Implementation of Information Technology in Local Government in Bali, Indonesia

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FLINDERS UNIVERSITY INSTITUTE OF INTERNATIONAL EDUCATION
RESEARCH COLLECTION
NUMBER 9

STUDIES IN COMPARATIVE AND INTERNATIONAL EDUCATION
Number 9

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Produced by the Flinders University Institute of International Education
Sturt Road, Bedford Park, Adelaide SA 5000

Designed by Katherine L. Dix
Published by Shannon Research Press, South Australia
ISBN: 1-920736-04-2

Preface

The adoption and implementation of information technology (IT) has been a source of interest for many people and sectors in developed countries. Research in this field has traditionally focused mainly on organisations in developed countries, in particular the United States and the United Kingdom, without considering how these frameworks and models can be applied and extended to developing countries. Very few empirical studies have been conducted on the factors affecting the diffusion and the use of information technologies in developing countries, particularly in local and regional governments.

The overall purpose of this study has been to investigate the adoption and utilisation of IT in the local government organisations in Bali from an innovation adoption-diffusion perspective. A four phase conceptual model of the process of adoption and implementation of innovations was proposed for this study, namely: initiation phase, adoption phase, implementation phase, and evaluation phase. Four groups of factors were considered to have the potential to influence each phase of the IT adoption and implementation processes, namely: environmental factors, organisational factors, technological factors and human factors. The constructs of IT usage and user satisfaction constituted the implementation phase. The perceived impact of IT on user performance was used to represent the evaluation phase.

There were two groups of employees involved in this study. The first group comprised employees who were involved in the initiation stage. The second group, on the other hand, consisted of employees who were not involved directly in the initiation stage. Therefore, two separate models were examined to accommodate the absence of the initiation phase in the second group. For the purposes of this study, the first group was called ‘the initiators’ while the second was called ‘the non-initiators’.

After an examination of the assumptions underlying the different techniques, a multiple imputation method (MI) was selected to replace the missing values, while exploratory factor analysis (EFA), cluster analysis (CA) and confirmatory factor analysis (CFA) were employed to investigate the construct validity of all scales. Partial least square path analysis (PLS), structural equation modelling (SEM) and hierarchical linear modelling (HLM) were considered appropriate analytical procedures to examine the effects of individual-, organisational-, and district-level factors on each phase of the IT adoption and implementation processes. SPSS, WesVarPC, PLSPATH, AMOS, MPLUS, and HLM were used to analyse the data.

The results show that at the individual level individuals’ perceptions and beliefs about IT were partly due to differences in individual characteristics. Employees’ individual characteristics together with their perceptions of IT affected their attitudes toward the technology.

At the organisational level, two other groups of factors were also added to the model, environmental characteristics and organisational characteristics. For the non-initiators, environmental factors were found to affect the organisational characteristics and average employees' perceptions but not the average level of IT utilisation in organisations. In addition, the average scores of individual characteristics were also influenced by environmental factors. Organisational characteristics influenced the average employees' perceptions of IT as well as their attitudes toward IT and the average IT utilisation in each organisation. The average scores of individual characteristics were associated with average scores of individual perceptions, level of IT utilisation, and perceived impact of IT on user performance. However, no relationship was found between employees' perceptions and beliefs in IT and employees' attitudes toward IT, as is revealed by the initiators model.

From the results of change analyses, it was found that centralisation and formalisation of organisations made no contribution to the IT implementation processes for both groups. Employees' perceptions of IT, however, were found to have a significant effect on the level of IT usage for both groups. In addition, employees' perceptions of IT also affected the level of centralisation and the attitudinal dimensions after IT implementation processes for both groups had been taken into consideration in the analyses. Perception also had a positive effect on IT usage, which in turn had a positive effect on user satisfaction and user performance. User satisfaction and user performance had positive effects on perception after the implementation process. Although attitudes toward change had no effect on IT usage, they had a positive relationship with user satisfaction and perceived user performance. Anxiety had negative effects on IT usage for both groups. However, once the users used the technology and felt satisfied with the technology, they became less anxious. Perception had a positive effect on IT usage, and IT usage had a positive effect on user satisfaction and perceived user performance. User satisfaction and perceived user performance, in turn, had positive effects on perception after the implementation process.

It is considered that the findings of this study contribute to the theoretical and methodological knowledge as well as management and policy formulation on the adoption and implementation of IT innovations by governmental agencies in developing countries, and in particular in the province of Bali, Indonesia. In addition, this study contributes to the identification of the facilitators and inhibitors of IT adoption and implementation in local government agencies of Bali. The identification of these factors may help government agencies in Bali and other parts of Indonesia to formulate better strategies for adopting and implementing IT in order to improve their service quality and productivity.

Acknowledgments

I would like to express my appreciation to those who helped and assisted in the production of the book.

First of all, my great thanks go to my supervisor Prof. Bruce Guerin for his encouragement, support, and guidance for my study. I am also deeply indebted to my co-supervisor, Associate Prof. Colin A. Sharp, who ensured that my time at Flinders Institute of Public Policy and Management (FIPPM) was both productive and enjoyable.

During the data analysis process, I have been guided and advised by Professor John. P. Keeves. I am greatly indebted to him. Without his constant intellectual guidance, critical assessments, endless support and untiring encouragement, it would have been impossible for me to complete this book.

Special thanks also go to Dr. Salah Kutieleh from the Study Skill Centre at Flinders University for his encouragement and support, which gave me the psychological strength needed as an international student. He and his family have become a part of my family in Australia. I am also grateful to Jeni Thomas and Katherine Dix for helping me with editorial service and Dr Hungi Njora for his valuable comments.

My work could not have been completed without the contribution of many other academic and administration staff members at FIPPM and School of Education at Flinders University. I am also grateful to all my colleagues at the Pendidikan Nasional University, Denpasar, Bali, for their warm attention and support.

This book would not have been possible without the financial support provided by AusAID. It is my sincere hope that the relationship between the two countries will continue to benefit both the Australian and Indonesian people.

I thank my three lovely daughters, Dyah, Dhani, and Cintya and last but not least, I would like to thank my wife, Kencana, who was an indispensable part of my journey in Australia. Although she had her own research to deal with, she managed to remain a great friend and a source of inspiration.

Contents

Figures

Tables

1

Introduction

The Inquiry in Perspective

In an era of globalisation, innovations in information technology (IT), centred in telecommunications and informatics, have had substantial influences on communities and businesses. The availability of ever cheaper and more powerful personal computers, combined with the capability of telecommunication infrastructures, has put increasing computing power into the hands of a much greater number of people in organisations (Kraemer & Dedrick, 1997; Rischard, 1996; Willcocks, 1994).

In the last two decades, there has been a proliferation of studies which examine some aspects of innovation in local government (Bingham, 1976; Brudney & Selden, 1995; Budic & Godschalk, 1996; Danziger, 1977; Danziger & Dutton, 1977; Donnelly, Dalrymple, & Hollingsworth, 1994; Griesemer & Colo, 1984; Heintze & Bretschneider, 2000; Kakabadse & Kouzmin, 1996; Kraemer & Dedrick, 1997; Masser, Campbell, & Craglia, 1996; McMillen, 1984; Perry & Danziger, 1980; Perry & Kraemer, 1978; Ventura, 1995; Voss & Eikmeier, 1984). A common belief is that the introduction of an innovation, especially in the form of more advanced technology, brings improvements to organisations (Downs & Mohr, 1976). From this perspective, IT is expected to benefit local governmental activities at operational, managerial and policy making levels (Kraemer & King, 1977; Muid, 1994; Rischard, 1996; Somers, 1987).

Most of the activities of a typical local government organisation are very information-intensive: "In managing resources, executing functions, measuring performance and in service delivery, information is the basic ingredient" (Isaac-Henry, 1993, p. 96). Whereas most private sector organisations might consider information as a supportive input into their production processes, a government organisation should see information and information handling activities as the essence of its operations (Howard, 1985; Taimiyu, 1993). If information is regarded as a fundamental resource of government, then information technology is a suitable and prominent tool for performing governmental functions. Muid (1994, p. 114) also mentioned that "Information systems provide the nervous system of government business. Improving the nervous system can help the body to function better." However, some studies have found that government organisations, both in developed and developing countries, have often been slower than their private sector counterparts in adopting modern IT for harnessing their administrative and socio-economic data (Kraemer & Dedrick, 1997; Taimiyu, 1993).

Although many studies focusing on the adoption of innovation have been conducted, no single best solution has been identified for adopting and implementing IT (Bingham, 1976; Brudney & Selden, 1995; Cooper, 1998; Gopalakrishnan & Damanpour, 1994; Moch & Morse, 1977). Local government agencies that have already acquired computerised technology have experienced various degrees of success in implementing it (Danziger & Kraemer, 1986). These agencies faced numerous obstacles during the IT implementation process. Such obstacles are reported even by the agencies that successfully implemented it (Croswell, 1991). Adoption and utilisation of IT in organisations is not a straightforward process. It involves a multitude of interacting components, such as the technology itself and factors constituting local conditions of the users. Careful design and management of the IT implementation process are essential for ensuring the desired outcomes of IT implementation (Croswell, 1991). Organisations need to consider all potential factors that might affect the success of IT implementation.

The rapid changes in IT in the developed countries also have serious managerial, financial, and human resource implications for information management in developing countries (Bowonder, Miyake, & Singh, 1993). It is evident that developing countries need to understand the pervasive nature of changes initiated by new IT and the consequences of not keeping pace with the changes occurring in the developed world. IT in a global environment is influenced by different cultures, laws, information technology infrastructure, and the availability and role of skilled personnel (Dasgupta, Agarwal, Ioannidis, & Gopalakrishnan, 1999). Therefore, the formulation and implementation of comprehensive IT strategies that take into account those differences have become critical for the developing countries. This is accentuated by the fact that the resources to support the operation of IT are usually scarce (Kahen, 1995; Lu & Farrell, 1990; Shahabudin, 1990).

Previous research suggests that successful implementation of IT is influenced by two major factors: the technology, and the local conditions of the users (Lu & Farrell, 1990). Since developing countries have distinctive environmental conditions which differ from those of developed countries and from each other, the formulation of effective strategies for IT development in a particular developing country requires a good understanding of its special environment which ranges from institutional to personal, social and economic factors. Each country needs to find effective ways of maximising the benefits and minimising the risks from IT (Mansell & Wehn, 1998). Simply borrowing or transplanting from developed countries' IT development experiences without a precise understanding of environmental differences is insufficient (Lu & Farrell, 1990). IT, along with many other technological innovations, does not have much operational value unless these technologies are developed in ways relevant to the needs and conditions of the potential users, which are specific in time and place.

A variety of factors may influence the outcomes of implementing IT in local governments. In addition to the technological factor, the local conditions of users, which range from institutional to personal, social and economic factors, may also play an important role. Past research in innovation highlights the importance of technological factors, human factors, organisational factors, and the environmental factors for successful adoption of innovation (Tornatzky & Klein, 1982; Zaltman, Duncan, & Holbek, 1973). Nevertheless, most studies do not provide an in-depth discussion and examination of the factors critical to the adoption and utilisation of IT in developing countries.

The importance of understanding the local conditions that might facilitate or inhibit the adoption and implementation of IT in developing countries is also stressed by the United Nations Commission on Science and Technology for Development (UNCSTD) Working Group on IT and Development which was set up in 1995. At that time, as cited in Mansell and Wehn (1998), the UNCSTD observed that:

> Although the technological revolution in information technology and telecommunications has aroused much interest among policy-makers, the business sector, the media and the academic world in industrialized countries, little is known about the obstacles to accessing information technology, the diffusion and use of information technologies in developing countries, particularly the low-income economies. These issues, especially the impediments to the diffusion of information technology, need to be better understood (Mansell and Wehn 1998, p. 6).

This research study examines various potential factors that may influence each phase of IT adoption and implementation with reference to Bali, Indonesia.

Bali: the Social Setting for the Study

Bali was chosen as the focus of this study partly because of its characteristics and partly because of the practical research advantages is presented. The island of Bali is a province which in many ways is almost self contained administratively. As well as its physical separation from other provinces, Bali also has a distinctive culture, a point of interest in applying innovation adoption analyses developed in other cultures. At the same time, its tourism industry has provided both opportunities to interact with people and businesses all over the world and challenges that required both private and public sectors in the area to find an effective and efficient ways in adopting and implementing IT in order to improve their service quality. In addition, as the home province of the researcher, Bali provided greater ease of access to people and organisations and the possibility of successfully managing the logistics of a large survey.

Bali has predominantly a Hindu population, but its Hindu culture is distinctive in important respects from the original Indian Hinduism. It has a unique culture and social institutions. Jensen and Suryani (1992) maintained that some aspects of Balinese culture are so elemental and pervasive that they can be regarded as the fundamental forces shaping the behaviour and character of Balinese people. These forces have their roots in two basic interrelated systems: (a) the Balinese Hindu religion and (b) the extended family, community, and ancestor systems. Furthermore, they perceived several important traits of the Balinese character: 'trust-belief', 'industrious creativity', 'hierarchical orientation', 'co-operation devotion', and 'conformism'. Four aspects of emotions have also been identified as character traits of the Balinese: 'tranquillity', 'non-verbal expression of emotion', 'controlled emotionality', and 'passive acceptance'.

Bali is probably one of the provinces of Indonesia best-known to the outside world. Despite the financial crisis which started in 1998 and that led to the Indonesian economic meltdown, in the past few decades the regional economy of Bali grew rapidly because of the growth of its tourism industry. Bali is one of the gateways to Indonesia. With the reputation of being one of the most beautiful and diverse tourists spots in Asia, Bali attracts over 1.5 million hotel visitors each year from around the world (KIB, 1997). For this to be maintained, all aspects of Bali tourism, including local government agencies and employees, have to look for improving service quality. This need is even greater after the Bali bombing on 12 October 2002. The quickly changed environment needs to be countered with even more effective and coordinated responses by all stakeholders. Information technology is one of the strategic tools that can be used to improve service quality. Some attempts had been made to utilise the technology previously. However, local government agencies in Bali were experiencing various obstacles in adopting and implementing IT to support their daily operations.

This research stems from the issues described above. On the one hand, there has been rapid development of IT technology and increasing need for the technology in both developed and developing countries. On the other hand, there have been major macro and micro environmental differences between developed countries and developing countries. Consequently, the frameworks and models of IT adoption in the developed world need to be reassessed for their applicability in developing country settings. Therefore, this research seeks to investigate the adoption and utilisation of IT in the local government organisations of Bali from an innovation adoption-diffusion perspective.

Aims of the Study and Research Questions

The purpose of this study is to investigate the IT adoption and implementation processes in Bali's local government. The analytical strategies used to achieve this end are to develop path models and hierarchical linear models in which the influences of various potential factors in IT adoption and implementation processes can be assessed. The first five questions relate to this examination. However, in these models, there is no feedback loop to accommodate the notion of IT adoption and implementation processes as an ongoing process. Therefore, as far as IT adoption and implementation are concerned, it is also necessary to explore the impact of IT implementation processes on the end users to accommodate the possible feedback loop. Question six arises from this particular issue. Consequently, the study seeks to address six questions of central concern to both research workers and policy makers in the field of government information technology.

1. What are the relationships between human factors and each phase of the IT adoption and implementation in Bali's governmental agencies?
2. What are the relationships between technological factors and each phase of the IT adoption and implementation in Bali's governmental agencies?
3. What are the relationships between organisational factors and each phase of the IT adoption and implementation in Bali's governmental agencies?
4. What are the relationships between environmental factors and each phase of the IT adoption and implementation in Bali's governmental agencies?
5. Are there any interactions among human, technological, organisational, and environmental factors in affecting each phase of the IT adoption and implementation in Bali's governmental agencies?
6. Do employees' attitudes toward IT, employees' perception of IT, and the level of centralisation of authority as well as the level of formalisation of procedures change after the implementation of IT in Bali's governmental agencies?

Significance of the Study

It is expected that the findings of this study will contribute to theoretical and methodological knowledge as well as management and policy formulation on the adoption and implementation of IT innovations by governmental agencies in developing countries, and in particular in the province of Bali, in the country of Indonesia. The theoretical frameworks and models which were mainly focused on the adoption and implementation of IT in developed countries are tested empirically in the context of Bali's local government. In order to address the complex sample design as well as the issue of hierarchical nature of the data, various data analysis methods are also employed to examine the proposed models. In addition, this study is also expected to contribute to the identification of facilitators and inhibitors of IT adoption and implementation in local government agencies of Bali. From the identification of these factors, government agencies in Bali and other parts of Indonesia are expected to be able to formulate better strategies for adopting and implementing IT in order to increase their service quality and productivity. This in turn could help Bali tourism to compete with other tourist destinations in a highly competitive worldwide tourism industry. It is also expected that the Indonesian government could gain a better understanding of the way in which the local conditions impact on the adoption and implementation of IT in a particular region.

Limitations of the Study

It is recognised that software and hardware have their own adoption and diffusion stages in organisations as well as having their own developmental rates and directions in the IT industry. Therefore it is useful to control one or the other. It may also be argued that the type of IT application would matter. It may be different to adopt IT for word processing than implementing a complex information system. However, in the case of government agencies in Bali, it is quite difficult to control either software or hardware in a quasi experimental design given the limitation in time and other resources available in this study. Sophistication and extensiveness of the systems adopted will be measured rather than controlled. Consequently, IT refers here to the broad range of technologies involved in information processing and handling, such as computer hardware, software, and telecommunication.

This study uses a modelling approach to impose asymmetrical relationships between variables as a way of interpreting the connections. This approach provides a system for expressing theoretical ideas about a sequence of events. Even though the procedure of path analysis used in this study is also commonly known as the causal modelling technique, and causality is commonly implied in modelling, the modelling does not necessarily establish causality, and the model needs to be tested for its level of adequacy. While an interpretation of asymmetrical relationships does not necessarily meet the strict criteria for deterministic arguments, it does provide a basis for theoretical description, understanding, and explanation.

In the models examined in this study, each causal path, with its arrow, in the model must be seen as a hypothesis. The causal links that are proposed in the model, and the model itself must be tested for adequacy. The findings may support the acceptance of the model, but do not establish the truth of the model, which remains only as adequate until a better explanatory model is proposed.

A longitudinal study obtaining multiple responses over a sufficiently long period of time could have provided a study that would have yielded stronger findings.

However, because of the limitations of time and other resources, only a cross sectional study could be conducted.

Moreover, this study does not try to evaluate all operations that are affected by the adoption and implementation of information technology. For the last phase, the evaluation phase, there are impacts of IT on collectivities, such as the work group, the department, the organisation, or even the society, as well as the impacts on individuals. This study focuses only on perceived user performance, which is the perceived impact of IT utilisation on user performance for individuals who work in governmental agencies.

In addition, this study was done in the time period when the local governments were subject to nationally centralised IT adoption and implementation policy, under Soeharto's administration. During this period, the level of central government interference in the IT adoption and implementation processes was very high. These interferences included centrally appointed software and hardware providers and uniform information systems, which sometimes were not suitable for local needs. These external factors might contaminate the findings of this study to an unknown extent.

Lack of statistical data and other information, difficulties of access to existing information due to the distance between the place of study and the place under study are some other problems that confront this investigation. Furthermore, the study is in many respects an exploratory investigation, rather than a confirmatory one because little information is available about the adoption and implementation of IT in Indonesia, in general, and in Bali, in particular. Moreover, the study poses many challenges in the collection and analysis of the data, which are multilevel in nature, operating at the individual, organisational level, and district level, where appropriate methods of analyses are not widely known and well established. These challenges, together with the practical implications of the study and the new theoretical understandings of the effects of local conditions on the implementation of an innovation, make this investigation a substantial and significant undertaking.

Structure of the Book

Chapter Two provides an overview of current IT development and its implications, IT potential for local government, and some problems faced by developing countries in attempting to adopt and implement IT.

Chapter Three presents the IT environment in Indonesia in general, and in Bali in particular. This includes an overview on Indonesian IT policy, national IT infrastructure, and background information on Bali.

Previous research in the area of innovation adoption and diffusion is reviewed in Chapter Four. A four phase conceptual model of the process of adoption and implementation of innovations is proposed for this study namely: initiation phase, adoption phase, implementation phase, and evaluation phase. Four classes of factors are considered to be potential factors that may influence each phase of IT adoption and implementation process, namely: environmental factors, organisational factors, technological factors, and human factors. Each of these four classes of factors influences the formation of pressures at the initiation phase. Furthermore, these variables also affect the adoption phase, implementation phase, and evaluation phase, both directly and the carriage of the previous phase as a mediator. The two constructs of IT usage and user satisfaction constitute the implementation phase. The perceived impact of IT on user performance is used to represent the evaluation phase.

Chapter Five discusses the final conceptual framework for this study, which is developed from the extended model discussed in Chapter Four. There are two groups of employees involved in this study. The first group is employees who were involved in the initiation stage. They identified themselves as having taken part in identifying the pressures emerging from various internal and external sources, and in recognising the sense of urgency for a strategic change. These perceptions, in turn, led to a decision being made by an organisation or organisational unit that resolved to incorporate IT in its operations. The second group, on the other hand, comprises employees who identified themselves as not involved directly in the initiation stage. Therefore, two separate models are examined to accommodate the absence of the initiation phase in the second group. For the purpose of this study, the first group is called 'the initiators' and the second group is called 'the non-initiators'. The propositions to be examined and the scales used to measure each construct are also discussed in this chapter.

Chapter Six introduces the development of survey instruments and data collection methods. The questionnaires were translated into the *Bahasa Indonesia* language and accompanied by a covering letter stating the nature and purpose of the study. The data collected in this study included information on variables gathered at the employee level through the use of both a questionnaire survey and interview schedules. In addition, there are also variables regarding the organisational characteristics collected through the use of an organisational questionnaire form as well as variables involving some district characteristics collected through various secondary data sources. Hence the data files contain information obtained at three different levels, namely the individual level, the organisational level, and the district level.

The research questions that are addressed in this study cover a wide variety of issues. They range from various factors that may affect each step of IT adoption processes to more technical issues involved in the measurement of attitude and perception changes before and after IT adoption. Furthermore, the structure of the available data also reflects a hierarchical nature that must be taken into consideration in analysis.

Chapter Seven discusses methods of analysis that are appropriate to the propositions to be tested in this study. The propositions of this study, advanced in Chapter Five, require that several different methods of analysis should be employed, which means that several different software packages must be used in this study. First, it considers some general methodological considerations associated with the examination of models like those proposed in the previous chapter. Then, several analytical techniques are discussed. The first part of the discussion of the analytical techniques consists of the use of the NORM program, followed by the use of the SPSS program in the second part, the use of Partial Least Square (PLS) path analysis in the third part, the use of AMOS in fourth part, the use of Hierarchical Linear Modelling (HLM) in the fifth part and the use of MPLUS in the sixth part.

In Chapter Eight, the NORM statistical software package is employed to replace the missing values (see also Darmawan 2002a). In order to examine the validity of each construct, exploratory factor analysis (EFA) (see Appendix A) and cluster analysis (CA) are undertaken using the SPSS software package (see Appendix B). A series of structural equation models is tested with the help of confirmatory factor analysis using the AMOS software package to compare various structural models obtained from the exploratory factor analyses and cluster analyses (see Appendix C). This analytical procedure is also used to examine the possibility of employing second order factor models to simplify further the overall models. Confirmatory factor analysis (CFA) is also used to investigate the construct validity of all scales.

Chapter Nine discusses demographic and descriptive information. In this chapter, demographic information on respondents, respondents' perception of IT attributes and IT adoption and implementation processes are described and the background data from the organisational level and the district level are discussed. These results are an essential part of the preparation of the subsequent analyses. The descriptive results in this chapter are generated using SPSS and WesVarPC.

PLSPATH and AMOS are software packages chosen as appropriate programs to explore the effects of various potential factors on each phase of IT adoption and implementation processes at both the individual and the organisational levels separately. By using PLSPATH and AMOS results as a starting point, MPLUS is used to analyse two-level path models of IT adoption and implementation in Bali in seeking the direct and indirect effects involved. Chapter Ten presents the results of two level path modelling analyses (see also Darmawan, 2001, 2002e; Darmawan & Keeves, 2002).

In order to examine the cross-level interaction effects, three level HLM analyses are undertaken and the results are discussed in Chapter Eleven (see also Darmawan, 2002b, 2002c).

Chapter Twelve considers the perceived impact of IT implementation on the structural, perceptual, and attitudinal dimensions. These relationships are examined by using AMOS as well as paired sample t-tests using SPSS and WesVarPC. Further details on the results of t-test using SPSS and WesVarPC are presented in Appendix D (see also Darmawan, 2000, 2002d).

