4.2).

**FIGURE 4.1 Model of EUC Success in Small Firms**



## 4.2 RESEARCH HYPOTHESES AND RELATED CONSTRUCTS

In this section, the constructs in the Final Research Model are described in more detail and justification for the paths in the model is discussed. The related hypotheses are also presented.

### 4.2.1 EUC Success

In reviewing IS success variables, Delone and McLean (1992) suggest that no single measure is intrinsically better than another. The author concludes that IS success is a multidimensional construct and that it should be measured as such.

The two most common measures of EUC success are EUC satisfaction (Doll and Torkzadeh, 1988; Ives, et al., 1983) and computer usage (Amoroso, 1986; Amoroso and Cheney, 1991, 1992; Davis, et al., 1989; DeLone, 1988; Ein-Dor and Segev (1982); Igarria, et al., 1989). There is strong support in the literature for the use of these two EUC success measures as dependent variables of interest (Amoroso, 1986; Amoroso and Cheney, 1991; 1992; Igarria, 1990; Raymond and Bergeron, 1992; Rivard and Huff, 1988; Srinivasan, 1985). Amoroso and Cheney (1992) recommend that the combination of EUC satisfaction and computer usage be used as a surrogate measure of EUC success.

DeLone and McLean (1992) recommend that IS researchers seek out success measures that have been developed, validated, and applied in previous empirical research. This approach would facilitate the comparison of results of similar studies and the building of a cumulative body of empirical knowledge. Cheney, et al. (1986) conclude that EUC satisfaction and computer usage provide readily available surrogate measures of EUC success. Consistent with the TAM (Davis, et al., 1989), for this study both computer usage (actual system use) and EUC satisfaction (attitudes toward use) were used as surrogate measures of EUC success.

#### **4.2.2 External Variables: Intra-organisational and Extra-organisational Factors**

According to Davis (1989), research on the influence of various externally controllable factors on perceived usefulness and perceived ease of use is important. The author concludes that a better understanding of these external factors would enable practitioners to formulate strategies for improving user acceptance. Similarly, Davis, et al. (1989) suggest that external factors affect both perceived ease of use and perceived usefulness; however, no empirical test was conducted.

The external variables in the research model included both intra-organisational and extra-organisational factors. The intra-organisational factors included: (1) internal support; (2) internal training; and (3) management support. These factors were identified in the literature (Chapter 2) and through the case studies (Chapter 3) as potential determinants of EUC success in small firms. Furthermore, based on EUC success factor studies in large firms, there is strong empirical support for the influence of these factors on EUC success. Since very few studies have investigated external factors in the TAM (Davis, et al., 1989),

there is very little empirical support for the influence of external factors on perceived usefulness and perceived ease of use, especially in a small firm context. Two recent studies (Igbaria, 1993; Igbaria and Baroudi, 1994) have provided empirical support for the influence of external variables on perceived ease of use and perceived usefulness.

Two extra-organisational factors were also included in the EUC Success model: (1) external support; and (2) external training. Since this is one of the first studies to investigate the influence of extra-organisational factors on perceived usefulness, perceived ease of use, and EUC success in small firms, there is little empirical support for the influence of these factors on the dependent variables. Although Raymond (1990b) proposed that external training and support could potentially be an important influence on EUC success in small firms, no empirical test was conducted. The author suggests that the lack of resources and technical sophistication that is typical in small firms would preclude the creation of internal ICs. Thus, the availability and quality of the extra-organisational support could be considered as a more relevant determinant of EUC success for small firms.

### **Intra-organisational Factors**

#### **i. Internal Support**

The importance of internal support to the success of EUC has been highlighted in many studies. Rivard and Huff (1988) concluded that user satisfaction with the support provided by the IS department is the construct most closely related to overall satisfaction. Similarly, Igbaria's (1990) results show that system usage and EUC satisfaction are strongly affected by Information Centre support. In addition, Igbaria (1993) reported that Information Centre support had positive effects on perceived usefulness. Technical support and support timeliness were found to be significant predictors of overall satisfaction with EUC in Buyukkurt's (1993) study. Amoroso (1986) and Amoroso and Cheney (1991) concluded that EUC success will increase when users have greater EUC support.

One of the most important internal support factors influencing EUC success is the availability of end user training (Cheney, et al., 1986; Nelson and Cheney, 1987; Sein et al., 1987). The results of Abdul-Gader's (1992) study show a significant positive association between availability of training and EUC success in small firms. However, Delone (1988) found that the availability of formal training to employees did not result in greater IS success. This

result could be due to the fact that it is the nature and quality of training that is important and not just the availability of training (Raymond, 1990b).

Raymond (1990b) states that the level of technical support provided by the IS function is crucial to the success of EUC, especially the nature and quality of the products and services provided by the Information Centre. However, in small firms, the lack of resources and technical sophistication would preclude the creation of an IC or an IS function. As a result, small firms often rely on systems analysts/programmers for EUC support. For example, both Abdul-Gader (1992) and Montazemi (1988) found a positive association between user satisfaction and the number of systems analysts present in the firm.

Rivard and Huff (1988) stress that in organizations where EUC is immature, support may be provided informally through personal contacts between users and individuals in the IS departments or between experienced and novice users. Since the IS function is at its early stages in most small firms (Raymond, 1990b), it is likely that EUC is also at its early stages and is thus supported informally.

Results from the case studies (Chapter 3) show that there was very little internal EUC support available to users in small firms. Informal support, in the form of help from users in other functional areas, manuals, purchased books, and help screens, was the only form of EUC support available to users.

## ii. EUC Training

Raymond (1990b) states that end user training is an EUC success factor which is common to both small and large firms. However, the author stresses that it is not only the fact that the user is trained which is important, but also the nature of training received. This training can range from broader knowledge and skills related to the role of IS, to more specialized instruction on the use of specific software tools. Raymond (1990b) proposes that certain operational dimensions of training would tend to be more effective than others depending on the organizational context. For example, the author suggests that broader knowledge and skills related to the role of IS might be the most appropriate form of training in small firms.

Raymond (1988) conducted a study of the attitudes and computer usage patterns of small business managers with and without formal computer education and training. The author concluded that training promotes greater understanding, more frequent use, and more diverse use of applications.

Raymond and Bergeron (1992) also found that microcomputer training had a significant effect on decision-making satisfaction of small firm managers who develop their own applications. Similarly, training was found to have a positive impact on application utilization (Amoroso, 1986; Igbaria, 1990; Nelson and Cheney, 1987) and user information satisfaction (Igbaria, 1990). Igbaria (1993) also reported that training had a positive effect on perceived usefulness and attitudes.

The case study results (Chapter 3) show that, in general, users had very little training on end user tools such as spreadsheets and databases. However, vendor or consultant training on standard software packages was very common. For many of the users, their only formal computer training was a limited exposure to a programming language as part of their general university education. In many cases, users commented on the importance and usefulness of this formal computer training in initiating them into the use of computers.

### iii. Management Support

An important finding of Igbaria's (1990) study was that top management support, including top management encouragement, IS staff support, and commitment to the allocation of resources, was positively related to the effectiveness of EUC. In a more recent study, Igbaria and Baroudi (1994) found that management support had a direct effect on usage. Similarly, Amoroso (1986) concluded that organizational support, in terms of resource allocation, management support, departmental support, and IS staff support had a strong influence on end user satisfaction. In addition, the availability and accessibility of hardware and software were found to be significantly related to overall end user satisfaction in Igbaria and Nachman's (1990) study.

The primary finding of DeLone's (1988) small firm study was that successful use of IS was strongly linked to CEO knowledge of computers and active involvement in the computerization efforts. Yap, et al. (1992) also found a positive correlation between IS

success and CEO support, which included CEO attendance in IS meetings and CEO involvement in decision-making and feasibility studies. In terms of financial support from top management, Yap, et al. (1992) found a positive correlation between IS success and sufficiency of financial resources allocated for IS implementation.

Martin (1989) identified the special role of top management in the development of IS in small firms and concluded that there are different levels of management involvement. The author stressed that the top manager holds a vital position in the running of the small firm, and his or her personal influence had a greater impact than his/her counterpart in the large firm. Jarvenpaa and Ives (1991) support this view and suggest that hands-on management in IS projects might be much more important in a small firm where the CEO commonly makes most key decisions and is perhaps the only individual who can link IT to corporate objectives and strategy.

Abdul-Gader (1992) concluded that top management support, in the form of interaction with the IS manager, had a positive influence on EUC success; in firms with no IS department (77%), levels of top management utilization and development of applications were used as measures of management support. Results from the case studies (Chapter 3) show that top management involvement, including allocation of resources, top management encouragement, and hands-on use had a positive influence on EUC success.

According to Davis, et al. (1989), perceived usefulness and perceived ease of use are affected by organisational support. In a recent study, Igarria and Baroudi (1994) found that management support had a strong direct effect on perceived usefulness.

The preceding discussion of the intra-organisational factors leads to the following research hypotheses:

**Hypothesis 1**      Intra-organisational factors will have both direct and indirect positive effects on EUC success through perceived usefulness and perceived ease of use.

Hypothesis 1(a) Intra-organisational factors will have a direct positive effect on EUC success.

Hypothesis 1(b) Intra-organisational factors will have a direct positive effect on perceived usefulness.

Hypothesis 1(c) Intra-organisational factors will have a direct positive effect on ease of use.

### **Extra-organisational Factors**

#### **External Support and External Training**

Raymond (1990b) proposed that the availability and quality of external EUC support could be considered as a more relevant determinant of EUC success for small firms. The author states that small firms probably look more to external sources of technical support for EUC, such as the small business consulting centres operated by government agencies, universities, or computervendors. Similarly, small firms could potentially rely on the same external sources for training.

Montazemi (1987) suggests that IS success can be achieved through an external computer bureau staffed with IS specialists knowledgeable about small firm needs and constraints. The author concludes that there is a growing need for educational institutions to offer in-depth IS programmes tailor-made for small firms.

Thong, et al. (1993) conclude that high quality external IS expertise is even more critical than top management support in small firms. Raymond and Bergeron (1992) suggest that end user computing satisfaction could be determined by the support provided by outside sources upon which small firms are often highly dependent. Yap, et al. (1992) empirically investigated external expertise as an IS success factor in small firms. The authors found that IS success is positively associated with the level of vendor support, including training and technical support, given to small firms. In addition, Thong, et al. (1993) concluded that the level of IS effectiveness is higher in firms with a high level of vendor support than those with a low level of vendor support. Cragg and King (1993) found that small firms were very reliant on the advice and support from vendors.

The experience and capabilities of consultants play an important role in IS implementation

in small firms (Gable, 1991a; Kole, 1983). Gable (1991a) cautions that engaging a consultant does not guarantee successful computerisation. The author stresses that there is a need for pro-active top management involvement even when a consultant is engaged. Yap, et al. (1992) concluded that in small firms with consultants, IS success is positively associated with consultant effectiveness. Thong, et al. (1993) also found that the level of IS effectiveness is higher in firms with a high level of consultant effectiveness than those with a low level of consultant effectiveness. However, Soh, et al. (1992) conclude that computer projects of small firms with consultants are less likely to be completed on time and within budget as compared to those without consultants. Despite these negative findings, small firms with consultants had higher levels of system usage and produced more up-to-date reports.

The case study results (Chapter 3) reveal that various sources of external EUC support had a positive influence on EUC success. The external sources of support included polytechnic and university training courses, outside associates, consultants, vendors, and computer clubs. The most common form of external support was from outside associates.

The preceding discussion of the extra-organisational factors leads to the following research hypotheses:

**Hypothesis 2** Extra-organisational factors will have both direct and indirect positive effects on EUC success through perceived usefulness and perceived ease of use.

Hypothesis 2(a) Extra-organisational factors will have a direct positive effect on EUC success.

Hypothesis 2(b) Extra-organisational factors will have a direct positive effect on perceived usefulness.

Hypothesis 2(c) Extra-organisational factors will have a direct positive effect on ease of use.

### 4.2.3 Perceived Ease of Use

Davis (1989) defines perceived ease of use as “the degree to which a person believes that using a particular system would be free of effort.” (p. 320). The author claims that an application perceived to be easier to use than another is more likely to be accepted by users. Based on the TAM model (Davis, et al., 1989), perceived ease of use affects attitude towards use. Since EUC satisfaction (Doll and Torkzadeh, 1988) is an attitude measure, it is hypothesized that perceived ease of use will have a direct positive effect on EUC satisfaction.

Based on the TAM (Davis, et al., 1989), perceived ease of use is proposed to be a potentially important determinant of system use and perceived usefulness. The importance of perceived ease of use is supported by the extensive research conducted by Bandura (1982) on self-efficacy theory. Self-efficacy is defined as “judgements of how well one can execute courses of action required to deal with prospective situations” (p. 122) and self-efficacy is similar to perceived ease of use in the TAM. According to Davis (1989), self-efficacy research provides a theoretical perspective suggesting that perceived ease of use is a basic determinant of user behaviour.

The results of several studies (Davis, 1989; Davis et al., 1989; and Adams, et al., 1992) indicate that perceived ease of use is a direct determinant of computer usage. Additional support is provided by Rogers (1983), who examined the impact of ease of use on adoption and found it to be significant. Similarly, Thompson, et al. (1991), reported a negative relationship between complexity of use (the opposite of ease of use) and usage. Therefore, it is hypothesized that perceived ease of use will have a direct positive effect on usage.

However, Davis (1989) suggests that perceived ease of use may actually be a causal antecedent to perceived usefulness, as opposed to a direct determinant of usage. Furthermore, Mathieson (1991) reported that ease of use explains a significant amount of the variance in perceived usefulness. Similarly, Igbaria and Baroudi (1994) reported a negative relationship between perceived complexity (the opposite of perceived ease of use) and perceived usefulness.

The preceding discussion leads to the following research hypotheses:

**Hypothesis 3** Perceived ease of use will have both direct and indirect positive effects on EUC success through perceived usefulness.

Hypothesis 3(a) Perceived ease of use will have a direct positive effect on EUC success.

Hypothesis 3(b) Perceived ease of use will have a direct positive effect on perceived usefulness.

