PERSONAL COMPUTER ACCEPTANCE BY SMALL AND MEDIUM SIZE COMPANIES IN PENANG, MALAYSIA

by

CHIN WENG WAH

Research report submitted in partial fulfillment of the requirements
for the degree of Master of Business Administration

May 1999

To Rose, Ziyang and my parents.

ACKNOWLEGEMENT

My sincere appreciation and thank to Professor Madya Dr. Muhamad Jantan for his invaluable assistance and guidance throughout the length of this research work.

I wish to thank Mr. Yeoh Oon Tean, Mr Ng Peng Liam, Mr. Saw Nee Cheong and particularly Mr. Chatiya Nantham for their invaluable assistance. I also wish to thank each and everyone of the respondents who made this study possible and I am most grateful for their time and cooperation.

Lastly I would like to thank Rose, my beloved wife, Ziyang, my son and my parents for their love, support and understandings throughout my MBA program.

TABLES OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRAK

Objektif kajian ini ialah untuk memahami faktor-faktor yang mempengaruhi penerimaan komputer peribadi (PC) di kalangan industri-industri kecil dan sederhana di Pulau Pinang, Malaysia. Kajian ini adalah replikasi kajian yang dibuat oleh Igbaria dan Zinatelli (1997) di New Zealand ke atas subjek yang sama. Model kajian ini ialah model penerimaan teknologi (TAM) yang diasaskan oleh Davis (1989). Tanggpan tahap kesusahan, tanggapan kebergunaan dan pengunaan sistem adalah faktor-faktor yang mempengaruhi penerimaan PC. Penggunaan sistem digunakan sebagai penunjuk terhadap penerimaan komputer peribadi. Faktor-faktor organisasi luaran and dalaman yang dimasukkan dalam model ini adalah sokongan komputeraan luaran, sokongon latihan luaran, sokongan pengurusan, sokongan komputeraan dalaman and sokongon latihan dalaman.

Hasil kajian ini adalah seperti berikut: (1) TAM didapati sah and boleh dipercayai dalam kajian ini. Tanggapan tahap kesukaran dan tanggapan kebergunaan didapati mempunyai pengaruh positif yang langsung ke atas penerimaan sistem. Tanggapan kebergunaan juga didapati mempunyai kesan pencelahan antara Tanggapan tahap kesukaran dan penerimaan sistem, (2) sokongan pengurusan adalah faktor penentu dan mempunyai pengaruh yang langsung ke atas tanggapan tahap kesukaran dan tanggapan kebergunaan, dan (3) sokongan komputeraan luaran didapati mempunyai pengaruh positif yang langsung ke atas tanggapan tahap kesukaran sahaja. Peranan yang dimainkan oleh pihak pengurusan SMI dan vendor IT luaran didapati mustahak and menyumbang dalam penyebaran penggunaan PC dalam kajian ini.

ABSTRACT

The objective of this study is to investigate and understand factors affecting the personal computer (PC) acceptance among the small and medium industries in Penang, Malaysia. This study replicates the study by Igbaria and Zinatelli (1997) on the similar subject in New Zealand where the basic technology acceptance model (TAM) (Davis, 1989) was used. System usage is the dependent variable while perceived ease of use, and perceived usefulness are the explanatory variables used. System usage is also used as the indicator for PC acceptance. The other variables included are the intra- and extraorganizational factors such as internal computing support, internal training support, management support, external computing support and external training.

Findings from this study are: (1) TAM is valid and reliable where the perceived ease of use and perceived usefulness has a positive direct influence on system acceptance. Perceived usefulness is also found to have intervening effect on perceived ease of use and system acceptance; (2) management support is found to be a determinant and have positive direct influence on both perceived ease of use and perceived usefulness; and (3) external computing support is found to have a positive direct influence on perceive ease of use only. The findings of this study implies the importance of roles played by the management of the SMIs and external IT vendors in supporting and promoting the acceptance of PCs.

Chapter 1

INTRODUCTION

1.1 Introduction

Ever since International Business Machines (IBM) launched the first personal computer (PC) in 1981, microcomputer technology has advanced at a very rapid pace. Today's PC processing capabilities have matched the mainframe's processing power of the 1980's and is widely available at a very much lower cost. With the abundance and varieties of user-friendly software, PCs have penetrated not only large and small organizations but also into homes as well. This has encouraged the information systems usage and makes personal computing a significant activity in small and large firms (Raymond and Bergeron, 1992).

In Malaysia, the number of personal computer (PC) active installed units has increased from 930,000 in 1997 to 1,200,000 in 1998, an increase of 29% (Table 1.1; PIKOM, 1999). Many PC makers are reconfiguring and repricing PCs and related hardware equipment for small businesses. The cost of ownership has been reduced to such a level that nearly all businesses, no matter how small, can afford to own a microcomputer or personal computer for their information processing and office automation needs. Compaq, one of the world's renowned computer manufacturer predicts that by the year 2000, small and medium size businesses will own more than half of the world's PCs (Caldwell and Wilde, 1998).

As in the case of Malaysia, our Prime Minister's Vision 2020 for Malaysia to be a fully developed nation has sparked the launching of the Multimedia Super Corridor (MSC). This idea is to provide a catalyst to transform the Malaysian society

from an industrial society to a knowledge-based society. The Government has encouraged the usage of information technology (IT) in all sectors by providing assistance, which includes the abolishment of import duty on IT and IT related hardware in order to reduce the cost of ownership. This in fact encourages and facilitates the optimized usage of low cost PCs in businesses, particularly the small and medium size industries.