In Chapter Thirteen the main findings are summarised. Issues arising from the results are discussed and proposition are tested. Simplified block models are developed to visualise the results in summary form.

Finally, the conclusions and implications of the study as well as some recommendations for further research are presented in Chapter Fourteen.

2

Information Technology and Local Government in Developing Countries

IT Developments and Their Implications

> Recent developments in the fields of communications and information technology are indeed revolutionary in nature. Information and knowledge are expanding in quantity and accessibility. In many fields future decision-makers will be presented with unprecedented new tools for development. In such fields as agriculture, health, education, human resources and environmental management, or transport and business development, the consequences really could be revolutionary. Communication and information technologies have enormous potential, especially for developing countries, and in furthering sustainable development.
>
> (Kofi Annan, 1997, as cited in Mansell & Wehn, 1998, p. 6)

United Nations Secretary General Kofi Annan, as cited above, emphasised the potential of information technology for development in his remarks to the first meeting of the United Nation Working Group on Informatics in 1997.

Some of the most powerful technological advances of the twentieth century are those associated with information and communication technology. Particularly during the past 50 years, the development of both computing and telecommunications has been very rapid, and has resulted in technological convergence. The term 'information technology (IT)', which is used in this study, refers to this convergence between computing technology and telecommunications technology.

There is, however, considerable divergence in interpreting the nature and implications of these IT developments. "On the one hand, the rhetoric of the information society is heady with golden age visions. On the other, far bleaker images are purveyed, though usually with less force, as images are conjured of the societal panopticon, of the all-seeing state" (Bellamy & Taylor, 1998, p. 18).

Despite the divergence between utopian and dystopian perspectives on IT implications and without subscribing to any of them, IT can still be considered powerful. Its specific importance derives from the potential for supporting new informational capabilities, as well as introducing changes in the way that information is communicated. However, the deployment of IT is the consequence of human choices, which are constrained and shaped by the social context.

IT can be a powerful enabler of development goals because its unique characteristics dramatically improve communication and the exchange of information. IT can be applied to a wide range of human activity from personal use to business and government. IT has made it possible to have a large variety of information systems capable of supporting individual users, large numbers of inter-connected users, and many users sharing the same system or databases. These are made possible through the advances in hardware, system architecture and software driven by new microprocessors, application-specific integrated circuits, and computer architecture.

These advances in computer technology have been accompanied by advances in telecommunication technology. The convergence of these technologies fosters the dissemination of information and knowledge by separating content from its physical location. This flow of information is largely impervious to geographic boundaries, allowing remote communities to become integrated into global networks and making information, knowledge and culture accessible, in theory, to anyone (Bellamy & Taylor, 1998).

In addition, there is continual decline in the real cost of storing, processing, and transmitting a unit of information (Adkins, 1988; Bowonder, Miyake, & Singh, 1993; Hanna, 1991; Mansell & Wehn, 1998). The digital and virtual nature of many IT products and services allows for reducing costs. Replication of content is virtually free regardless of its volume, and marginal cost of distribution and communication is very low. As a result, IT has a potential to reduce transaction costs. Furthermore, IT has the power to store, retrieve, sort, filter, distribute and share a large volume of information, and seamlessly has a potential to lead to substantial efficiency gains. The increase in efficiency and subsequent reduction of costs brought about by IT has the potential for creating new products, services and distribution channels.

These characteristics suggest that IT has the potential, if conceived as a means and not an end in itself, to be a powerful enabler of development in key areas, such as industry, services, and public sector management (Hanna, 1991). However, in order for IT to foster positively development goals, it must be employed effectively. Table 2.1 provides an overview of the potential capabilities as well as social, economic, and political impacts of IT trends, adapted from the summary by Mansell and Wehn (1998) which was, in turn, based on the study by the United States Office of Technology Assessment in 1995.

IT Potential for Facilitating Local Government Activities

It can be seen from the above brief review of IT developments that computers and telecommunications are functionally conjoined, providing the infrastructure for digital information flow. The adoption and diffusion of this technology in local government in Bali, Indonesia is the context of this study.

Mansell and Wehn (1998) argued that public administrations are playing a central role in today’s information age. They provide a range of services to citizens and industry, and engage in functions as diverse as economic development, environmental

Table 2.1 IT Trends, Capabilities and Their Potential Uses

IT Trends	IT Capabilities and Application	Social, Economic, and Political Impacts
Increased performance at greatly reduced cost	Permits developing countries to 'leapfrog' to advanced technology.	National political/economic integration, more efficient markets and more effective administration and control.
Technology convergence	Cost efficiency in services	Greater support for the low cost provision of public services
Increased user-friendliness	Supports greater access and usage, reduces the level of expertise required	Reduces access barriers with positive benefits for both competitive markets and democratic politics
Decentralised intelligence	Provides for two-way interaction and greater user control.	In many developing countries, two-way interactive media can support local grass root participation.
Increased networking capabilities	Supports distributed client-server computing and cooperative work application such as e-mail, EDI, etc.	Supports democratic politics by helping individuals to locate information, deliberate and voice opinions. Reduces cost for business
Increased mobility and portability	Greater ease and speed of deployment. Allows for greater network flexibility, and support for remote information access and processing.	Facilitates network configuration and shared information systems, which support the competence of local government, and reinforces community ties.

Source: Adapted from Mansell and Wehn (1998, pp. 96-97)

monitoring, and the provision of public information. This argument is also supported by Heeks (2001, p. 16), who said that "government has been, and still remains, the single largest collectors, users, holders and producers of information"[1].

Information is a central resource for government activities (Isaac-Henry, 1993). Four common types of formal information in local government are: (a) information to support internal management, (b) information to support public administration and regulation, (c) information to support public services, and (d) information made publicly available (Heeks, 2000, 2001).

Given this information intensity, any initiative to improve local government should consider IT as one enabling factor. IT has the ability to increase the speed and to reduce the cost of information tasks. IT has considerable potential to cut costs through the reorganisation of internal administration, that is, process automation and staff reduction, and through the alternative provision of services, namely the electronic delivery of services. Considering the four types of formal information and IT capabilities in improving the quality and the quantity of information handling within local government, there are basically three vital roles of IT in any type of organisation (O'Brien, 1999):

a) the operational role (support of daily operations);

b) the managerial role (support of managerial decision making); and

c) the strategic role (support of strategic competitive advantage).

---

[1] Information may be defined as 'data that has been processed to make it useful to its recipient'. It is thus differentiated from data ('raw, unprocessed information'), and knowledge ('information that has been assimilated into a coherent framework of understanding') (Heeks, 2000, p. 197).

Figure 2.1 illustrates these three roles which yield three types of information systems.

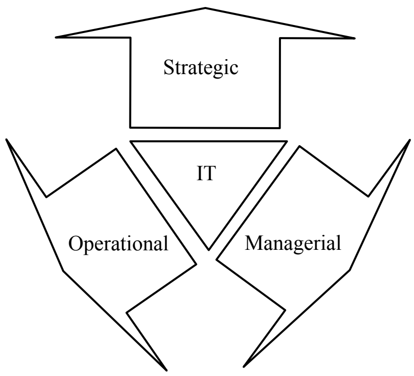

Figure 2.1 Three Vital Roles of IT

Operations Support Systems (OSS)

In operation support systems (OSS), IT is used to process efficiently transactions, control processes, support collaboration, and update databases (O'Brien, 1999). The technology is mainly used to "automate the existing human-executed processes which involve accepting, storing, processing, outputting or transmitting information" (Heeks, 2001, p. 17). This type of system is designed to improve efficiency, for example, the automation of payroll procedures. However, these systems do not emphasise producing the specific information products that can best be used by managers.

Management Support Systems (MSS)

Management support systems (MSS) are designed to provide managerial end users with information products that support much of their day-to-day decision-making needs (O'Brien, 1999). MSS provide a variety of reports and displays to management. Decision support systems (DSS) are one example of using IT for assisting the existing processes of government decision-making.

Strategic Information Systems (SIS)

The strategic role of IT involves using the technology to develop new products, services and capabilities (O'Brien, 1999), for example, "creating new methods of public service delivery" (Heeks, 2001, p. 17). Furthermore, electronic delivery points of access, which can be made available from homes, schools, libraries, and kiosks, include audio-text, voice and data information services, teletext and interactive television services, and fax. The electronic availability of public information can be of major assistance to small and medium sized enterprises (SMEs) in administrative procedures for export, import, tax completion, and business opportunities. So-called 'one stop' government services kiosks can further increase efficiency service for SMEs (Mansell & Wehn, 1998).

Research indicates that institutions go through several stages in learning to apply this technology (Hanna, 1991). First, they automate administrative functions, such as budgeting and billing, to improve efficiency. Second, they improve information for decision-making processes to increase flexibility and effectiveness; and finally, they create new products and services and craft new relationships with clients. Most institutions in developing countries are at the first stage and some are entering the second. Only the most advanced organisations are at the third stage (Hanna, 1991).

In general, then, new information technology has demonstrated a potential to support local government activities. However, moving on from the issue of potential, what are the realities of IT adoption and implementation in local governments in developing countries?

It is not certain that the potential benefits of IT applications for developing countries will always be the same as those described above. Mansell and Wehn (1998) have argued that if the specific social, cultural, and economic conditions, the expertise and commitment of users, and components of the infrastructure are not assembled together, IT application will fail to yield benefits.

Some Problems for Developing Countries

It is realised that the rapid developments of IT in developed countries have serious implications for information management in developing countries (Bowonder et al., 1993). The combination of the recent advances in information technology and the prevailing needs of developing countries have prompted the interest in the role of IT in the development process (Chiang, 1990; Korac-Kakabadse, Kouzmin, Knyght, & Korac-Kakabadse, 2000; Sanwal, 1991; Shahabudin, 1990; Taimiyu, 1993; Tye & Chau, 1995; Yick, 1993). The implications of the recent advances in IT and the need for strengthening information management competence in developing countries are also highlighted by the United Nations Commission on Science and Technology for Development's (UNCSTD) Working Group, that assesses the role of scientific and technological innovation as developing countries become more deeply engaged in building so-called innovative 'knowledge societies' (Mansell & Wehn, 1998). In 1997 UNCSTD Working Group, cited in Mansell and Wehn (1998), reached two principal conclusions.

> Although the costs of using information and communication technologies to build national infrastructures which can contribute to innovative 'knowledge societies' are high, the costs of not doing so are likely to be much higher.
>
> Developing countries are at very different starting positions in the task of building innovative and distinctive 'knowledge societies' and in using their national information infrastructures to support their objectives.
>
> (Mansell and Wehn 1998, p. 7)

There is a big gap between the potentials of IT and its current use and diffusion in developing countries (Chandrasekhar & Ghosh, 2001; Hanna, 1991). In order to bridge this gap, developing countries may need to understand the pervasive nature of changes initiated by new IT (Hanna, 1991). It is important to realise potential benefits of these technologies. However, it is no less important also to realise various factors that may affect the adoption and implementation of this technology in developing countries.

In order to understand better the IT environment, the interconnected components can be viewed as an onion ring model presented in Figure 2.2. Heeks and Bhatnagar (2001) have argued that information systems (IS) consist of information, information technology (IT), processes, management and people.

Furthermore, they said that:

> All information systems operate within a reform context that has two main components. The first is the *organisation* within which the IS is located. This has an organisational culture, a political dimension, a set of overt or covert management strategies relating to reform, and both formal and informal organisational structures. The second is a wider *environment* outside the organisation. Within this wider environment there are other institutions; there are new technologies being developed; there is the state of the economy and markets; there are political pressures which are likely to be particularly significant in reform; and there are a variety of cultures and other social systems.
>
> (Heeks and Bhatnagar, 2001, p. 55)

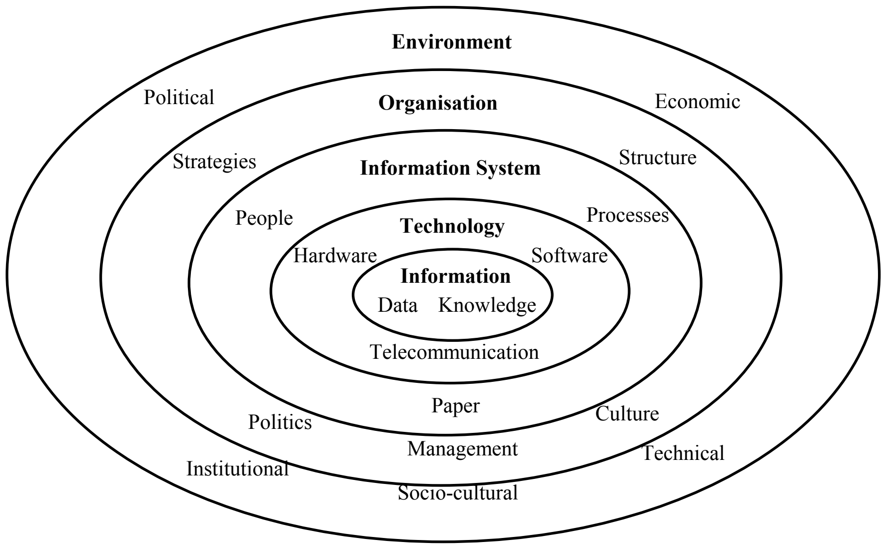

Figure 2.2 Onion Ring Model of Information System

Source: Adapted from Heeks and Bhatnagar (2001, p. 54)

Heeks and Bhatnagar (2001) have shown that information systems are often developed on the basis of a set of assumptions that is pertinent to a certain context of a particular country. Furthermore, they have argued that this can cause problems in the transfer of such systems from one country to another. This issue becomes even more difficult when the transfer is from a developed country to a developing country. Developed and developing countries stereotypically differ in many ways. Therefore, the assumptions underlying the adoption and implementation of IT in developed countries may not match the realities in developing countries.

Previous studies provide some suggestion on these differences (Heeks & Bhatnagar, 2001; Kahen, 1995; Lu & Farrell, 1990). Formal information stored outside the human mind is valued less in developing rather than developed countries. Therefore, assumptions about the perceived value of a computerised information system in developing countries may be dissimilar with those in developed countries. Moreover, the technology infrastructure (telecommunications, networks, and electricity) in many developing countries is rather limited. Consequently, assumptions about availability of Internet and other connections to support inter-agency information flow may be ill informed or misguided. Public sector work processes in developing countries are often influenced by political, economical, and social instability. Therefore, assumptions about the viability of automating an overt, stable set of processes may not be necessarily correct in some developing countries (Heeks & Bhatnagar, 2001).

There are other major differences between developed and developing countries in terms of the structure of government agencies, IT literacy and skills, and financial resources (Heeks & Bhatnagar, 2001; Kahen, 1995; Lu & Farrell, 1990). Government agencies in some developing countries are more hierarchical and more centralised. Furthermore, the availability of human resources with IT skills in developing countries is rather limited. These include IT skills of system analysis, programming skills and operation-related skills including computer literacy and familiarity with English as a language that dominates computing. Developing countries also have less money. In addition, the cost of computing equipment is relatively higher than in developed countries, whereas the cost of labour is less. These factors often inhibit the adoption and implementation of information technology in developing countries as presented in Table 2.2.

Table 2.2 Factors Inhibiting Information Technology Adoption and Implementation in Developing Countries

Factors	Conditions	Reference
Information Technology	Information is valued less	(Heeks & Bhatnagar, 2001)
	Poor quality of telecommunication services	(Heeks & Bhatnagar, 2001; Kahen, 1995; Lu & Farrell, 1990)
	Lack of library and information standards	(Kahen, 1995)
	Unreliable electric power supply	(Lu & Farrell, 1990)
	Lack of vendor support	(Sanwal, 1991)
Processes	Unstable government	(Kahen, 1995)
	More politicised	(Heeks & Bhatnagar, 2001)
Cultural	Technological backwardness	(Karaomerlioglu, 1997)
	Language barrier	(Heeks & Bhatnagar, 2001; Kahen, 1995)
	Fear of modern technology	(Heeks & Bhatnagar, 2001; Lu & Farrell, 1990)
Staffing and Skills	Lack of available IT professionals	(Heeks & Bhatnagar, 2001; Kahen, 1995)
	Lack of continuing education in computing literacy	(Lu & Farrell, 1990)
	Lack of experience	(Shahabudin, 1990)
	Large percentage of unskilled workers	(Kahen, 1995)
Management	Centralisation of decision makers	(Heeks & Bhatnagar, 2001; Lu & Farrell, 1990)
	Lack of national IT strategy	(Bowonder et al., 1993)
	Lack of coordination	(Karaomerlioglu, 1997)
Other Resources	Labour intensive society	(Kahen, 1995)
	Unavailable capital and hard currency	(Heeks & Bhatnagar, 2001; Kahen, 1995)
	Low wage level	(Heeks & Bhatnagar, 2001; Lu & Farrell, 1990)
	High price of computing equipment due to importation and tariffs	(Heeks & Bhatnagar, 2001; Lu & Farrell, 1990)

In order to achieve their potential benefits, there are needs for systematic investigation of the significance of changing IT capabilities for government, and for effective information policies. Effective IT policies and initiatives to take advantage of the new applications must be embedded in the local environment and in the organisations which expect to benefit from them. If applications do not reflect user needs or involve them in the process of development, they may not bring the expected benefits. They are likely to create new problems that can be costly to address. If the specific social, cultural, and economic conditions, the expertise and commitment of users, and components of the infrastructure are not assembled together, IT applications may fail to yield benefits. The needs for appropriate adoption, adaptation, and transfer, and the selection of IT applications as a result of informed choices and the development of user capabilities should not be underestimated.

One possible approach in formulating an effective information policy involves mapping and measuring IT diffusion. This approach offers an understanding of the diffusion of IT. Therefore, recognition of various potential factors that may affect IT adoption and implementation processes and understanding of the way that these factors affect the processes are essential parts in formulating effective IT policies and initiatives. Unfortunately, IT research in these areas has traditionally focused on organisations in developed countries. Moreover, in moving from developed countries to developing countries, it is necessary to ask how can these frameworks and models be applied and extended to developing countries? There is a lack of detailed studies in this area, especially in the context of local government in developing countries. Bali’s local government was chosen as a case example in order to investigate various potential factors and the way they affect IT adoption and implementation processes.

Summary

This chapter discusses the trend of IT development and its implication for developing countries. The proposal for the frameworks and models of IT adoption and implementation for developing countries in general, and Bali, Indonesia, in particular, has emerged in the context of the dilemmas experienced in developing countries as they have tried to improve their governments in the information age.

This study seeks to identify potential factors that inhibit or facilitate the adoption and implementation of IT in Bali’s government agencies. Relevant factors specific to developing countries are identified for inclusion in the research model. Further examination of these specific characteristics is presented in Chapter Three with particular relevance for the local conditions of Bali, Indonesia.

3

Information Technology Environment in Bali, Indonesia

Indonesia and Its National IT Policy

The Government of Indonesia regards policies on information technology as being vital and strategic due to its importance in supporting national unification, education, and economic competitiveness (Telkom, 1996). The Government has established the National Telecommunication Council as its highest policy-making body with regard to the industry. The council reports directly to the President of Indonesia and is composed of representatives from all Government agencies and Ministerial levels with involvement in information technology and telecommunications.

In realising the need for a national IT strategy, the Ministry of Tourism, Post and Telecommunications of Indonesia held a workshop on the topic 'Ensuring National Competitiveness in the Information Economy' in April 1996 (Telkom, 1996). In this workshop, sponsored by the World Bank, follow-up action plans were formulated including programs for preparing national IT policy.

In 1997, the Indonesian Government moved one step further by establishing an Indonesian Telematics Coordination Team. The formation of this team was based on the *Decision of Indonesian President* (*Keputusan President/KEPRES*) *no. 30 of 1997*. In this decision it is stated that the reasons for this action were that the Indonesian Government realises that in the era of global competition, the development and utilisation of telematics, which is the synergy of telecommunication and informatics, is becoming an important issue, and that coordination is one of the key factors in increasing the benefits of telematics. This movement is in accordance with the UNCSTD conclusions and suggestions for developing countries (Mansell & Wehn, 1998) as described in Chapter Two.

In accordance with the *Decision of Indonesian President* (*Keputusan Presiden/KEPRES*) *no. 30 of 1997,* the coordination team was chaired by the

Coordinator Minister of Production and Distribution. This team was set up to be the coordinator of all participating agencies and communities that supported or used telematics both at the central level and local level.

The main responsibilities of this coordination team were:

a) formulating Government policies in telematics;

b) deciding the phases, development priorities, and the utilisation of Indonesian telematics;

c) observing and controlling the practices of Indonesia telematics; and

d) reporting any telematics development in Indonesia to the President.

In 2000, the Indonesian Telematics Coordination Team was reformulated based on the *Decision of Indonesian President* (*Keputusan Presiden/KEPRES*) *no. 50 of 2000*. This team is now chaired by the Vice President of Indonesia. The acting director for this team is the State Minister of Administrative Reform. The main responsibilities of this coordination team remain the same.

National IT Infrastructure

The rapid development of Indonesia's telecommunications industry began in 1976 with the launching of its 'Palapa A1' communications satellite, developed by the Hughes Corporation in the United States. Since then, telephone, telegraph, telex communications and also radio and television broadcast activities have been boosted significantly. Indonesia has also developed terrestrial communication through microwave transmission and marine cable systems so as to support the further expansion of services (ASTEC, 1992). Indonesia now has three major complementary telecommunication systems: satellite, microwave and optic fibre. There have been seven Palapa satellites launched, one of which failed. The latest, Palapa B4, launched by the United Stated space shuttle in May 1992, carries 24 transponders and is expected to serve for 11 years (ASTEC, 1992).

Currently, about 5.3 million telephone lines are in operation. The increasing number of telephone subscribers in Indonesia from 1989 to 1997 can be seen in Table 3.1. PT Telkom and PT Indosat, are the main providers in Indonesia of telecommunication services. PT Telkom has concentrated on the domestic network, whereas PT Indosat has focused on the international arena. The cellular mobile phone services are open to the private sector to supply.

In 1996, PT Telkom launched a national network and information systems masterplan called NUSANTARA-21 (N-21) (Telkom, 1996). N-21 is a project to build a telecommunications and information technology infrastructure to link the archipelago electronically, and to allow Indonesia to enter the global information society. With a budget of at least US$14 billion, partly supported by the World Bank (World Bank, 1998), it was planned that by the year 2001 people in all district capitals would have access to the N-21 information superhighway either from homes and workplaces, or through community access centres (Telkom, 1996).

Development and utilisation of NUSANTARA-21 has the purpose of building a prosperous Indonesian society through the infrastructure and the capability of utilising information so that the Indonesian community is well capable of having a role and taking the greatest benefits from the economy of the very competitive global information environment. These conditions are considered to increase national economic competitiveness (Telkom, 1996).

Table 3.1 Number of Telephone Subscribers, Indonesia 1989 - 1997

	Automatic			Manual		
Year	**Paid**	**Official**	**Total**	**Paid**	**Official**	**Total**
1989	772,220	26,506	798,726	91,594	2,825	94,419
1990	938,109	21,590	959,699	81,543	2,677	84,220
1991	1,209,123	29,308	1,238,431	36,788	1,374	38,162
1992	1,485,273	38,287	1,523,560	17,652	775	18,427
1993	1,791,560	42,079	1,833,639	14,386	653	15,039
1994	2,374.473	57,631	2,432,104	7,196	370	7,566
1995	3,180,196	31,703	3,211,899	2,401	104	2,505
1996	4,073,395	37,830	4,111,225	1,277	31	1,308
1997	5,173,212	46,531	5,219,743	727	18	745

Source: Central Bureau of Statistics Republic of Indonesia, 1998

In the early stages NUSANTARA-21 was established as an information infrastructure connecting the 27 capitals of provinces in Indonesia and their connection with regional as well as global information infrastructure.

In the initial stage of utilisation of NUSANTARA-21, there was rapid growth within the Government as well as the general public through various networks which had been in operation since 1996: IPTEKNET, SISKOMDAGRI, DEPERINDAG ON-LINE, INFORIS, ITB-NET, INDONET, RADNET, SISTELINDO-IBM-NET, IDOLANET, CBNNET, MELSANET, INDOSATNET, TELKOMRISTINET, WASANTARA-NET.

By the end of 2001, there were more than 150 licenses for Internet Service Providers (ISPs) issued by the Government (*Dirjen Postel*: Post and Telecommunication[2]). Most ISPs operate in Jakarta. At least five of them had operations in various cities in Indonesia, that extended to the remote islands and provinces such as Irian (Tembaga Pura), Maluku (Ambon), and Sulawesi (Ujung Pandang). Hundreds of other cities in Sumatra, Java, and Bali were also connected through this network of telecommunications, forming the embryo for the NUSANTARA-21 project to connect the whole of Indonesia into a future national information superhighway (Simandjutak, 1998).