#### **4.2.4 Perceived Usefulness**

Davis (1989) defines perceived usefulness as “the degree to which a person believes that using a particular system would enhance his or her job performance.” (p. 320). Based on the TAM model (Davis, et al., 1989), perceived usefulness is an important factor influencing attitude towards use. Since EUC satisfaction (Doll and Torkzadeh, 1988) is conceptualised as the “affective attitude towards a specific computer application by someone who interacts with the application directly” (p. 261), it is hypothesised that perceived usefulness will have a direct positive effect on EUC satisfaction.

Based on the TAM model (Davis, et al., 1989), perceived usefulness also influences behaviour. The results of several studies (Adams, et al. 1992; Davis, 1989; Davis et al., 1989; and Igbaria and Baroudi, 1994; Thompson, et al., 1991) indicate that perceived usefulness is a direct determinant of computer usage. In most cases, usefulness was found to be more influential than ease of use on computer usage. The preceding discussion leads to the following research hypothesis:

**Hypothesis 4** Perceived usefulness will have a direct positive effect on EUC success.

### **4.3 CHAPTER SUMMARY**

This Chapter discussed the development of the Final Research Model (Figure 4.1), which is an enhanced version of the Revised Research Model (Figure 3.2). This Chapter proposed a model of the factors influencing EUC success in small firms and provided a set of four main hypotheses for empirical study. The Final Research Model (Figure 4.1) was developed based on the TAM (Davis, et al., 1989) theory, which was discussed in Chapter 2. The external

variables in the model were identified based on the case study results (Chapter 3) and the small firm computing literature (Chapter 2). It was hypothesized that intra-organisational and extra-organisational factors as well as perceived ease of use and perceived usefulness are important influences on EUC success in small firms. The next Chapter describes the survey phase of the study.



## CHAPTER 5 - THE SURVEY

### 5 THE SURVEY

This chapter describes the survey methodology. The survey design is similar to that of the multiple case studies; the unit of analysis is the individual computer user and the primary objective of the survey is explanation. Section 5.1 describes the initial phase of data collection which involved the identification of companies that were willing to participate in the study and the computer users in each company. Section 5.2 discusses the second phase of data collection which involved a survey of computer users in the participating companies. Descriptive statistics are also presented. Section 5.3 discusses the development and pretest of the survey instrument.

#### 5.1 THE COMPANY AND USER IDENTIFICATION PHASE

Since very little was known about computing in small firms in New Zealand, the main purpose of the initial phase of the survey was to identify small firms that were using computers and to identify the individuals who were using computers in the small businesses.

##### 5.1.1 Data Collection Procedures

The first phase of the study involved identifying all companies in New Zealand that met the criteria in Table 5.1. In total, 726 firms met the criteria and a database to store the names and addresses of the companies was developed.

**TABLE 5.1 Characteristics of Firms**

- |  |
|--|
| <ul style="list-style-type: none"> <li>(i) Listed in the New Zealand Business Who's Who 1993 directory.</li> <li>(ii) Included in the manufacturing and engineering sectors.</li> <li>(iii) Between 20 and 100 employees.</li> <li>(iv) Independent (i.e. not a subsidiary).</li> <li>(v) Involved with End User Computing.</li> </ul> |
|--|

Dillman's (1978) Total Design Method (TDM) for survey research was used in this study for both the initial identification phase and the survey phase (Section 5.2) of data collection. Based on Dillman's (1978) suggestions, a postal questionnaire was chosen as the most appropriate data collection strategy for this study. In Dillman's (1978) TDM data collection methodology, several suggestions for increasing overall response rates are discussed. For example, suggestions related to format and sequencing of questions, content and format of letters, timing of mailings, and format of questionnaires are described. In addition, the

TDM for mail surveys relies heavily on personalisation throughout the entire data collection procedures.

A letter explaining the purpose of the research project and inquiring about the firm's willingness to participate in the study was sent to one contact person in each of the 726 firms. Appendix A presents the letter of introduction to the contact person.

The company accountant or financial controller was targeted as the initial contact person. The choice of contact person was based on the case study results, which indicated that the most knowledgeable computer users were the accountants and financial controllers. If the name of the accountant or financial controller was not available, the letter was sent to a manager or director of the firm. For very few firms, no names of individuals were available and therefore letters were sent to "The Director".

The contact people were asked to provide the names and job titles of all computer users on a one-page form. Firms that had more than five computer users were asked to submit the names and job titles of their most knowledgeable computer users. In addition, to gain a better understanding of the number of computer professionals in small firms, the names and job titles of all staff who were using computers were requested. The Q&A software package was used to develop a database to store the names and addresses of computer users, to produce mailing labels, and to record response rates.

### **5.1.2 The Population**

This study investigated EUC in the manufacturing and engineering industry sectors, which provided a large number of small firms in New Zealand (Hamilton and English, 1993). This choice of industry sectors was also based on the results of Kagan et al.'s (1990) study, which concluded that small firm use of computers is unique to each small business sector and that the intensity of computing varies among sectors. In addition, the authors found that small firms have different computing uses depending upon their industry classification. Therefore, an in-depth study of the manufacturing and engineering industry sectors seemed to be more appropriate than a study involving many unrelated industry sectors.

According to Raymond (1985), manufacturing firms offer the widest functional range of IS applications. Kagan, et al. (1990) concluded that the manufacturing sector has the largest proportion of firms that write their own software applications. Since several other small firm computing studies have investigated the manufacturing sector (Delone, 1988; Martin, 1989; Raymond, 1985), an in-depth study of the manufacturing sector would facilitate the comparison of results to similar studies.

### **5.1.3 Definition of Small Firm**

For this study, in order to ensure a large enough sample size of computer users, a small firm in the manufacturing and engineering sectors was defined as having between 20 and 100 employees. This definition was based on Bollard's (1984) suggestion and on the results of the case studies. The case studies revealed that most firms with fewer than 20 employees had no computer users at all. Firms with between 20 and 50 employees had at most three computer users. In addition, this definition would facilitate the comparison of results of similar studies, which define small firms as having fewer than 100 employees (Soh, et al., 1992; Yap, et al., 1992) and fewer than 250 employees (Delone, 1988; Kagan et al., 1990; Raymond, 1985; Raymond (1987a); Raymond and Bergeron, 1992).

### **5.1.4 Sampling Frame**

The study needed a comprehensive list of small manufacturing and engineering firms in New Zealand. Also, to implement Dillman's (1978) approach to survey design, individual names were required, as well as the company names and addresses. Such up-to-date information was not readily available for small firms. In an attempt to achieve an up-to-date and accurate list of all small manufacturing and engineering firms in NZ, various organizations with lists were approached. For example, organisations such as the Department of Statistics, Chambers of Commerce, the Manufacturers' Association, and business development centres were contacted. However, the New Zealand Business Who's Who Directory was selected as the only up-to-date available list, with individual names, and the best coverage of small firms.

### 5.1.5 Results of the Company and User Identification Phase

#### i. Response Rate

Responses were received from 504 (69%) of the 726 firms. Table 5.2 contains data on the responses to phase 1 of the survey. Responses included refusals, ineligible, and eligible companies. In total, 203 companies that agreed to participate in the research project also met the criteria for the survey. From the final sample of 203 participating companies, the names of 773 computer users were identified. As shown in Table 5.2, only 79 of the 503 responding firms were not using computers. Thus, most of the responding firms (84%) were using computers.

Due to the high response rate of 69%, a formal analysis of non-response bias was not conducted. However, there were no apparent differences between participating and non-participating companies in terms of size and geographic location. Telephone interviews were conducted with a random sample of ten non-respondents to identify the reasons for non-response. The most common reason for non-response was that the company did not meet the criteria for the study. Others were either too busy or had a company policy not to respond to surveys.

**TABLE 5.2 Responses to Phase 1**

Type of Response	Number	Percentage
<b>Total Number of Letters Mailed</b>	726	
<b>Total Number of Responses</b>	504	69%
<b><u>Usable Responses</u></b>	203	28%
<b><u>Non-Usable Responses</u></b>		
Refusals/Incomplete	36	
Ceased Trading/Unreachable	10	
Under 20 Employees	128	
Over 100 Employees	22	
Subsidiary	38	
No Computer Users	79	
<b>*Total Non-Usable Responses</b>	301	41%

\*Note: For several firms, two of the criteria for participation in the study were not met. Thus, the total of non-usablereturns (301) is less than the total number of instances that the criteria for the study were not met.

#### ii Firm Sizes

Only firms with between 20 and 100 employees were included in the study. Table 5.3 presents a summary of firm sizes by number of employees. Over 80% of firms had fewer than 50

employees. Thus, most firms were within the NZ small manufacturing firm definition (Bollard, 1988). The average firm size was 38 employees.

**TABLE 5.3 Size of Firm by Number of Employees**

Number of Employees	Number of Firms	Percentage
20-30	93	46%
31-40	44	21%
41-50	28	14%
51-60	16	8%
61-70	6	3%
71-100	16	8%
<b>Total Number of Firms</b>	<b>203</b>	

### iii. Computer Users

Only firms with at least one computer user are included in the study. In total, 773 users from 203 firms were identified. Table 5.4 presents details of the number of computer users per firm. Over 50% of the firms had between 1 and 4 computer users.

The previous case study findings, described in Chapter 3, indicated that very few firms would have more than 5 computer users. Surprisingly, the average number of computer users per firm was 6. In addition, over 30% of the firms had more than 5 computer users. This result indicates that there is a considerable number of computer users in small firms.

**TABLE 5.4 Number of Computer Users Per Firm**

Number of Users	Number of Firms	Percentage
<b>Average Number of Users Per Firm</b>	<b>6</b>	
1 or 2 users	46	23%
3 or 4 users	60	30%
5 or 6 users	39	19%
7 or 8 users	18	9%
9 or 10 users	7	3%
More than 10 users	33	16%
<b>Total Number of Firms</b>	<b>203</b>	

### iv. End User Job Titles

Respondents were asked to provide the names and job titles of computer users. Since there was a concern that respondents would not want to provide the names of computer users, information on no more than 5 users was requested. The names of the most knowledgeable computer users were requested from firms with more than 5 computer users. The selection

of most knowledgeable computer users ensured a larger sample of more sophisticated end users for the Survey Phase of the study (Section 5.2)

Table 5.5 contains information on job titles of computer users identified for this study. The results indicate that a considerable amount of managerial EUC exists (34%). A large proportion of Accountants and Financial Controllers (21%) as well as clerical and secretarial staff (21%) were also identified as computer users. However, only 4 users had computer programmer or analyst in their job titles. This finding highlights the lack of internal computer expertise in small firms in the manufacturing and engineering sectors.

**TABLE 5.5 Types of Users by Job Title**

Job Title	Number of Users	*Percentage
Manager/Director	267	34%
Accountant/Financial Controller	159	21%
Clerk/Secretary	160	21%
Marketing/Sales	72	9%
Administration	57	7%
Other	58	8%
<b>Total Number of Users</b>	<b>773</b>	

\*Since information on at most five users per firm was requested, not all computer users are represented in the study.

Therefore, Table 5.5 shows the percentages by job title of the computer users identified for this study only.

## 5.2 THE SURVEY PHASE

Based on the results of the identification phase (Section 5.1), questionnaires were sent to all of the 773 computer users in the 203 companies that agreed to participate in the study. Appendix B presents a letter describing the research project which was mailed along with the questionnaires (Appendix D) to computer users.

### 5.2.1 Sample Selection and Response Rate

For this study, a computer user was defined as anyone who uses a computer for work related purposes. However, the main focus of this study was on the use of computers by knowledge workers, which include professionals and managers but exclude clerical/secretarial staff. It was assumed that any individuals who indicated that their jobs were either clerical or secretarial were using computers on a mandatory basis. Since the study's focus was on

optional use, these respondents were not included in the final data analyses. A total of 773 questionnaires (Appendix D) were sent to individuals in the participating firms. Although 596 (77%) questionnaires were returned, not all responses were usable for the data analyses. Some of the returned questionnaires were not completed due to the following reasons: (1) too busy, (2) not a computer user, (3) no longer with the company, and (4) company policy not to respond. Only questionnaires that were fully completed (i.e. no missing values) were used in the final data analyses.

In addition, 84 of the respondents who completed the questionnaire identified themselves as having clerical/secretarial positions and were therefore removed from the sample prior to the statistical analyses. Thus, of the total responses, only 358 (60%) were used in the final data analyses.

Due to the high response rate of 77%, a formal analysis of non-response bias was not conducted. However, there were no apparent differences between responses and non-responses in terms of industry sector, company size, and geographic location. Telephone interviews were conducted with a random sample of ten non-respondents to identify the reasons for non-response. The most common reasons for non-response were similar to the reasons previously described for the return of incomplete questionnaires.

### **5.2.2 Descriptive Statistics**

This section summarizes the descriptive findings of the questionnaire results. The respondents were asked questions of a demographic nature in order to provide the background to understand the varying responses of the computer users.

#### i. EUC Sophistication

Table 5.6 shows the EUC sophistication of end users based on the Rockart and Flannery (1983) classification. The majority of end users (81%) fell into the nonprogramming and command level categories. These results indicate a very low level of EUC sophistication in small firms. Only 1% of the computer users identified themselves as being computer specialists. This result highlights the lack of internal computer expertise available in small firms.

**TABLE 5.6 EUC Sophistication**

End User Type	Number of Users	Percentage of Users
Nonprogramming	215	36
Command Level	267	45
End User Programmers	72	12
End User Programmers/Support	27	5
Computer Specialist	6	1
<b>Total</b>	<b>587</b>	<b>99</b>

Note: 1% of the values were missing.

### ii. Computer Experience

Table 5.7 reveals that respondents had a lot of experience with microcomputer packages, such as spreadsheets and word processors, but very little experience with any other type of computer software. As shown in Table 5.7, 49% of the users surveyed had extensive experience with packages. Most of the users (over 70%) reported little or no experience with building models and programming with fourth generation languages (4GLs) and/or third generation languages (3GLs). These findings are consistent with the results of previous studies of small firm computing.

The number of years of computer experience ranged from 6 months to 25 years and the mean/median number of years of computer experience was 7 years. Personal computers were used by a majority of respondents; approximately 69% of the respondents indicated that they use a personal computer to do most of their computer work.