Table 1.1: PIKOM's on PC's- Active Installed Units in Malaysia 1999

	1993	1994	1995	1996	1997	1998
PC's-Active Installed Units	400,000	490,000	610,000	760,000	930,000	1,200,000
No. of Internet Subscribers	N/A	9,000	18,000	90,000	200,000	400,000

1.2 Importance of Computers

The powerful, low-cost microcomputers and user-friendly software have widely allowed a greater number of small and medium-size companies to implement information systems (IS). Computer-based information systems (CBIS) is able to benefit these companies by providing better information to managers, increase organizational effectiveness (Raymond and Bergeron, 1992) and help to resolve problems such as issues with accounts receivables and inventory control which has been cited as contributing to 17% of manufacturing business failure. These problems can be addressed by computerization. Evidently, computer utilization in small businesses can also help to improve sales and services which are important contributions considering that inadequate sales is involved in 59 percent of business failures (Igbaria et. al., 1997). The growing popularity of internet and its usage in businesses such as electronic mails and electronic commerce that can be easily

delivered by PCs have further increase the importance of computer usage (Table 1.1). The number of internet users has increased from 200,000 in 1997 to 400,000 in 1998, an increased of 100 %. Therefore, usage of computers in small businesses has the potential to make an important contribution for a significant large number of small firms.

1.3 The Importance of SMIs in Malaysia

Small and medium industries (SMI) constitute approximately 84% of the manufacturing establishment in Malaysia. In 1997, their contribution to the manufacturing sector was 17.47% of total output, 19.13% of value added and 12.27% of total employment (ACTETSME, 1998). They are beginning to participate in the export market. At the moment only 20% of the total SMIs in Malaysia have made in-road into the export market.

The SMIs play a very significant role in a country's industrialization program. As suppliers and service providers to larger and leading industries, SMIs act as a forward and backward linkages among the various industries (ACTETSME, 1998). The Malaysian government recognizes this importance and devised various development programs to assist the growth of SMI. The Ministry of International Trade and Industry (MITI) has setup a special agency called Small and Medium Industries Development Corporation (SMIDEC) to look into the development of SMIs.

Apart from this, SMIs have been identified as part of the National Economic Recovery Plan (NERP, 1998) to help Malaysia to overcome the recent economic crisis. "MITI and SMIDEC have been instructed by NERP committee to assist SMIs

by exploring the possibility for larger SMIs to acquire excess production capacity created by MNCs, assisting SMIs in securing working capital and to actively promoting IT-related industry according to the National IT Agenda."

1.4 Problem statement

Even with the increasing advancement and importance of microcomputing technology, it cannot be assumed that PCs are widely accepted and benefited by small businesses. Previous study on IS implementation success in small firms by Yap et. al. (1992) found that small firms face a higher risk of IS implementation. This is generally due to smaller firms' lack of computer knowledge, lack of financial resources to employ internal expertise, have inadequate hardware and software, and have to rely on external expertise for support. Similar study carried out on large organizations (DeLone, 1981) have suggested that organization characteristics have direct influence on computer success factors. However, these findings of the large firms cannot be generalized for smaller firms as smaller firms have their own unique IS needs, technology acceptance patterns, characteristics of families or homesteads owners and growth is not necessarily a prime motivating force (Igbaria et al., 1997).

As such, this research study focuses on small and medium size companies and the researcher recognizes that this group of companies represents a distinct group, which extensively play a vital role in supporting the existing large number of multinational companies (MNC) and actively contributing towards the industrialization of this country.

This study replicates the effort done by Igbaria et. al. (1997) on PC acceptance by SMIs in New Zealand whose findings may not be applicable now in the Malaysian

context. The uniqueness of local businesses, different cultural background of owners or organizations, environmental factors such as the vast presence of the MNCs in Penang, the technology advancement over the past years and the emphasis placed by the Malaysian Government on development of SMIs as an impetus to the nation's industrialization and meeting the Vision 2020 objective, are the primary reason why the researcher choose to replicate this study in Penang, Malaysia.

As such, this study involving both the small and medium size firms will be able to give some insight into the understanding of personal computer acceptance and usage by SMIs.

1.5 Objective of study

The objective of this study is to understand the factors affecting the personal computing acceptance by local SMIs in Penang, Malaysia. Penang has been chosen for this study as it has 11% of the total SMIDEC SMIs in Malaysia (Table 1.2). The model used in this study is the enhanced version of the technology acceptance model that is adopted from Igbaria et al.'s 1997 research. The dependent variable used in this model is personal computing acceptance and the explanatory variables considered are perceived ease of use, perceived usefulness, intraorganizational and extraorganizational variables. This study attempts to answer the following questions:

1. What is the impact of perceived ease of use and perceived usefulness on microcomputer usage?
2. What is the impact of perceived ease of use on perceived usefulness?
3. What is the impact of management support on microcomputer usage?
4. What is the impact of intraoragnizational factors such as internal training and support on microcomputer usage?

5. What is the impact of external factors such as external training and support on microcomputer usage?
6. Do perceived ease of use and perceived usefulness mediate the effects of the intraorgranizational and external factors on microcomputer usage?