Background on Bali

Bali is a province of Indonesia. The island of Bali measures 150 km. (about 90 miles) along its longest, east-west dimension, and 80 km. (about 50 miles) along a north-south axis, as can be seen in Figure 3.1. This gives it an area of 5,561 sq. km. Around three million people live on this little island, giving it a population density of about 600 people per sq. km. Bali lies between 8 and 9 degrees south latitude and between 114.5 and 115.5 east longitude.

Just as it has been for centuries, farming is the principal occupation of most of the Balinese people, and rice is the principal farm crop. The farmers in Bali employ a highly sophisticated system of irrigated rice cultivation. Only about half of the island is arable because of the central spine of high mountains, and about half of the arable land is planted with rice. However, the tourism industry has influenced the island. Bali's major export is now ready-to-wear garments. Not far behind is the manufacture

[2] http://www.postel.go.id

and export of handicrafts for the tourist trade - primarily items of wood and bamboo. With the tremendous growth of the tourist industry, more and more Balinese people have been giving up traditional jobs in farming and fishing and taking jobs in hotels, art shops, and other tourist-related businesses. This trend has opened the doors for many locals to interact with people and businesses from all over the world.

Figure 3.1 Map of Bali

Bali has a unique culture and social institutions. Religion plays a very important part in the lives of the Balinese people, which are predominantly Hindu. Most Balinese spend a significant part of their lives performing spiritual activities (Jayasuriya & Nehen, 1989). A descriptive summary about the Balinese people's characteristics is presented in the following paragraphs, drawn from Jensen and Suryani (1992) and from the perspective of the author who was born, bred and educated in Bali.

Balinese people demonstrate a strong trait of trust-belief (*percaya*). *Percaya* means both trust and belief and these two attitudes go hand in hand. From birth to about three years, the child is in contact with a kind caretaker virtually all the time. Child abuse, especially of infants or toddlers, is almost unheard of in Bali. From infancy through to maturity, the Balinese people develop and maintain an unfailing belief in God along with the other principles of their religion, which not only provide them with a sense of security but also play a governing role in their behaviour. The Balinese grow up to trust their parents and elders because they have always been taught to respect them. They trust the priests, the village headman, and believe the laws of the community are in their best interests.

Industrious creativity (*glitik*) refers to the self-initiated industrious trait of the Balinese personality and character. The Balinese are conscientious and hard working. Adults stay at tasks that Westerners would consider arduous, tedious, or boring. Perhaps this characteristic is common to a number of Asian cultures. Creativity is expressed in daily life by innovations and variations in performing ceremonies and the arts, including painting, dance, woodcarving, and music.

Hierarchical orientation (*linggih*) refers to the importance of levels to every Balinese. The Balinese are preoccupied with etiquette and a critical part of this relates to rank and the hierarchy basic to Hinduism.

Co-operation devotion (*ngayah*) is a striking aspect of many activities and jobs but nowhere more evident than in the club (*seka*), the irrigation systems (*subak*), ceremonials and families, and within the community group (*banjar)*. Co-operation is associated with a sense of devotion or dedication to friends, family, and village. *Ngayah* means not only working for the *banjar* but also working for family and relatives.

Conformism (*manut*) is reflected in the traditional ways of doing things such as strictly following the rules of the *banjar*. The trait of conformism lends a quality of timelessness and stability to the culture and could be an element in the Balinese resistance to cultural change, for better or for worse.

Tranquillity or peace (*rhea*) is an inner state of emotion that combines feelings of calmness and absence of sickness, problems, and conflicts because all burdens have been given to the God. It is a feeling that the Balinese people experience in various contexts, for example, when making offerings, receiving blessing, and on *Nyepi*, the day of silence. It is also achieved by meditation. This feeling is not experienced continually, but intermittently. When life is stressful or anxiety intervenes, peace is lost for a time but it always returns.

Non-verbal expression of emotion (*semita*) is a trait that often strikes and puzzles foreigners. Verbalisation is not the way that the Balinese express emotions. It is not their custom to say ‘thank you’ or comment on the dinner being good or delicious. The Balinese show appreciation by subsequent deeds not words. They are said to feel the positive emotion ‘in the heart’ but express little outwardly. This has a deeper meaning than words and reflects more a so-called ‘psychic power’.

The trait of control of strong emotion (*nabdabang kayun*) is considered a virtue by Balinese. This pertains to anger as well as elation. The trait has the same basis in religion and myth. The religious principle of harmony and balance of the emotions as well as all things in the universe are powerful influences. Of course, the Balinese also experience feelings of anger but they learn early in life how to deal with these feelings.

Passive acceptance (*nrima*) is a mechanism of adjustment to life situations that one regards as unchangeable or for which there are no perceived alternatives. They are patient in the face of what Westerners would regard as frustrating inconveniences. The Balinese do not think in terms of changing the system or implementing measures to prevent such inconveniences from occurring. This pertains to both private and public issues. The traits of control of emotion and passive acceptance combine to lend a dimension of tolerance to everyday life.

It is expected in this study that these cultural characteristics of the Balinese will affect people’s values, beliefs, perceptions, and attitudes. In some respects, it may be found that their beliefs, perceptions, and attitudes toward IT also differ from those of people who base their culture on Western values. Their perceptions on IT are mainly related to technological factors, while their attitudes toward IT are parts of more human factors. Along with other factors, environmental and organisational factors, they are potential factors that may affect IT adoption and implementation processes.

The Structure of Local Government in Bali

Under the unity of the Republic of Indonesia, local government[3] in Bali, as for all other local governments in Indonesia, follows the the *Act of the Republic of Indonesia Number 5 of 1974* concerning government at the local level (*Undang-Undang Republik Indonesia Nomor 5 tahun 1974 tentang Pokok-Pokok Pemerintahan di Daerah).* Although a new *Act of the Republic of Indonesia Number 22 of 1999* concerning local government (*Undang-Undang Republik Indonesia Nomor 22 tahun 1999 tentang Pokok-Pokok Pemerintahan Daerah)* has been created, this act was not yet implemented on a full scale at the time of this study. Many problems need to be resolved beforehand. At the time the field study was done, Bali's local government practices were still based on the previous Act.

According to the *Act of the Republic of Indonesia Number 5 of 1974* concerning government at the local level (*Undang-Undang Republik Indonesia Nomor 5 tahun 1974 tentang Pokok-Pokok Pemerintahan di Daerah*), there are three principles of local government, decentralisation, deconcentration and *medebewind*, which are widely used in Indonesia.

Conceptually, decentralisation has been defined as the transfer of authority from central government to the *Daerah Tingkat I* (the first level of local government), or the transfer of authority from the *Daerah Tingkat I* to the *Daerah Tingkat II* (the second level of local government). Deconcentration has been translated into the delegation of authority from central government to its agencies at the local level, or the delegation of authorities from the top level to the lower level of hierarchy within the central government offices. Meanwhile, *medebewind* means the delegation of such policy implementation from the central government to the local government. In brief, the setting of government structure in Indonesia can be seen in Figure 3.2. This structure also applies in Bali.

Bali consists of eight *Kabupaten*/districts (Jembrana, Tabanan, Badung, Gianyar, Bangli, Klungkung, Karangasem, and Buleleng) and one *kotamadya*/municipality (Denpasar). Despite the economic crisis that led to the Indonesian economic meltdown, in the past few decades the regional economy of Bali has been very good, more so, in fact, than for Indonesian as a whole. However, at the *kabupaten* level, the economic growth rates have been uneven.

The southern part of Bali, which includes Denpasar and Badung, represents a major slice of the job market, such as in the hospitality and tourism industry, the textile and garment industry, and in many small scale and home industries producing handicrafts and souvenirs. Textiles, garments, and handicrafts have become the backbone of Bali's economy providing 300,000 jobs, and exports had been increasing by around 15% per year to US$400 million in 1998 (BaliGuide.Com, 2003). Textiles and garments contribute about 45%, and wood products including statues, furniture and other handicrafts 22% to the province's total income from exports. Silver work is ranked third (4.65%) with 5,000 workers employed. Main importers are the US and Europe with 38% each, and Japan with 9% (BaliGuide.Com, 2003).

Bali's population distribution is shown in Table 3.2. Table 3.3 shows the regencies' own receipts and their expenditure on science and technology which include IT expenditures. In these tables, it is obvious that Badung, Denpasar, and Gianyar are three regions within Bali that have relatively high revenues.

[3] Local government in Indonesia usually means any sub-national government including province, district and municipality.

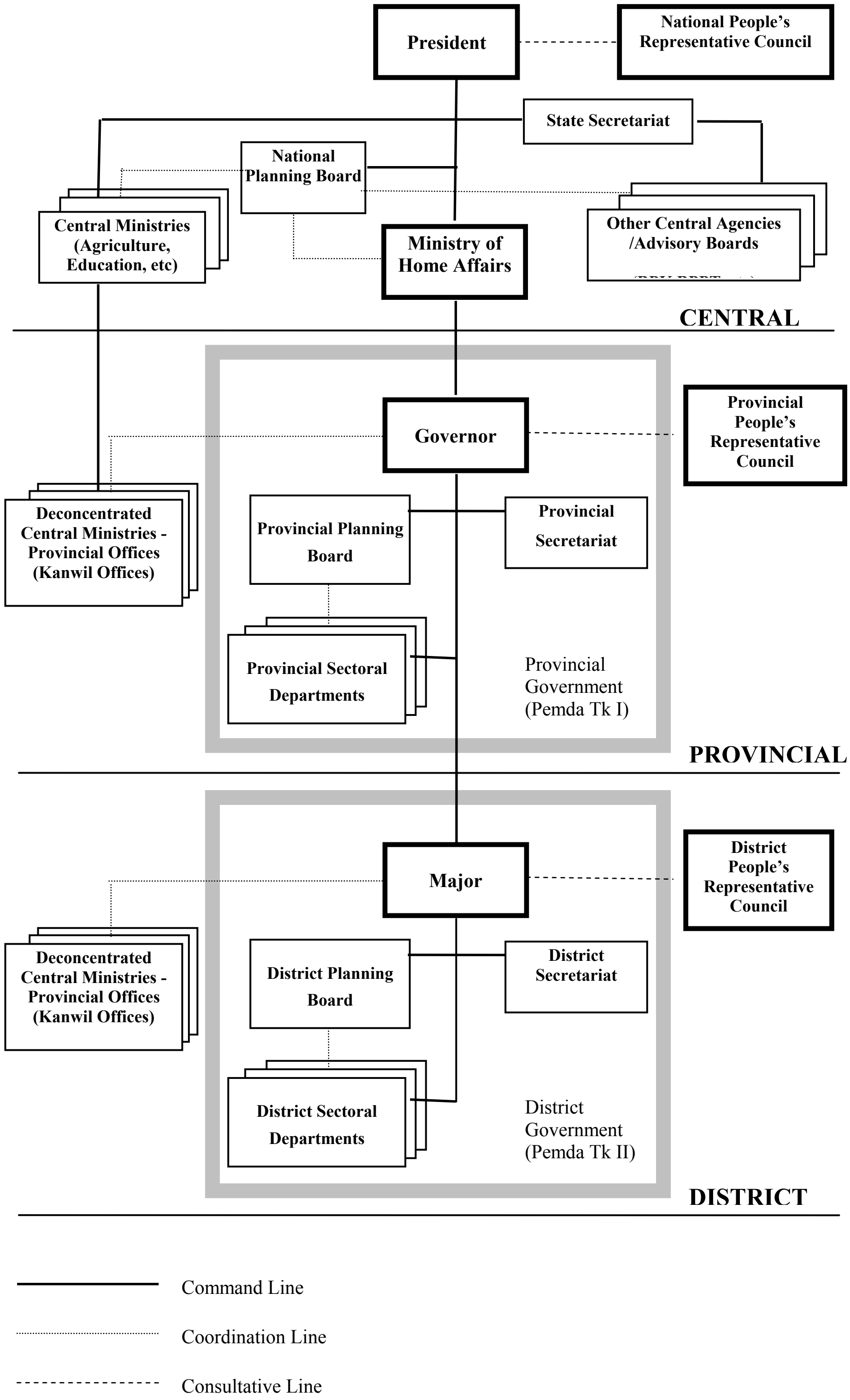

Figure 3.2 Simplified Diagram of the Government Structure in Indonesia

Table 3.2 Bali's Population and Distribution in 1997

No	District	Area (km^2)	Population	Density per km^2
1	Jembrana	841.80	212,675	253
2	Tabanan	839.33	377,100	449
3	Badung	418.52	290,877	695
4	Gianyar	368.00	350,147	951
5	Klungkung	315.00	163,603	519
6	Bangli	520.81	195,420	375
7	Karangasem	839.54	374,351	446
8	Buleleng	1,365.88	569,137	417
9	Denpasar	123.98	373,272	3,011
	Bali	5,632.86	2,906,582	516

Source : BPS, *Bali Dalam Angka 1997* (Bali in Figure 1997), Denpasar, 1998, pp. 48-49

Table 3.3 Districts' Own Receipts and Expenditure on Science & Technology in 1997 (Rp thousand)

No	District	Own Receipts	Science & Technology Expenditure	Total Expenditure
1	Jembrana	2,956,138	119,187	29,571,352
2	Tabanan	5,152,310	14,500	44,288,442
3	Badung	82,406,904	981,531	122,536,289
4	Gianyar	28,173,594	412,960	42,622,316
5	Klungkung	2,873,892	181,369	24,094,972
6	Bangli	3,562,238	33,498	25,323,187
7	Karangasem	4,903,266	115,823	34,744,290
8	Buleleng	4,274,892	39,000	50,771.360
9	Denpasar	30,988,137	412,960	54,191,358

Source : BPS, *Bali Dalam Angka 1997* (Bali in Figure 1997), Denpasar, 1998, pp. 376-379

Denpasar has the advantages of being the capital city of Bali. As the centre of economic activities, it is not surprising that its local revenue is relatively higher than for other regions. Denpasar also has the highest population density in Bali. Meanwhile, most tourist facilities, hotels and restaurants, are located in the Badung area. These facilities are the main source of income of Badung. Gianyar, on the other hand, is the centre of art production.

IT in Local Government of Bali

The local government of Bali along with other local governments in Indonesia is responsible for ensuring good governance. However, government employees in performing their routine tasks including formulating policies and deciding strategies have to struggle with low availability and reliability of information when attempting to make good decisions. These obstacles are partly caused by poor information handling procedures, which can not handle the increasing workloads. With the increasing volume of data that needs to be handled and the increasing demand to obtain quick and accurate information, manual systems are no longer suitable.

Initially, before the establishment of a provincial coordinating body for IT, computerisation in local government agencies in Bali was introduced only partially. Some agencies such as the Local Revenues Agency *(Dinas Pendapatan Daerah),* Local Planning Board (*BAPPEDA),* and the Finance Bureau *(Biro Keuangan)*, had developed their own computerised information systems. In 1990, Bali's Local Planning Board (*BAPPEDA Tk I Bali)* began to formulate a plan for Bali's management information systems. Under this plan, the hardware and software acquisitions were controlled by a team appointed by the Governor of Bali. At that time, a mini computer (AS 400) and several PCs, which were connected to a local area network (LAN), were bought. Some applications were also developed, for example, payroll systems, inventory systems, and project management systems. However, these efforts were far from well directed and well coordinated (KPDE, 1998).

In trying to overcome such problems in local governments, the Department of Home Affairs formulated a policy regarding computerised information systems, which was empowered by the *Decision of The Minister of Home Affairs* (*Keputusan Menteri Dalam Negeri) no. 45 of 1992* concerning the Department of Home Affairs' Management Information Systems Policy (*Sistem Informasi Managemen Departemen Dalam Negeri/SIMDAGRI*). At the provincial level, these decisions were followed by the *Decision of Governor of Bali (Keputusan Gubernur Kepala Daerah Tk. I Bali) No. 69 of 1995* concerning Management Information Systems for Local Government of Bali. This policy was operationalised by the *Decision of The Minister of Home Affairs* (*Keputusan Menteri Dalam Negeri) no. 140 of 1997* concerning the Department of Home Affairs' Management Information Systems Master Plan (*Rancangan Induk Sistem Informasi Managemen Departemen Dalam Negeri/SIMDAGRI*).

Under the instructions from the Minister of Home Affairs *(Instruksi Menteri Dalam Negeri*) no. 5 of 1992, local governments were expected to establish an electronic data processing unit. In agreement with these instructions, the local government of Bali established an electronic data processing office at the end of 1993 with a *Decision of Governor of Bali (Keputusan Gubernur Kepala Daerah Tk. I Bali) No. 329 of 1992*. This office was empowered by the local law *(Peraturan Daerah/Perda*) *No. 2 of 1996*.

The Electronic Data Processing Office of Bali (PDE Bali) remains responsible for implementing the *Decision of Governor of Bali (Keputusan Gubernur Kepala Daerah Tk. I Bali) No. 69 of 1995* concerning Management Information Systems for Local Government of Bali. In addition, PDE Bali also acts as a coordinator for computerisation in Bali's local government agencies to ensure:

a) information integrity across all units and sub-units within Bali's local government administration;

b) sustainability of information system development; and

c) consistency and accuracy of information available in each system.

It is hoped that in the long run this planning can benefit the local government of Bali in terms of (a) efficiency, (b) effectiveness, (c) asset optimisation, and (d) data security (KPDE, 1998). In other words, the PDE Bali is responsible for formulating Bali's Government policies and development priorities in computing. This agency has to observe, control and report any development in computing to the Governor.

As another consequence of these policies and regulations, PDE offices were also established in every district. These offices were to be responsible for the implementation of SIMDA at the district level and under a direct order of *Bupati* (district's major).

In some districts, another initiative was also launched. By using more advanced information systems, integrated services units (*Unit Pelayanan Terpadu/UPT*) were introduced in Badung, Gianyar, Bangli, and Negara by the time the field-work for this study was undertaken. These units are basically centralised licensing units which were established to bring together all inquiries and coordinate the licensing procedures between other related agencies. People no longer need to go to various individual agencies to obtain their licences.

In Bali, IT is used in many basic organisational tasks such as report and document preparations. A well-organised plan and a strategic use of IT are yet to be realised. Although awareness of IT's potential is expanding, its use so far is relatively low and expertise on the part of employees is scarce. A strategic gap exists between technological advancement and application. The signs and symptoms shown are similar to those of Nolan's Expansion Stage (Gibson & Nolan, 1974). However, the acquired computing capacity is not as excessive as suggested in that model.

The way EDP is organised in Bali also reflects Nolan's four-stage model. According to Gibson and Nolan (1974), at the beginning, the initiation stage, EDP is a small unit under the department that first used computerised systems. In the second stage, the expansion stage, the EDP manager is moved up in the organisation; systems analysts and programmers are assigned to work in the various functional areas. In the next stage, the formalisation stage, EDP moves beyond application; a steering committee is set up; control is exerted though centralisation; maintenance programming and system programming become dominant activities. Finally, in the maturity stage, (a) EDP is set up as a separate functional area; (b) the EDP manager taking on a higher level position; (c) some systems analysts and sometime programmers are decentralised to user areas; (d) high specialisation appears in computer configuration and operation; and (e) systems design and programming take on a consulting role.

The EDP units that have been established in Bali show the movement toward bringing the EDP unit in as a separate functional area in local government. However, this tendency has not been equally followed by the availability of computing capacity and personnel expertise.

Beside the great opportunity offered by this new technology, the report published by PDE office in 1998 (KPDE, 1998) also stated that the local government of Bali has to face some critical problems that need to be addressed in order to be able to gain full benefits promised by the technology. Among other things, financial and human resources are seen to be the two major problems. Lack of financial support from both local and central governments have slowed down the IT developments. The economic crisis that has hampered Indonesia since 1998 is one among many other factors that contributes to this financial difficulty. A low level of IT expertise available in each organisation is yet another serious problem. Employees' knowledge and skills with regard to IT are relatively low. Approximately, only 14 per cent of the total employees in the participating agencies in this study are computer literate. Among these employees, only a few of them (5 %)[4] have programming skills.

Moreover, it is also apparent that some external problems are unavoidable. Central government intervention is another problem. There is no sustainable maintenance for application software packages, which are developed and distributed by central government. As a result, these software packages rarely deliver their full benefits. During the period of the study, it was found that vendors of software and hardware, which are also appointed by the central government, are more often becoming a

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[4] For further details, see Chapter Nine.

problem generator rather than a problem solver. Local government agencies have no other choice. They also have limited exposure to the technology prior to adoption. The physical location of the vendors in Jakarta has made it difficult, if not impossible to obtain the support needed in Bali when it is required. Consequently some software packages are often only partly utilised. These represent a waste of an already limited financial resource.

Summary

As in many other developing countries, the Government of Indonesia regards policies on information technology as being vital and strategic. As a result, in 2000, the Indonesian Telematics Coordination Team was reformulated and based on the *Decision of Indonesian President* (*Keputusan Presiden/KEPRES*) *no. 50 of 2000*. In terms of telecommunication infrastructure, PT Telkom launched a national network and information systems master plan called NUSANTARA-21.

In the context of the public sector, the Department of Home Affairs formulated a policy regarding computerised information systems, which was empowered by the *Decision of The Minister of Home Affair* (*Keputusan Menteri Dalam Negeri) no. 45 of 1992* and the *Instruction of the Minister of Home Affairs (Instruksi Menteri Dalam Negeri*) *no. 5 of 1992*. In agreement with these instructions, the local government of Bali established an electronic data processing office at the end of 1993 with a *Decision of Governor of Bali (Keputusan Gubernur Kepala Daerah Tk. I Bali) No. 329 of 1992*.

Besides the great opportunity offered by this new technology, the local government of Bali has to face some critical problems. By realising these problems and incorporating relevant local characteristics into the research model, it is hoped that this study has positive implications for both theoretical and empirical knowledge.

The hypothesised conceptual model based on the previous studies in IT adoption is discussed in Chapter Four. This model is adapted and extended to accommodate the local characteristics. The expanded research models are discussed in Chapter Five.

4

Previous Studies in Innovation Adoption and Diffusion

General Background on Innovation

The aim of this study is to describe the adoption and implementation of IT in Bali's governmental agencies by identifying various potential factors that may affect IT adoption and implementation processes in these agencies. This research is grounded in the areas of innovation adoption and diffusion, organisational computing, and cross cultural technology transfer. The three theoretical approaches offer a set of concepts, principles and factors applicable to the research on adoption and diffusion of IT in developing countries' governmental agencies.

The tendency to view innovation as something that is socially good has inspired considerable interest and vast research in many disciplines both at the individual and organisational level. Despite such extensive research, there has been considerable disagreement as to what constitutes an innovation, with some describing it as a process of bringing an invention into use (Schon, 1967), and others describing it more as an idea, product or program perceived to be new by the adopting unit (Damanpour, 1991; Damanpour & Evan, 1984; Rogers & Shoemaker, 1971; Zaltman, Duncan, & Holbek, 1973). This research has also raised the issue of the level (individual, adopting unit or agency, industry, or the entire world) at which the adoption and implementation occur, or by whom the criterion of newness should be judged.

Criticisms have also been levelled against the notion of the success of the innovation emerging from the perceptions of the adopting unit, and the need for a more objective assessment has been underscored (Kimberley & Evanisko, 1981; Kimberly, 1981). Within this view, perceptions of newness and success by organisational members are factors, which influence receptivity, rather than criteria to determine whether something is, or should be considered, an innovation. Ultimately it is the perceptions of the dominant decision making group within the adopting unit that will, or will not, result in the successful adoption and implementation of the innovation. Hence, for the purpose of this study, innovation is defined as any idea, practice, or object that the adopting unit regards as new (Damanpour, 1991; Damanpour & Evan, 1984; Rogers & Shoemaker, 1971; Zaltman et al., 1973), which is adequately broad and yet precise. In particular, the study is limited to the adoption and implementation of Information Technology (IT) in local government agencies. IT refers here to the broad range of technologies involved in information processing and handling, such as computer hardware, software, and telecommunications.

Innovation Adoption and Diffusion

The wide varieties of perspectives that are considered reasonable have led to considerable variability and inconsistency in the findings of empirical adoption-diffusion studies. This has caused some disillusionment and scepticism concerning the practicability of developing a single theory of innovation (Downs & Mohr, 1976). Notwithstanding these difficulties, a meta-analysis of past studies by Tornatzky and Klein (1982) reveals that most of the problems have emerged from inadequate conceptualisation, lack of methodological rigour, and the very narrow scope of the research. This suggests that well planned research could certainly add significant insights into an understanding of the adoption, implementation and diffusion process of organisational innovation.