**TABLE 5.7 Computer Experience**

Type of Experience	Little or No Experience		Very or Extremely Extensive	
	Number of Responses	Population Proportion	Number of Responses	Population Proportion
Microcomputer Packages	143	24%	294	49%
Programming with 4GLs	514	86%	36	6%
Building Models	436	73%	75	13%
Programming with 3GLs	531	89%	21	4%

### iii. Sources of Training

Table 5.8 reveals that users in small firms have received very little computer training. The results in Table 5.8 show that more than 50% of the users had received little or no training from external sources. Only 24% of the users reported receiving internal training to a great or very great extent.

As shown in Table 5.8, self-training far outweighs any of the other training sources.

**TABLE 5.8 Training Sources**

Training Source	Never or to a Little Extent		To a Great or Very Great Extent	
	Number of Responses	Population Proportion	Number of Responses	Population Proportion
University or Polytech	411	69%	73	12%
Vendor or Consultant	333	56%	84	14%
Internal Training	286	48%	141	24%
Self Training	118	20%	326	55%

#### iv. End User Software

Users were asked to indicate to what extent they used various software packages. Table 5.9 presents a summary of the number of users who indicated that they used each software package to some extent, to a great extent, or to a very great extent (3, 4, or 5 on the Likert scale). As shown in Table 5.9, application packages are being used by a majority of users (65%). In addition to application packages, the most popular software tools based on extent of usage are word processors (55%), spreadsheets (46%), and databases (31%).

**TABLE 5.9 End User Software**

Software	To Some Extent - To a Very Great Extent	
	Number of Responses	Population Proportion
Application Packages	388	65%
Word Processing	326	55%
Spreadsheet	273	46%
Database	183	31%
Graphics	124	21%
Statistical Analysis	109	18%
Electronic Mail	30	5%
Programming Languages	31	5%

#### v. End User Tasks

Users were asked to indicate to what extent they used a computer to perform various tasks. Table 5.10 presents a summary of the number of users who indicated that they performed each task to some extent, to a great extent, or to a very great extent (3, 4, or 5 on the Likert scale).

Table 5.10 shows that approximately 70% of the respondents used computers for generating reports and for data storage/retrieval, and 48% used computers for letters and memos (48%). Over 30% of the respondents used computers to perform somewhat more sophisticated data analysis such as analysing trends, making decisions, planning and forecasting, controlling and guiding activities, budgeting, and analysing problems.

**TABLE 5.10 End User Tasks**

<b>Task</b>	<b>To Some Extent - To a Very Great Extent</b>	
	<b>Number of Responses</b>	<b>Population Proportion</b>
<b>Data Storage/Retrieval</b>	468	79%
<b>Reports</b>	440	74%
<b>Letters and Memos</b>	283	48%
<b>Analysing Trends</b>	236	40%
<b>Making Decisions</b>	234	39%
<b>Planning/Forecasting</b>	230	39%
<b>Controlling/Guiding</b>	224	38%
<b>Budgeting</b>	218	37%
<b>Analysing Problems</b>	179	30%
<b>Electronic Communications</b>	71	12%

vi. End User Functional Area

The respondents held positions in a wide range of functional areas. Table 5.11 indicates that 24% of the participants classified their job function as accounting or finance, 14% as clerical/secretarial, and 12% as administrative. It was assumed that the 84 respondents who indicated that their jobs were either clerical or secretarial were using computers on a mandatory basis. Since the study's focus was on optional use and on knowledge workers, these respondents were removed from the sample prior to the statistical analysis.

Other job categories included manufacturing/production (11%), management (11%), and sales (8%), engineering (4%) and marketing (2%). Not surprisingly, approximately 7% of users selected more than one functional area to describe their functional roles. In a small business context, it is not uncommon for staff to be involved in more than one functional area. Of the 596 respondents, 73 (12%) were the top managers in their companies. There was also a considerable range in the number of subordinates reporting to managers and supervisors (1 to 75).

**TABLE 5.11 End User Functional Area**

Functional Area	Number of Responses	Population Proportion
Accounting/Finance	142	24%
Clerical/Secretarial	85	14%
Administration	71	12%
Manufacturing/ Production	68	11%
Management	67	11%
Sales	48	8%
Engineering	22	4%
Marketing	12	2%
*Other	57	10%

Note: Other includes people who listed more than one functional area.

### vii. Other End User and Company Characteristics

Of the 596 participants, 54% were female and 46% were male. Age ranged from 19 to 76 and the mean/median age of respondents was 38 years. Approximately 25% of the respondents had either completed some university education or were university graduates and an additional 15% were polytech graduates. The remaining respondents had either completed high school (37%) or had done some polytech studies (21%).

All of the respondents were employed in small firms in the manufacturing and engineering sector. Firm size ranged from 20 to 100 employees and the median size was 35 employees. The company ages ranged from 1 to 150 years and the median company age was 25 years.

## **5.3 INSTRUMENT DEVELOPMENT**

This section describes the development and pretest of the survey instrument (Appendix C). In particular, the operationalisation of the constructs in the Final Research Model (Chapter 4) is discussed. Descriptive statistics for the construct measurement items are included in Appendix E.

### **5.3.1 Operationalisation of Constructs**

The development of the research instrument involved a review of many existing survey instruments. To ensure the reliability and validity of the measures used in this study, previously validated measurement scales were adopted wherever possible. The following section discusses the development of the measurement scales used in the study. The

complete measures are provided in Appendix C. Questionnaire items related to the research model are included in Appendix D.

#### i. Internal Support

Internal support was defined as the technical support provided by individuals (or groups) with computer knowledge who were internal to the company. This construct was operationalised using a scale adapted from Amoroso (1986), Igarria (1990, 1993), and Thompson, et al. (1991). Both Amoroso (1986) and Igarria (1990, 1993) used instruments that included questions on the support provided by Information Centres. Since small firms would generally not have Information Centres, Thompson's (1991) instrument, which was based on Amoroso's (1986) work, was selected as the most appropriate measure in a small firm context.

The internal support scale consisted of four items (Appendix C) that measured the availability of technical assistance and specialized instruction on a 5-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. In particular, respondents were asked to indicate the level of internal support provided to them by computer users or computer specialists in the company.

#### ii. Internal Training

Internal training refers to the amount of training provided by other computer users or computer specialists in the company. The scale used to measure training in previous EUC studies (Amoroso, 1986; Amoroso and Cheney, 1991; and Igarria, 1990) included the amount of training received by users from both internal and external sources.

For this study, two separate measures of internal and external training were needed. In addition, the amount of internal training rather than the specific source of internal training was of most interest to this study. Therefore, based on several studies (Amoroso, 1986; Amoroso and Cheney, 1991; Nelson and Cheney, 1987), one indicator of the amount of internal training was developed.

Respondents were asked to indicate on a 5-point Likert scale, ranging from (1) never/very little extent to (5) very great extent, the extent to which they had received internal training

on hardware, operating systems, and eight different software packages (Appendix C). The amount of internal training was calculated by a simple count of those items for which the response for extent of training was 'to some extent' or greater (3, 4, or 5 on the Likert scale).

### iii. Management Support

Management support refers to the perceived level of general support offered by management for EUC. The measurement scale was developed on the basis of work conducted by Igbaria (1990, 1993) and Amoroso (1986). The scale consisted of six items (Appendix C) that measured management encouragement and allocation of resources for EUC on a 5-point Likert scale ranging from (1) strongly disagree to (5) strongly agree.

### iv. External Training

External training refers to the amount of training provided by other computer users, friends, vendors, consultants, or educational institutions external to the company. As mentioned previously, the scale used to measure training in previous EUC studies was not appropriate for this study.

Therefore, based on the internal training measure, one indicator of external training was developed for this study (Appendix C). Respondents were asked to indicate on a 5-point Likert scale, ranging from (1) never/very little extent to (5) very great extent, the extent to which they had received external training on hardware, operating systems, and eight different software packages. The amount of external training was calculated by a simple count of those items for which the response for extent of training was 'to some extent' or greater (3, 4, or 5 on the Likert scale).

### v. External Support

External support was defined as the technical support provided by individuals (or groups) with computer knowledge who were external to the company. Various measures of external support, including vendor and consultant support, have been used in previous studies (Brancheau and Wetherbe, 1990; Gable, 1991a; Thong, et al., 1993; Yap, et al., 1992). However, these measures focused primarily on project specific support from either vendors or consultants.

For this study, the amount of external support for EUC from all possible external sources was of main interest. Since it was decided that none of the previously developed instruments were appropriate, the external support scale was developed using the same four items that were used to measure internal support (Appendix C). Respondents were asked to indicate the level of external support provided to them by friends, vendors, consultants, or other external sources on a 5-point Likert scale ranging from (1) strongly disagree to (5) strongly agree.

#### vi. Perceived Ease of Use

Perceived ease of use refers to the degree to which a person believes that using a particular computer system would not require a great deal of effort (Davis, 1989). The scale contains four items (Appendix C) adapted from prior research (Davis, 1989; and Davis, et al., 1989), with appropriate modifications to make them specifically relevant to EUC. The measures were developed using a 5-point Likert scale ranging from (1) strongly disagree to (5) strongly agree.

#### vii. Perceived Usefulness

Perceived usefulness is defined as the extent to which a person believes that using a particular computer system would improve his or her job performance. The scale contains four 5-point Likert items (Appendix C) adapted from prior research (Davis, 1989; Davis et al., 1989; and Igarria, 1993). The scale range was from (1) strongly disagree to (5) strongly agree. Some modifications were made to the items to make them appropriate for an EUC context.

#### viii. Computer Usage

Based on several studies (DeLone, 1988; Igarria, 1993; Igarria, et al., 1989; Srinivasan, 1985), four indicators of computer usage were included in this study: (1) perceived daily use of a computer; (2) perceived frequency of use of a computer; (3) the number of different software packages used; (4) the number of different business tasks for which the system was used (Appendix C).

The first two indicators (i.e., perceived daily use and perceived frequency of use) are the most commonly used measures of usage (DeLone, 1988; Igarria, 1990; Lee, 1986; Raymond,

1985; Thompson et al., 1991). In this study, individuals were asked to indicate how frequently they used a computer and how much time they spent per day using a computer for job-related work. Each item was measured on a six-point Likert scale ranging from (1) less than once a month to (6) several times a day (for frequency of use) and ranging from (1) almost never to (6) more than 3 hours (for amount of use).

The third and fourth measures of usage are based on several previous studies (Amoroso and Cheney, 1992; Amoroso, 1986; Igarria, 1993; and Thompson, 1991). To measure the third indicator, diversity of software packages, a list of eight software packages was provided and respondents were asked to indicate the extent of use of each one of these packages on a 5-point Likert scale, ranging from (1) never/very little extent to (5) very great extent. Diversity of software packages was calculated by a simple count of those packages for which the response for extent of use was 'to some extent' or greater (3, 4, or 5 on the Likert scale).

The fourth indicator, diversity of tasks, was measured in a similar manner. Ten tasks were defined and the respondents were asked to indicate to what extent they used a computer to perform each task on a 5-point Likert scale ranging from (1) never/very little extent to (5) very great extent. Diversity of tasks was calculated by a simple count of the tasks for which the response for extent of use was 'to some extent' or greater (3, 4, or 5 on the Likert scale).

#### ix. EUC Satisfaction

For the sake of reliability, simplicity, and ease of administration, the Doll and Torkzadeh (1988) EUC satisfaction instrument was used in this study. The authors define EUC satisfaction as the affective attitude towards a specific computer application by someone who interacts with the application directly. The instrument consists of twelve items that measure the extent to which the application meets the user's requirements in terms of information content, accuracy, format, ease of use, and timeliness (Appendix C). Each item was measured on a five-point Likert scale, ranging from (1) almost never to (5) almost always.

One of the criteria Raymond (1987c) discussed for measuring UIS in small firms is that the instrument should be short and easy to answer to ensure a sufficient level and validity of response. The EUC satisfaction instrument used in this study was selected because it is

short, easy to use, has adequate reliability and validity across a variety of applications, and is appropriate for research purposes (Doll and Torkzadeh, 1988).

### **5.3.2 Instrument Pretest**

A pretest was performed in order to eliminate problems in the construction and administration of the questionnaire. The research instrument was reviewed by twelve academics in the IS field. Forty five instruments were administered to students in a third year systems analysis class. Twenty additional users completed the questionnaire. Five users completed the questionnaire with the researcher present in order to answer questions and monitor progress.

As a result, the phrasing of several questions was changed and the sequencing or length of other questions modified. Discussions with respondents led to the expansion of several sets of questions (job tasks, functional areas) to include a more realistic selection.

## **5.4 CHAPTER SUMMARY**

This chapter described the survey methodology used in the study. The initial phase of data collection involved the identification of companies that were willing to participate in the study and the computer users in each company. The second phase of data collection involved a national survey. Descriptive statistics were presented and the development of the survey instrument was described. Chapter 6 describes the data analysis technique used and the results of the empirical study.

## CHAPTER 6 - DATA ANALYSIS

### 6 DATA ANALYSIS

In this chapter, the results of the data analysis are discussed. Section 6.1 describes the Partial Least Squares (PLS) data analysis technique used in this study to analyse the survey data. Section 6.2 presents an assessment of the measurement model (construct validity). Section 6.3 describes the evaluation of the structural model.

#### 6.1 DATA ANALYSIS TECHNIQUE

The data analysis technique chosen for this research is PLS, which is a structural equation modelling technique based on the work of Herman Wold. PLS is a second generation multivariate technique that facilitates testing of the psychometric properties of the scales used to measure a construct, as well as estimating the magnitude and direction of the relationships among constructs in a structural model (Fornell, 1982; Lohmoller, 1989; Wold, 1982). Barclay, et al. (1993) argue that PLS should be strongly considered for a variety of technology research studies.

PLS and similar second generation multivariate techniques such as LISREL have emerged as powerful ways to study causal models involving multiple constructs with multiple measures (Thompson, 1988). According to Fornell (1982), these techniques, which are referred to as second generation multivariate analysis techniques, represent a major improvement over first generation multivariate methods. A brief overview of the differences between first and second generation multivariate methods is presented and a comparison of PLS and LISREL is then discussed.