Table 1.2: Distribution of SMI by State in Malaysia

States	Distribution
Perlis	< 1%
Kedah	3%
Penang	11%
Perak	13%
Kuala Lumpur	10%
Selangor	18%
Negeri Sembilan	2%
Melaka	2%
Johor	18%
Pahang	3%
Kelantan	8%
Terengganu	6%
Sabah	3%
Sarawak	< 2%
Labuan	< 2%

(SMIDEC, 1999)

In accordance to answering the above questions, the outcome of the study will be able to:

1. Provide an insight into the factors leading to PC acceptance or barriers, especially in organizations within Penang.
2. Provide a blueprint for small organizations to ensure the success of IS implementation.
3. Provide computer vendors and external consultants a better understanding of small business and PC acceptance.

4. Validate the technology acceptance model (TAM) adopted in this study.
5. Contribute to the field of knowledge on PC usage and acceptance in Malaysia in line with Vision 2020.

1.6 Definition of variables

This research involves a field study to examine the relationship between the interaction of seven (7) different independent variables and a dependent variable. The dependent variable is personal computer acceptance in which the system usage is selected as the primary indicator. The seven (7) different independent variables mentioned are perceived ease of use, perceived usefulness, internal training, internal support, management support, external support and external training. Perceived ease of use and perceived usefulness are also treated as intervening variables. These variables are the same as those used in Igbaria et al.'s (1997) study and the definition for these variables are tabled in Table 1.3.

Table 1.3: Variable Definition

Variables	Definition
Perceived Computer Acceptance	The dependent variable which measured by system usage as the PC acceptance level by small firm.
Perceived Usefulness	The degree to which a person believes that using a particular system would enhance his/her job performance (Davis, 1989).
Perceived Ease of Use	The degree to which a person believes that using a particular system would be free of effort and easy to understand (Davis, 1989).
Internal Computing Support	The technical support by individuals (or groups) with computer knowledge who are internal to the small firm (Igbaria et. al., 1997).
Internal Computing Training	The amount of training users had received from other users or computer specialist within the firm (Igbaria et. al., 1997).
Management Support	The perceived level of general support offered by top management in small firm (Igbaria et. al., 1997).
External Computing Support	The technical support by individuals (or groups) with computer knowledge who are external to the small firm (Igbaria et. al., 1997).
External Computing Training	The amount of training users had received from friends, vendors, consultants or training institution external to the small firm (Igbaria et. al., 1997).

1.7 Definition of small and medium industries (SMI)

The definition for SMI in Malaysia varies as there is no one official definition (Chew, 1998). Basically there are two major elements to be considered in identifying SMIs. They are (1) paid-up capital or shareholder's fund and (2) the number of full time employees.

According to the Malaysian Productivity Report in 1995, the definition of an SMI is: A manufacturing establishment with a paid-up capital of less than RM 2.5 million and employing less than 100 employees. However, the most recent definition of SMIs by SMIDEC (SMIDEC, 1999) is as follows:

> Small and Medium Industries (SMIs) New Definition:
> (For The Manufacturing Sector: Effective 18 January 1998)
>
> SMI is defined as a company with not more than 150 employees and with an annual sales turnover of not exceeding RM 25 million
>
> Administratively, the demarcation between small and medium:
>
> **Small Company**: a company with full time employees of not more than 50 and with an annual sales turnover of not more than RM 10 million;
>
> **Medium Company**: a company with full time employees between 51 to 150 employees and with an annual sales turnover of more than RM 10 million to RM 25 million.
>
> Small Scale Industries (SIs)
>
> Manufacturing establishments employing between 5 to 50 employees (inclusive) or with shareholders fund up to RM 500,000 (US$ 200,000).
>
> Medium Industries (MIs)
>
> Manufacturing establishments with shareholders fund between RM 500,000 (US$ 200,000) to RM 2.5 million (US$ 1.0 million) or employing between50 to 75 (inclusive) full-time employees.

The companies selected for this study follow these guidelines from SMIDEC.

1.8 Organization of this report

This report consists of five (5) chapters, including this chapter. Literature survey is discussed in Chapter 2. This is where a survey of past researches related to microcomputer user acceptance are being discussed chronologically beginning with the development of the technology acceptance model (TAM) by Fred Davis in 1989 through the 1997. In this chapter, the theoretical framework and the hypotheses of this study are documented. Chapter 3 discusses the research design where the researcher briefly describes the model of this study and the variables used the design of the questionnaire, the sampling design, and how the questionnaire was administered and the statistical analysis adopted. The results and the statistical findings of this study are in Chapter 4. Discussion of the findings is discussed at length in Chapter 5. Limitation of the study, suggestions for future research, implications of the study and the conclusion are also discussed in this concluding chapter.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

One of the main focus of management information systems (MIS) implementation research has been to determine why people accept or reject new technology. In many of the past MIS studies, user acceptance is regarded as one of the several factors used for determining the successful implementation of this new technology (Delone and McLean, 1992; Davis, 1989; Chau, 1996; Igbaria, 1992, 1995). Although numerous individual, organizational and technological variables had been investigated, researches have been limited by the shortage of high-quality measures for key determinants of user acceptance (Igbaria et al., 1997).