Much research on innovation and adoption and diffusion seeks to explain target adopter attitudes and their innovation-related behaviour. Some of the core frameworks for this kind of study are 'Diffusion of Innovation' (Rogers, 1983), the 'Technology Acceptance Model' (Davis, 1989) and the 'Theory of Planned Behaviour' (Ajzen, 1985).

These innovation adoption models have received considerable attention in the IS literature. These frameworks are well grounded in theory and have proved their value. These frameworks have limitations, however, as has been argued by Fichman (1992). He stated that the outcomes of applying such innovation models to IT adoption were sensitive to the fit between assumptions underlying these models and the specific features of the adoption context and the technology in question.

These frameworks have received widespread validation for many technological innovations where individual autonomy was permitted to adopt or reject an innovation. However, further and increasing evidence suggests that these traditional frameworks neglect the realities of implementing technology innovations within organisations, especially when adoption decisions are made at the organisational level rather than at the individual level (Fichman & Kemerer, 1997).

Zaltman, Duncan and Holbeck (1973) examined innovation adoption within organisations and found that the adoption process often occurs in two stages: a firm-level decision to adopt the innovation (primary adoption), followed by actual implementation, which includes individual adoption by users (secondary adoption). This process has been labelled as 'two-step adoption' (Leonard-Barton & Deschamps, 1988). Zaltman et al. (1973) label this two-stage implementation scenario 'a contingent adoption decision', because employees cannot adopt the innovation until primary adoption has occurred at a higher level of authority; actual user adoption is thus contingent on a prior event. This two-stage process may even be broadened to a multi-stage framework if additional, intermediated levels of adoption approval are required.

Under these conditions, which correspond to 'contingent authority innovation decisions' (Zaltman et al., 1973), authorities make the initial decision to adopt and targeted users have few alternatives but to adopt the innovation and make the necessary adjustments for using it to perform their jobs. Thus rather than fitting the conditions under which these models of innovation adoption and diffusion (Zaltman et al., 1973) are created, the reality of innovation adoption and implementation within organisational settings may require modifications to these frameworks to explain implementation of contingent authority innovation decisions, that are non-voluntary adoption processes. Since innovation diffusion theory is based on voluntary adoption decisions, one of its primary limitations is its incompleteness in the area of organisational implementation of innovations after authoritarian or contingent adoption decisions.

Organisational Innovation Literature

Past research in innovation has followed the event or process approach in understanding organisational implementation of innovations. In the event approach, attempts are made to establish a relationship between the characteristics of the organisational unit and its members and the date or time period of adoption or rate of diffusion. However, as noted by Zaltman et al. (1973), such an approach obscures the decision-making processes and the implementation problems faced by the adopting unit. Also, innovation should be viewed as involving an interrelated and complex set of forces that shift continually over time and that can not be treated as if they were a single event. The process approach tries to overcome this criticism by proposing the innovation as an unfolding process consisting of stages of multiple interconnected decisions in which the characteristic factors not only appear in greater or smaller degree (as in the event approach), but in a certain order of occurrence.

The process view typically has assumed two key stages of process-initiation and implementation of the innovation. The initiation phase signifies a point where the idea or innovation has become legitimised by the power-holders of the unit or where a decision has been taken to implement this new idea or innovation. Traditionally it is supposed to represent knowledge awareness, attitude formation, and decision sub stages (Zaltman et al., 1973). However, there has been considerable difficulty in resolving which one of the two, knowledge or awareness of innovation, or the development of a need to innovate, occurs earlier. The pressure exerted by an organisational situation beset with performance gaps emerging from the organisation’s external and internal factors would seem to provide further insight to resolve this issue (Zaltman et al., 1973).

Such performance gaps spur organisational decision makers to order a greater search for information and to seek out alternative solutions to enhance their perception and awareness of the potential of the innovation to address their deficiencies. Once the necessary awareness has been generated and there is some motivation for change, the formation of appropriate attitudes by organisational members toward the innovation assumes significant importance. If and when favourable attitudes are generated, efficient and effective communication mechanisms, such as environmental scanning, strategic planning, and control systems, are necessary for an organisation to gather and process information for making the adoption decision. The implementation phase, on the other hand, is one where the efforts are made to develop or acquire the innovation, implement it and manage the consequential organisational changes. Unfortunately, much of the research done has been narrowly focused on disparate aspects of the issues; innovation-diffusion researchers have concentrated on the acquisition phase and the research studies into planned change have emphasised the issues involved in managing the change process (Zaltman et al., 1973).

Rogers (1983) proposed another two-stage model of innovation adoption and implementation in organisations. In his model, initiation includes agenda-setting and matching activities, including all of the information gathering, conceptualising, and planning for the adoption of an innovation, leading up to the decision to adopt. The second stage, implementation, includes all of the events, actions, and decisions involved in putting an innovation into use. Implementation consists of three stages: redefining or restructuring, clarifying, and routinizing. Other models describe innovation processes in a similar way. For example Kwon and Zmud's Information System Implementation Model (1987) moves from initiation, providing scanning of organisational problems and opportunities where IT could provide a possible solution, through to incorporation of the innovation.

Another, closely similar, view of organisational innovation is that of a three-stage process: initiation, adoption, and implementation (Pierce & Delbecq, 1977; Thompson, 1965). At the initiation stage, pressures to change can evolve from need-pull, technology-push or other competitive forces. However, in each case attempts are made to achieve proper balance between needs and appropriate technologies through idea and information exchanges. The adoption stage represents a decision to invest the needed resources in order to accommodate the effort needed for change. The implementation stage denotes the expenditure of the resources to develop or acquire, install and maintain the technological innovations, and promote behaviours that would help to achieve the expected benefits from such large-scale investments.

Some models consider the routinization phase as an integral part of the implementation stage (Pierce & Delbecq, 1977; Roger, 1983, 1995), while others regard it as the next stage after the implementation stage (Huff & Munro, 1985; Fullan, 2001). When it is regarded as a separate stage, routinization, also called institutionalisation, denotes activities that bring the innovation become part of the normal life and activities of the organization. In this study, the first approach is used for the hypotheses generation.

With the increasing investment in computers and computer-based information systems and the potential risks associated with them, the follow-up evaluation of these systems is becoming an important issue in management and control of IT (Kumar, 1990; Panizzolo, 1998). This post-implementation evaluation stage is an important one within the process of introducing these technologies, not only because it allows the effective costs and benefits that derive from the investment to be evaluated, but also because it offers a series of suggestions that could be useful for future projects (Panizzolo, 1998).

In this study, the three-stage process approach is adapted. In addition to the three stages, namely initiation, adoption and implementation, a fourth stage, post-implementation evaluation stage, is added based on Panizollo's (1998) model. Although 'post-implementation evaluation phase' is a more appropriate label for this fourth stage, for the sake of simplicity, the term 'evaluation phase' will be used for the rest of the book.

From a comparison of the findings of previous research into the innovation process, a four-phase conceptual model of the process of adoption and implementation of innovation is proposed for this study, namely the initiation phase, adoption phase, implementation phase, and evaluation phase. Table 4.1 shows the many different terms that have been used by various authors in their conceptualisation of the different stages in the innovation process and how they relate to the four-phase model proposed in this study.

Table 4.1 Comparison of stages in the innovation process in organisations

Proposed Stages	**Rogers (1962)**	**Thompson (1965)**	**Hage & Aiken (1970)**	**Rogers & Shoemaker (1971)**	**Zaltman et al. (1973)**	**Rogers (1983)**	**Huff & Munro (1985)**	**Cooper & Zmud (1990)**	**Panizzolo (1998)**
Initiation	Awareness Interest Evaluation Trial	Initiation	Evaluation Initiation	Stimulation Initiation Legitimiza-tion	Awareness Attitude	Agenda setting Matching	Awareness Interest Evaluation Trial	Initiation	Adoption (include justification)
Adoption	Adoption	Adoption		Adoption	Decision	Redefining Clarifying Routinizing		Adoption	
Implemen-tation		Implemen-tation	Implemen-tation Routinization	Implemen-tation	Initial Implementa-tion Continued/ sustained Implemen-tation		Implemen-tation Diffusion	Adaptation Acceptance Routinization Infusion	Implementa-tion
Evaluation									Evaluation

Initiation

A successful initiation phase is represented by the identification of the pressure emerging from various internal and external sources, the recognition of a need for strategic change as well as a sense of urgency and felt responsibility on the part of key decision makers to change, in this case by adopting the new technology. When managers are not satisfied with their unit's performance they perceive a need for change (Anderson & Paine, 1975). The antecedent to sensing such a need is rendered possible by the recognition of a performance gap in the efficiency or in the effectiveness of organisational performance (Zaltman et al., 1973), or changes emerging from other internal and external developments. Although the innovation research field has sought to distinguish between 'need-pull' (a need or change usually triggered by a performance gap) and 'technology-push' (emergence of a new technology that promises to enhance organisational performance), successful innovations are most often believed to occur when both the need and means to resolve a particular problem simultaneously emerge (Zmud, 1984).

Quite often, there are also other competitive and social pressures to adopt a new innovation. Therefore three factors are used in this study, namely (a) need-pull, (b) technology-push, and (c) social pressures.

Adoption

The adoption phase starts when an organisation or organisational unit decides to incorporate IT and ends with the acquisition of the technology (Budic & Godschalk, 1996). Danziger and Dutton (1977) developed a technological innovation scale with regard to the utilisation of EDP in local government. Three components, which are relevant to the level of IT adoption in organisations, are adapted for use in this study. The three components are: (a) the speed of adoption (number of years IT has been utilised by the local government agencies); (b) the level of commitment (total expenditure on the complete computing installation as a percentage of total local expenditure of each local government agency); and (c) the extensiveness (the number of computer applications that are indicated to be operational). The component, per capita investment in IT, can not be considered at the organisation level as it is a concern at the district level. Therefore, this component is not included in this study. The other component, the sophistication (the number of different types of information processing tasks supported by the use of IT), is regarded to be more appropriate to measure the level of IT utilisation in this context.

Implementation

The success of an IT implementation is a multi-dimensional concept, composed of objective and perceptual dimensions. Two dimensions of utilisation and satisfaction are usually considered as major components of this phase. IT utilisation and user satisfaction are considered to be two major factors that reflect the success of an IT implementation (Kim, Suh, & Lee, 1998).

IT utilisation has been noted as an indicator of computer acceptance by a number of studies (Baroudi, Olson, & Ives, 1986; Gelderman, 1998; Mahmood, 1995; Mahmood, Hall, & Swanberg., 2001; Taylor & Todd, 1995a; Taylor & Todd, 1995b; Thompson, Higgins, & Howell, 1991). Most have argued that IT utilisation is one of the primary variables that affect an individual's performance. IT utilisation is frequently used as a surrogate for evaluating IT success and has occupied a central role in IT implementation research.

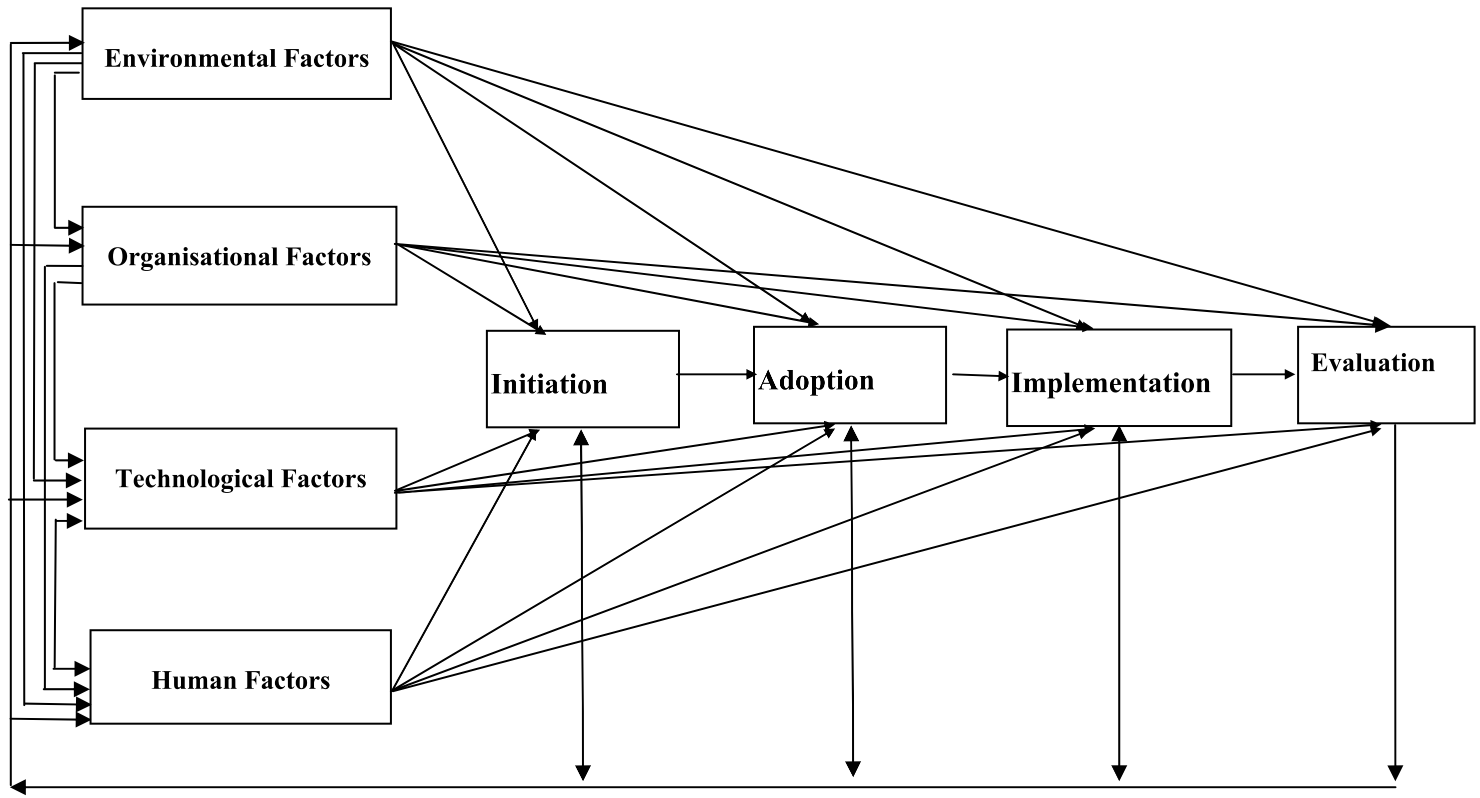

Figure 4.1 Hypothesised Conceptual Model for Investigating Factors and Relationships

User satisfaction reflects the interaction of IT with users. User satisfaction is frequently employed to evaluate IT success. A number of researchers have found that user satisfaction with the organisation's computer information systems has a strong bearing on IT utilisation by employees or that there is a significant relationship between user satisfaction and information technology usage (Al-Gahtani & King, 1999; Baroudi et al., 1986; Cheney, 1982; Doll & Torkzadeh, 1991; Etezadi-Amoli & Farhoomand, 1996; Gelderman, 1998; Khalil & Elkordy, 1999; Kim et al., 1998)

Evaluation

IT utilisation and user attitude towards IT have an impact on performance (Dishaw & Strong, 1999; Goodhue & Thompson, 1995; Kim et al., 1998; Woodroof & Kasper, 1998). Because the impacts of IT on organisations are so pervasive, it is useful to define the domain of IT impacts as a focus of this study. There are the impacts of IT on collectivities, such as the work group, the department, the organisation, or even the society, as well as the impacts on individuals. This study plans to focus on the impacts of IT utilisation and user satisfaction on user performance in term of efficiency, effectiveness, and appropriateness (Kahen, 1995; Sharp, 1996, 1998).

An initial hypothesised conceptual model proposed to be examined is shown in Figure 4.1. In this model, the adoption and implementation of information technology is viewed as a four-phase process which involves an initiation phase, an adoption phase, an implementation phase and an evaluation phase. The research model hypothesises that a number of the variables in an organisation's external and internal environments, together with attributes of the innovation, influence the formation of pressures at the initiation phase. These variables might affect the adoption phase, implementation phase, and evaluation phase both directly or through the previous phase as a mediator.

Previous findings suggest that the success of the implementation phase is a multi-dimensional concept, composed of objective and perceptual dimensions (Kim et al., 1998). Among others, the two dimensions of utilisation and satisfaction constitute this phase and they are considered to be two major factors that reflect the success of an IT implementation (Kim et al., 1998). Therefore these two dimensions are used to represent the implementation phase.

At the evaluation phase, there are impacts of IT implementation on collectivities, such as the work group, the department, the organisation, or even the society, as well as the impacts of IT utilisation on individuals who use the technology directly and indirectly. This study only evaluates the impact of IT utilisation on individuals in terms of the perceived impacts of IT on user performance.

Predictors of Innovation Adoption and Diffusion

Research findings on adoption and diffusion of new technology indicate various sets of variables that affect the successful implementation of IT. Researchers have defined these variables in various ways and have grouped them differently. Various research studies that involve investigating factors which influence each phase of the adoption and implementation of technological innovation processes are presented in Table 4.2. Nevertheless, all of these approaches and investigations in one form or another consider the environmental, human, organisational, and technological factors to be the potential factors that affect the successful adoption and implementation of IT. Each of these four classes of factors warrants further and more detailed consideration.

Table 4.2 Previous Studies on the Adoption of Technological Innovation

Factors	References
Environment	Baldridge & Burnham, 1975; R.D Bingham, 1976; Bingham, Freeman, & Felbinger, 1984; Danziger & Dutton, 1977; Dasgupta, Agarwal, Ioannidis, & Gopalakrishnan, 1999; Lu & Farrell, 1990
Organisation	Baldridge & Burnham, 1975; Bingham et al., 1984; Cheney, 1982; Cheney, Mann, & Amoroso, 1986; Dasgupta et al., 1999; Ein-Dor & Segev, 1982; Hackney & McBride, 1995; Hage & Aiken, 1967; Iacovou, Benbasat, & Dexter, 1995; Kakabadse & Kouzmin, 1996; Lai & Guynes, 1997; Mahmood et al., 2001; Mitropoulos & Tatum, 2000; Moch & Morse, 1977; Mohr, 1969; Mutschler & Hoefer, 1990; Perry & Danziger, 1980; Raymond, 1985; Sanders & Courtney, 1985; Ventura, 1995; Zaltman et al., 1973
Technology	Al-Gahtani & King, 1999; Carey, 1988; Gopalakrishnan & Damanpour, 1994; Huff, 1991; Karahanna, Straub, & Chervany, 1999; Margetts & Willcocks, 1993; Perry & Kraemer, 1978; Teng, Grover, & Guttler, 2002; Tornatzky & Klein, 1982
Human	Baldridge & Burnham, 1975; Budic & Godschalk, 1996; Carey, 1988; Hanna, 1991; Mutschler & Hoefer, 1990; Peterson & Peterson, 1988; Warner, 1974; Willcocks, 1994
Initiation	Chengalur-Smith & Duchessi, 1999; Gibson & Nolan, 1974
IT adoption	Agarwal & Prasad, 1998; Bagozzi, Davis, & Warshaw, 1992; Bingham, 1976; Bingham et al., 1984; Brudney & Selden, 1995; Budic & Godschalk, 1996; Chengalur-Smith & Duchessi, 1999; Compeau & Higgins, 1995; Danziger & Dutton, 1977; Dasgupta et al., 1999; Downs & Mohr, 1979; Ettlie & Vellenga, 1979; Fichman & Kemerer, 1997; Gopalakrishnan & Damanpour, 1994; Hage & Aiken, 1967; Huff, 1991; Huff & Munro, 1985; Iacovou et al., 1995; Kimberley & Evanisko, 1981; Lai & Guynes, 1997; Mascarenhas, 1991; Masser, Campbell, & Craglia, 1996; Mitropoulos & Tatum, 2000; Moch & Morse, 1977; Mohr, 1969; Nabih, Bloem, & Poiesz, 1997; Panizzolo, 1998; Perry & Kraemer, 1978; Sandee & Rietveld, 2001; Taylor & Williams, 1991; Teng et al., 2002; Tornatzky & Klein, 1982; Tye & Chau, 1995
IT usage	Adams, Nelson, & Todd, 1992; Al-Gahtani & King, 1999; Bagozzi et al., 1992; Baroudi et al., 1986; Carey, 1988; Donnelly, Dalrymple, & Hollingsworth, 1994; Gelderman, 1998; Harrison & R. Kelly Rainer, 1996; Ives & Olson, 1984; Karahanna et al., 1999; Khalil & Elkordy, 1999; Kim et al., 1998; Mahmood, 1995; Mahmood et al., 2001; Pinsonneault & Rivard, 1998; Robey, 1979; Sanwal, 1991; Schewe, 1976; Taylor & Todd, 1995a; Taylor & Todd, 1995b; Thow-Yick, 1993; Torkzadeh & Doll., 1999
User satisfaction	Al-Gahtani & King, 1999; Baroudi et al., 1986; Baurodi, 1985; Cheney, 1982; Doll & Torkzadeh, 1988, 1991; Doll, Xia, & Torkzadeh, 1994; Etezadi-Amoli & Farhoomand, 1996; Gelderman, 1998; Hage & Aiken, 1967; Harrison & Rainer, 1996; Ives, Olson, & Baroudi, 1983; Jagodzinki & Clarke, 1988; Khalil & Elkordy, 1999; Kim et al., 1998; Lawrence & Low, 1993; Mahmood, 1995; McKeen, Guimaraes, & Wetherbe, 1994; Palvia, 1996; Palvia & Palvia, 1999; Ryker, Nath, & Henson, 1997; Sengupta & Zviran, 1997; Torkzadeh & Doll., 1999; Woodroof & Kasper, 1998; Yoon, Guimaraes, & O'Neal, 1995
Perceived user performance	Dasgupta et al., 1999; Dishaw & Strong, 1999; Etezadi-Amoli & Farhoomand, 1996; Gelderman, 1998; Goodhue & Thompson, 1995; Harrison & Rainer, 1996; Jagodzinki & Clarke, 1988; Kim et al., 1998; Mahmood et al., 2001; Taylor & Todd, 1995a

Environmental Factors

There are two classes of environmental factors that might influence innovation adoption: community environment and organisational environment (Bingham, 1976; Danziger & Dutton, 1977; Ventura, 1995). Within the community environment there appear to be demographic variables (Bingham, 1976; Danziger & Dutton, 1977). The importance of demographic, local demographic and socio-economic, variables as bases of government's policy output have been repeatedly stressed by economists and political scientists over the past quarter of a century (R.D Bingham, 1976).

With respect to the organisational environment for local government, the three factors that have been considered are: organisational resources (Bingham, 1976; Danziger & Dutton, 1977), intergovernmental relations (Bingham, 1976; Danziger & Dutton, 1977; Ventura, 1995), and the private sector influence (Bingham, 1976; Danziger, 1977).

The intergovernmental influence of one level of government on another has played an important role in adoption relations (Bingham, 1976; Danziger & Dutton, 1977; Ventura, 1995). In the case of Bali, Indonesia, the central government support and support is one of the major factors in adopting new technology. With regard to the private sector influence, Bingham (1976) and Danziger (1977) document the importance of vendor activity in the adoption of new technology. Consequently, in this study the private sector influence is tapped by the vendor support.

Organisational Factors.

The increasing importance of emerging information technologies has prompted researchers to examine the nature of innovation adoption within organizations. However, the nature of organizational influences in the innovation adoption process is still not well understood. Organisational environment or context and organisational structure are two groups of factors that may influence the successful implementation of IT. In this study, the first group of factors, the organisational environment is treated as a part of environment factors which has been described earlier. The second group of factors is discussed in the paragraphs which follows.

The major dimensions studied under this category have been centralisation, formalisation, complexity, and organisational size. Lai and Guynes (1997, p. 148) have defined centralisation to be "the degree to which power and control are concentrated in the hands of relatively few individuals". There have been mixed views about the effects of centralisation; higher degrees of this dimension have negative effects on innovation adoption due to severe constraints on autonomy and authority (Lai & Guynes, 1997), whereas positive effects have also been observed because, under such circumstances, it may be easier to impose the adoption and implementation of innovations (Rogers & Shoemaker, 1971; Zaltman et al., 1973). However, some studies (Moch & Morse, 1977; Grover & Goslar, 1993 cited in Lai and Guynes 1997) have suggested that a centralised organisation can be expected to interact negatively with the decision to adopt those innovations that are more compatible with the interests of lower-level personnel.