First generation multivariate methods (e.g., multiple regression, factor analysis, and cluster analysis) have become very useful tools for researchers; these methods make possible the evaluation of constructs and the relationships between constructs. However, the use of first generation methods precludes the simultaneous evaluation of constructs (the measurement model) and the relationships between constructs (the theoretical model). In contrast, second generation techniques simultaneously evaluate both the measurement model and the theoretical model. Furthermore, by incorporating multiple dependent constructs, and by explicitly integrating theory with empirical data, second generation methods provide the capability to advance understanding by combining theoretical with

empirical knowledge to the extent not possible with first generation techniques (Barclay, et al., 1993). For example, PLS performs the factor analysis and regression analysis simultaneously, which allows the construct to be defined and tested within the context of the theoretical model (Thompson, et al., 1992).

Causal or structural equation modelling, emerging from the social sciences, is an approach to simultaneously assessing the reliability and validity of the measures of theoretical constructs and estimating the relationships among these constructs (Barclay, et al., 1993). The most widely accepted implementation of structural equation modelling is the LISREL computer program. Unfortunately, LISREL requires some rather restrictive assumptions, including multivariate normal data distributions of the indicators, interval scales, and fairly large sample sizes (Fornell, 1982). In addition, LISREL is best suited to research problems that have a strong theoretical base and where indicators or observed variables are reflective versus formative. According to Falk and Miller (1992), these restrictive assumptions about measurements, distributions, and theory are unrealistic for most social science data.

The authors suggest that in order to produce results, researchers often must make computational and theoretical compromises. PLS is an alternative causal or structural equation modelling technique developed by Wold (1985). In comparison with LISREL, PLS is a more flexible approach, requiring very few assumptions about the nature of data. For example, Falk and Miller (1992) suggest that PLS can be used appropriately even if one or more of the following conditions and circumstances exist:

- (1) Hypotheses are derived from theory in which all relevant variables are not known.
- (2) Relationships between theoretical constructs and their manifestations are vague.
- (3) Relationships between constructs are conjectural.
- (4) Some or all of the manifest variables are categorical or they represent different levels of measurement.
- (5) Manifest variables have some degree of unreliability.
- (6) Data come from non-normal or unknown distributions.
- (7) Cross-sectional, survey, secondary data, or quasi-experimental research designs are used.
- (8) A large number of manifest and latent variables are modeled.
- (9) Too many or too few cases are available.

Based on these conditions and circumstances, an important advantage of PLS in comparison with LISREL is that PLS does not depend on having multivariate normally distributed data. Furthermore, PLS can be applied to non-interval-scaled data and it can be used with small sample sizes. In terms of sample size, the rule of thumb for the smallest sample size required to perform a PLS analysis is that the sample size must be ten times the number of items in the largest construct (Barclay, et al., 1993; Falk and Miller, 1992). In this study, the largest construct was EUC satisfaction, which was measured with 12 items. Thus, a minimum sample of at least 120 questionnaires was required.

Igbaria and Baroudi (1994) suggest that PLS is a powerful analytical technique for testing structural equation models and it can be used in many cases where the use of LISREL is inappropriate. For example, PLS is more appropriate in research areas where theoretical knowledge is not as strong as that demanded by LISREL (Fornell, 1984). Thus, PLS is generally recommended for predictive research models where the emphasis may be more on theory development. In contrast, LISREL is more suited to testing, in a confirmatory sense, how well a theoretical model fits observed data, which requires much stronger theory than PLS. According to Barclay, et al. (1993), the two techniques should be viewed as complementary or in some cases PLS can be viewed as a precursor to the use of LISREL.

Given the early stage of theory development in EUC (Igbaria, 1990; Rivard and Huff, 1988), and the uncertain distribution of the data, PLS was selected as the most appropriate data analysis method. The use of PLS is consistent with several previous EUC studies (Igbaria, 1990, 1993; Igbaria and Baroudi, 1994; Rivard and Huff, 1988; Thompson, et al. 1991). PLS identifies two components of a causal model: the structural model and the measurement model. In this study, PLS is used to assess the overall validity of the proposed structural model (Chapter 4) and to determine the extent to which the model explains the variance observed in the dependent variables. The model describes the relationships or paths among theoretical constructs. For each construct, there is a related measurement model, which links the construct in the diagram with a set of items.

PLS was also used to test the measurement model, which consists of the relationships between the items (indicators) and the construct which they measure. Another advantage of PLS is its ability to handle both formative and reflective indicators of constructs.

According to Fornell (1984), reflective indicators are used when the construct is clearly defined and readily measurable. In contrast, formative indicators are generally created by the researcher in situations where there are no widely accepted operationalisations of a construct. The choice between formative and reflective indicators is left to the individual researcher.

For this study, since the usage construct was not well-defined and potentially contained multiple dimensions (such as frequency of use, amount of use, diversity of tasks and diversity of software), usage was modeled with formative indicators, while the remaining eight constructs were modeled with reflective indicators. Since the initial PLS analysis revealed that usage did in fact contain two dimensions, the construct was split into the two separate constructs of usage and utilisation.

## **6.2 ASSESSMENT OF THE MEASUREMENT MODEL**

According to Barclay, et al. (1993), the first step in a PLS analysis is for the researcher to explicitly specify both the structural (or path) model and the construct-to-measures relationships in the measurement model. The construct validity of the measurement scales within the context of the overall model can then be examined. Researchers using first generation techniques often calculate Cronbach's alpha coefficients (Cronbach, 1951) and use factor analysis to test the reliability and validity of measurement scales. This approach restricts researchers to testing the measurement model separately from the structural model. In contrast, PLS allows the researcher to test the measurement model within the context of the structural model by examining the loadings of each indicator with its associated construct (Thompson, 1988).

Barclay, et al. (1993) explain that although the measurement and structural parameters are estimated together, the analysis and interpretation of a PLS model is conducted in two stages. The first stage consists of the assessment of the reliability and validity of the measurement model and the second stage involves the assessment of the structural model. This two stage process ensures the reliability and validity of constructs before attempting to draw conclusions about the relationships between constructs.

The measurement model is assessed by examining: (1) individual item reliability, (2) composite reliability, (3) average variance extracted, and (3) discriminant validity. This approach has been adopted by several previous researchers (Grant, 1989; Igbaria, 1990; 1993; Rivard and Huff, 1988; Thompson, et al., 1991).

### **6.2.1 Individual Item Reliability**

Item reliability indicates the amount of variance in a measure due to the construct rather than to error. In PLS, individual item reliability is assessed by examining the loadings, or simple correlations, of each measure on its corresponding construct. According to Fornell (1984), a good rule of thumb is to accept items with loadings greater than .7. Since loadings are correlations and squared loadings are the variance extracted, a loading of .7 translates into almost 50% of the variance explained. This result implies that the measure has more explanatory power than error variance (Thompson, 1988) and that the variance in the observed variable is shared with the construct. When weak loadings (below .7) are observed, it is necessary to determine whether to revise the scales by dropping items to improve reliability, or leave the scales intact to allow comparisons with previous research using the same scales.

According to Barclay, et al. (1993), weak loadings may be due to the fact that: (1) an item could be unreliable, (2) an item could not be measuring its corresponding construct, or (3) the construct to which the item is linked is multidimensional. The authors recommend that in the latter instance, researchers should consider splitting a construct originally considered unidimensional into two constructs, or eliminating items so that a unidimensional construct remains in the model.

Table 6.1 presents the factor loadings of the items on the constructs in the final structural model. An interpretation of the loadings shows that only one item was slightly below the .7 level of acceptable reliability. Since this item was only slightly below .7 and since the item was one of twelve items from a standard EUC satisfaction (Doll and Torkzadeh, 1988) scale, the item was not dropped from the construct.

**TABLE 6.1 Factor Loadings**

<b>Variables</b>	<b>Factor Loadings</b>
<b>Internal Support</b>	INSUP01 .85 INSUP02 .83 INSUP03 .86 INSUP04 .84
<b>Internal Training</b>	1 item only
<b>Management Support</b>	MSUPP01 .69 MSUPP02 .82 MSUPP03 .86 MSUPP04 .83 MSUPP05 .81 MSUPP06 .81
<b>External Support</b>	EXSUP01 .86 EXSUP02 .88 EXSUP03 .83 EXSUP04 .79
<b>External Training</b>	1 item only
<b>Perceived Ease of Use</b>	EASE01 .87 EASE02 .87 EASE03 .89 EASE04 .91
<b>Perceived Usefulness</b>	USEFUL1 .89 USEFUL2 .88 USEFUL3 .84 USEFUL4 .89
<b>Usage</b>	FREQUSE .75 TIMEUSE .96
<b>Utilization</b>	APPLIC .91 TASKS .88
<b>EUC Satisfaction</b>	SATIS01 .68 SATIS02 .73 SATIS03 .76 SATIS04 .80 SATIS05 .75 SATIS06 .81 SATIS07 .74 SATIS08 .76 SATIS09 .74 SATIS10 .74 SATIS11 .74 SATIS12 .70

Of the nine original constructs, eight remained unchanged and one was split in two (i.e. computer usage), resulting in ten constructs in the final structural model. Computer usage was measured by four items in the initial PLS analysis. However, the PLS analysis showed that the four items forming the usage measure were not a homogeneous group. The loading pattern revealed that these four items formed two distinct constructs: usage and utilisation. The subsequent PLS analysis showed that these two separate constructs had significant reliability. Thus, the results of the analysis confirmed the splitting of the original construct into two distinct constructs, i.e. usage and utilisation. This finding is supported by other studies that measured either usage (DeLone, 1988; Igbaria, 1990; Igbaria and Baroudi, 1994; Igbaria, et al., 1989; Raymond, 1985) or utilisation (Amoroso, 1986; Amoroso and Cheney, 1991; 1992).

### **6.2.2 Composite Reliability**

Researchers using PLS typically report the measure of internal consistency developed by Fornell and Larcker (1981) as a measure of reliability. Internal consistency is computed as the sum of the loadings, all squared, divided by the sum of the loadings, all squared, plus the sum of the error terms. The composite reliability is similar to Cronbach's alpha as a measure of internal consistency. However, Cronbach's alpha presumes, a priori, that each

indicator of a construct contributes equally. Fornell and Larcker (1981) argue that their measure is superior to Cronbach's alpha since it uses the item loadings estimated within the causal model. Barclay, et al. (1993) point out that the composite reliability, which is not influenced by the number of items in the scale, is more general than Cronbach's alpha.

Although the composite reliability is more general than Cronbach's alpha, the interpretation of the values obtained is similar. More specifically, Nunnally's (1978) guideline for assessing Cronbach's alpha coefficients (Cronbach, 1951) can be adopted for the composite reliability. In these guidelines, Nunnally suggests .70 as a guideline for modest reliability applicable in early stages of research. For this study, Nunnally's (1978) guidelines were used. However, Hair, et al. (1987) recommended retaining items with factor loadings of .50 or above and considered them to be very significant.

The internal consistency of each scale from this analysis is shown in Table 6.2. The results show that the composite reliabilities of the constructs range from .85 to .98. Thus, all scales demonstrate adequate internal consistency since Nunnally's (1978) guideline is satisfied.

### **6.2.3 Average Variance Extracted**

Average variance extracted by each construct is the amount of variance in the item explained by the construct relative to the amount of variance due to measurement error (Igbaria, 1990, 1993; and Rivard and Huff, 1988). Fornell and Larcker (1981) propose that to more fully examine the composite reliability in the measurement scale, the average variance extracted or the average variance shared with a construct should be assessed. Fornell and Larcker's (1981) criterion that the average extracted variance should be .5 or more was used to assess the shared variance coefficients. If the average variance extracted is less than .5, the variance due to error in measurement is greater than the variance captured by the construct, and the validity of the individual indicators as well as the construct is questionable.

The average variance extracted for each construct is presented in Table 6.2. The results show that all constructs met Fornell and Larcker's (1981) criterion for average variance extracted.

TABLE 6.2 Assessment of the Measurement Model

<b>Variables</b>	<b>The Composite Reliability (Alpha Coefficients)</b>	<b>Average Variance Extracted/Explained</b>
<b>Internal Support</b>	.91	.72
<b>Internal Training</b>	1.00	1.00
<b>Management Support</b>	.92	.65
<b>External Support</b>	.91	.71
<b>External Training</b>	1.00	1.00
<b>Perceived Ease of Use</b>	.93	.78
<b>Perceived Usefulness</b>	.93	.77
<b>Usage</b>	.85	.74
<b>Utilization</b>	.89	.80
<b>EUC Satisfaction</b>	.98	.56

#### 6.2.4 Discriminant Validity

Discriminant validity refers to the extent to which items measure distinct concepts. With PLS, one criterion for adequate discriminant validity is that a construct should share more variance with its measures than it shares with other constructs in the model (Barclay, et al., 1993). Fornell and Larcker (1981) recommend the use of the average variance extracted (i.e. the average variance shared between a construct and its measures) to assess discriminant validity. The authors suggest a comparison between the average variance extracted for each factor and the variance shared between the constructs (i.e. the squared correlations between the constructs). The average variance extracted should be greater than the variance shared between the construct and other constructs in the model. Thus, for adequate discriminant validity, the diagonal elements should be significantly greater than the off-diagonal elements in the corresponding rows and columns.

The results of the discriminant validity are presented in Table 6.3. The diagonals represent the average variance extracted (as reported in previous Table) while the other matrix entries represent the shared variance among variables (the squared correlations). Table 6.3 shows that there were no violations of the criteria for discriminant validity. This result suggests

that all of the constructs are distinct and unidimensional constructs.

**TABLE 6.3 Intercorrelations Among Study Variables**

Variables	1	2	3	4	5	6	7	8	9	10
1. Internal Support	.72									
2. Internal Training	.34	1.00								
3. Management Support	.31	.13	.65							
4. External Support	.10	.05	.20	.71						
5. External Training	-.08	.06	.01	.20	1.00					
6. Perceived Ease of Use	.05	.08	.05	.10	.15	.78				
7. Perceived Usefulness	.13	.11	.27	.19	.07	.46	.77			
8. Usage	.11	.09	.14	.15	.07	.35	.41	.74		
9. Utilization	-.02	.11	.12	.26	.26	.35	.25	-.32	.80	
10. EUC Satisfaction	.13	.05	.34	.19	.02	.10	.23	-.14	.10	.56

Notes: The diagonals represent the average variance extracted. The absolute values of correlations  $\geq .11$  are significant at .05 or lower.