A review of MIS literature suggested several measures of a successful computer based information system (CBIS) for large organizations, which are also appropriate for smaller organizations. Among the suggested measures are (a) system quality, (b) information quality, (c) system use, (d) user satisfaction, (e) individual impact and (f) organizational impact (DeLone and McLean, 1992). A frequently suggested measure of success is the extent to which IS has been used by management (Yap et. al., 1992; Igbaria, 1992, 1995; Igbaria et. al., 1997). Different measures of computer success are mutually dependent and system usage has been chosen as the primary criterion variable for their research. System usage has a notable practical value for managers interested in evaluating the impact of IS (DeLone and McLean, 1992). It has been regarded as the primary indicator for user acceptance in several studies (Davis, 1989; Adam et. al., 1992; Thompson et. al., 1991; Igbaria, 1992, 1997; Chau, 1996; Szajna, 1994). These studies made use of multiple-act indicators for

system usage to improve reliability of the measures (Fishbein and Ajzen, 1975), instead of relying on only one indicator. Some of the indicators used in enhancing the reliability of measuring the system usage are

(1) making use of wide a variety of software packages in CBIS environment (eg. spreadsheet, word processing, graphic, data processing, etc.);

(2) the number of business task performed using systems such as budgeting, planning, analysis and forecasting;

(3) the actual amount of time spent on system each time; and

(4) frequency of usage per day.

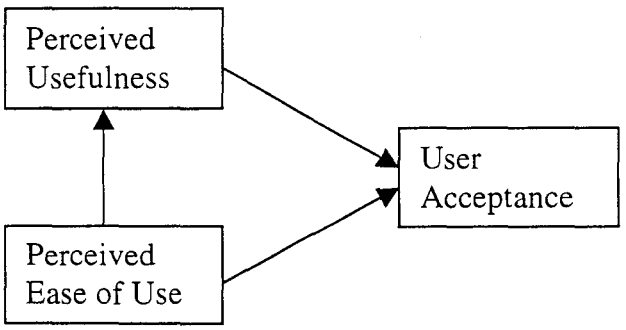
2.2 Development of Technology Acceptance Model

Several models have been developed to investigate and understand the factors affecting the acceptance of computer technology in large organizations. Some of the notable models include technology acceptance model (TAM), theory of reasoned action (TRA) and theory of planned behavior (TPB). According to Orbell and Hodgkins (1997), "Fishbein and Ajzen's TRA is an important account of willingness (volitional) behavior in social psychology. The TRA and its successor, the TPB which was developed to permit prediction of behaviors not entirely under volitional control, both propose that performance of a behavior can be predicted from an intention to perform the behavior (eg., 'I intend to do X this week')."

TAM was developed from TRA, adopting the same general belief of belief—attitude—intention—behavior relationship in the context of technology acceptance. Out of these models identified, TAM and TRA have been used by MIS researchers as a theoretical foundation to conduct research on those factors which affect the user acceptance of computer technology (Igbaria, 1992).

However, technology acceptance model (TAM) (Davis, 1989) is one of the most influential models widely used in the studies of the determination of IS/IT acceptance. It is also one of the five models identified by Venkatesh and Brown (1998) which were utilized to investigate the user acceptance, adoption and usage behavior of PC acceptance. Many studies have been done by adopting and expanding on this TAM (figure 2.1) (Chau, 1996; Davis, 1989; Mathieson, 1991; Adams et. al., 1992; Segars and Varun., 1993; Igbaria, 1992, 1995; Igbaria et. al., 1997) which has empirically proven to have high validity. Table 2.1 summarizes the past TAM studies cited with TAM has been found to be valid.

Figure 2.1: Davis' TAM (1989)



This TAM was developed by Fred Davis in 1989 to explain the computer-usage behavior and has adopted the generic Fishbein and Ajzen's (1975) TRA model to the particular domain of user acceptance of computer technology. According to the TRA model, beliefs influence attitudes, which in turn lead to intentions, which then generate behaviors. TAM adapted this belief—attitude—intention—behavior relationship to model user acceptance of IT; and the goal of TAM was "to provide an explanation of the determinants of computer acceptance that is generally capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified" (Davis, 1989).

Table 2.1: Summary of Previous TAM Studies

Authors	Constructs	Method	Findings
Davis (1989)	Usage, Usefulness (U), Ease of Use (EOU)	Survey & Experiment	U – Usage EOF - Usage
Davis, Bagozzi & Warshaw (1989)	Usage, EOF, U, Attitude (A), Behavioral Intention (BI)	Experiment	EOU – U, U – A, EOU – A,
Mathieson (1991)	Usage, EOU, U, A, BI, Environment Variables	Experiment	U – Usage EOU – Usage
Adams, Nelson & Todd (1992)	U, EOU, Usage	Survey	U – Usage, EOU – U EOU – Usage,
Segars & Vanun (1993)	Usage, U, EOU	Experiment	U – Usage EOU - Usage
Szajna (1994)	U, EOU, BI, Usage	Experiment	U – Usage, EOU – Usage
Hendrickson & Collins (1996)	Usage, U, EOU	Experiment	U – Usage, EOU – U, EOU – Usage
Chau (1996)	Near-term U, Long-term U, EOU, U, BI	Experiment	NTUsefulness – Usage, LTUsefulness – Usage, EOU – NTU, EOU – BI, NTU – LTU
Igbaria, Cragg, Cavage & Zinatelli (1997)	EOU, U, Usage, Intraorganizational & Extraorganizational factors	Survey on SMI	EOU – Usage, U – Usage, EOU – U, EOU & U mediating, MS, ICS, ECS – Usage

(Lederer et al., 1997)

Davis replaced the TRA's attitudinal determinants, derived separately for each behavior with a set of two variables (i.e. perceived ease of use and perceived usefulness) employed in many computer technology acceptance contexts. Both TRA and TAM models were found to predict intentions and usage satisfactorily (Mathieson, 1991). However, the TAM was found to be a simpler and easier one to use but more powerful as a model for the determination of the user acceptance of computer technology. In addition, the TAM attitudinal determinants outperformed the TRA's much larger set of measure.