Formalisation and complexity are two attributes of organisations believed to account for significant differences in the adoption of technologies. Formalisation is the degree to which an organisation emphasises rules and procedures in the role of performance of its members (Lai & Guynes, 1997). It is believed that formalisation has a negative effect on the adoption of innovations (R.D Bingham, 1976; Lai & Guynes, 1997).

When studying the adoption of IT, it is important to know the complexity of the organisation involved. Organisational complexity has been typically measured in terms of vertical complexity and lateral complexity (Baldridge & Burnham, 1975). Vertical complexity refers to the number of management levels in the hierarchy of authority. Lateral complexity refers to the number of departments that exist in the organisation. Organisational complexity also implies employees' range of knowledge, expertise, experience, and professionalism in IT (Lai & Guynes, 1997). The greater the complexity of the organisation the greater the possibility of adopting IT (Lai & Guynes, 1997).

Organisational size has been researched extensively in many studies. It is argued that size may have a positive effect on IT adoption (DeLone, 1981; Lai & Guynes, 1997), possibly because of the greater resource capacity and greater ability to capitalise on the need for economies of scale (Moch & Morse, 1977) and negative effects, perhaps due to organisational inertia (Utterback, 1974).

Technological Factors and Attributes of the Innovation

Despite the importance of this domain, particularly for technological innovations, past research has been plagued by a number of conceptual and methodological problems, as articulated by Tonatzky and Klein (1982). Over 25 attributes (e.g. compatibility, complexity, costs, risk, trialability, relative advantage, profitability, etc.) have been studied. Glaser, Abelson, and Garrison (1983 cited in Kiresuk, 1993) summarised the characteristics of the innovation with the acronym CORRECT, standing for Credibility, Observability, Relevance, Relative Advantages, Ease of understanding and installation, Compatibility, and Trialability. Rogers' summary of research in a variety of disciplines states the five most important attributes of innovations as: (a) relative advantage, (b) compatibility with existing operational practices and values, (c) complexity, (d) trialability, and (e) observability (Rogers, 1983).

Relative advantage, as the phrase implies, depicts the degree to which an innovation is perceived as being better than the existing *status quo* situation it supersedes or superior to other competing alternatives, and the extent to which it can provide more benefits (Rogers, 1983). This attribute has been evaluated from several perspectives such as profitability, productivity, time saved, and hazards removed (Tornatzky & Klein, 1982).

Compatibility refers to the degree of fit that the innovation has with the adopting organisational unit and has been conceptualised to encompass two aspects: (a) fit or match with current technical and operational practices, and (b) fit with or conformance to the prevailing beliefs, attitudes, needs of receivers and value system (culture) (Rogers & Shoemaker, 1971). A greater degree of compatibility on both dimensions has generally been observed to generate more favourable adoption attitudes and behaviour (Ettlie & Vellenga, 1979). However, some negative findings have also been noted (Fliegel & Kivlin, 1966).

The complexity of an innovation is "the degree to which an innovation is perceived as relatively difficult to understand and use" (Tornatzky & Klein, 1982, p. 35). Most past research has demonstrated a negative effect of complexity on adoption and implementation of innovation. A greater degree of complexity has generally been observed to generate less favourable adoption attitudes and behaviour (Fliegel & Kivlin, 1966; Tornatzky & Klein, 1982).

Trialability is "the degree to which an innovation may be experimented with on a limited basis" (Tornatzky & Klein, 1982, p. 38). Theoretically, innovation that can be tried on the instalment plan will be adopted and implemented more often and more quickly than less trialable innovations.

Observability is the "degree to which the results of an innovation are visible to others" (Tornatzky & Klein, 1982, p. 38). It seems that the more visible the results of an innovation, the more likely the innovation is quickly adopted and implemented.

Human Factors

Rogers (1983) classified individual adopters into five categories regarding their innovativeness: (a) innovators, (b) early adopters, (c) early majority, (d) late majority, and (e) laggards. He claimed that temporal distribution of adopters of a given innovation follows a bell-shaped curve and approaches normality. These five categories are characterised by three sets of variables namely: (a) socio-economic status, (b) personality variables, and (c) communication behaviour.

Finally, the major dimensions that are considered as human factors have been age, education, communication channel, attitude toward change, and computer-related anxiety of the administrators and other organisational personnel who may potentially be direct or indirect users of the innovation. Any innovation affects various subgroups differently. Studies of the diffusion of innovations have found that early adopters of innovations are younger individuals with higher socio-economic status, higher levels of intelligence and rationality, more open to change, more knowledgeable about innovation, and with intensive communication patterns (Rogers, 1983). It seems that education generates a better receptivity to change, and the extent that the innovation meets the needs of the users can have a positive effect on initiation and adoption behaviour.

Relationships and interactions among people within an organisation represent yet another relevant factor affecting implementation of information technology. Relationships between staff members with different positions within organisations, especially between users and experts, are equally important as the relationships between personalities in general (Campbell, 1990).

The reasons for ignoring, resisting or even sabotaging new technology must also be considered. These can be considered as the inhibitor factors for the adoption of innovation. Resistance to change is a widely recognised phenomenon (Leonard-Barton & Kraus, 1985; Robey, 1979; Rogers, 1983; Zaltman et al., 1973). At the individual level, the most important attitudinal factors are fear of change (Mohr, 1969; Peterson & Peterson, 1988) and the feeling of anxiety (Anderson, 1996; Peterson & Peterson, 1988).

Fear of change is expressed through an individual's concern about safety, security or self-esteem. IT is manifested primarily through worrying about loss of skill or possible replacement by more efficient equipment. Loss of power and absence of an obvious personal benefit may also be a sufficient ground for rejection. The modified version of Kirton Adaption-Innovation (KAI) Inventory (Monavvarian, 1998) is adapted in this study to measure user attitudes toward change. The Kirton Adaption-Innovation (KAI) Inventory has been examined in different countries. The results lend support to the view that the KAI is a valid measure of A-I cognitive style which is largely independent of national culture (Monavvarian, 1998; Tullett & Kirton, 1995). The second attitudinal factor of anxiety is a natural feeling of uneasiness when exploring and facing unfamiliar terrain.

By adding various identified potential variables to the model, the hypothesised conceptual model in Figure 4.1 is modified accordingly, as shown in Figure 4.2. Rather than mentioning the specific hypotheses upon which the model is based one by one, the diagram is displayed, as shown in Figure 4.2, in which each hypothesis is explicitly indicated. Each path in the model, with its arrowhead indicating direction, can be viewed as a hypothesised effect that needs to be tested.

However, given the constraints on time and other resources, this study does not seek to examine all possible links. For the sake of clarity, the research models and a set of propositions are further discussed in Chapter Five.

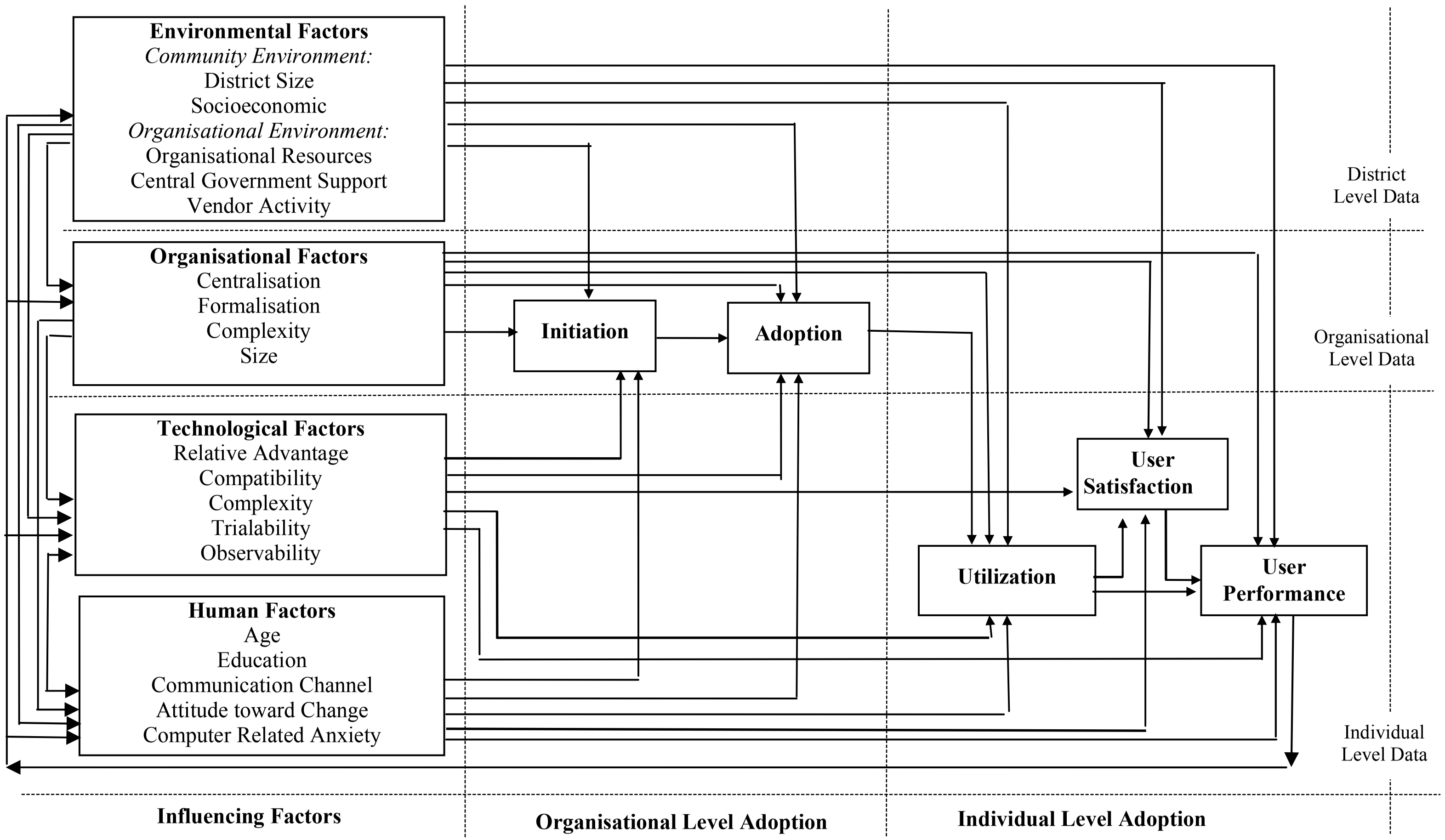

Figure 4.2 Modified Hypothesised Conceptual Model

Summary

This chapter has discussed the history of the idea of innovation adoption and diffusion, as well as some theoretical roots of the concepts. From various findings focused on IT adoption in developed countries, a conceptual model for IT adoption and implementation is advanced. In this model, four groups of factors may affect IT adoption and implementation processes, namely environmental factors, organisational factors, technological factors, and human factors. The IT adoption and implementation is viewed as a four-phase process which includes the initiation phase, the adoption phase, the implementation phase, and the evaluation phase. The four groups of factors influence the formation of pressures at the initiation phase.

These factors also affect the adoption phase, implementation phase, and evaluation phase both directly or through the previous phase as a mediator.

In this study, two dimensions of utilisation and satisfaction constitute the implementation phase. Furthermore, at the evaluation phase, this study only evaluates the impact of IT utilisation on individuals in term of the perceived impacts of IT on user performance.

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The previous two chapters discuss IT development and its implication for developing countries and the IT environment in Bali, in particular, and in Indonesia in general. These chapters consider the local conditions that may also affect the IT adoption and implementation processes. Consequently, the research model proposed in this chapter is modified further to accommodate these local constraints. The final research models are discussed in Chapter Five.

5

Research Models and Measurements

Research Models

The conceptual models adapted for this study are discussed in Chapter Four. Previous studies in the field found that a variety of factors, which range from technological and institutional to personal, social and economic factors, may influence the process of adopting and implementing IT in organisations. Past research in innovation highlights the importance of human factors, organisational factors, technological factors, and the environmental factors for successful adoption and implementation of an innovation (Tornatzky & Klein, 1982; Zaltman, Duncan, & Holbek, 1973).

The four phase conceptual model of the IT adoption and implementation process was formulated for this study[5] by comparing various stages of the innovation adoption process proposed by previous authors (Hage & Aiken, 1967; Huff & Munro, 1985; Panizzolo, 1998; Rogers, 1983; Rogers & Shoemaker, 1971; Zaltman et al., 1973). This four-phase adoption process consists of an initiation phase, an adoption phase, an implementation phase, and an evaluation phase. At least four types of factors (environmental, organisational, technological, and human factors) are believed to affect each phase of the IT adoption process directly or through the previous phases as mediators.

With the constraints of time and other resources, this research study does not seek to evaluate all aspects that are affected by the adoption and implementation of this technology. This study focuses on the perceived impact of IT utilisation on individuals who work in governmental agencies in terms of efficiency, effectiveness, and appropriateness. However, the data collected at the individual level can be aggregated to the organisational level and effects at this higher level can be examined, in so far as the effects arise from the individual level.

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[5] For further details, see Chapter Four.

This study also does not try to examine all possible links. With one cross-sectional study, it is not possible to examine the feedback loops. However, by using a retrospective technique it is possible, to some degree, to gather respondents' perceptions of some variables especially respondents' perceptions of organisational structure, respondents' perceptions of the attributes of IT, and respondents' attitudes toward IT before the IT implementation, as well as their perceptions and attitudes after the IT implementation. It is acknowledged that this technique is not free from bias, however, it can be used as a ground for considering IT adoption as an ongoing process which is subject to further research.

In addition, there were two groups of employees involved in this study. The first group was a group of employees who were involved in the initiation stage. They identified themselves as having taken part in identifying the pressure emerging from various internal and external sources, and recognising the sense of urgency for a strategic change, which in turn, led to a decision being made by an organisation or organisational unit to incorporate IT into its activities. In most cases, they were mid- and upper-level staff members. The second group, on the other hand, was a group of employees who identified themselves as not having been involved directly in the initiation stage. They were usually low-level staff members. It is believed that the level of involvement at the initiation stage and job responsibilities have significant effects on the IT adoption and implementation processes (Lai & Guynes, 1997). Therefore, it is interesting to examine the similarity and differences between the two groups. Consequently, two separate models are examined to accommodate the absence of the initiation phase in the second group. For the purpose of this study the first group is called 'the initiators' and the second group is called 'the non-initiators'.

Two research models (derived from the hypothesised conceptual and research models in Chapter Four) proposed for examination are shown in Figure 5.1 and Figure 5.2 for the initiators and non-initiators respectively. The main difference between the two models is that for the non-initiators model, there is no initiation phase. The research model for initiators proposes that a number of variables in an organisation's external and internal environments, and attributes of the innovation, as well as individual characteristics influence the initiation phase. These variables are also proposed to affect the adoption phase, the implementation phase and the evaluation phase both directly and indirectly through the previous phases as mediators in both models.

The success of IT implementation is a multi-dimensional concept, composed of objective and perceptual dimensions. The two dimensions of utilisation and satisfaction constitute this phase and they are considered to be two major factors that affect the success of IT implementation (Kim, Suh, & Lee, 1998). Technology utilisation and user attitudes toward technology have an impact on user performance (Goodhue & Thompson, 1995; Woodroof & Kasper, 1998).

In these two models, there is no feedback loop. It has been discussed earlier that with one cross-sectional study, it is not possible to examine the feedback loops. In addition, there are also some limitations in the techniques available in examining a model with many non-recursive paths. Therefore, these two models are simplified into recursive models. However, by using the responses on some variables, especially respondents' perceptions of organisational structure, respondents' perceptions of the attributes of IT, and respondents' attitudes toward IT before the IT implementation, as well as their perceptions and attitudes after the IT implementation, a conceptual change model is proposed in addition to the two research models mentioned earlier as shown in Figure 5.3 to accommodate the possible feedback loops. This model is further discussed in Chapter Twelve.

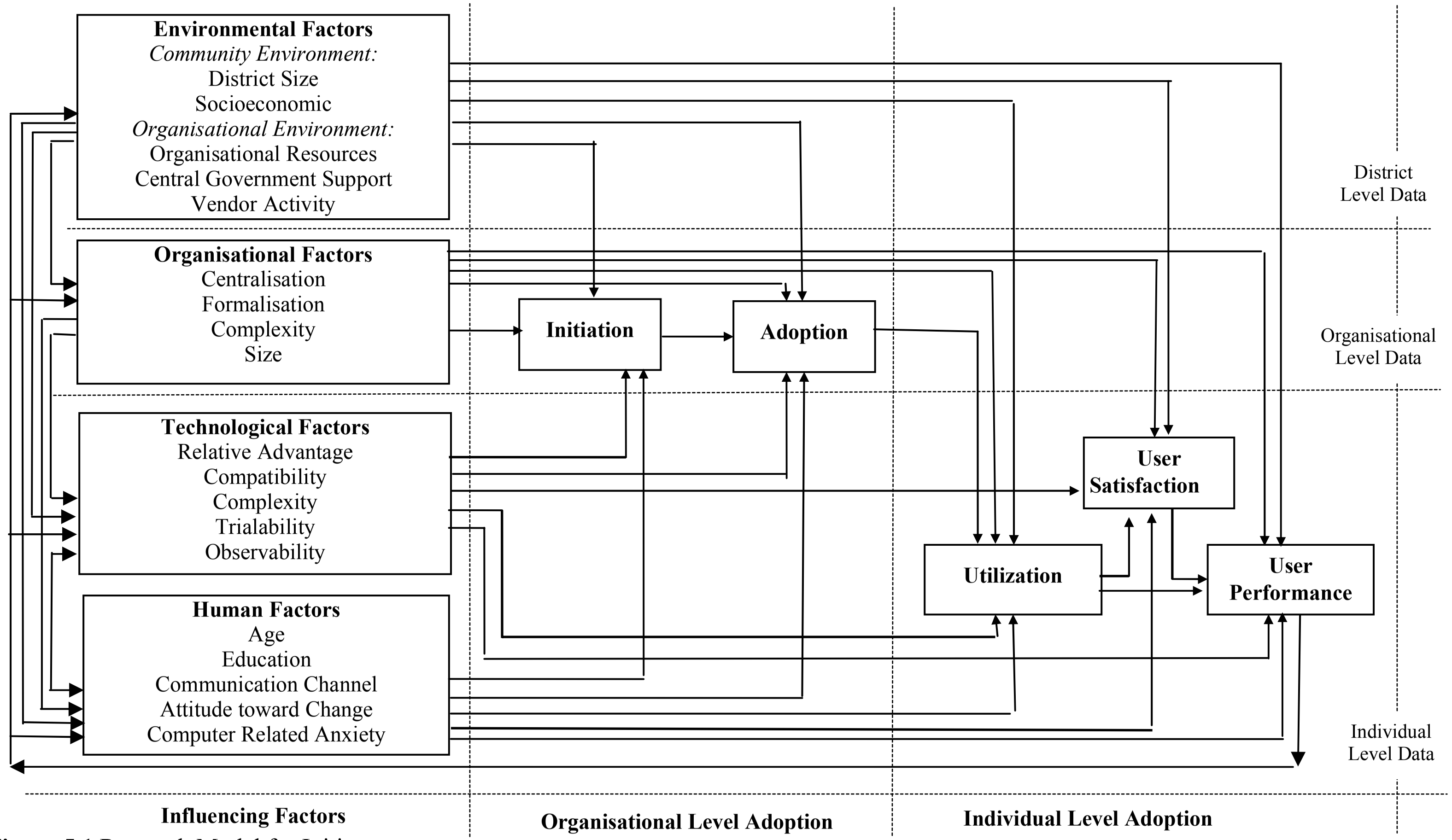

Figure 5.1 Research Model for Initiators

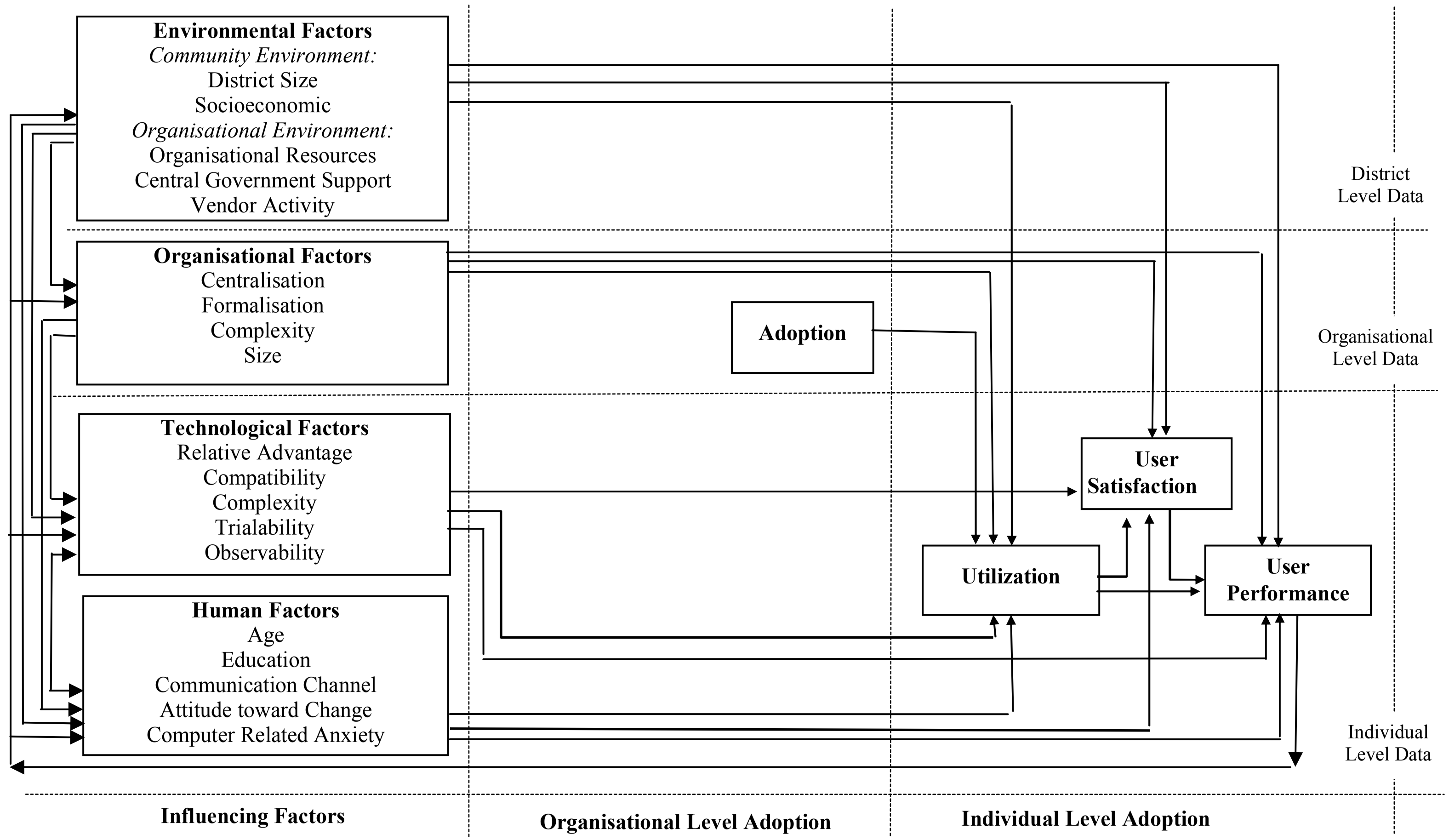

Figure 5.2 Research Model for Non-Initiators

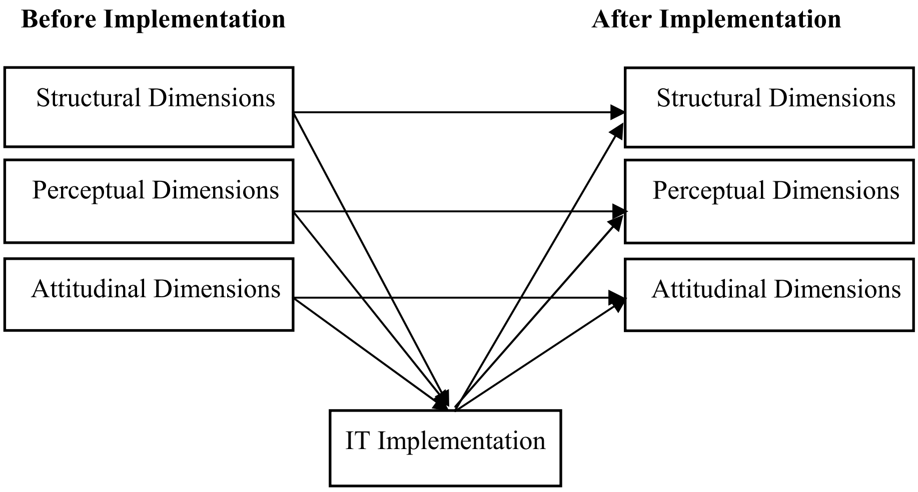

Figure 5.3 Conceptual Model of the Effects of IT Implementation

Operationalisation and Measurement

Measurement issues are critical to any quantitative research study. Multiple items argued to represent the constructs for the present research need to be identified and evaluated for validity and reliability. These issues are also elaborated in Appendix VI with regard to data analysis methods. Primary and secondary data are used to answer the main research questions stated above. A longitudinal study obtaining multiple responses over a sufficiently long period of time could have provided a study that would have yielded stronger findings. However, because of the limitations in time and other resources, only a cross-sectional study was possible.