In addition, to assess the discriminant validity of the measures, the correlations between the measures of potentially overlapping constructs were examined (Grant, 1989). If the items comprising an instrument that measures a construct correlate more highly with each other than with items measuring other constructs in the model, the measure is determined to have adequate discriminant validity. This criterion can be tested within PLS by examining the factor structure which is a listing of the loadings of all indicators on every construct. If a given indicator loads more highly on any construct other than the one it was intended to measure, then this criterion for discriminant validity has been violated. In this study, the intercorrelations amongst the items within each construct were found to be stronger than between items from other constructs.

### 6.3 EVALUATION OF THE STRUCTURAL MODEL

Following the assessment of the measurement model, PLS was used to evaluate the structural model. Structural equation modelling, which is sometimes referred to as causal modelling, is a relatively new approach to testing multivariate models with empirical data (Igarria and Baroudi, 1994; Rivard and Huff, 1988). A structural model consists of unobservable constructs (latent variables) and the theoretical relationships (paths) among them.

In a structural model, each construct has a corresponding measurement model, which relates the construct to a set of manifest or observable variables. The manifest variables are usually responses to items on a questionnaire. The factor loadings for individual items indicate the strength of measures in the measurement model. In terms of the structural model, the estimated path coefficients indicate the strength and sign of the theoretical relationships. The structural equation modelling approach allows for the assessment of the structural model and the measurement model simultaneously.

According to Bagozzi (1982), examination of a structural model is the assessment of the degree to which predictions from a formal theoretical network, which contains concepts of interest, are confirmed. This assessment would include the evaluation of the explanatory power of the model and the significance of paths in the structural model, which represent the hypotheses to be tested.

Since the objective of PLS modelling is to explain variance, predictive ability is an important criterion for model evaluation and for assessing the strength of a theory (Thompson, 1988). The PLS analysis consisted of an assessment of the explanatory power of the independent variables through the measures of explained variance (R-squared) in the endogenous constructs in the structural model. Hypothesis testing consisted of examining the size, sign, and statistical significance of the path coefficients between constructs in the structural model.

The evaluation of the structural model was conducted with the entire sample. The computer software used for this analysis was LVPLS 1.6 (Latent Variable Path Analysis Using Partial Least Squares), which was developed by Lohmoller (1981; 1989). To test the statistical significance of path coefficients, t-statistics were calculated using jackknifing (Tukey, 1958; Wildt, Lambert & Durand, 1982). Jackknifing is a non-parametric technique which is robust in the sense that it is not as affected by violations of the usual assumptions of normality associated with regression analysis (Barclay, et al., 1993).

### **6.3.1 Variance Explained**

Table 6.4 shows that the model explained 3% and 28% of the variance in perceived ease of use and perceived usefulness respectively. Table 6.5 reveals that the model variables

explained 21% and 22% of the variance in usage and utilisation. As shown in Table 6.6, 15% of the variance in EUC satisfaction was explained by the model.

### 6.3.2 Perceived Ease of Use

Table 6.4 shows that internal training (.06), external support (.07), and external training (.13) had significant direct effects on perceived ease of use.

### 6.3.3 Perceived Usefulness

Table 6.4 results reveal that management support (.22), external support (.10), and perceived ease of use (.44) had strong direct effects on perceived usefulness. An indirect effect of external training on perceived usefulness was also found. The indirect effect of external training on perceived usefulness through perceived ease of use was much stronger than the direct effect. A small but significant effect was found for internal training.

**TABLE 6.4 Prediction of Perceived Ease of Use and Perceived Usefulness**

Variables	Perceived Ease of Use	Perceived Usefulness		
		Direct	Indirect	Total
Internal Support	.03	.02	.01	.03
Internal Training	.06*	.03	.03	.06*
Management Support	.01	.22*	0	.22*
External Support	.07*	.10*	.03	.13*
External Training	.13*	-.01	.06	.05
Perceived Ease of Use		.44*		.44*
R-Squared	.03	.28*		

\*  $p \leq .01$

### 6.3.4 Usage

As shown in Table 6.5, perceived ease of use (.20), and perceived usefulness (.29) had very strong direct effects on usage. A smaller but significant direct effect was observed for external support (.06). Indirect effects of management support and perceived ease of use

on usage were also found. The results show that perceived ease of use had both direct and indirect effects on usage through perceived usefulness. The indirect effect of management support through perceived ease of use and perceived usefulness was found to be much stronger than the direct effect. A small but significant effect was found for internal support.

### 6.3.5 Utilisation

Table 6.5 results show that all seven antecedent variables had a significant direct effect on utilization. The strongest effects are from external support (.18), external training (.16), and perceived ease of use (.27). Smaller but significant direct effects are observed for internal support (-.09), internal training (.08), management support (.07), and perceived usefulness (.06). Internal support was found to be negatively related to utilisation.

### 6.3.6 EUC Satisfaction

As shown in Table 6.6, management support (.29), external support (.10), and perceived usefulness (.12) had strong direct effects on EUC satisfaction. Perceived ease of use also had a small but significant effect on EUC satisfaction.

**TABLE 6.5 Prediction of Usage and Utilisation**

Variables	Usage			Utilization		
	Direct	Indirect	Total	Direct	Indirect	Total
Internal Support	.04	.02	.06*	-.09*	.01	-.08*
Internal Training	.02	.03	.05	.08*	.02	.10*
Management Support	.02	.07	.09*	.07*	.02	.09*
External Support	.06*	.05	.11*	.18*	.03	.21*
External Training	.01	.04	.05	.16*	.04	.20*
Perceived Ease of Use	.20*	.13	.33*	.27*	.03	.30*
Perceived Usefulness	.29*		.29*	.06*		.06*
R-Squared	.21*			.22*		

\* p <= .01

**TABLE 6.6 Prediction of End User Computing Satisfaction**

<b>Variables</b>	<b>End User Computing Satisfaction</b>		
	<b>Direct</b>	<b>Indirect</b>	<b>Total</b>
<b>Internal Support</b>	.02	0	.02
<b>Internal Training</b>	-.01	.01	0
<b>Management Support</b>	.29*	.03	.32*
<b>External Support</b>	.10*	.02	.12*
<b>External Training</b>	-.02	.01	-.01
<b>Perceived Ease of Use</b>	.03	.05	.08*
<b>Perceived Usefulness</b>	.12*		.12*
<b>R-Squared</b>	.15*		

\* P <= .01

#### 6.4 CHAPTER SUMMARY

In this chapter, the results of the data analysis were presented. The Partial Least Squares (PLS) data analysis technique used in the study was described. An assessment of the measurement model (construct validity) was discussed along with an evaluation of the structural model. Chapter 7 presents an interpretation of the main findings of the study.



## CHAPTER 7 - INTERPRETATION AND DISCUSSION OF RESULTS

### 7 INTERPRETATION AND DISCUSSION OF RESULTS

This Chapter presents an interpretation and discussion of the results of the study. The primary objective of this study was to examine the determinants of EUC success in small firms. An empirical study was conducted to assess the relationships between the external variables (intra-organisational and extra-organisational factors) and perceived ease of use, perceived usefulness, and EUC success.

As stated in Chapter 6, the validity and reliability of all constructs in the Final Research Model (Figure 4.1) were satisfactory (Tables 6.2 and 6.3). Chapter 7 presents an interpretation of the results in Tables 6.4, 6.5, and 6.6; these tables present the results of the structural model and indicate the direct and indirect effects as well as the amount of variance explained by all of the predictors. Overall, the data provide considerable support for The Final Research Model (Figure 4.1).

To aid in the interpretation of the results, each hypothesis developed in Chapter 4 is presented and an interpretation of the results is provided. Figure 7.1 presents a summary of the direct effects of predictors on EUC success. Implications for small firm managers and external sources of assistance are also discussed.

#### 7.1 THE INFLUENCE OF INTRA-ORGANISATIONAL FACTORS

**Hypothesis 1: Intra-organisational factors will have both direct and indirect positive effects on EUC success through perceived usefulness and perceived ease of use.**

Hypothesis 1(a) Intra-organisational factors will have a direct positive effect on EUC success.

The most unexpected results were that no relationship was found between internal support and EUC satisfaction and a negative relationship was found between internal support and utilisation (Table 6.5). Since this result is inconsistent with most previous studies of EUC in large firms (Abdul-Gader, 1992; Amoroso, 1986; Amoroso and Cheney, 1991; Buyukkurt, 1993; Igbaria, 1990; Rivard and Huff, 1988), the differences may be a result of the small firm context under investigation in the present study.

For example, Delone (1988) found that the availability of formal training, which was one of the measures of internal support for the present study, did not result in greater IS success for small firms. According to Raymond (1990b), the nature and quality of training is just as important as the availability of training in small firms. Thus, another possible explanation is that the quality of internal support is just as important as the availability of internal support. Since very few firms in this study employed internal computer specialists, it is likely that the quality of internal support may not have been very high. As a result, a negative relationship between internal support and utilisation was found. Similarly, the case study results (Chapter 3) show that lack of internal support had a negative influence on EUC success.

Although internal support did not have a positive influence on EUC satisfaction or utilisation, the results of the study reveal a direct positive relationship between internal support and usage; usage was measured as the amount and frequency of computer use. Similarly, Igbaria (1990) found that internal support had a direct positive influence on usage.

The availability of internal support in small firms had a strong influence on usage but it did not affect utilisation. As mentioned previously, these findings are inconsistent with the results of previous studies of EUC in large firms, which typically have Information Centres to; (1) encourage users to use systems, (2) develop a wider selection of different types of software tools potentially useful in their jobs, (3) provide substantial educational programmes, and (4) apply IT to support a wider variety of business tasks. Since a lack of resources and technical sophistication make it impossible for small firms to establish internal Information Centres, Raymond (1990b) proposed that the availability and quality of external support could be considered as a more relevant determinant of EUC success in small firms.

Internal training, which refers to the amount of training users had received from other users or computer specialists in their company, had a direct effect on utilisation. This result is consistent with the findings of many previous studies (Amoroso, 1986; Igbaria, 1990; Nelson and Cheney, 1987; and Raymond, 1988). These findings emphasise the need for small firms to provide training for users to encourage them to use a greater diversity of software for a wider variety of tasks.

Management support had a very strong direct effect on EUC satisfaction. This finding is consistent with the results of Amoroso (1986) and Igbaria and Nachman (1990). Similarly, Abdul-Gader (1992) reported that management support had a strong influence on EUC satisfaction in small firms. The results of this study also show that management support did not have a direct effect on usage; this finding is inconsistent with the results of DeLone (1988) and Igbaria and Baroudi (1994). However, an indirect effect of management support on usage through perceived ease of use and perceived usefulness was found. Furthermore, management support had a direct effect on utilisation.

In general, the results of the study show that management support had a very strong influence on EUC success. In this study, management support included encouragement, support, and enthusiasm for the use of computers as well as good access to hardware, software, and any necessary resources. Thus, any efforts to strengthen managerial support would have a positive influence on EUC success. Formal computer education and training for small firm managers could lead to stronger management support. For example, Raymond (1988) conducted a study of the attitudes and computer usage patterns of small business managers with and without formal computer education and training. The author concluded that, for small firm managers, training promotes greater understanding, more frequent use, and more diverse use of applications.

Hypothesis 1(b) Intra-organisational factors will have a direct positive effect on perceived usefulness.

The results of the study reveal that management support had the strongest influence on perceived usefulness. In addition, internal training had a smaller but significant direct effect on perceived usefulness. Since management support and internal training are external variables, these findings provide further support for the TAM (Davis, et al., 1989), which predicts that external variables affect perceived usefulness.

Hypothesis 1(c) Intra-organisational factors will have a direct positive effect on ease of use.

Internal training, which is an intra-organisational factor in The Final Research Model (Figure 4.1), had a direct positive effect on perceived ease of use. Since internal training is also an external variable in the TAM (Davis, et al., 1989), this result provides further support

for the TAM , which predicts that external variables affect perceived ease of use.

## **7.2 THE INFLUENCE OF EXTRA-ORGANISATIONAL FACTORS**

**Hypothesis 2: Extra-organisational factors will have both direct and indirect positive effects on EUC success through perceived usefulness and perceived ease of use.**

Hypothesis 2(a) Extra-organisational factors will have a direct positive effect on EUC success.

External support had a direct positive effect on all three measures of EUC success, including usage, utilisation, and EUC satisfaction. These results are consistent with the case study findings (Chapter 3) and provide support for Raymond's (1990b) proposition that the availability of external support is an important determinant of EUC success in small firms. Furthermore, the results of the study show that external support had a much stronger influence on EUC success in comparison with internal support. Several authors identified the potential influence of external support on EUC success in small businesses (Montazemi, 1987; Raymond, 1990; Raymond and Bergeron, 1992).

In addition, the results of previous empirical studies highlighted the importance of consultant support (Gable, 1991b; Kole, 1983; Soh, et al., 1992; Thong, et al., 1993; Yap, et al., 1992), and vendor support (Cragg and King, 1993; Thong, et al., 1993; Yap, et al., 1992) on small firm computing. Since small firms must rely on external support for EUC success, both the availability and quality of the external support must be taken into consideration during the selection process (Gable, 1991; Thong, et al., 1993).

External training had a direct effect on utilisation. In this study, external training measured the amount of training individuals had received from external sources, which included other computer users, friends, vendors, consultants, or educational institutions external to the company. These results provide support for Raymond's (1990b) suggestion that small firms could potentially rely on external sources of support for training. Similarly, Montazemi (1987) identified a growing need for educational institutions to offer in-depth IS programmes specifically designed for small firms.

Hypothesis 2(b) Extra-organisational factors will have a direct positive effect on perceived usefulness.

The results of the study show that external support had a direct positive effect on perceived usefulness. In addition, external training had an indirect effect on perceived usefulness through perceived ease of use. Since external support and external training are external variables, these findings provide further support for the TAM (Davis, et al., 1989), which predicts that external variables affect perceived usefulness.