The two main determinants of the TAM were perceived usefulness and ease of use. Davis (1989) defined perceived usefulness as "the degree to which a person

believes that using a particular system would enhance his or her job performance." This follows from the definition of the word useful: "capable of being used advantageously." Within organizational context, a system that is high in perceived usefulness is one that the user believes will have a positive use-performance relationship. Perceived ease of use "refers to the degree to which a person believes that using a particular system would be free of effort." This follows from the definition of 'ease': 'freedom from difficulty or great effort.' All else being equal, an application perceived to be easier to use than another is more likely to be accepted by users.

Perceived usefulness was found to be significantly correlated to system usage and hence a major determinant. The findings suggested that "perceived ease of use may actually be a causal antecedent to perceived usefulness, as opposed to a parallel, direct determinant of system usage." Hence, perceived ease of use is a predictor of perceived usefulness; and perceived usefulness mediates the relationship between perceived ease of use and system usage. Future research is needed to address how other variables related to usefulness, ease of use and acceptance, can establish a better understanding of the measurements.

Mathieson (1991) tested the validity of TAM via an experimental study on usage of spreadsheets and calculator. He compared TAM with TPB to predict an individual's intention to use an IS. The study found that both TAM and TPB predicted this well. Therefore, he commented that TAM is a relatively easier model to be applied in practice as it is only supplying a very general information about user's opinion of a system. TPB, on the other hand, provided more specific information but is much more difficult to apply.

Subsequently, Adams et. al. (1992) replicated Davis' TAM in two studies within one research. The purpose of these studies is to focus on evaluating the psychometric properties of the ease of use and the usefulness scales while examining the relationship between ease of use, usefulness and system usage. "The results of the studies demonstrated reliable and valid scales for measurement of perceived ease of use and usefulness. It indicated the importance of both of these factors and suggesting that usefulness is an important determinant of system usage." This is also consistent with the original TAM proposed by Davis (1989). Adams et. al. (1992) called for more research on this model because there are limited studies in this area. Thus they suggested that a variety of factors, such as user experience and characteristics, type or sophistication of system use, and other task characteristics might mediate the relationship among ease of use, usefulness and usage. As such, it has been suggested that future research is required to focus on the replication, refinement and development of this model and measures to address these factors.

Igbaria (1992) argued that Davis' TAM model has some limitations even though it provided good insights into the user acceptance of computer technology. He claimed that:

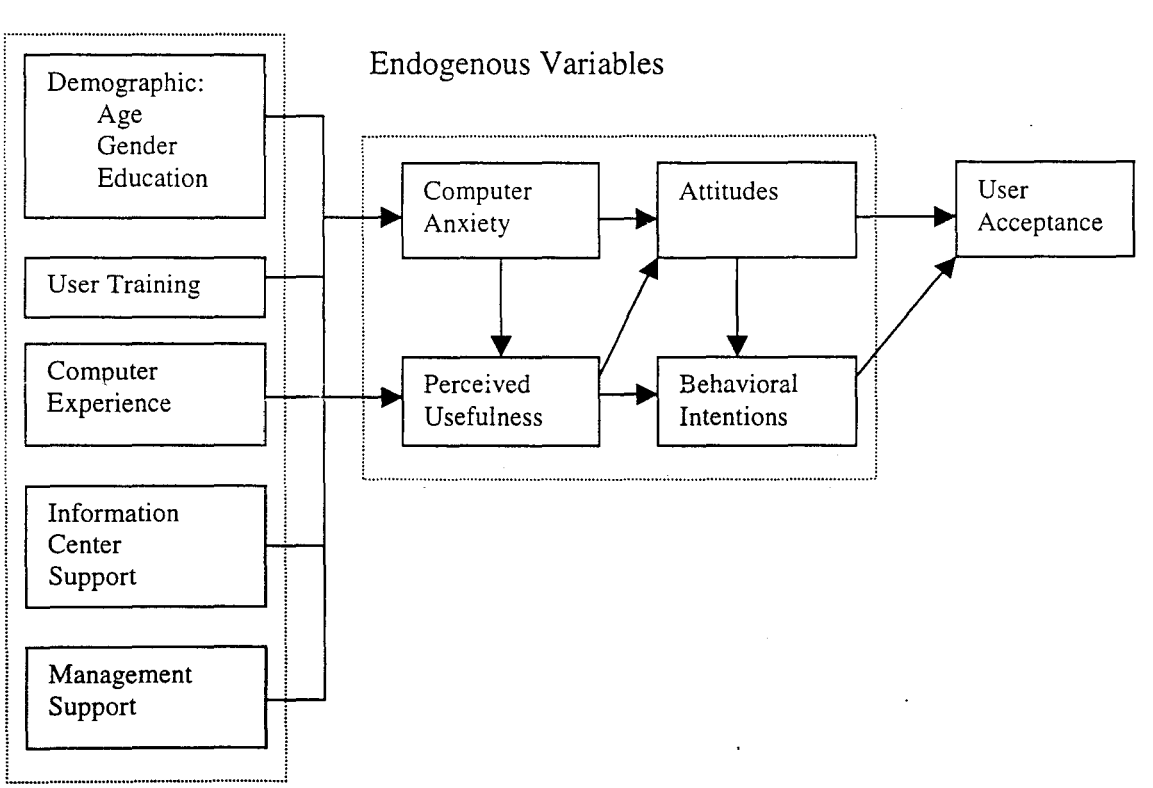
(1) this model focused only on the determinants of usage (eg. perceived usefulness and ease of use) rather than external factors affecting these determinants;

(2) Davis' (1989) research was conducted on college students and not adult employees; and

(3) only focused on one specified application (a word processing – WriteNow) rather than microcomputer applications in general.