Environmental Factors

In the literature review section, it is argued briefly that there are at least two classes of environmental factors that might influence innovation adoption and implementation, namely: community environment and organisational environment (Bingham, 1976; Danziger & Dutton, 1977; Ventura, 1995). A number of researchers have developed instruments to measure these factors (Bingham, 1976; Brudney & Selden, 1995; Danziger & Dutton, 1977). Some of them were adapted for this study.

Community Environment Variables

Community environment variables are thought to represent characteristics of the information processing environment which relate to the need for or limits on an organisation's adoption and implementation of the innovation, given the current functional capabilities of the particular innovation. The functional need for IT in local government might relate directly to the size of the information processing environment. The size of the community is tapped by two indicators. They are:

a) population (Bingham, 1976; Brudney & Selden, 1995; Danziger & Dutton, 1977), and

b) land area (Bingham, 1976; Danziger & Dutton, 1977).

Socio-economic status might also facilitate the adoption of IT. With respect to the community support, research shows that higher status socio-economic groups express greater support for the use of modern information technology (Bingham, 1976; Danziger & Dutton, 1977). The socio-economic status of the community is measured by:

a) per capita income (Bingham, 1976),

b) the number of phone lines, and

c) the amount of local and long distance calls.

Organisational Environment Variables

Various works suggest that the organisational environment of local government agencies consist of at least three areas: (a) the availability of organisational resources (Bingham, 1976; Danziger & Dutton, 1977), (b) intergovernmental relations (Bingham, 1976; Danziger & Dutton, 1977; Ventura, 1995), and (c) the private sector influence (Bingham, 1976).

Selected indicators of the district's financial resources are used to measure the availability of organisational resources and the inter-organisational relationships. For the private sector influences, vendor support (Bingham, 1976; Danziger, 1977; Perry & Danziger, 1980) is captured by the number of IT related services and offices (such as hardware and software suppliers, computer service related offices, and computer training institutions) at the district level.

The measurements that are used in this study are listed below.

1. Organisational resources:
   - (a) total district's revenues (Bingham, 1976),
   - (b) district's per capita general revenue (Bingham, 1976), and
   - (c) district's per capita IT budget (Danziger & Kraemer, 1986).
2. Central/Provincial Government support:
   - (a) provincial government financial support, and
   - (b) central government financial support (Bingham, 1976; Danziger & Dutton, 1977).
3. Vendor support:
   - (a) the number of hardware and software suppliers (Perry & Danziger, 1980),
   - (b) the number of service related offices (Perry & Danziger, 1980), and
   - (c) the number of training institutions.

All of the environmental data were obtained from various secondary sources.

Organisational Factors

It has been argued in previous studies that organisational attributes (size and structural characteristics) play an important role in the adoption of IT in an organisation. Four widely studied dimensions under this category have been organisational size, centralisation, formalisation, and complexity (DeLone, 1981; Lai & Guynes, 1997; Moch & Morse, 1977; Raymond, 1985). With regard to the Indonesian governmental agencies, another dimension, type of agency, is introduced.

Size

Organisational size has been reported to be one of the organisational factors that affects the IT adoption and implementation in an organisation. It is argued that size may have a positive effect on IT adoption (DeLone, 1981; Lai & Guynes, 1997), possibly because of the greater resource capacity and greater ability to capitalise on the need for economies of scale (Moch & Morse, 1977). In order to measure the organisational size, two items that had been developed by Mutschler and Hoefer (1990) are used. The two measurements are:

a) the number of employees in the agency, and

b) the amount of the total budget of the agency.

Centralisation

Centralisation is the degree to which authority is concentrated in an organisation (Hage & Aiken, 1967; Lai & Guynes, 1997; Miller, 1991). Power is an important component in every organisation. The distribution of authority has major consequences for the performance of organisation and the behaviour of the members (Miller, 1991).

An important consideration in dealing with authority is the manner in which it is distributed (Miller, 1991). The maximum degree of centralisation exists if all authority is exercised by a single individual; the minimum degree of centralisation exists if all authority is exercised equally by all members of the organisation. Most organisations fall between these two extremes.

This study uses four items to capture the locus of decision-making responsibility for:

a) decision relating to new service introduction,

b) capital budgeting,

c) major changes to operational processes, and

d) the hiring, firing, promoting, and rotating of employees.

Formalisation

Formalisation involves the use of rules in an organisation (Miller, 1991). Some organisations describe in detail the specific authority, responsibilities, duties, and procedures to be followed in every job and then supervise job occupants to ensure conformity to the job definitions. A penalty system may be spelled out in writing for impartial monitoring of discipline for infractions. Other organisations have loosely defined jobs and do not carefully control work behaviour. The three dimensions of formalisation may be specified as the extent of:

a) formal documentation of operating procedures,

b) adherence to documented procedures, and

c) tolerance for violation of these documented rules and procedures.

Organisational Complexity

Organisational complexity has been typically measured in terms of vertical complexity and lateral complexity. Vertical complexity refers to the number of management levels in the hierarchy of authority. Lateral complexity refers to the number of departments that exist in the organisation. The literature review revealed that organisational complexity has also been commonly taken to imply the employees' range of knowledge, expertise, and experience (Rogers, 1983) which could be measured by employees' experience and employees' skill level (Perry & Danziger, 1980). Consequently, four indicators for organisational complexity are used in this study. They are:

a) number of vertical management levels within the organisation,

b) number of distinctly different departments or functions in the organisation,

c) level of employees' experience in computing, and

d) level of employees' skill in computing.

Type

The legal basis for the current system of regional and local government in Indonesia is set out in *Law No 5 of 1974*. Building on earlier legislation, this law separates governmental agencies at the local level into two categories (Devas, 1997):

a) decentralised agencies (decentralisation of responsibilities to autonomous provincial and local governments), and

b) deconcentrated agencies (deconcentration of activities to regional offices of central ministries at local level).

In addition to these two types of governmental agencies, government owned enterprises also operate at the local level. These three types of government agencies have distinctly different functions and strategies. It is believed that these differences affect attitudes toward the adoption of innovation (Lai & Guynes, 1997).

Technological Factors and Attributes of the Innovation

Although there has been considerable activity in the domain of innovation attributes, as is evidenced in the review by Rogers and Shoemaker (1971) as well as the critique by Downs and Mohr (1976) about the relevance of this area as a body of research inquiry, past research has been plagued by a number of conceptual and methodological problems as articulated by Tonatzky and Klein (1982). Rogers' (1983) summary of research in a variety of disciplines indicates five most important attributes of innovations: (a) relative advantage, (b) compatibility with existing operational practices and values, (c) complexity, (d) trialability, and (e) observability.

Relative Advantage

The technology has to offer clear benefits to the organisational members in order to be adopted. IT has to have a comparative advantage over previous practices used. Some measurements of relative advantage have been developed by various researchers (Danziger & Kraemer, 1986; Downs & Mohr, 1976, 1979; Iacovou, Benbasat, & Dexter, 1995; Moore & Benbasat, 1991; Panizzolo, 1998; Rogers, 1983; Rogers & Shoemaker, 1971; Tornatzky & Klein, 1982). Danziger and Kraemer (1986) summarised the benefits that might be anticipated from the use of computing in an organisation. They classified the benefits into three categories: information benefits, efficiency benefits, and effectiveness in serving the public.

For the purpose of this study, the information benefits are measured by gathering the assessments of end users regarding the extent to which IT has improved four aspects of their information environment:

a) speed with which information can be obtained,

b) ease of access to information,

c) availability of new information, and

d) timeliness of the information.

The efficiency benefits are measured by assessing the extent to which IT has:

a) reduced departmental staff,

b) reduced the cost of departmental operations, and

c) enabled the department to increase its work volume without corresponding increases in cost.

Lastly, effectiveness is measured by including end user evaluation of whether IT has improved their department's effectiveness in serving the public.

Compatibility

IT is thought more likely to be used if compatible with organisational members' existing values and beliefs, need and previous experiences regarding computerised technology (Moore & Benbasat, 1991). Three dimensions of compatibility that are used in this study are: (a) personal values and belief compatibility, (b) work-style compatibility, and (c) previous experience compatibility.

Four items to measure work-style compatibility which were proposed by Moore and Benbasat (1991) are used. In addition, one item involving previous experience (Rogers, 1983) and four items involving values and beliefs (Budic & Godschalk, 1996) are proposed to capture the two other dimensions of compatibility. Items that are used are the extent of respondent's feeling that IT would:

a) change the world rapidly[6] (Budic & Godschalk, 1996),

b) create more jobs than it would eliminate (Budic & Godschalk, 1996),

c) isolate people by inhibiting normal social interaction among users (Budic & Godschalk, 1996),

d) have the potential to control our lives (Budic & Godschalk, 1996),

e) fit well with the way I like to work (Moore & Benbasat, 1991),

f) fit into my work style (Moore & Benbasat, 1991),

g) be compatible with all aspects of my work (Moore & Benbasat, 1991),

h) be completely compatible with my situation (Moore & Benbasat, 1991), and

i) be compatible with my previous experiences (Rogers, 1983).

[6]From the pre-test of the questionnaire questions, this item was dropped because of its unclear meaning

Complexity

It is clear that new technologies or even ideas that are simpler to understand are more readily and rapidly accepted than those that require the adopting organisation to develop new skills and understandings (Rogers, 1983). Complexity is associated with difficulty to understand and use the technology. Two items dealing with the difficulty experienced in understanding and using the technology are employed to operationalise technological complexity. Items that are used are the extent of respondent's feeling that IT would be:

a) very difficult to understand, and

b) very difficult to use.

Trialability

Innovation that can be tried on an instalment plan is expected to be adopted more quickly (Rogers & Shoemaker, 1971). Trialability is operationalised by using two items. The respondents were asked to what extent they agreed that IT would be able to be:

a) tried out in a smaller version, and

b) implemented module by module.

Observability

It is hypothesised that organisational members who have been exposed to IT are more likely to adopt it if given a choice in future. Observability is defined as the opportunity to try out or view the technology (Rogers & Shoemaker, 1971). Two items are used to operationalise observability. The respondents were asked whether they had the opportunity to:

a) try out the technology, and

b) attend any presentation or demonstration regarding the technology.

Human Factors

Human factors play an important role in IT adoption and implementation in an organisation. The major dimensions considered have been age, education, communication channel, attitude toward change, and computer-related anxiety (Anderson, 1996; Budic & Godschalk, 1996; Leonard-Barton, 1987; Peterson & Peterson, 1988; Rogers, 1983; Yoon, Guimaraes, & O'Neal, 1995).

Studies of the diffusion of innovations have found early initiators of innovations are younger individuals with higher socio-economic status, higher levels of intelligence and rationality, more open to change, more knowledgeable about innovation, and with intensive communication patterns (Rogers, 1983).

Obviously, there have to be strong reasons for accepting and starting to use IT. By the same token, the reasons for not using the technology are equally worth studying. These can be considered as the inhibitor factors for the adoption of innovation. At the individual level, the most important attitudinal factors are fear of change (Mohr, 1969; Peterson & Peterson, 1988) and the feeling of anxiety (Anderson, 1996; Peterson & Peterson, 1988).

Apart from gender, position, and work experience the following scales are used in this research to measure human factors.

Age, Education, and Communication channel

Items that are used to capture age, level of education, and communication channel are:

a) age,
b) highest qualification received,
c) training in computers, and
d) source of information regarding the technology which include:
e) formal contacts (e.g. workshop, seminar, or technical meeting),
f) informal contacts (e.g. friends), or
g) written material (e.g. brochure, magazine, newspaper, or journal).

Attitudes toward Change

The items that are used to measure user attitudes toward change are based on the Kirton Adaptor-Innovator inventory (Kirton, 1976). This Inventory originally consists of 32 questions, using a five-point scale, measuring individual creativity in terms of the form or style of creativity behaviour. A higher score indicates greater tendency to prefer innovation. In this study, a modified version is used.

Computer Related Anxiety

Computer related anxiety has been found to be a detrimental factor for engagement in using computerised technology. A feeling of apprehensiveness may result in rejection of the source of uneasiness. Anderson (1996) developed a ten-item measure of computer related anxiety. Five items out of the ten items are adopted for use in this study.

The items that are used to measure the computer related anxiety are as follows:

1. I feel apprehensive about using a computer terminal.
2. If given the opportunity to use a computer, I am afraid I might damage it in some way.
3. I have avoided computers because they are unfamiliar to me.
4. I hesitate to use computers for fear of making mistakes that I cannot correct.
5. Computer terminology sounds like confusing jargon to me.

Innovation Processes

The research model employed in this study is a multiple mediator model. The higher the level of pressures in the first phase of initiation affects the attitudes toward adoption. Likewise, it is expected that attitude in the adoption phase exerts mediating effects on the implementation process. The level of IT usage and user satisfaction at the implementation phase is expected to play a major role in influencing the result of post-implementation evaluation.

IT usage has been noted as an indicator of computer acceptance (Gelderman, 1998). It reflects the interaction of IT with the users. Most studies have argued that IT usage is one of the primary variables, which affects an individual’s performance (Goodhue & Thompson, 1995). Another dimension, which is regarded to be a major factor in measuring implementation success is user satisfaction with the technology performance. A number of researchers have found that user satisfaction has a positive association with the IT usage (Baroudi, Olson, & Ives, 1986; Cheney, Mann, & Amoroso, 1986; DeLone & McLean, 1992; Doll & Torkzadeh, 1991; Gelderman, 1998; Goodhue & Thompson, 1995; Thompson, Higgins, & Howell, 1991). DeLone and McLean (1992) in their study showed that user satisfaction also affects user performance. Their findings are also supported by Gelderman (1998), who found that the relationship between user satisfaction and user performance is significant. It is hypothesised in this study that these two dimensions, IT usage and user performance, affect employees' perception of the impacts of IT on their performance.

Initiation

The identification of the pressures emerging from various internal and external sources, and the recognition of a sense of urgency and felt responsibility on the part of key decision makers to perceive a need for strategic change represents a successful initiation phase (Anderson & Paine, 1975). Three dimensions are used to capture this construct. They are listed below.

1. Need-pull:
   (a) gaps in performance efficiency, and
   (b) gaps in performance effectiveness.
2. Technology-push:
   (a) awareness of technological development.
3. Social pressure:
   (a) pressures from customers,
   (b) pressures from vendors, and
   (c) top management and upper level authority pressure.

Adoption

Danziger and Dutton (1977) developed a technological innovation scale with regard to the utilisation of electronic data processing (EDP) in local government. Three components in their scale, which are relevant to the level of IT adoption in organisations, are adapted for this study. The three components are:

a) speed of adoption (number of years IT has been utilised by the local government agencies),
b) level of commitment (total expenditure of all computing installations as a percentage of total local expenditure of each local government agency), and
c) extensiveness (the number of computer applications that are indicated to be operational).

Implementation

Implementation has a number of variables of which two are addressed here: (a) utilisation and (b) user satisfaction.

Utilisation

The utilisation of IT scale was taken from Thompson et al. (1991). Three dimensions are suggested for the utilisation of IT: (a) intensity of use, (b) frequency of use, and (c) diversity of software packages used. The first two dimensions are also supported by Geldermen (1998). For the purpose of this study, four different measures are used to assist in capturing IT usage, namely:

a) frequency of use,

b) time of use,

c) number of tasks for which the system is used by employees, and

d) number of computer applications used by employees.

User Satisfaction

Doll and Torkzadeh (1988, 1991, 1994) developed a 12-item scale to measure user satisfaction. Their scale is a measure of overall user satisfaction that includes a measure of the satisfaction of the extent to which computer applications meet the end-user's needs with regards to five factors, namely: (a) content, (b) accuracy, (c) format, (d) ease of use, and (e) timeliness. The use of these five factors and the 12-item instrument developed by Doll and Torkzadeh (1988, 1991, 1994) as a general measure of user satisfaction has been supported by Harrison and Rainer (1996). In this study, this 12-item instrument developed by Doll and Torkzadeh (1988, 1991, 1994) is used to measure user satisfaction. In addition to these five factors, four more factors are adopted from Palvia's (1996) measurement of small business user satisfaction. The four additional factors are hardware, software, vendor support, and computer training adequacies. In addition to the original two items on vendor support, one more item on the timeliness of vendor supports is added. The factors used are:

a) hardware adequacy,

b) software adequacy,

c) information content,

d) information accuracy,

e) information format,

f) ease of use,

g) timeliness,

h) vendor support, and

i) training and education

Evaluation

This study concentrates only on evaluating employees' perception of the impact of IT utilisation and user satisfaction on their performance. User performance is measured in terms of self-rating of efficiency, effectiveness, and appropriateness (Kahen, 1995; Sharp, 1996, 1998). The importance of appropriateness has been recognised in program evaluation (Sharp, 1996, 1998) and has emerged in IT evaluation as identified by Kahen (1995). He argued that the problems and complexity of information technology transfer to developing countries are affected by the existing local and national characteristics. Therefore a successful IT transfer should involve the criterion of appropriateness. Some items that have been developed by Moore and

Benbasat (1991) are modified for this study. The respondents were asked to what extent they find that IT:

a) enables me to accomplish tasks more quickly;

b) improves the quality of work I do;

c) makes it easier to do my job;

d) improves my job performance;

e) enhances my effectiveness on the job;

f) gives me greater control over my job;

g) increases my productivity;

h) allows me to handle a greater volume of work without increasing associated costs;

i) improves my job performance;

j) offers a great utility to me;

k) is a beneficial aid to me;

l) is acceptable to me; and

m) is appropriate for my needs.

An open-ended question was added to each section to capture additional comments that were not covered in the questions provided. A summary of the various research constructs and the items representing these constructs is provided in Table 5.1 and the complete questionnaire is given in Appendix II. Any number in the fourth column represents the corresponding item number in the questionnaire form.

Propositions to be tested

Major issues to be addressed in this study are the investigation of factors influencing IT adoption and implementation processes in the local governments in Bali. These propositions are derived from (a) the aims of the study and the main research questions described in Chapter One, (b) the issues to be examined presented in Chapter Four, and (c) the methods of data analysis discussed in Chapter Seven. The first set of propositions deals with factors influencing IT adoption and implementation processes at the individual level. The second set of propositions deals with various factors affecting IT adoption and implementation processes at the organisational level. Both the first and the second sets of propositions require the use of a two-level path modelling technique. The third set of propositions requires the use of a hierarchical linear modelling (HLM) technique to investigate three-level hierarchical models of factors influencing IT adoption and perceived user performance. Finally, the fourth set of propositions deals with structural, perceptual and attitudinal dimension changes before and after the IT implementation process.

Propositions in Set A: Factors Influencing IT Adoption and Implementation Processes at the Individual Level

Proposition 1

Employees' characteristics influence their perceptions; and, in turn, employees' characteristics and perceptions influence their attitudes toward IT of both initiators and non-initiators.

Table 5.1 Research Factors, Variables, and Measurements

Factors	**Variables**	**Measurements**	**Source of Data or Questionnaire Items**	**References**
Community environment	District size	Land area	Secondary data:	(Bingham, 1976; Brudney & Selden, 1995; Danziger & Dutton, 1977)
		Total population	Bali Statistical Bureau	
	Socio-Economic	Per capita income	Tourism, Post & Telecommunication Department publications	
		The number of phone lines		
		The number of local and long distance calls	*Bappeda* (Local Planning Agency)	
Organisational environment	Organisational Resources	Total district's revenues		(Bingham, 1976; Danziger & Dutton, 1977; Danziger & Kraemer, 1986; Perry & Danziger, 1980)
		Per capita general revenues	Other relevant sources	
		Per capita IT budget		
	Central Government Support	Provincial government financial support		
		Central government financial support		
	Vendor support	The number of hardware and software suppliers		
		The number of service related offices		
		The number of training institutions		
Organisational Factors	Centralisation	Locus of decision for:	Questionnaire item:	(Hage & Aiken, 1967; Lai & Guynes, 1997; Miller, 1991)
		- New service	III.6.a .	
		- Capital budgeting	III.6.b.	
		- Major changes	III.6.c.	
		- Personnel policy	III.6.d	
	Formalisation	Formal documentation of operating procedures	III.6.e	(Miller, 1991)
		Adhere to documented procedures	III.6.f	
		Degree of tolerance for violation of documented procedures/rules	III.6.g	

continued

Table 5.1 Research Factors, Variables, and Measurements (continued)

Factors	Variables	Measurements	Source of Data or Questionnaire Items	References
Organisational factors	Complexity	The number of management levels within the organisation	Organisational profile	Lai & Guynes, 1997; Perry & Danziger, 1980; Rogers, 1983
		The number of distinctly different departments or functions in the organisation		
		Level of employees experience in computing		
		Level of employees skills		
	Size	The number of employees		
		Total budget		
	Type	Enterprise/decentralisation agency/ deconcentration agency		
Technological Factors	Relative advantage	Efficiency benefits	III.1.a – III.1.c	Danziger & Kraemer, 1986; Downs & Mohr, 1976, 1979; Iacovou et al., 1995; Moore & Benbasat, 1991; Panizzolo, 1998; Rogers, 1983; Rogers & Shoemaker, 1971
		Effectiveness in serving the public	III.1.d	
		Information benefits	III.1.e - III.1.h	
	Compatibility	Values & beliefs compatibility	III.1.i – III.1.k	Budic & Godschalk, 1996
		Work-style compatibility	III.1.l - III.1.m	Moore & Benbasat, 1991
		Previous experience compatibility	III.1.n	Rogers, 1983
	Complexity	Difficulty in understanding systems	III.1.o	Rogers, 1983
		Difficulty in using systems	III.1.p	
	Trialability	Could be tried in a smaller version	III.1.q	Rogers & Shoemaker, 1971
		Modular in design	III.1.r	
	Observability	Opportunity to try out	III.1.s	Rogers & Shoemaker, 1971
		Presentation and demonstration	III.1.t	

continued

Table 5.1 Research Factors, Variables, and Measurements (continued)

Factors	Variables	Measurements	Source of Data or Questionnaire Items	References
Human	Age	Age	VII.2	Rogers, 1983
	Education	Level of education	VII.3	Leonard-Barton, 1987
	Communication channel	Formal contact Informal contact Written material	III.3	Budic & Godschalk, 1996; Rogers, 1983; Yoon et al., 1995
	Attitude toward change	Kirton Adoption-Innovation Inventory	III.4.1 – III.4.32	Kirton, 1976
	Computer related anxiety	Feeling of : - Apprehensiveness - Fear of making mistakes - Unfamiliarity	 III.4.33 III.4.34, III.4.36 III.4.35, III.4.37	Anderson, 1996
Initiation	Need-pull	Gaps in performance efficiency Gaps in performance effectiveness	II.2.a - II.2.b II.2.c - II.2.d	Anderson & Paine, 1975
	Technology push	Awareness of technological development	II.2.e - II.2.f	
	Social pressure	Pressures from customers and vendors Top management pressure	II.2.g – II.2.h II.2.i	
Adoption	Adoption	Speed of adoption	I.1	Danziger & Dutton, 1977
		Level of commitment	I.2.a – I.2.c	
		Extensive use	I.3	

continued

Table 5.1 Research Factors, Variables, and Measurements (continued)

Factors	Variables	Measurements	Source of Data or Questionnaire Items	References
Implementation	Utilisation	Intensity	IV.1.a – IV.1.b	Gelderman, 1998; Thompson et al., 1991
		Frequency	IV.2.a – IV.2.c	
		Diversity	IV.3 – IV.6	
	Satisfaction	Hardware adequacy	V.1.a - V.1.c	Palvia, 1996
		Software adequacy	V.2.a - V.2.c	
		Content	V.3.a. - V.3.d	Doll & Torkzadeh, 1988, 1991; Doll, Xia, & Torkzadeh, 1994; Harrison & R. Kelly Rainer, 1996
		Accuracy	V.4.a - V.4.b	
		Format	V.5.a - V.5.b	
		Ease of use	V.6.a - V.6.b	
		Timeliness	V.7.a - V.7.b	
		Vendor Support	V.8.a - V.8.c	Palvia, 1996
		Training & Education	V.9.a - V.9.c	
Evaluation	Performance	Efficiency	VI.1.a - VI.1.c	Moore & Benbasat, 1991; Sharp, 1996, 1998
		Effectiveness	VI.1.d - VI.1.h	
		Appropriateness	VI.1.i - VI.1.l	

Proposition 2

Individual characteristics are associated with pressures at the initiation phase, levels of IT adoption, utilisation, user-satisfaction, and user-performance.