Hypothesis 2(c) Extra-organisational factors will have a direct positive effect on perceived ease of use.

The results of the study indicate that both external support and external training had direct positive effects on perceived ease of use. Since external support and external training are external variables, these findings provide further support for the TAM (Davis, et al., 1989), which predicts that external variables affect perceived ease of use.

### **7.3 THE INFLUENCE OF PERCEIVED EASE OF USE**

**Hypothesis 3: Perceived ease of use will have both direct and indirect positive effects on EUC success through perceived usefulness.**

Hypothesis 3(a) Perceived ease of use will have a direct positive effect on EUC success.

The results indicate that ease of use had a direct effect on EUC satisfaction. Since EUC satisfaction is an attitude measure (Doll and Torkzadeh, 1988), these findings provide further support for the TAM (Davis, et al., 1989), which predicts that ease of use is an important factor influencing attitude toward use.

The strong direct and indirect effects of ease of use on usage, and the direct effect of ease of use on utilisation are consistent with many previous studies (Adams, et al., 1992; Davis, 1989; Davis, et al., 1989; Igbaria and Baroudi, 1994; Rogers, 1983; Thompson, et al., 1991). This result suggests that any efforts to improve perceived ease of use could have a strong influence on computer usage behaviour in small firms. For example, computer training could be used to influence perceived ease of use by improving the self-efficacy (Bandura,

1982) of computer users. In other words, training could affect self-efficacy, which refers to the belief that an individual can develop the skills necessary to use computers. Thus, training aimed at improving perceived ease of use could have a positive influence on actual usage.

Hypothesis 3(b) Perceived ease of use will have a direct positive effect on perceived usefulness.

The strong positive relationship between perceived ease of use and perceived usefulness was also expected and supports previous research (Davis, 1989; Igarria and Baroudi, 1994; Mathieson, 1991).

#### **7.4 THE INFLUENCE OF PERCEIVED USEFULNESS**

**Hypothesis 4: Perceived Usefulness will have a direct positive effect on EUC success.**

The importance of the direct positive influence of perceived usefulness on EUC success in small firms is confirmed by the results of the study. The results of the study show that perceived usefulness had a direct effect on EUC satisfaction. Since EUC satisfaction is an attitude measure (Doll and Torkzadeh, 1988), these findings provide further support for the TAM (Davis, et al., 1989), which predicts that perceived usefulness is an important factor influencing attitude toward use. Igarria (1993) also reported that perceived usefulness had a strong positive effect on attitudes.

The results indicate that perceived usefulness had the strongest direct effect on usage and a significant direct effect on utilisation. These findings confirm the TAM (Davis, et al., 1989) which predicts that perceived usefulness influences behaviour. Several other studies have reported the importance of perceived usefulness as a direct determinant of computer usage (Adams, et al., 1992; Davis, 1989; Davis, et al., 1989; Igarria and Baroudi, 1994; and Thompson, et al., 1991).

In addition, consistent with the results of these prior studies, perceived usefulness was found to be more influential than ease of use on computer usage. These results indicate that although ease of use is clearly important, the usefulness of the system is far more

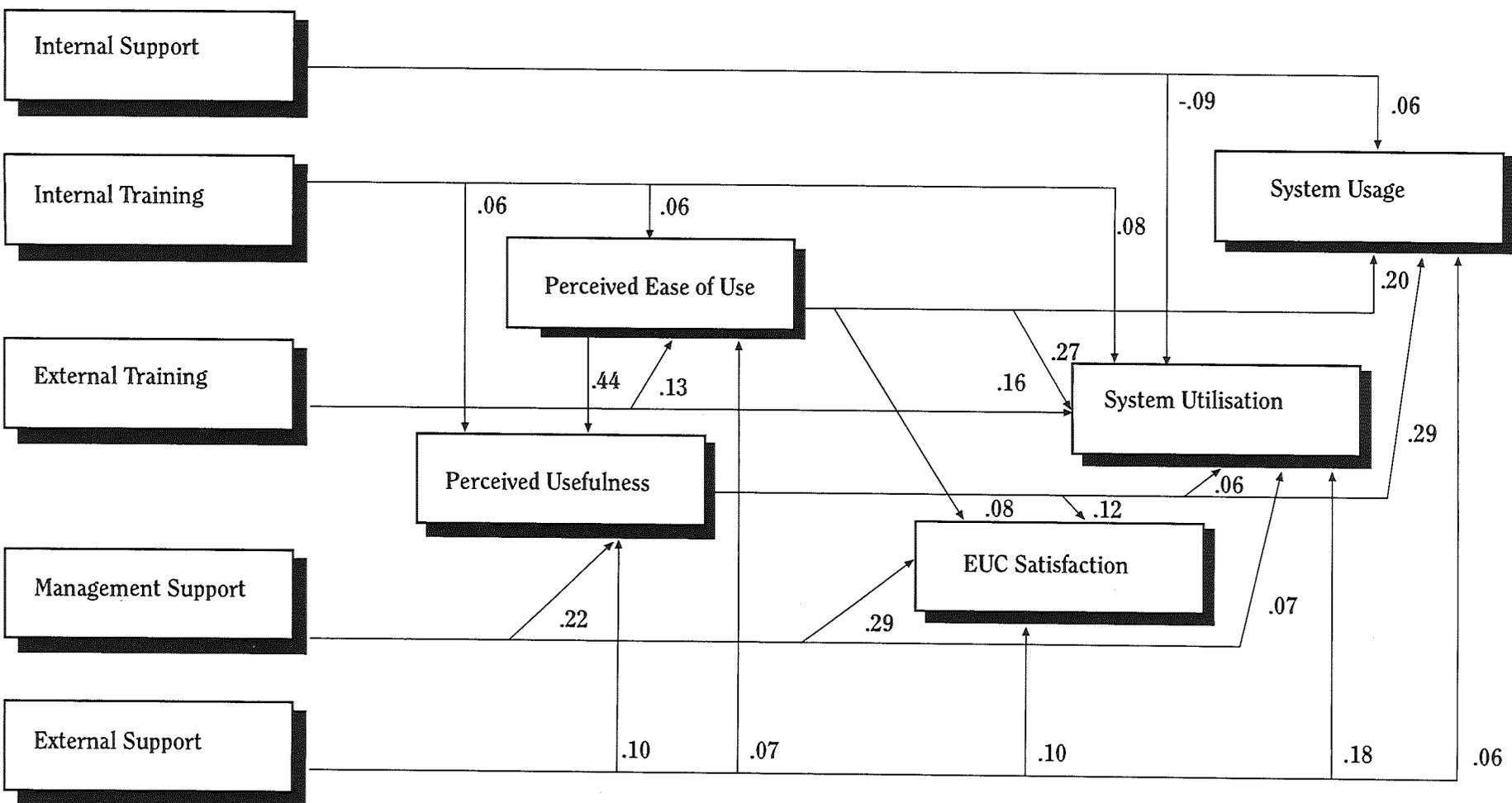
important and it must be taken into consideration. In other words, users adopt a system mainly because of the functions it performs for them; the effort required to use the system to perform the functions is of secondary importance (Davis, 1989). The implication of this finding is that regardless of how easy a system is to use, the user must perceive the system to be useful, to ensure usage. Similarly, a difficult user interface would not necessarily prevent the usage of a system that was extremely important in terms of its functionality. Although ease of use is not as important as perceived usefulness to the level of use of a system, it may influence the initial decision to adopt a system (Adams, et al., 1992). In fact, it has been shown that ease of use is an important predictor of intention to use a computer (Davis, et al., 1989).

The importance of perceived usefulness in comparison with perceived ease of use has important implications for both managers and software developers. Since perceived usefulness had the strongest influence on usage, managers should emphasize the functionality of a system in order to encourage usage. In addition, education and training aimed at increasing the awareness of potential applications of computers for current job positions may influence perceived usefulness. Similarly, education aimed at strengthening the expected consequences of using computers, for example greater effectiveness and efficiency in performing job tasks, could have a positive influence on utilisation (Thompson, et al., 1991). Software developers must begin to address not only ease of use, but also usefulness, as important design objectives for the development of successful systems.

## **7.5 SUMMARY OF RESULTS**

The study findings provided considerable support for The Final Research Model (Figure 4.1). However, the specific linkages in the model received differential degrees of support. Figure 7.1 presents the direct effects of the influencing factors as stated in the research hypotheses.

Figure 7.1 Path Diagram of the Direct Effects of Predictors on EUC Success  
 Numbers Correspond to the Direct Effects of the Predictors



In summary, the validity and reliability of all constructs were satisfactory (Tables 6.2 and 6.3). Tables 6.4, 6.5, and 6.6 present the results of the structural model and indicate the direct and indirect effects as well as the amount of variance explained by all of the predictors. Overall, the data provide considerable support for The Final Research Model (Figure 4.1).

## **7.6 CHAPTER SUMMARY**

This Chapter discussed the results of the study. Overall, strong support was found for the structural model proposed in Chapter 4. The relationships between the external variables (intra-organisational and extra-organisational factors) and perceived ease of use, perceived usefulness, and EUC success were assessed. Each hypothesis developed in Chapter 4 was presented and an interpretation of the results was discussed. Implications for small firm managers and external sources of assistance were identified. Chapter 8 concludes the thesis with further discussion on implications of the study findings and future directions for research.



## **CHAPTER 8 - CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH**

### **8 CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH**

This Chapter concludes the investigation of EUC success in small firms. Section 8.1 presents a summary of the research and study contributions. Section 8.2 focuses on the implications of the Revised Research Model (Figure 3.2). Section 8.3 discusses the implications of the Final Research Model (Figure 4.1). Section 8.4 identifies the limitations and directions for future research. Section 8.5 presents a Chapter summary and Section 8.6 concludes the thesis.

#### **8.1 SUMMARY OF THE RESEARCH AND STUDY CONTRIBUTIONS**

This section presents a summary of the research and study contributions including: the research objectives, the case studies, the conceptual models (the Revised Research Model, and the Final Research Model), the survey, and the construct measurement and hypothesis testing.

##### **8.1.1 The Research Objectives**

This study was motivated by the researcher's concern that there has been very little research into a significant development in the IS field. EUC is becoming an increasingly important activity in small firms, but yet little is known about EUC issues in small businesses. Although many studies have investigated EUC success in large firms, there has been very little research into the factors influencing EUC success in a small business context. Since small firms are likely to face problems which are different from those faced by larger organisations, EUC success in small firms is an important area for IS researchers to investigate. For example, due to economic and other constraints, small firms are especially dependent upon external EUC support. Yet little is known about the influence of extra-organisational factors on the success of EUC in small firms.

##### **8.1.2 The Case Studies**

Case studies were used to investigate the factors identified in the Initial Research Model (Figure 3.1) as having a potential influence on EUC success in small firms. In addition, the case studies were used to identify new success factors and to gain a better understanding of the relationships in the model. A pilot case study was conducted followed by a multiple

case study of eight firms. The Revised Research Model (Figure 3.2) relating intra-organisational and extra-organisational factors to EUC sophistication and success was proposed. In addition, this model identified external variables (specific to a small firm context) in the TAM (Davis, et al., 1989), which was the theoretical grounding for this research.

### **8.1.3 The Final Research Model**

The Final Research Model (Figure 4.1) was developed based on the TAM (Davis, et al., 1989), the case study results (Chapter 3), and a review of relevant literature (Chapter 2). This study was one of the first to adapt the TAM (Davis, et al., 1989) to the context of small firms and to test the theory within a small firm context. Furthermore, several aspects of the Davis, et al. (1989) study that limited the generalisability of their results were addressed in this investigation (Chapter 4).

This study hypothesized that external factors, including intra-organisational and extra-organisational factors would influence perceived ease of use, perceived usefulness, and EUC success. It was also hypothesized that perceived ease of use and perceived usefulness would affect EUC success (Figure 4.1).

### **8.1.4 The Survey**

A national survey was conducted to test the Final Research Model (Figure 4.1). The initial phase of data collection involved the identification of companies that were willing to participate in the study and the computer users in each company. Responses were received from 504 (69%) of the 726 manufacturing and engineering firms selected for the study. In total, 203 companies that agreed to participate in the research project also met the criteria for the survey (Chapter 5).

The second phase of data collection involved a survey of the computer users in the participating firms. Questionnaires were sent to all of the 773 computer users in the 203 companies that agreed to participate in the study. Although 596 (77%) questionnaires were returned, only 358 (60%) were usable for the data analyses; all clerical/secretarial users were unusable for this study.

### **8.1.5 Construct Measurement and Hypothesis Testing**

The Partial Least Squares (PLS) data analysis technique was used in this study to analyse the survey data. Based on the PLS analysis, the validity and reliability of all constructs were satisfactory (Tables 6.2 and 6.3). Tables 6.4, 6.5, and 6.6 present the results of the structural model and indicate the direct and indirect effects as well as the amount of variance explained by all of the predictors. Figure 7.1 presents a path diagram of the direct effects of predictors on EUC success. Overall, the data provide considerable support for The Final Research Model (Figure 4.1).

## **8.2 DISCUSSION AND IMPLICATIONS FOR FUTURE RESEARCH: THE REVISED RESEARCH MODEL**

This section discusses the factors influencing EUC sophistication and success that were identified in The Revised Research Model (Figure 3.2) and highlights the implications for future research.

The case studies revealed that EUC sophistication and success were influenced by many intra-organisational and extra-organisational factors, including both positive and negative influences. Intra-organisational factors, including high interest, high investment of outside work time, and top management support, had the strongest positive influence on EUC sophistication and success. Factors which had the strongest negative influences included: lack of computer training, lack of both internal and external EUC support, and financial constraints. These factors should also be validated in other settings such as in other industry sectors and in other countries.

Based on the case study results, many of the factors that influenced EUC sophistication and success were similar to the factors identified in large organizations. However, it should be noted that several negative influencing factors that emerged from the case study data (Glaser and Strauss, 1967), including lack of time, financial constraints, and lack of internal and external EUC support, illustrate that EUC in small firms has special needs due to the unique organizational characteristics of small firms. To address these problems, small firms will have to draw on expertise from their extra-organisational environment to a greater extent (Raymond, 1990b). Thus, new roles for computer consultants (Gable, 1991a), vendors,

small business centres, and tertiary institutions will be required.