Thus, Igbaria (1992) went on to extend this model to include other external factors (eg. individual and organizational characteristics), computer anxiety, perceived usefulness, attitudes, behavioral intentions to use and actual system use among managers. His revised model is shown in Figure 2.2. The purpose of his study was to test this integrated model of user acceptance technology, incorporating variables found to consistently explain and predict acceptance and success of computer technology across studies, particularly TAM.

Figure 2.2: Igbaria's expanded TAM (1992)



Generally external factors were found to have positive effects on all the endogenous variables [ie. computer anxiety, perceived usefulness and perceived acceptance (ie. usage)]. His findings claimed to have several strengths. Firstly, his work is based on theory grounded on the existing MIS studies including Davis' TAM.

Secondly, the data analysis was based upon a large poll of managers from various industries using a wide variety of microcomputer applications for different tasks and applied sophisticated testing techniques. Thirdly, the research design and execution used a structural equation model (a casual model) rather than simply correlation hypotheses. Finally, the validity of the model demonstrated that the user acceptance by managers was the product of network of external factors, computer anxiety, perceived usefulness, attitudes and behavioral intention. Perceived usefulness was found to be the major determinant of attitudes towards microcomputer. "It was found to have positive effects on attitudes, behavioral intentions, and user acceptance. Behavioral intentions were found to be the determinants of user acceptance."

Then, in 1995, Igbaria and Guimaraes conducted another study to gain a better understanding of the factors affecting user acceptance of technology. They developed and tested an integrated model of microcomputer usage based on TAM, TPB and other models on user acceptance computer technology. Their model (Figure 2.3) included five sets of variables:

(1) individual characteristics: user training and computer experience;

(2) organizational characteristics: organizational support;

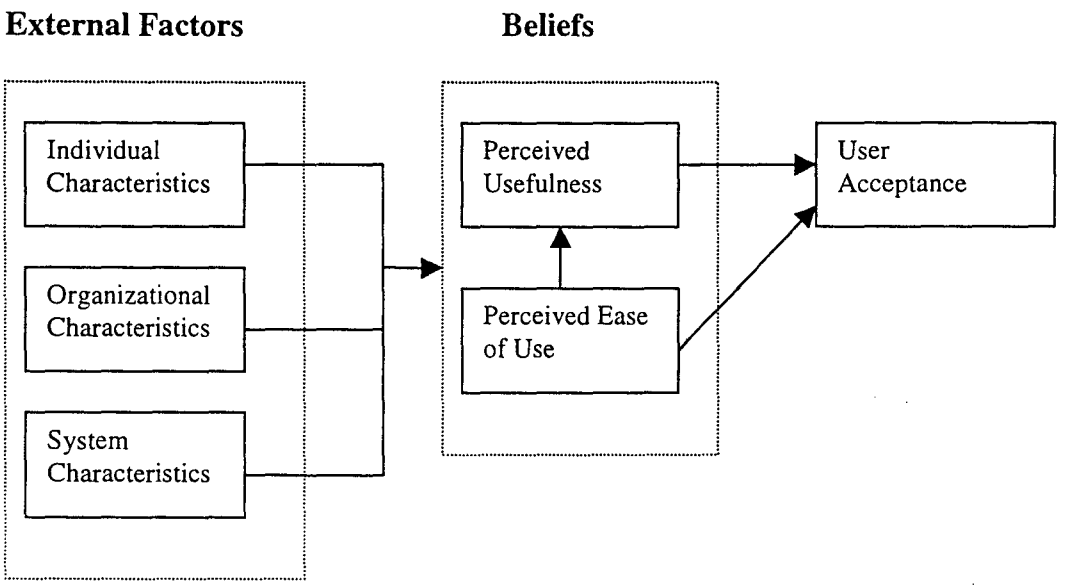
(3) system characteristics: system quality;

(4) beliefs: perceived ease of use and perceived usefulness; and

(5) microcomputer usage.

They attempted to understand what is the impact of the external factors on microcomputer usage, perceived ease of use and perceived usefulness, considering them as important determinants of computer technology acceptance as proposed by Davis (1989).

Figure 2.3: Igbaria et. al. User Acceptance Model (1995)



The test of reliability on both the constructs and the model was found to be satisfactory and significant. The findings of this study "corroborate the findings by Davis (1989) that perceived ease of use is a predictor of perceived usefulness. And perceived usefulness mediates the relationship between perceived ease of use and system usage." Similar to Igbaria's (1992) study, perceived usefulness was found to be a major determinant of system usage. The external factors in this model were also found to have positive effects on the two determinants. Systems with higher user-perceived quality are likely to be used more frequently than those of lower quality. For organizational support, favorable management support will lead to a favorable belief and greater system usage. While prior computer experience and the effect of user training (as individual factors) improve the user perceptions and systems usage, further refinement of the measures was suggested by Igbaria to increase the reliability and validity of the measurement model.

Chau (1996) reviewed the concept of perceived usefulness and modified the TAM to include the types of perceived usefulness: perceived near-term usefulness and

perceived long-term usefulness. His study did not include any other exogenous variables and focused only on the relationship between these two usefulness variables. Generally, Chau's findings supported the overall validity of the modified TAM. "Perceived near-term usefulness had the most significant influence on the behavioral intention to use a technology, perceived long-term usefulness also exerted a positive, though lesser impact. No significant direct relationship was found between ease of use and behavioral intention to use a technology."