Proposition 3

Employees' perceptions on IT attributes are associated with pressures at the initiation phase, levels of IT adoption, utilisation, user-satisfaction, and user-performance.

Proposition 4

Employees' attitudes toward IT are associated with pressures at the initiation phase, levels of IT adoption, utilisation, user-satisfaction, and user-performance.

Proposition 5

Each phase of IT adoption and implementation processes has positive effects on the subsequent phases.

Propositions in Set B: Factors Influencing IT Adoption and Implementation Processes at the Organisational Level

Proposition 6

District characteristics are associated with organisational characteristics; district and organisational characteristics along with average individual characteristics in organisations are associated with average perceptions of IT attributes; and, in turn, these factors affect the average attitudes toward IT in those organisations.

Proposition 7

District characteristics are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

Proposition 8

Organisational characteristics are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

Proposition 9

Average individual characteristics are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

Proposition 10

Average employees' perceptions of IT attributes are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

Proposition 11

Average employees' attitudes toward IT are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

Proposition 12

Each phase of IT adoption and implementation processes has positive effects on the subsequence phases.

Propositions in Set C: Three-Level HLM Model for IT Adoption and Perceived User Performance

Proposition 13

There are environmental, organisational, and individual factors that influence the level of IT adoption in the three-level hierarchical model for initiators. Moreover, there are cross-level interaction effects among variables influencing the level of IT adoption in the three-level hierarchical model for initiators.

Proposition 14

There are environmental, organisational, and individual factors that influence the level of employees' perceptions of the impact of IT on their performance in the three-level hierarchical model for both initiators and non-initiators. Moreover, there are cross-level interaction effects among variables influencing the level of employees' perceptions of the impact of IT on their performance in the three-level hierarchical model for both initiators and non-initiators.

Propositions in Set D: Structural, Perceptual and Attitudinal Dimensions Changes before and after IT Implementation Process

Proposition 15

There are some changes in structural dimensions, employees' perceptions of IT attributes, employees' attitudes toward IT after the IT adoption and implementation processes for both initiators and non-initiators.

Summary

The research model expanded in Chapter Four is modified accordingly to accommodate the local characteristics of Bali. Two additional variables are added to the model, namely gender and organisational type. Furthermore, two different models are developed to accommodate the two groups of respondents, the initiators and non-initiators.

In order to measure each variable, multiple items are used. Multiple items are argued to represent the constructs for the present research and are identified and evaluated for validity and reliability. Wherever validated measures are already available, they are adopted or adapted to suit the specific needs of this study. The data collection process, data preparation, preliminary analysis, demographic information on respondents, and the results are presented in the following chapters.

6

Data Collection

Population and Sample

Governmental agencies in Bali can be categorised by type into three groups, as shown in Table 6.1. As the time of the study, the provisions of government structures were based on the *Act No. 5 of 1974.* In Chapter Three, it has been discussed that the institutional setting is basically similar for the autonomous local governments[7] of the *Daerah Tingkat I* and *Tingkat II*. It is asserted in the *Act No. 5 of 1974* that an autonomous local government consists of the *Kepala Daerah* (the head of autonomous local government) and the *Dewan Perwakilan Rakyat Daerah* (the local representative body, abbreviated DPRD). In conducting day-to-day government, the *Kepala Daerah* is assisted by the *Sekretariat Daerah* (local secretariat) and *Dinas-Dinas Daerah* (local government agencies). Elsewhere in Indonesia, there is also another institution, which is called the *Badan Perencanaan Pembangunan Daerah* (regional development planning board, abbreviated *Bappeda*). The number of the *Dinas Daerah* varies from one local government to another, because it depends on the number of authorities that have already been decentralised from the central government to the local governments.

In addition, the institutional setting for the administrative government consists of the *Kepala Wilayah* (the head of administrative government) and the *Sekretariat Wilayah* (the administrative secretariat). Besides, there are also some *Instansi Vertikal* (central government agencies at the local level).

In order to embody the deconcentration principle, some ministry offices in Jakarta have been allowed to establish their *instansi vertikal* at certain levels of local government. The *instansi vertikal* at the provincial level is called *Kantor Wilayah* (regional office, abbreviated *Kanwil*). While, the *instansi vertikal* at the district level is named *Kantor Departemen* (departmental office, abbreviated *Kandep*). In addition to these institutions, there are also some governmental bodies that are involved in

[7] Indonesia refers to any sub-national government as ‘local government’ which includes province, districts, and municipality.

business practice. They are government owned companies. Some of them also have branches that operate at both the provincial and district levels. Consequently, according to their type, governmental agencies can be categorised into three groups. The population for this study is all employees who are working in government agencies across all regions of Bali.

In this investigation, a cluster sample design was employed. First, the targeted agencies were chosen randomly in order to select about 50 per cent of each category in each district. These agencies were drawn without replacement. Table 6.1 shows the list of agencies in Bali.

From among these agencies, 20 agencies were chosen in each district. However, in the final list the number of agencies that were involved in this study varied slightly from district to district. This was due to the fact that not all agencies that were chosen exist in each district. In addition, some of those that exist refused to participate because they did not have any computing in their work place. One institution, *Bank Pembangunan Daerah* (Local Development Bank/BPD), only allowed the survey to be conducted at their provincial office not at their district level branches. In addition to those agencies at district level, nine agencies at the provincial level also participated in this survey. The total number of agencies that finally participated in this study was 153 across all regions of Bali.

All IT users and managers in each agency at the district level were the target of the questionnaire survey. This was based on the fact that only a small number of employees in government agencies in Bali were IT users. In addition, around 10 to 20 questionnaire forms were distributed to each of nine provincial level agencies depending on the number of end users in these organisations.

Data Collection Methods

Because almost all data collection methods have some biases associated with them, collecting data through alternative methods and from different sources lends more rigour to research (Patton, 1980; Sekaran, 1992). This is often known as 'triangulation' (Patton, 1980). Therefore this research uses both primary and secondary data from various types of data collection sources.

Secondary data

In order to collect environmental data as well as a part of the organisational data, this study used secondary data. Most of the demographic data were obtained from Bali's Statistical Office and other relevant sources. Some organisational data were obtained from governmental agencies' reports and archives.

Primary Data

Interview

In order to explore and understand the complex issues of IT adoption and utilisation, a face-to-face semi-structured interview with key individuals (the head of the office and the IT manager) in some organisations was conducted in this study. This method enabled the researcher to get some valuable information quickly and directly from respondents (Zikmund, 1997).

Table 6.1 Government Agencies at Local Level

	Decentralised Agencies (*Dinas*)
1	Sekretariat Wilayah Daerah (Local Secretariat)
2	*Inspektorat Wilayah* (Regional Inspectorate)
3	*Bappeda* (Regional Development Planning Board) *
4	*BP-7* (Pancasila Empowerment Body)
5	*Unit Pelayanan Terpadu* (Integrated Services Unit) *
6	*Kantor Pembangunan Desa* (Village Development Agency)
7	*Kantor Sospol* (Social and Politics Agency)
8	*Kantor Pengolahan Data Elektronik* (Electronic Data Processing Unit) *
9	*Mawil Hansip* (Civil Defence Agency)
10	*Kantor Catatan Sipil* (Community Record Office)*
11	*Sekretariat DPRD* (Local People Representative Secretariat)
12	*Dinas Pendapatan* (Local Revenues Agency)*
13	*Dinas Pariwisata* (Tourism Agency)*
14	*Dinas Pekerjaan Umum* (Public Works Agency) *
15	*Dinas Perikanan* (Fishery Agency)
16	*Dinas Perkebunan* (Plantation Agency)
17	*Dinas Kesehatan* (Health Agency)*
18	*Dinas Peternakan* (Animal Husbandry Agency)
19	*Dinas Pertamanan* (Parks and Recreational Areas Agency)
20	*Dinas Pertanian dan Tanaman Pangan* (Agriculture and Food Crops Agency)*
21	*Dinas Pendidikan dan Kebudayaan* (Education and Culture Agency)*
22	Dinas Lalu Lintas Angkutan Jalan (Transport Agency)*
	Deconcentrated Agencies (*Kanwil/Kandep*)
23	*Kandep Perindustrian dan Perdagangan* (Industry and Trade Departmental Office)*
24	*Kandep Penerangan* (Information Departmental Office)
25	*Kandep Koperasi* (Departmental Office for Koperasi and SMEs)*
26	*Kandep Agama* (Religions Departmental Office)
27	Badan Pertanahan Nasional (National Land Board)*
28	*Kandep Sosial* (Social Departmental Office)
29	*Kandep Pendidikan dan Kebudayaan* (Education and Culture Departmental Office)
30	*Kandep Tenaga Kerja* (Workforce Departmental Office)
31	*Biro Pusat Statistik* (Statistical Bureau)*
32	*BKKBN* (National Family Planning Coordination Body)*
	Government Enterprises (SOEs)
33	*PT POS* (Post Agency)*
34	*Bank Pembangunan Daerah* (Local Development Bank)*
35	*Perusahaan Daerah Air Minum* (Local Enterprise for Drinking Water)*
36	*Perusahaan Listrik Negara* (State Electrics Enterprise)
36	*Telkom* (State Owned Enterprise in Telecommunications)*
38	*PD.Pasar* (Local Enterprise for Managing Markets)
39	*Pegadaian* (Pawnshop Services)

* chosen agencies

It also helped to elicit many ideas that some people would find difficult to write about (Sekaran, 1992). The interview was used to triangulate the data from the questionnaire and explore issues that might emerge from the questionnaire.

Survey

The instruments employed in this study included questionnaires designed to collect information on human factors and technological factors as well as the organisational factors. Consequently, there were two types of questionnaire employed: (a) individual questionnaire and (b) organisational questionnaire. The questionnaires were translated into the *Bahasa Indonesia* language and accompanied by a covering letter stating the nature and purpose of the study.

This technique was used because a questionnaire survey could provide a quick and inexpensive means of obtaining information for a variety of objectives (Zikmund, 1997). The questionnaires were particularly useful in this study because all potential respondents were literate and clearly understood their field of expertise.

Data Collection Procedures

The survey instruments initially were prepared and presented using the English language to obtain the acceptance of the supervisors and the Social and Behavioural Research Ethics Committee of Flinders University. Then, they were translated into the Indonesian language as the medium of communication and official language in all Indonesian agencies. For the best possible translation and to verify the accuracy of the translation, the Indonesian version of each questionnaire was translated back to English by a panel. The panel consists of two Indonesian Ph.D. students and one Study Skills staff member at Flinders University.

Development of survey instruments

The survey questions included in the questionnaire for the employees (see Appendix II) were developed in order to assess: (a) various potential factors that affected the adoption and implementation of IT in government agencies in Bali, (b) the pressures at the initiation phase, (c) the level of adoption, (d) the level of IT utilisation, (e) user satisfaction, and (f) user performance.

The questionnaire for the employees that was used in this study had seven sections. The first five sections were devoted to measuring the adoption level, the initiation pressures, various potential factors, level of IT utilisation, level of user satisfaction, and user performance respectively. The last section was used to gather demographic information such as age, gender, educational level, and position. The items in the second section were only answered by employees who identified themselves as initiators. Those who identified themselves as not involved in the initiation stage did not have to answer these items.

The questionnaire for organisations, on the other hand, was used to obtain the organisational profile. The first part of this questionnaire was used to record agency name, address, phone number, and total number of employees. The second part was used to assess: (a) total number of employees with IT skills, (b) the level of IT skills, and (c) the extensiveness of IT expertise. The third part was used to gather additional information with respect to: (a) organisational structure to assess the number of vertical and horizontal levels, (b) total budget and total IT budget within the last five years, and (c) IT development plan.

Pre-testing and pilot testing of the employee questionnaire

The employee questionnaire was pre-tested with a number of Indonesian post-graduate students at Flinders University. Approximately 20 students attended the pre-testing session that was held on 4 June 1999. Pre-testing of survey instruments was done to assess clarity, comprehensiveness, and acceptability of the drafted survey instruments.

The revised questionnaires and interview questions were then pilot tested with a small number of respondents within the government agencies in Bali in July 1999. Two agencies in Denpasar, *Dinas Pariwisata* (Tourism Agency) and *Dinas Pendapatan* (Local Revenue Agency) were conveniently chosen in this pilot testing process. Finally the revised questionnaires were prepared and distributed to potential respondents and the revised interview questions were used in conducting in-person interviews.

Administration of Questionnaires and the Interview Processes

Approval for the fieldwork was initially sought from the Social and Behavioural Research Ethics Committee of Flinders University and was obtained on 1 December 1998.

Before the actual questionnaire survey and interviews were carried out, the researcher also had to get approvals from province level and district level authorities in Bali. Therefore to get such approvals and to make the initial contacts with various agencies in Bali, a preliminary field study was conducted from December 1998 until February 1999.

The actual field study was conducted from July 1999 until January 2000. A covering letter that explained the purposes of the research and the expected number of employees and managers who would participate in this study, the letter of introduction from the Director of the Flinders Institute of Public Policy and Management (FIPPM), and the letters of approval from relevant authorities were personally delivered to all agencies that had been chosen in the sample for this study. This was followed up with a telephone contact to ensure that the letter had been received. At the same time permission to conduct a questionnaire survey in the agency and agreement to participate in a face-to-face interview were sought from the head of the agency. If the head of the agency agreed, then a formal appointment was made with respect to the exact time of the delivery and collection of survey forms as well as the time suitable for conducting the interviews. The survey forms were delivered and collected personally. In addition to survey forms for employees, an organisational questionnaire was also distributed to each participating agency.

Response Rate

The total number of agencies that participated in this study was 153 across all regions of Bali. Initially, the questionnaire forms for organisations were distributed to establish the organisational profile. The first two parts of the questionnaire were used to record agency’s details, namely name, address, phone number, and total number of employees and the level of IT expertise available in the organisation, such as the total number of employees with IT skills, the level of IT skills, and the extensiveness of IT expertise. From these organisational profiles, it was revealed the 153 agencies employed a total of 10,034 employees. Of these, 1,427, or approximately 14 per cent, used information technology in their daily duties. They were considered to be end-users. A total of 1,187 questionnaire forms were distributed at the beginning of

August 1999. The questionnaires were handed back to the heads of the agencies. The number of questionnaire forms that were distributed to each organisation depended on the number of IT users in the organisation.

After one month, in the beginning of September 1999, the researcher collected the questionnaire responses personally. During this first attempt, 427 completed questionnaire responses were collected and 15 interviews were conducted. Some difficulties were faced at this stage. Some agencies argued that the person in charge of handling this matter was not in the office at that time, while some others said that the questionnaire forms were missing. For those agencies that were still unable to complete the questionnaire, the researcher gave a reminder and allowed them time to complete the forms within the following month. On the second attempt, the researcher made phone calls to each agency to remind them and to arrange an interview session as well. On the second attempt, 271 responses were collected, and 11 interviews were conducted.

Table 6.2 Return Rate

	Distributed	Collected				Total	%
	Aug. '99	Sept. '99	Oct. '99	Nov. '99	Jan. '00		
Questionnaires	1,187	427	271	203	57	957	81
Interviews	requested	15	11	3	0	29	

On the 21 October 1999 there were riots throughout Bali. Most of the governmental offices at Badung, Buleleng, and Jembrana were burned. Some of them were the target of the survey that still had questionnaire responses to be returned. For these agencies additional questionnaires were re-distributed to replace the missing forms. Consequently, in order to increase the response rate as well as to undertake the interview session that could not be done for various reasons, a third attempt was made in November 1999. As a result, 203 more responses were collected and three interviews were conducted. Those who were still unable to return the forms were given a self-addressed envelope. By January 2000, 57 more responses were returned. This gave a total of 957 completed questionnaire responses returned. The return rate is given by ratio of completed to the distributed forms (81% return rate) as presented in Table 6.2. In addition, in total, 29 interview sessions were conducted.

7

Methods of Data Analysis

The research questions that are addressed in this study cover a wide variety of issues. They range from various factors that may affect each step of IT adoption processes to more technical issues involved in the measurement of attitude and perception changes before and after IT adoption. Furthermore, the structure of the available data also reflects a hierarchical nature that must be taken into consideration in analysis.

Thus, the aim of this chapter is to identify those methods of analysis that were appropriate for the propositions to be tested in this study. The propositions of this study, advanced in Chapter Five, required that several different methods of analysis should be employed, which meant that several different software packages had to be used in this study. This chapter discusses the methods of analysis to be employed in this study and describe each software package to be used. First, it considers some general methodological considerations associated with the examination of models like those proposed in the previous chapter. Then, several analytical techniques are discussed.

The first part of the discussion of the analytical techniques consists of the use of the NORM program, followed by the use of the SPSS program in the second part, the use of Partial Least Square (PLS) path analysis in the third part, the use of AMOS in fourth part, the use of Hierarchical Linear Modelling (HLM) in the fifth part and the use of MPLUS in the sixth part.

General methodological considerations

Some general methodological issues have to be considered when assessing the appropriateness of an individual analytical method for the different purposes of this study. These considerations refer to: (a) missing data, (b) the notion of causality, (c) significance testing in social science research, (d) and levels of analysis. Each of these aspects is discussed in the following sections.

Missing Values

Missing observations occur in many areas of research and evaluation (Kline, 1998). In longitudinal studies, subjects may drop out early or be unavailable during one or more data collection periods. When data are collected by surveys, questionnaire responses may be incomplete due to refusal of some respondents to answer certain questions. Ethics requirements for research and evaluation demand the respondents should be told they do not have to complete the questionnaire.

Little and Rubin (1987) contend that, with standard statistical techniques, there are basically three methods to handle multivariate data with missing values: (a) complete case analysis (listwise deletion), (b) available case methods (pairwise deletion), and (c) filling in the missing values with estimated scores (imputation methods).

Some advantages of the complete case approach are: (a) simplicity, since standard analyses can be applied without modification, and (b) comparability of univariate statistics, since these are all calculated with a common sample base of cases. However, there are disadvantages. Some problems may stem from the potential loss of information in discarding incomplete cases. When the incomplete cases comprise only a small fraction of all cases (5% or less) then listwise deletion maybe a perfectly reasonable solution for the missing data problem (Schafer, 1997). However, in multivariate settings, where missing values occur on more then one variable, the loss in sample size can be considerable, particularly if the number of variables is large (Little & Rubin, 1987). If so, deleting cases may be inefficient, causing large amounts of information to be discarded. In addition, case-deletion procedures may bias the results if the subjects who provide complete data are unrepresentative of the entire sample. The second approach uses all cases where the variable of interest is present. This technique has the advantage of being simple and increases the sample size. However, its disadvantage is that the sample base changes from variable to variable according to the pattern of missing data.

Other methods of imputation are also no less problematic. The mean substitution, the imputed average on a variable-by-variable basis, preserves the observed sample means, but it distorts the covariance structure, biasing estimated variance and covariance toward zero. Regression substitution, imputing predicted values from regression models, on the other hand, tends to inflate observed correlations, biasing them away from zero (Schafer, 1997). Even if the missing values could be imputed in such a way that the distributions of variables and relationships among them were perfectly preserved, the imputed dataset would still fail to provide accurate measures of variability. The subsequent analysis would fail to account for missing-data uncertainty.

Fortunately, in the last two decades, substantial progress has been made in developing software to handle statistical procedures for missing data. In the late 1970s, Dempster, Laird, and Rubin (1977, as cited in Schafer and Olsen 1998) formalised the EM algorithm, a computational method for efficient estimation from incomplete data. More recently, Rubin (1987) has developed a procedure for multiple imputations (Schafer & Olsen, 1998). Rubin argued that an important limitation of single imputation methods is that "standard variance formulas applied to the filled-in data systematically underestimated the variance of estimates" (Little & Rubin, 1987, p. 61). Multiple Imputation (MI) methods allow valid estimates of the variance to be calculated using standard complete data procedures.

The Notion of Causality.

There is one particular type of inference that this study needs to make from the correlational data collected: namely, a causal inference. The notion of causality applies whenever the occurrence of one event is reason enough to expect the production of another.

Heise (1975) gives a more precise statement to guide and restrict the application of the causality principle in theory construction and the design of research.

> An event C, causes another event, E, if and only if
>
> (a) An operator exists which generates E, which responds to C, and which is organized so that the connection between C and E can be analyzed into a sequence of compatible components with overlapping event fields;
>
> (b) Occurrence of event C is coordinated with the presence of such an operator - such an operator exists within the field of C;
>
> (c) When conditions (a) and (b) are met, when the operator is isolated from the fields of events other than C, and neither C nor E is present to begin with, the occurrence of C invariably starts before the beginning of an occurrence of E.
>
> (d) When conditions (a) and (b) are met, C implies E; that is, during some time interval occurrences of C are always accompanied by occurrence of E, though E may be present without C or both events may be absent.
>
> (Heise, 1975, p. 12)

Condition (a) reflects the fact that highly structured circumstances must be present before there is a possibility of a particular causal relation existing. Condition (b) implies that events must be coordinated with such circumstances before they can have effects. Temporal directionally is defined in condition (c). Condition (d) states the requirement for logical implication from cause to effect. Another definition of cause and effect is given by Kenny (1979).

> A causal statement, to no one's surprise, has two components: a cause and effect. Three commonly accepted conditions must hold for a scientist to claim that X causes Y: (1) Time precedence, (2) Relationship, and (3) Nonspuriousness.
>
> (Kenny, 1979, pp. 2-3)

Kenny's definition is also supported by Vogt (1993).

> To attribute cause, for X to cause Y, three conditions are necessary (but not sufficient): (1) X must precede Y; (2) X and Y must covary; (3) no rival explanations account for the covariance between X and Y.
>
> (Vogt, 1993, p. 31).

The first condition appears to be met in longitudinal studies, where a sample of cases is followed over a specified period of time. However, time and financial limitations in conducting overseas field research, such as this study, do not allow such designs. With such limitation, a cross sectional study combined with a retrospective approach to measure respondents' attitudes and perceptions before the adoption are conducted.

With regard to the second conditions, an examination of correlation coefficients might indicate whether or not variation in the presumed cause is associated with the variation in the effect.

With respect to the third condition, Tuijnman and Keeves (1994) have emphasized the need to specify the model under examination as precisely as possible.

> The function and purpose of the causal models which are used in path analysis and structural equation modeling are to specify as fully as possible the interrelations between variables so that appropriate statistical control might be employed. (Tuijnman & Keeves, 1994, pp. 4340-4341)

On the basis of this principle and taking into consideration that the causal inference begins with the assumption that any predecessor event might be a cause of any successor event, it is then meaningful to eliminate relations that are impossible or implausible in particular circumstances. This eliminating approach is dictated by the premise that deterministic relations pervade the physical and social world and they may exist even though humans are unaware of them. However, in both the physical and social world most relationships that exist are probabilistic in nature rather than deterministic. If models were to be constructed of deterministic relations in terms of those relations that are known to exist, the model might be seriously deficient; that is, more important probabilistic processes might be ignored and thus give rise to spurious conclusions. Instead models are developed by eliminating the relations that are not statistically significant when assessed in probabilistic terms.

Significance Testing in Social Research

Tuijnman and Keeves (1994) have emphasised the widespread but inappropriate reliance of researchers and computer programs on significance tests, which assume a simple random sample when most of the studies in social research do not follow such a design. This statement is also supported by Brick et al. (1997). They argue that when data are collected as part of a complex sample survey, there is often no easy way to produce approximately unbiased and design-consistent estimates of variance analytically.

Some procedures attempt to take into consideration such sample characteristics. For example, design effects are employed to adjust for complex cluster design and multilevel techniques seek to take into account the nested structure of samples. In this study, the WesVarPC program, which employs a class of techniques called 'replication methods' for estimating variances for complex sample design, was used to calculate the significance of differences. Furthermore multilevel techniques were employed to analyse the two and three level models.

Level of Analysis

It has already been pointed that the data collected in this study include not only the information on variables gathered at the employee level but also on questions regarding the characteristics of each organisation involved in the study. In addition, there are also some district characteristics collected from various secondary data sources. Hence the data files contain information obtained at three different levels, namely individual level, organisational level, and district level. Models of IT adoption might be developed from theory that incorporate certain individual, organisational and district variables, which might influence each phase of the IT adoption processes. The examination of such models is undoubtedly of particular interest, yet several problems arise from the combination of data that were obtained at different levels into the one model. Unless these problems are allowed for in the analysis of the data, both bias and incorrect estimates of error arise.