The case study research explored two relatively new constructs in the EUC literature: (1) EUC sophistication and (2) perceived impact as a measure of EUC success. Researchers must decide what EUC sophistication and success variables to measure. Further research is needed to develop valid and reliable instruments for measuring these two constructs. In particular, the measures must be tested in both large and small firms to ensure the appropriateness of these measures to both organisational contexts. A further investigation into the factors influencing EUC sophistication could lead to higher levels of EUC sophistication in small firms.

Based on results from the eight case studies, the Revised Research Model (Figure 3.2) which identified the primary factors influencing EUC sophistication and success in small firms, was developed. This model was used in the development of the Final Research Model (Figure 4.1). In particular, the Revised Research Model identified the external variables in the TAM (Davis, et al., 1989), which was used as the theoretical grounding for this research. However, not all of the external variables identified in the case study research were investigated in the Final Research Model (Figure 4.1). Thus, further research is needed to investigate these and other external variables in order to identify the relative importance of these influences on EUC success in small firms.

### **8.3 DISCUSSION AND IMPLICATIONS FOR FUTURE RESEARCH: THE FINAL RESEARCH MODEL**

This section discusses the factors influencing EUC success that were identified in The Final Research Model (Figure 4.1). Overall, the results of the survey provide considerable support for the TAM (Davis, et al., 1989) theory in a small firm context.

#### **8.3.1 Factors Influencing EUC Success**

##### **i. Perceived Usefulness**

The results of the study confirm the importance of the direct effect of perceived usefulness on EUC success in small firms. In particular, perceived usefulness had a direct effect on all

three measures of EUC success, including EUC satisfaction, usage, and utilisation. The results indicate that perceived usefulness had the strongest direct effect on usage. In addition, perceived usefulness was found to be more influential than ease of use on computer usage; this finding has important implications for both managers and software developers.

In order to encourage usage, small firm managers must emphasise the functionality of a system. Education and training programmes aimed at increasing the awareness of potential applications of computers for current job positions could influence perceived usefulness. Similarly, education aimed at emphasising the benefits of using computers, such as greater effectiveness and efficiency in performing job tasks, could have a positive influence on usage. Software developers must begin to address not only ease of use but also usefulness as important design objectives for the development of successful systems.

#### ii. Perceived Ease of Use

Ease of use had a direct effect on EUC satisfaction, utilisation, and usage. This result suggests that any efforts to improve perceived ease of use could have a strong influence on EUC success in small firms. For example, computer training could be used to influence perceived ease of use, by improving the self-efficacy (Bandura, 1982) of computer users, which could have a positive influence on EUC success.

#### iii. Intra-organisational Factors

Internal support had a positive influence on usage but no influence on EUC satisfaction. Thus, any efforts to encourage internal support in small firms could have a strong influence on usage. However, the most unexpected result was that internal support had a negative influence on utilisation. One possible explanation for this negative relationship is that since very few firms in this study employed internal computer specialists, it is likely that the quality of internal support was not very high. This result implies that users must be provided with good internal support in order to encourage better utilisation (i.e. diversity of software and diversity of tasks performed using a computer). In contrast, training had a positive influence on utilisation, which highlights the need for small firms to provide training for users to encourage them to use a greater diversity of software for a wider variety of tasks.

In general, management support had a very strong influence on EUC success. In particular, management support had a very strong influence on EUC satisfaction and a direct effect on utilisation. In order to strengthen management support for EUC in small firms, formal computer education and training programmes designed specifically for small firm managers are required. Vendors, consultants, and educational institutions can play a more active role in providing small firm managers with computer education and training.

#### iv. Extra-organisational Factors

External support had a strong influence on all three measures of EUC success. Furthermore, external support had a much greater effect on EUC success than internal support. Similarly, external training had a stronger effect on utilisation than internal training. These results highlight the importance of external sources of support and training for EUC success in small firms. Several implications for small firm managers, vendors, consultants, and educational institutions must be addressed.

Since external support and external training are important factors influencing EUC success, small firms should seek assistance from external sources (i.e. vendors, consultants and educational institutions). In terms of training, there is a strong need for educational institutions to offer training programmes specifically designed for small firms. In selecting vendors and/or consultants, small firm managers must take into consideration both the availability and quality of external support. To minimize the risks associated with hiring external sources of support, management involvement in the selection process is essential.

The results indicate that there is a strong need for consultants and vendors to assist small firms in their computing efforts. However, since small firms typically cannot afford the services of established vendors and consulting firms, they must rely on independent consultants. Based on the results of the case studies (Chapter 3), small firms are reluctant to hire independent consultants because of the risks involved. Similarly, vendors and consultants are often reluctant to provide services to small firms due to the low potential for profits involved. Thus, strategies for making external support more profitable for vendors and consultants and at the same time more affordable for small firms are required.

One possible strategy could involve small firms employing vendors or consultants as “part-time external IS managers”. The external IS manager could provide IS support on a monthly basis for each individual company. However, support and training sessions could be made available to companies through an “External Information Centre” that could be utilised (and funded) by any number of small firms. Alternatively, this “External Information Centre” could be operated by a government agency (for example, a small business development centre) or an educational institution.

### **8.3.2 Factors Influencing Perceived Usefulness**

Perceived ease of use had the strongest effect on perceived usefulness. In addition, a number of external variables influenced perceived usefulness. In particular, management support had a very strong influence on perceived usefulness. External support and internal training also had direct effects on perceived usefulness. External training had an indirect effect on perceived usefulness through perceived ease of use. Since these external variables are controllable, any efforts to strengthen management support and to enhance training and support would have a positive influence on user perceptions on the usefulness of EUC.

### **8.3.3 Factors Influencing Ease of Use**

External support, external training, and internal training had positive influences on perceived ease of use. This result shows that the availability of training and support, both internal and external to the company, has an importance influence on user perceptions of ease of use.

## **8.4 LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH**

Several limitations of the research are apparent and must be considered in future investigations of the research model. Implications for future research are discussed and several examples of relevant future research directions are proposed. The results of the study suggest that the potential for further research is substantial. This finding is not surprising given the lack of previous research into EUC in a small firm context.

One limitation relates to the use of subjective (self-report) scales to measure most of the study variables. Although a strong correlation between subjective and objective measures of behaviour is often assumed, there is little evidence to support this assumption within

this context. Therefore, there is a need for the development of more direct and objective measures, in particular for EUC success, which would enable future studies to use both objective and subjective measures. Since refining measures would increase the reliability and validity of the measurement model, it is acknowledged that more evidence of construct validity and reliability (Kerlinger, 1986) is needed.

The findings of this study apply only to small firms in the manufacturing and engineering sectors. Hence, the generalisability of these results to other industries remains to be determined. A further limitation is that the data used to test the hypotheses were cross-sectional. A preferred approach would be to take measurements from individuals as they begin using computers and then take subsequent measures as they become more experienced. Thus, further research using longitudinal designs could provide additional insights into the adoption and use of computers.

No attempt has been made within the scope of this research to study the influence of several potentially important external variables, including organisational size, individual age, gender, education, task characteristics, social factors, and experience (DeLone, 1988; Igbaria, 1990, 1993; Igbaria and Baroudi, 1994; Raymond, 1990b; Raymond and Bergeron, 1992). In this study, data related to many of these external factors were collected, however the potential effects of these variables were not examined. In addition, many of the variables identified in the case study research were not investigated. Further research is needed to include these and other external variables in order to identify the relative importance of these influences on EUC success in small firms.

This study made no attempt to measure "EUC effectiveness" as a measure of EUC success. Further research is needed to develop additional and perhaps better measures of EUC success to address the effectiveness aspect of EUC. For example, one of the basic assumptions underlying this study is that the respondents have the option of using a computer. This assumption was particularly relevant in the past, when managers and professionals could choose not to use a computer. More recently, the use of computers has become a necessary requirement for most knowledge workers. Thus, future research questions should address the issue of effective usage rather than optional usage (Raymond and Bergeron, 1992; Thompson, 1988). In addition, the quality of user-developed applications, which includes

dimensions such as reliability, effectiveness, portability, economy, user-friendliness, and understandability, could also be used as a measure of EUC success (Rivard, et al., 1993).

A further possible extension of the current study would be to examine the impact of EUC success on small firm performance. For example, more research is needed to examine the influence of EUC success on both individual and organisational performance (DeLone, 1988; Thong, et al., 1993).

The above research agenda illustrates the need for further studies of EUC in small firms. Both qualitative and quantitative research methods are needed to explore the intra-organisational and extra-organisational factors influencing the success of EUC in small firms.

## **8.5 CHAPTER SUMMARY**

This Chapter concluded the investigation of EUC success in small firms. It discussed the implications of the case study research results. Implications of the survey research on small firm managers, practitioners, and educational institutions were examined. The Chapter concluded with a discussion of the limitations of the survey research and directions for future research.

## **8.6 FINAL CONCLUSIONS**

This research presents significant progress toward explaining the factors affecting EUC success in small firms. The purpose of this study was to develop and empirically test a conceptual model of the factors influencing EUC success in small businesses. Overall, the results largely support the proposed Final Research Model (Chapter 4). Thus, the findings provide strong support for the TAM theory in a small firm context. Several directions for future research have been identified and if pursued should extend the general knowledge of EUC success in small firms. Implications of the results were drawn for small firm managers, practitioners, and educational institutions.



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**APPENDIX A**  
**COMPANY CONTACT AND USER IDENTIFICATION LETTER**

24 November 1993

Name  
Job Title  
Company  
Street  
City, Zone

Dear

I am a lecturer at Lincoln University and I am conducting a national research project on computing in small and medium-sized firms. The study investigates factors which contribute to successful computer use. It is expected that the research findings will enable firms to improve the management of their computing activities.

I would like to invite your organization to participate in this study. The results of the study will be made available to participating firms.

The initial phase of the study will identify staff who are using computers. Please provide the names of the computer users in your firm on the enclosed form, which should only take a few minutes to complete. Please try to complete the form within a week if possible.

On return of the form, your name will be placed in a draw for a FREE copy of The Microsoft Office for Windows package, which retails at \$1550. This product includes Microsoft Excel, Word, PowerPoint, and Mail.

On receipt of your list of computer users, I will send a questionnaire to each of them. It should take no more than 15 minutes to complete. The names of any computer users who return completed questionnaires will also be placed in the draw for the software prize. If there are no computer users in your firm, your name will still go in the draw for the software prize if you complete and return the enclosed form.

Your response is crucial to the results of my study. The information you provide will be completely confidential. All information published will be in aggregate form so that there will be no possible means by which your firm or its employees could be identified. The code number on the form will be used simply to check whether I have received your completed form.

I would greatly appreciate your participation in this study. If you have any questions, please ring Nancy Zinatelli or Sheila McLaren collect at (03) 325-3825. Thank you very much for your assistance.

Sincerely  
Nancy Zinatelli

Lecturer in Applied Computing

**APPENDIX B****LETTER TO USER/PARTICIPANT FROM RESEARCHER**

1 March 1994

Name  
Job Title  
Company  
Street  
City, Zone  
Dear

I am a lecturer at Lincoln University and I am conducting a national research project on computing in small and medium-sized firms. Your firm has agreed to participate in this study and you have been identified as a computer user by a contact person in your organisation.

The study investigates factors which contribute to successful computer use. It is expected that the research findings will enable firms to improve the management of their computing activities.

I would be grateful if you would complete the enclosed questionnaire, which should only take fifteen minutes to fill out.

On return of the questionnaire, your name will be placed in a draw for a FREE copy of the Microsoft Office for Windows package, which retails at \$1550. This product includes Microsoft Excel, Word, PowerPoint, and Mail. In addition, the results of the study will be made available to your firm.

Your response is crucial to the results of my study. The information you provide will be completely confidential. All information published will be in aggregate form so that there will be no possible means by which your firm or its employees could be identified. The code number on the questionnaire will be used simply to check whether I have received your completed questionnaire.

I would like to thank you in advance for your participation in this study. If you have any questions, please ring Nancy Zinatelli or Sheila McLaren collect at (03) 325-3825. Please try to complete your questionnaire by Wednesday 9 March if possible.

Sincerely

Nancy Zinatelli  
Lecturer in Applied Computing

PS If you were the initial contact person for this study, your name will be placed in the draw for the FREE software a second time on return of your questionnaire. userid

## APPENDIX C

### OPERATIONALISATION OF CONSTRUCTS

#### Internal Support

Internal support refers to the support provided by other computer users or computer specialists in the company.

INSUP01 - A specific person (or group) is available for assistance with hardware difficulties.

INSUP02 - A specific person (or group) is available for assistance with software difficulties.

INSUP03 - Specialised instruction and education concerning software is available to me.

INSUP04 - Guidance is available to me in the selection of hardware, software, printers, and other equipment.

#### Internal Training

INTRAIN - The extent of training provided by other computer users, or computer specialists in the company on hardware, operating systems, and eight different software packages.

#### Management Support

MSUP01 - Management is aware of the benefits that can be achieved with the use of computers. MSUP02 - Management always supports and encourages the use of computers for job-related work.

MSUP03 - Management has provided most of the necessary help and resources to enable people to use computers effectively.

MSUP04 - Management is really keen to see that people are happy with using computers.

MSUP05 - People have good access to hardware when they need it.

MSUP06 - People have good access to various types of software when they need them.

### External Support

External support refers to the support provided by friends, vendors, consultants, or other external sources.

EXSUP01 - A specific person (or group) is available for assistance with hardware difficulties.

EXSUP02 - A specific person (or group) is available for assistance with software difficulties.

EXSUP03 - Specialised instruction and education concerning software is available to me.

EXSUP04 - Guidance is available to me in the selection of hardware, software, printers, and other equipment.

### External Training

EXTRAIN - The extent of training provided by other computer users, friends, vendors, consultants, or educational institutions external to the company on hardware, operating systems, and eight different software packages.

### Perceived Ease of Use

EASE01 - Learning to use computers is easy for me.

EASE02 - I find it easy to get computers to do what I want them to do.

EASE03 - It is easy for me to become skilful at using computers.