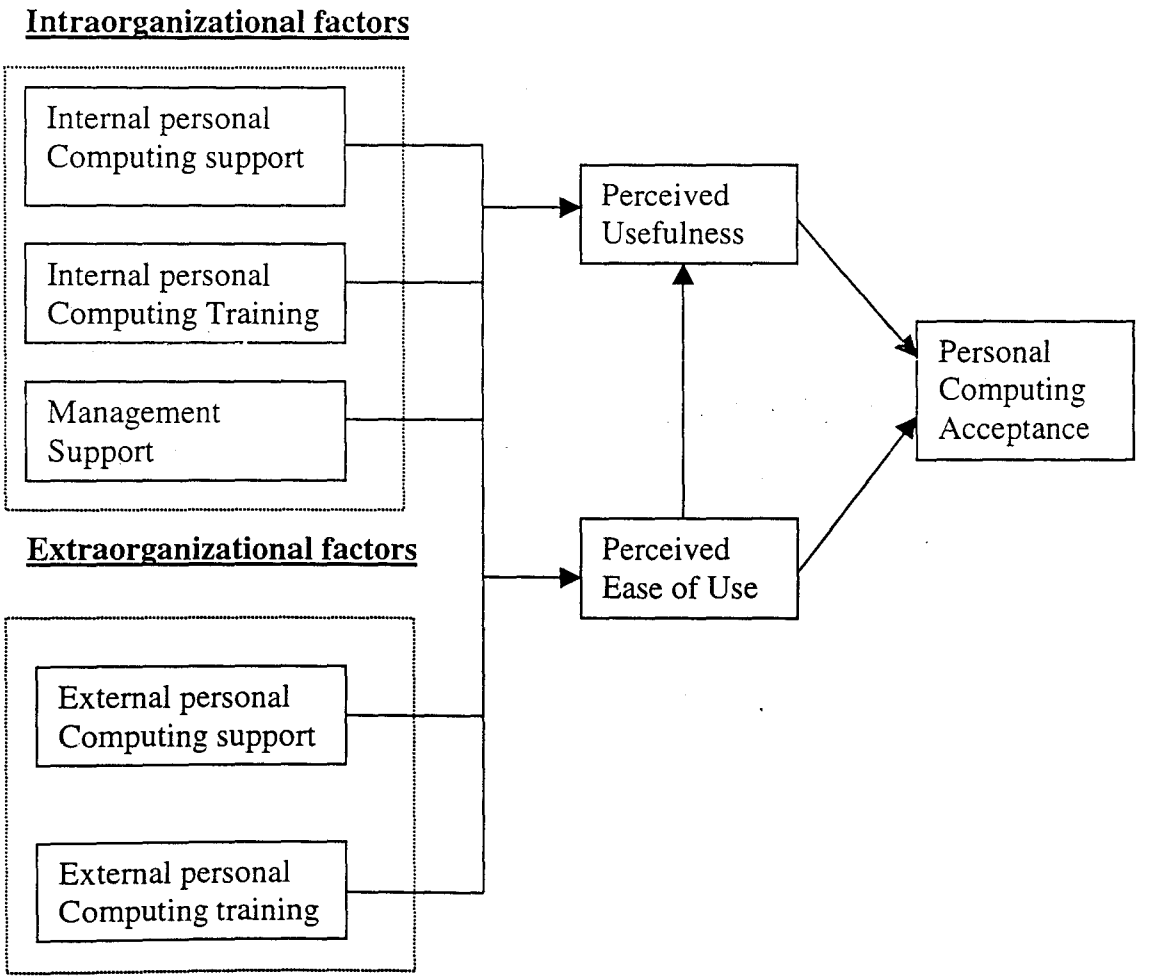
2.3 Personal Computer Acceptance for Small Firms

Recognizing that small firms represent a distinct and an important group and not many known studies on this group had been carried out, Igbaria et. al. (1997) came up with a modified TAM to understand the factors affecting the user acceptance of microcomputer technology in small firms in New Zealand. Igbaria et. al. incorporated exogenous factors such as intraorganizational and extraorganizational into the TAM. The relationship among intraorganizational factors, extraorganizational factors, perceived ease of use, perceived usefulness and personal computer acceptance (ie. system usage) were examined. Behavioral intentions were excluded since Szajna (1994) reported that perceived usefulness has direct effect on acceptance while attitudes were excluded based on reports by Szajna and Adams et. al. The modified version of TAM is shown in figure 2.4.

Based on the literature survey, many studies on TAM had verified the validity and reliability of the systems usage, perceived ease of use and perceived usefulness (Davis, 1989; Mathieson, 1991, Adams et. al, 1992; Igbaria, 1992; Igbaria et. al., 1995) for adoption in this model. Previous studies on IS implementation and small firms also discovered that there were various exogenous controllable factors that

influence technology acceptance (Davis et. al., 1989; DeLone, 1988; Igbaria, 1992; Raymond, 1988; 1990b; Thompson et. al., 1991; Thong et. al., 1994; Yap et. al., 1992). These exogenous factors included both intraorganizational and extraorganizational factors. The intraorganizational factors were (1) internal support, (2) internal training, and (3) management support. Two extraorganizational factors were also included in the model: (1) external support and (2) external training. The inclusion of both intraorganizational and extraorganizational factors into the model was to provide a better understanding and to show the importance of these factors in relation to small firms (Thong et. al., 1994).

Figure 2.4. Personal Computer Acceptance Model



Internal personal computing support is the technical support by individuals (or groups) with computer knowledge who are internal to the firm. Its importance has been highlighted in many studies (Cragg and King 1993; Igbaria, 1992, 1995; Igbaria et. al., 1997). Researchers reported that systems were more successful when there was a user computer support (Bergeron et. al., 1990; Mirani and King, 1994;). Igbaria et. al. (1997) stated that the level of computing support was crucial to the acceptance of end-user computing in small firms. However, in small firms, the lack of resources prohibited the setting up of an internal information center. This led to little or no internal support. Montazemi (1996) reported that personal computer acceptance was also highly dependent on the number of system analysts available in small firms. The internal computing support as a factor, which was included in this Igbaria et. al.'s (1997) work was basically based on previous findings (Igbaria et. al., 1995) that high level of technical support was thought to promote more favorable beliefs about the system among users and for greater computing success. However, findings by Igbaria et. al. showed that this factor of internal computer support has no influence on system usage.

Internal training which refers to the amount of training users had received from other users or computer specialists within the firm. Igbaria et. al. (1997) stated that personal computing training was an important factor affecting acceptance in both small and large firms. It was reported that user training had a significant effect on the decision-making satisfaction of small firm managers who develop their own applications (Raymond and Bergeron, 1992). Similarly, training was found to have a positive impact on perceived usefulness and technology acceptance, which was consistent with other studies (Igbaria et. al., 1995, 1997).

The management support in promoting greater personal computer acceptance has been well-recognized (Thong et. al., 1994; Igbaria et. al., 1995, 1997). It can take a variety of forms such as encouragement to the use of the system, providing wider selection of technology and education, applying systems to a wider variety of business tasks and encouraging experimentation with microcomputers. Therefore, management support was associated with greater system success and a lack of it was considered a critical barrier to the effective utilization of technology. Many studies (Yap et. al., 1992; Igbaria, 1992; Cragg and King, 1993) concluded that management support has a positive influence on computer acceptance. Igbaria et. al. (1997) has proven this again.

Igbaria stated that small firms rely on external sources for both technical support as well as training. Studies (Raymond and Bergeron, 1992; Yap et. al., 1992; Thong et. al., 1994) concur that personal computing success in small firms was positively associated with a high level of vendor support than those with a low level of vendor support. Such reliance on external help was due to insufficient internal expertise of small firms (Cragg and King, 1993). Igbaria et. al.'s studies supported the findings of previous research. External support has a direct positive influence on perceived ease of use and perceived usefulness. Adequate and high quality external support help users understand and use IS effectively. External support was found to have a stronger influence on personal computer acceptance than internal support. Thus, suggesting that small firms were very reliant on their external support, which was consistent with Cragg and King's findings. However, external training was found to have positive effect on perceived ease of use. Its effect on perceived usefulness was only indirect through perceived ease of use. Igbaria et. al. suggest that "external training was beneficial to individuals' knowledge about computers and their

operations may be beneficial in enhancing computer skills and reducing attitudinal barriers to the acceptance of computer technology."

The overall findings by Igbaria et. al. (1997) was that the modified TAM with perceived ease of use, perceived usefulness and system usage constructs were reliable and were applicable to small firms. Their findings indicated that perceived ease of use was a dominant factor in explaining perceived usefulness and system usage. Exogenous variables had positive influence on both perceived ease of use and perceived usefulness, particularly management support and external support.

From the literature survey on the development and progress of TAM, it can be concluded that fundamentally TAM was found to be reliable and consistent in providing a good indicator for user acceptance of technology. The belief—attitude—intention—behavior relationship holds very well. TAM can be applied on future studies for both large and small firms.

2.4 Theoretical Framework

The objective of this study is to investigate the factors affecting the personal computing acceptance by SMIs in Penang. The model adopted in this study is an expanded model of TAM to include exogenous variables such as intraorganizational and extraorganizational variables and management support. Figure 2.4 presents the model used in this study and is an adoption of Igbaria et. al.'s (1997) study. In this model, the relationship among the personal computer acceptance, perceived ease of use, perceived usefulness and the exogenous variables used are graphically represented. It has been found to be reliable and valid for small firms. The discussion of this model has been done prior to this section.

2.5 Hypotheses

The research hypotheses are duplicated from Igbaria et. al. as well. They are hypothesized around the belief on individual factor influence on personal computing acceptance, perceived usefulness and perceived ease of use. These hypotheses are listed as follows:

Hypothesis 1. *Perceived usefulness has a direct effect on personal computing acceptance.*

Hypothesis 2a. *Perceived ease of use has a direct effect on perceived usefulness.*

Hypothesis 2b. *Perceived ease of use has a direct effect on personal computing acceptance.*

Hypothesis 3a. *Internal personal computing support has a direct effect on perceived ease of use.*

Hypothesis3b. *Internal personal computing support has a direct effect on perceived usefulness.*

Hypothesis 4a. *Internal personal computing training has a direct effect on perceived ease of use.*

Hypothesis 4b. *Internal personal computing training has a direct effect on perceived usefulness.*

Hypothesis 5a. *Management support has a direct effect on perceived ease of use.*

Hypothesis 5b. *Management support has a direct effect on perceived usefulness.*

Hypothesis 6a. *External computing support has a direct effect on perceived ease of use*

Hypothesis 6b. *External computing support has a direct effect on perceived usefulness*

Hypothesis 7a. *External computing training has a direct effect on perceived ease of use*