EASE04 - I find computers easy to use.

### Perceived Usefulness

USEFUL1 - Using computers improves my job performance.

USEFUL2 - Using computers increases my productivity on the job.

USEFUL3 - I find computers useful in my job.

USEFUL4 - Using computers enhances my effectiveness on the job.

Usage

FREQUSE - On average, how frequently do you use a computer for job-related work?

TIMEUSE - On average, how much time do you spend per day using a computer at your office for job-related work?

Utilisation

APPLIC - To what extent do you use the following computer software (eight different packages)?

TASKS - For the following specific job tasks (ten different tasks), please indicate to what extent you use a computer to perform each task?

EUC Satisfaction

SATIS01 - Is the computer software user friendly?

SATIS02 - Do you get the information you need in time?

SATIS03 - Does the computer provide the precise information you need?

SATIS04 - Does the information content meet your needs?

SATIS05 - Does the computer software provide reports that seem to be just exactly what you need?

SATIS06 - Does the computer software provide sufficient information?

SATIS07 - Is the computer software accurate?

SATIS08 - Are you satisfied with the accuracy of the computer software?

SATIS09 - Do you think the output is presented in a useful format?

SATIS10 - Is the information clear?

SATIS11 - Is the computer software easy to use?

SATIS12 - Does the computer software provide up-to-date information?

**APPENDIX D**  
**QUESTIONNAIRE ITEMS**

Note: Only items relevant to the operationalisation of the constructs have been included.

**PART 1. COMPUTER USAGE**

1. On average, how frequently do you use a computer for job-related work (include both **office** and **home** use)? (Please circle **ONE number only**.)

- |  |  |
|--|--|
| <p>(1) Less than once a month</p> <p>(2) Once a month</p> <p>(3) A few times a month</p> | <p>(4) A few times a week</p> <p>(5) About once a day</p> <p>(6) Several times a day</p> |
|--|--|

2. On average, how much time do you spend **per day** using a computer at your **office** for job-related work? (Please circle **ONE number only**.)

- |  |  |
|--|--|
| <p>(1) Almost never</p> <p>(2) Less than 1/2 hour</p> <p>(3) From 1/2 hour to 1 hour</p> | <p>(4) 1-2 hours</p> <p>(5) 2-3 hours</p> <p>(6) More than 3 hours</p> |
|--|--|

**PART 2. UTILISATION**

1. For the following specific job tasks, please indicate to what extent you use a computer to perform each task: (composite score - sum of tasks performed 'To Some Extent' or more - 3, 4, or 5 on a 5-point Likert type scale).

**Please circle ONE number for each item.**

1 = Never or to a very little extent	3 = To some extent	5 = To very great extent
2 = To a little extent	4 = To a great extent	

- |                           |   |   |   |   |   |
|---------------------------|---|---|---|---|---|
| a. Producing Reports      | 1 | 2 | 3 | 4 | 5 |
| b. Letters and Memos      | 1 | 2 | 3 | 4 | 5 |
| c. Data Storage/Retrieval | 1 | 2 | 3 | 4 | 5 |
| d. Making decisions       | 1 | 2 | 3 | 4 | 5 |
| e. Analysing trends       | 1 | 2 | 3 | 4 | 5 |

f.	Planning/Forecasting	1	2	3	4	5
g.	Analysing problems/alternatives	1	2	3	4	5
h.	Budgeting	1	2	3	4	5
i.	Controlling and guiding activities	1	2	3	4	5
j.	Electronic communications with others	1	2	3	4	5

2. To what extent do you currently use the following computer software? (composite score - sum of packages used 'To Some Extent' or more - 3, 4, or 5 on a 5-point Likert type scale).

**Please circle ONE number for each item.**

1 = Never or to a very little extent	3 = To some extent	5 = To very great extent
2 = To a little extent	4 = To a great extent	

a.	Spreadsheet (eg. Lotus 1-2-3)	1	2	3	4	5
b.	Word Processing (eg. Word)	1	2	3	4	5
c.	Database (eg. dBASE)	1	2	3	4	5
d.	Statistical Analysis	1	2	3	4	5
e.	Electronic Mail	1	2	3	4	5
f.	Programming Languages (eg. COBOL)	1	2	3	4	5
g.	Graphics	1	2	3	4	5
h.	Application Packages (eg. Accounting or Payroll Packages)	1	2	3	4	5

### PART 3. PERCEIVED EASE OF USE

**Please circle ONE number for each item.**

1 = Strongly disagree	3 = Uncertain	5 = Strongly agree
2 = Disagree to some extent	4 = Agree to some extent	

1.	Learning to use computers is easy for me.	1	2	3	4	5
2.	I find it easy to get computers to do what I want them to do.	1	2	3	4	5
3.	It is easy for me to become skilful at using computers.	1	2	3	4	5
4.	I find computers easy to use.	1	2	3	4	5

#### PART 4. PERCEIVED USEFULNESS

- |    |  |   |   |   |   |   |
|----|--|---|---|---|---|---|
| 1. | Using computers improves my job performance.             | 1 | 2 | 3 | 4 | 5 |
| 2. | Using computers increases my productivity on<br>the job. | 1 | 2 | 3 | 4 | 5 |
| 3. | I find computers useful in my job.                       | 1 | 2 | 3 | 4 | 5 |
| 4. | Using computers enhances my effectiveness on<br>the job. | 1 | 2 | 3 | 4 | 5 |

#### PART 5. MANAGEMENT SUPPORT

This section is used to assess the level of management support for computers in your firm.

**Please circle ONE number for each item.**

1 = Strongly disagree	3 = Uncertain	5 = Strongly agree
2 = Disagree to some extent	4 = Agree to some extent	

- |    |  |   |   |   |   |   |
|----|--|---|---|---|---|---|
| 1. | Management is aware of the benefits that can be achieved<br>with the use of computers.                             | 1 | 2 | 3 | 4 | 5 |
| 2. | Management always supports and encourages the<br>use of computers for job-related work.                            | 1 | 2 | 3 | 4 | 5 |
| 3. | Management has provided most of the necessary help and resources to enable people<br>to use computers effectively. | 1 | 2 | 3 | 4 | 5 |
| 4. | Management is really keen to see that people are happy with using computers.                                       | 1 | 2 | 3 | 4 | 5 |
| 5. | People have good access to hardware (eg. mainframes,<br>microcomputers, and printers) when they need it.           | 1 | 2 | 3 | 4 | 5 |
| 6. | People have good access to various types of software when<br>they need them.                                       | 1 | 2 | 3 | 4 | 5 |

**PART 6. INTERNAL AND EXTERNAL COMPUTER TRAINING**

1. To what extent have you had **computer training** from the following **internal and External training** sources: (composite scores - sum of training types that were used 'To Some Extent' or more - 3, 4, or 5 on a 5-point Likert type scale).

**Internal Training** (eg. NOT **self-training** but training provided by other computer users or computer specialists **in the company**)

**External Training** (eg. training provided by other computer users, friends, vendors, consultants, or educational institutions **external to the company**).

**Please circle ONE number for each item for internal and external training.**

1 = Never or to a very little extent	3 = To some extent	5 = To a very great extent
2 = To a little extent	4 = To great extent	

	<b>Internal Training</b>	<b>External Training</b>
<b>Hardware:</b> (eg. microcomputers)	1 2 3 4 5	1 2 3 4 5
<b>Operating Systems:</b> (eg. DOS)	1 2 3 4 5	1 2 3 4 5
<b>Software:</b>		
Spreadsheet (eg. Lotus 1-2-3)	1 2 3 4 5	1 2 3 4 5
Word Processing (eg. Word)	1 2 3 4 5	1 2 3 4 5
Database (eg. DBASE)	1 2 3 4 5	1 2 3 4 5
Statistical Analysis	1 2 3 4 5	1 2 3 4 5
Electronic Mail	1 2 3 4 5	1 2 3 4 5
Programming Languages (eg. COBOL)	1 2 3 4 5	1 2 3 4 5
Graphics	1 2 3 4 5	1 2 3 4 5
Application Packages (eg. Accounting or Payroll Packages)	1 2 3 4 5	1 2 3 4 5

## PART 7. COMPUTER SUPPORT

This section is used to assess the level of **computer support** you have in your current job from the following two sources:

**Internal Support** (eg. support provided by other computer users or computer specialists in the company)

**External Support** (eg. support provided by friends, vendors, consultants, or other external sources).

**Please circle ONE number for each item for internal and external support.**

1 = Strongly disagree

3 = Uncertain

5 = Strongly agree

2 = Disagree to some extent

4 = Agree to some extent

	Internal Support	External Support
1. A specific person (or group) is available for assistance with hardware difficulties.	1 2 3 4 5	1 2 3 4 5
2. A specific person (or group) is available for assistance with software difficulties.	1 2 3 4 5	1 2 3 4 5
3. Specialized instruction and education concerning software is available to me.	1 2 3 4 5	1 2 3 4 5
4. Guidance is available to me in the selection of hardware, software, printers, and other equipment.	1 2 3 4 5	1 2 3 4 5

### PART 8. COMPUTER SATISFACTION

Please circle the number that corresponds to your best description of how **satisfied** you are with the computer software you **use most often**. For example, if you use a **spreadsheet most often**, then your answers should indicate how satisfied you are with using a spreadsheet.

**Please circle ONE number for each item.**

1 = Almost never	3 = About half of the time	5 = Almost always
2 = Some of the time	4 = Most of the time	

**What computer software do you use most often?** \_\_\_\_\_

**If you use a word processor most often, please skip the 12 questions below.**

Otherwise, complete **ALL** questions.

- |   |           |
|---|-----------|
| 1. Is the computer software user friendly?  | 1 2 3 4 5 |
| 2. Do you get the information you need in time?   | 1 2 3 4 5 |
| 3. Does the computer software provide the precise information you need?                         | 1 2 3 4 5 |
| 4. Does the information content meet your needs?  | 1 2 3 4 5 |
| 5. Does the computer software provide reports that seem to be just about exactly what you need? | 1 2 3 4 5 |
| 6. Does the computer software provide sufficient information?                                   | 1 2 3 4 5 |
| 7. Is the computer software accurate?   | 1 2 3 4 5 |
| 8. Are you satisfied with the accuracy of the computer software?                                | 1 2 3 4 5 |
| 9. Do you think the output is presented in a useful format?                                     | 1 2 3 4 5 |
| 10. Is the information clear?   | 1 2 3 4 5 |
| 11. Is the computer software easy to use?   | 1 2 3 4 5 |
| 12. Does the computer software provide up-to-date information?                                  | 1 2 3 4 5 |

## APPENDIX E

## DESCRIPTIVE RESULTS FOR MEASUREMENT ITEMS

Table E.1

Construct/Measure	Likert Scale	Mean	Standard Deviation	Median
<b><u>Internal Support</u></b>	5-Point			
INSUP01		2.7	1.6	3
INSUP02		2.8	1.5	3
INSUP03		2.1	1.3	2
INSUP04		2.3	1.4	2
<b>*INTRAIN</b>	N/A			
<b><u>Management Support</u></b>	5-Point			
MSUP01		4.4	.9	5
MSUP02		4.2	1.0	4
MSUP03		3.7	1.2	4
MSUP04		3.7	1.2	4
MSUP05		3.7	1.2	4
MSUP06		3.4	1.2	4
<b><u>External Support</u></b>	5-Point			
EXSUP01		3.6	1.4	4
EXSUP02		3.7	1.4	4
EXSUP03		3.0	1.5	3
EXSUP04		3.1	1.5	3
<b>*EXTRAIN</b>	N/A			
<b><u>Perceived Ease of Use</u></b>	5-Point			
EASE01		4.1	.9	4
EASE02		3.7	1.0	4
EASE03		3.9	1.0	4
EASE04		4.1	.9	4
<b><u>Perceived Usefulness</u></b>	5-Point			
USEFUL1		4.5	.7	5
USEFUL2		4.4	.8	5
USEFUL3		4.6	.6	5
USEFUL4		4.5	.7	5
<b><u>Usage</u></b>	6-Point			
FREQUSE		5.8	.6	6
TIMUSE		5.0	1.3	6
<b>*Utilisation</b>	N/A			
APPLIC				
TASKS				
<b><u>EUC Satisfaction</u></b>	5-Point			
SATIS01		4.0	.9	4
SATIS02		4.0	.9	4
SATIS03		3.9	.9	4
SATIS04		3.9	.9	4
SATIS05		3.8	1.0	4
SATIS06		3.9	.9	4
SATIS07		4.3	.8	4
SATIS08		4.3	.8	4
SATIS09		4.0	.9	4
SATIS10		4.1	.8	4
SATIS11		4.1	.9	4
SATIS12		4.1	.9	4

\*Note: Descriptive results for these measures are in Table E.2

## DESCRIPTIVE RESULTS FOR MEASUREMENT ITEMS

Table E.2

Construct/Measure	Response	Percent
<u>Internal Training</u> INTERTR	0	56.7
	1	17.9
	2	13.4
	3	7.3
	4	4.7
<u>External Training</u> EXTERTR	0	52.8
	1	15.6
	2	13.1
	3	8.1
	4	10.3
<u>Utilisation</u> APPLIC	0	7.5
	1	21.2
	2	24.0
	3	20.7
	4	14.5
	5	7.0
	6	3.9
	7	.6
	8	.6
<u>Utilisation</u> TASKS	0	2.8
	1	11.5
	2	11.7
	3	13.7
	4	7.5
	5	10.3
	6	9.8
	7	10.9
	8	11.2
	9	8.9
	10	1.7

**Notes:****Internal Training:**

The amount of internal training was calculated by a count of those items for which the response for extent of training was 'to some extent' or greater (3, 4, or 5 on the Likert scale).

**External Training:**

The amount of external training was calculated by a count of those items for which the response for extent of training was 'to some extent' or greater (3, 4, or 5 on the Likert scale).

**Utilisation:**

Diversity of software packages was calculated by a count of those packages for which the response for extent of use was 'to some extent' or greater (3, 4, or 5 on the Likert scale).

Diversity of tasks was calculated by a simple count of the tasks for which the response for extent of use was 'to some extent' or greater (3, 4, or 5 on the Likert scale).