Two methods that are commonly employed when data are combined from two or more levels into a single- level analysis are: (a) the aggregation of data collected at the lower level (e.g. individual) to the higher level (e.g. organisation); or (b) the disaggregation of higher level data to the lower level, for example by assigning organisation-level data to each individual employee (Snijders & Bosker, 1999). Both techniques, aggregation and disaggregation, quite typically introduce bias, leading to an over- or under- estimation of the magnitude of effects associated with variables that are aggregated or disaggregated and incorrect estimation of error.

Aggregation Effects

By aggregating individual data to the organisation level, the predictive power, or fit of the regression line, commonly increases (Sellin, 1990). Furthermore, it is possible that certain variables show negative effects at one level of analysis whereas positive effects are found at another level of analysis (Sellin, 1990). Snijders and Bosker (1999) point out four potential errors in aggregating individual data to the organisational level.

(a) *The shift of meaning*. A variable that is aggregated to the macro-level refers to the macro units, not directly to the micro units.

(b) *Ecological fallacy*. A correlation between macro level variables can not be used to make assertions about micro level relations.

(c) *Neglect of the original structure*. In the examination of the effects of sampling error, inappropriate tests of significance are applied.

(d) *Loss of cross-level interactions*. It prevents the examination of potential cross level interactions effects between a specified micro-level variable and an as yet unspecified macro level variable.

These problems are the same for all types of multivariate analysis which are confined to a single level of analysis such as ordinary least square (OLS), partial least squares path analysis (PLS) or linear structural equation modelling (SEM).

Disaggregation Effects

The distorting effects of the disaggregation of group level data (organisational and district variables) to the individual level is referred to as dissagregation bias. In this case, the same value for a group level variable is assigned to members of the same group at the individual level. As a consequence, the assumption of the independence of observation ceases to apply. However, because of the complexity of the issue, it is not possible to discuss the problem of dissagregation bias in greater detail here.

A separate earlier analysis of the IT adoption study data using the single-level analytical tool PLSPATH was limited to information collected at the individual level and organisational level. The two single level models were then confirmed using the structured equations modelling tool AMOS. However, one of the aims of the present study as outlined in the research questions is to examine organisational and district level variables and their impact on the IT adoption processes. Hence, further consideration has to be given to this issue in the present study.

Since the late 1980s, attempts have been made to model social science data that conform to a nested structure (Bryk & Raudenbush, 1992). These techniques seek to take into account the hierarchical structure of most of the data obtained in social science research and are therefore now commonly referred to as applications of hierarchical linear modelling, abbreviated as HLM. In order to examine further the indirect as well as direct effects, a multilevel path analysis technique is employed using MPLUS.

The Use of Multiple Imputation with NORM

Multiple imputation (MI) is a technique in which the missing values are replaced by $m > 1$ plausible values drawn from their predictive distribution. The variation among the m imputations reflects the uncertainty with which the missing values can be predicted from the observed ones. As a result, there are m complete datasets. In

Rubin's method for multiple imputed inference, each of the simulated complete datasets is analysed by standard methods, and the results (estimates and standards errors) are combined to produce estimates and confidence intervals that incorporate missing data uncertainty.

Lack of computational tools for creating MIs was one of main reasons why the method has remained largely unknown since it was proposed. The probability distributions from which proper MIs must be drawn tend to be very complicated (Schafer & Olsen, 1998). Very recently, however, new simulation methods, known as Markov chain Monte Carlo (MCMC), have appeared in the statistical literature (Gilks, Richardson, & Spiegelhalter, 1996). Schafer (1997) has adopted and implemented MCMC for the purpose of multiple imputation. The remainder of this section introduces the key ideas of Schafer's MI approach and the use of his software.

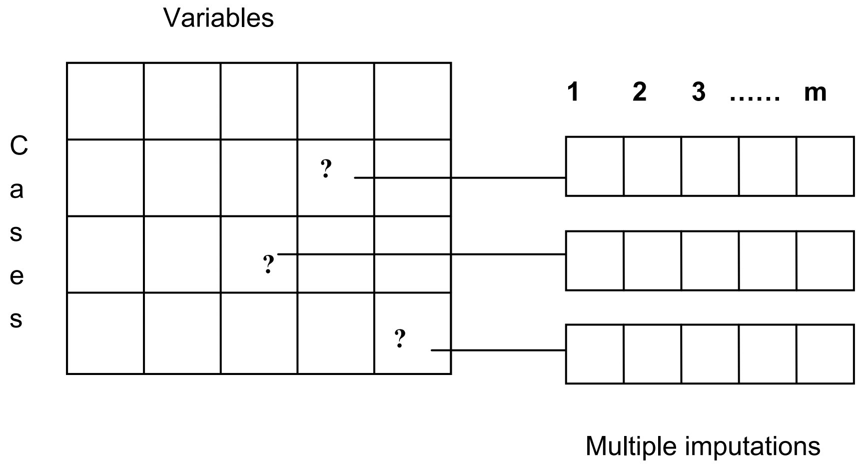

Figure 7.1 Multiple Imputations for Missing Values

Source: adapted from StatSol, *What is Multiple Imputation*?, [online: http://www.statsol.ie/solas/solas.htm, accessed: 20/07/01]

Assumptions

Like any statistical method, MI is based upon certain assumptions. These assumptions pertain to (a) the population of the data, (b) the prior distribution of the model parameters, and (c) the mechanism of non-response.

In this approach, the first step is to specify one encompassing multivariate model for the entire dataset. Four different classes of multivariate complete data models are available: (a) normal model, which performs multiple imputation under a multivariate normal distribution, (b) log-linear model, which has been traditionally used by social scientists to describe associations among variables in cross-classified data, (c) general location model, which combines a log-linear model for the categorical variables with a multivariate normal regression model for the continuous ones, (d) two-level linear regression model, which is commonly applied to multilevel data (Schafer & Olsen, 1998). It should be noted that an imputation model should be chosen to be (at least approximately) compatible with the subsequent analyses. In particular, the model should be rich enough to preserve the associations or relationships among variables that will be the focus of later investigation. Therefore, a rich imputation model that preserves a large number of associations is desired because it may be used for a variety of post-implementation analyses.

The statistical theory underlying MI involves the fundamental law of probability known as Bayes's Theorem (Schafer, 1997). The Bayesian nature of MI requires the imputer to specify a prior distribution for the parameters of the imputation model. In most cases, especially when the data sample size is moderately large, nearly any reasonable prior distribution should lead to essentially the same results. Therefore, a non-informative prior distribution that corresponds to a state of prior ignorance about model parameters applies well in many cases. In some unusual situations, with small samples or high rates of missing values, it may be necessary to apply an informative prior distribution. Extended discussion on the choice of a prior distribution is given by Schafer (1997).

Every missing-data method must make some largely untestable statistical assumptions about the manner in which the missing values were lost. Schafer's methods assume that the missingness mechanism is ignorable. This is also called the ignorability assumption. In other words, missing values are assumed to be missing at random (MAR).

The methods have their origins in two distinct bodies of statistical literature. The first concerns likelihood-based-inference with incomplete data, in particular, the EM algorithm. The second concerns techniques of MCMC, in particular, the data augmentation algorithm (Schafer, 1997).

Expectation - Maximisation (EM)

The EM algorithm is a general technique for fitting models to incomplete data. If the missing values were known, the model parameters could be estimated easily. Similarly, if the parameters of the data model were known, it would be possible to obtain unbiased predictions for the missing values. This interdependency, then, suggests an iterative method with two distinct steps:

(a) **the Expectation or E-step**: Replace missing sufficient statistics by their expected values given the observed data, using estimated values for the parameters; and

(b) **the Maximisation or M-step**: Update the parameters by their maximum-likelihood estimates, given the sufficient statistics obtained from the E-step.

The formal definition and key properties of the EM algorithm are reviewed by Little and Rubin (1987) and Schafer (1997). The convergence behaviour of EM is related to the rates of missing information (how much information about the parameters is contained in the missing part of the data relative to the observed part). If there were no missing values, then convergence would be immediate; if large amounts of information were missing on one or more parameters, then convergence would require many iterations. In other words, high rates of missing information could lead to slow convergence; low rates lead to rapid convergence (Schafer, 1997).

Data Augmentation

Data augmentation (DA) is an iterative simulation technique promote by Tanner and Wong (1987 as cited in Schafer 1997). DA is a special kind of Markov chain Monte Carlo (MCMC) method. In DA there are three types of quantities: observed data, missing data, and parameters. The missing data and parameters are unknown.

DA alternately performs the following steps:

(a) **the Imputation or I-step**: impute the missing data by drawing them from their conditional distribution given the observed data and assumed values for the parameters; and

(b) **the Posterior or P-step**: simulate new values for the parameters by drawing them from a Bayesian posterior distribution given the observed data and the most recently imputed values for the missing data.

Alternating between these two steps sets up a Markov chain that converges to a stationary distribution, the joint distribution of the missing data and parameters given the observed data. DA bears a strong resemblance to the EM algorithm, and may be regarded as a stochastic version of EM. The E-step of EM calculates the expected complete-data sufficient statistics, whereas the I-step of DA simulates a random draw of the complete-data sufficient statistics. The M-step of EM is a maximisation of a complete-data likelihood, while the P-step of DA is a random draw from a complete-data posterior. By running DA for a large number of cycles, and storing the results of a few I-steps along the way (with enough cycles in between to ensure independence), it is possible to obtain more appropriate multiple imputations of the missing data (Schafer, 1997).

Rule for MI inference

Once MIs have been created, the data sets can be analysed by nearly any method that would be appropriate if the data were complete. These subsequent analyses can be carried out using procedures in SPSS, LISREL, AMOS, or virtually any other statistical package. After performing identical analysis on each of the m datasets, the results are combined using simple rules provided by Rubin (1987), to produce overall estimates and standard errors.

NORM

The normal model used by NORM assumes that each variable in the dataset is normally distributed. In practice, transformations can often help to produce reasonable imputations for variables that are continuous and non-normal. Binary or ordinal variables can often be imputed as normal and then rounded off to the nearest observed value. Fully observed categorical variables can be replaced by a set of dummy codes to preserve their associations with other variables.

Data Preparation

Before using NORM, it is necessary to prepare a data file. NORM accepts data only in ASCII (text) form. Data for each individual or sample unit should be placed on a single line. The variables on each line should be separated by one or more blank spaces or tab characters, and each line should end with a carriage return. Missing values must be denoted by a single numeric code, such as -9 , -99, or 10000, not by blank spaces, periods, or other non-numeric characters. NORM expects the file to be named *.dat, where * is any filename of 8 alphanumeric characters.

There is essentially no limit to the number of variables or the number of cases in NORM. Very large data sets are not a problem, provided that the computer has enough memory (RAM) to process the data. The only firm limit is that each line of the data file must be less than 2000 characters long, including spaces. Non-numeric or text data are not allowed in the data file. If the data set contains non-numeric variables, it is necessary to either (a) convert them to numeric codes, or (b) remove them from the data file before using NORM.

Managing Variables

The variables in the data set are managed by the so-called 'variables' grid. On this grid the following may be done: (a) edit variable names, (b) select variables for the model, (c) select variables to be written to imputed data sets, (d) apply transformations to variables, (e) round off variables to a specified precision, and (f) examine a variable's distribution.

When variables are not normally distributed, it often helps to apply transformations before imputing. When NORM creates an imputed version of the dataset (*.imp file), it automatically rounds each variable to a precision, which must be specified. Rounding, perhaps in conjunction with transformations, helps to impute values that resemble the observed data.

EM Algorithm

The EM algorithm in NORM estimates means, variances and covariances using all of the cases in the dataset, including those that are partially missing. Before using NORM to impute missing data, it is almost always a good idea to run EM first.

Any run of the EM algorithm will create two files: an output (*.out) file reporting the results of EM, and a parameter (*.prm) file where the resulting parameter estimates are stored. When EM has finished running, the output file is automatically displayed but the parameter file is not. Either of these files may be displayed at any time by using the Display menu.

DA Algorithm

The data augmentation (DA) algorithm in NORM simulates random values of parameters and missing data from their posterior distributions. It is the method by which NORM creates proper multiple imputations for the missing data. Before running DA , it is a good idea to run EM first. Running EM first will provide a nice set of starting values for the parameters.

Any run of DA will create two files: an output (*.out) file reporting the results of DA, and a parameter (*.prm) file where the final simulated values of the parameters are stored. When DA has finished running, the output file is automatically displayed but the parameter file is not. Either of these files may be displayed at any time by using the Display menu.

In NORM, proper multiple imputations are created through data augmentation. Running data augmentation for k iterations, where k is large enough to guarantee convergence, produces a random draw of parameters from their posterior distributions. Imputing the missing data under these random parameter values results in one imputation. Repeating the whole process *m* times produces *m* proper multiple imputations.

In most cases, good results can be obtained with only a small number of imputations (3-5 imputations). Unless the fraction of missing information is unusually high, the efficiency gained by taking more than 5-10 imputations is minimal.

Multiple Imputation Inference

Once *m* imputed versions of the dataset have been obtained, they may be analysed in nearly any manner that would be appropriate without missing data. NORM does not perform these analyses. However, NORM does offer a helpful facility for combining the results (estimates and standard errors) from *m* analyses into a single set of results, according to Rubin's (1987) rules for scalar estimands. For joint inferences concerning a group of parameters, use the MI multiparameter inference option. NORM performs multiparameter inference using the extension of Rubin's (1987) rules for multidimensional estimands. Once the data have been imputed and analysed *m* times, NORM combines *m* vector estimates and *m* covariance matrices to produce a single vector estimate and covariance matrix. NORM also performs an F-test of the hypothesis that all parameters are simultaneously zero.

The Use of SPSS

Factor Analysis

Factor analysis is employed in this research as an exploratory tool, primarily to reduce the number of variables to be used in subsequent analysis and to represent items by a small number of hypothetical variables, called factors (Norusis, 1994).

Factor analysis is also employed in this research to identify relationships among sets of inter-related variables and items, so that underlying constructs or dimensions can be ascertained (Hair, Anderson, Tatham, & Black, 1995). The tool is considered an important method of construct validation as it allows examination of the underlying structure of the overall measure (Kerlinger, 1986).

The Factor analysis model expresses each factor as a linear combination of items, which are not actually observed (Norusis, 1994).

The general expression for estimation of a factor F_j is represented mathematically as follows:

$$F_j = W_{ji}X_i = W_{j1}X_1 + W_{j2}X_2 + \ldots + W_{jp}X_p$$

where:

W_{ji} = Factor score coefficient of X_i

P = the number of variables

X_i = the *i*th variable

F_j = the *j*th factor

The analysis is carried out in four basic steps. A correlation matrix is computed for all items in the first step. This identifies items, which are poorly related to others, and provides a means of evaluating the appropriateness of the factor model. Factors are extracted in the second step during which the number of factors necessary to represent the variable are determined. The factor matrix is rotated in the third step in which loadings are redistributed to make factors more interpretable. Factor scores are computed for each case on each factor in the final step (Norusis, 1994).

Linear combinations of items are formed during the factor extraction stage. The first combination accounts for the largest amount of variance in the sample. The next combination explains the next largest amount of variance. Successive combinations account progressively for smaller portions of total sample variance (Norusis, 1994). There can be as many linear combinations (factor) as there are items.

A number of methods are available for extracting factors. These include principal component analysis (PCA), maximum likelihood method, the unweighted least squares method, the alpha method and image factoring. The principal component analysis method is employed in this study.

Various criteria are suggested for determining the number of factors necessary to represent the data. The most common criterion is the Kaisar-Guttman rule of thumb also referred to as the 'roots criterion' (Loehlin, 1992). This criterion calls for selections of only those factors with eigenvalues greater than one. This is used as a default in SPSS.

Another criterion is provided by the scree plot which is a plot of successive eigenvalues on a graph (Loehlin, 1992). Factor selection stops at the point immediately prior to where the curve of decreasing eigenvalues changes from a rapid to a decelerating decline to a flat gradual slope (Loehlin, 1992).

A third criterion is the chi-square test of residuals produced by the maximum likelihood method which determines whether the correlations implied by extracting factors provide an adequate account of the original correlations (Loehlin, 1992). The chi-square test provides a test of goodness of fit of the factor model to the data.

A final criterion is suggested by Fornell and Laker (1981). They argue that the average extracted variance (That is, the amount of variance in items explained by selected factors relative to the amount due to measurement error) should be equal or greater than 50 per cent.

Researchers suggested various cut-off points for selecting items for interpretation within each factor based on their factor loadings. Hair et al. (1995) recommends interpretation from items with a factor loading of 0.50 or more. Others suggest the use of a more conservative criterion (Kim & Mueller, 1993). Tabachnick and Fidell (1996) suggest 0.30 and above as a rule of thumb for factor loadings which can be interpreted. This research used 0.40 and above as a cut-off for factor loading size.

Rotation helps to transform the initial factor matrix into one that is easier to interpret. It provides a simple structure in which each factor can have relatively strong loadings on relatively few items. This step allows factors to be differentiated from one another. The most commonly used rotation method is the varimax method, which minimises the number of items with high loadings on a factor. Another orthogonal method is quartimax that minimised the number of factors needed to explain each variable, which, in turn, will simplify the interpretation of observed variables.

However, in real world samples factors will by nature be correlated with one another. Therefore, it is also advisable to employ the oblimin rotation (in this study, the default measure of obliqueness d=0, was used). So, the three rotation procedures were compared in determining the measurement structures.

Cluster Analysis

Cluster analysis is an analytical technique for developing meaningful subgroups of individuals or variables (Hair et al., 1995). The objective is to classify the sample of entities (individuals or variables) into a smaller number of mutually exclusive groups based on the similarities among the entities. In this analysis, the groups are not predefined. Instead, the technique is used to identify the groups.

Cluster analysis usually involves at least two steps (Hair et al., 1995). The first is the measurement of some form of similarity or association between the entities to determine how many groups really exist in the sample. The second step is to profile the persons or variables to determine their compositions. This second step is somewhat similar to discriminant analysis where linear combinations of predictor variables or cases are used to classify variables or cases into groups (Hair et al., 1995).

The Use of WesvarPC

The analyses to examine the between-group differences as well as to investigate the changes of structural, attitudinal, and perceptual dimensions after the implementation processes are undertaken using the WesVarPC computer package developed by Brick et al. (1996). The WesVarPC program can be used for the testing of significance in multilevel data. Since the data in this study are clearly multilevel, the use of WesVarPC to analyse the between-group differences in this chapter is considered necessary. In this analysis, the difference between estimates is regarded as being significant at the five per cent level. This means that if the value of the probability from the WesVarPC output (prob>|t|) is smaller than 0.05 for a difference, then the difference is considered to be significant.

In addition, two other indices are also added to each table of comparison to provide more information about the magnitudes of the differences. The first index is the standard error of estimate for each variable being compared, calculated separately using SPSS.

The second index is the effect size for comparison, calculated using the following formula:

$$\text{Effect Size} = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\dfrac{sd_1^2 + sd_2^2}{2}}}$$

Where:

$\bar{x}_1$ = the mean of group one,
$\bar{x}_2$ = the mean of group two,
sd_1 = the standard deviation of group one, and
sd_1 = the standard deviation of group two.

Cohen (1992) has suggested that the effect size of smaller than 0.20 should be considered as trivial, the effect size 0.20 as small, the effect size of 0.50 as medium, and the effect size of 0.80 should be considered as large.

The Use of PLS for Single Level Path Analysis

The PLS path analysis computer program used in this study was PLSPATH version 3.01 developed by Sellin (1989) based on the partial least squares procedure introduced by Wold (1982) as a method for estimation of path models with latent constructs measured by multiple indicators. Sellin (1995, p. 266) has claimed that PLS is "a flexible and extremely powerful technique for the examination of path models with latent constructs measured by multiple indicators." Sellin (1995) argued that PLS was flexible and powerful for several reasons, such as: could handle a big data file as well as a small data file, technically simple, took little time running it in the computer, and did not require rigorous distributional assumptions. The use of latent variables was of great convenience because several manifest or observed variables could be grouped together to form a latent variable so that the number of paths in the model could be reduced to a reasonable number. In addition, Sellin (1995, p. 256) suggested that the use of PLS was to be recommended in a condition where "the research situation at hand demands the investigation of complex models in an exploratory rather that a confirmatory fashion."

Falk (1987) reported that path analysis had been used by some researchers as early as the late 1920s. However, major developments of path analysis in social science research studies took place only in the late 1960s, Tuijnman and Keeves (1994, p. 4339) suggested that path analysis did not get much attention for over 40 years "largely because of heavy computational work involved". With the development of computer technology, the use of path analysis became more popular since the work of heavy computation was no longer a problem. Keeves (1988, p. 724) suggested that the use of path analysis made it possible for the researchers "to shift from verbal statements of a complex set of interrelationships between variables to more precise mathematical ones and to estimate the magnitude of the causal links involved."

However, PLSPATH does not allow for multilevel data. Hence, most significance testing that involves dissaggregated variables is associated with inappropriate estimates of error and the levels of significance are over-estimated.

Furthermore additional shortcomings of PLSPATH are:

(a) PLSPATH does not allow for estimation on measurement errors of MVs; and

(b) PLSPATH does not allow for inter-correlation between MVs

The relationships among variables in the PLS path models are developed by using two sets of linear equations, referred to as the inner model and the outer model (Noonan & Wold, 1988; Sellin, 1995). Sellin (1995, p. 257) defines the inner model as "the relationships between unobserved or latent variables (LVs)", and the outer model as "the relationships between LVs and their associated observed or manifest variables (MVs)." The relationships between latent variables and their associated manifest variables (outer model) are of two types. The first type is where the constructs (latent variables) are viewed as causes of measures, meaning that variation in a construct leads to variation in its measures (Edwards & Bagozzi, 2000). Such measures are termed reflective, because the represent reflections, or manifestations, of a construct. The second type is where the measures are viewed as causes of constructs (Edwards & Bagozzi, 2000). Such measures are termed formative, meaning the construct is formed or induced by its measures. Furthermore, Edwards and Bagozzi (2000) break the two types down into a more detail classifications as shown in Table 7.1. In this study, the two direct models are employed.

Table 7.1 Classification of Models Relating Constructs to Measure

Type of Measure	Reference of Measure		
	Cause of Construct	**Inherent Attributes of Construct**	**Effect of Construct**
Reflective	Spurious model	Direct reflective model	Indirect reflective model
Formative	Indirect formative model	Direct formative model	Unanalysed Model

Adopted from Edwards and Bagozzi (2000), On the nature and Direction of Relationships Between Constructs and Measures, *Psychological Methods*, 5(2), p. 167.

The relationships between latent variables (inner model) in the path model signify the causal relationships between the latent variables, and are indicated by a unidirectional arrow from the determining variable to the variable dependent on it. Keeves (1988) stated that the determining variables, which did not depend on any other variables, were referred to as exogenous variables, simply indicated by the fact that there was no unidirectional arrow pointing towards the variable. The variables, which are dependent on any other variables, indicated by one or more unidirectional arrows pointing towards the variables, are referred to as endogenous variables. In addition, the variable, which is dependent only on other variables, is referred to as the outcome latent variable.

Model Building in the PLSPATH program

Falk (1987) suggested that the best way to start model building using PLS was by drawing a path diagram of the data analysis to be undertaken. Model building in the PLSPATH program is based on the path diagram presented in the propositions to be tested in Chapter Five. All latent variables and their associated manifest variables were defined in the input file in such a way that they were all systematically ordered. For this purpose, it was helpful to number all latent variables used in the path diagram, and the order of the latent variables defined in the input file was undertaken following this order.

It should be noted that one of the limitations of the use of the PLSPATH program is the absence of the test of significance. However, Sellin (1989) indicated that the estimates of the standard errors through the jackknife method could be used in the test for the significance of the result. This use of the jackknife method made clear that commonly in the social sciences cluster samples rather than simple random samples were employed and the use of the simple random sample significance testing procedures was, in general, inappropriate.

Trimming the Model

Model trimming in PLSPATH involves deleting the manifest variables and the latent variables, which do not have significant paths in the model. The procedure to trim the model is undertaken by using the outer model and the inner model results from the analysis.

The outer model results specify the strength of relationships between a latent variable and the manifest variables, which form or reflect the latent variable concerned as defined in the PATTERN command line. Any manifest variable, which does not contribute significantly to the formation or reflection of the latent variable, is removed from further analysis.

The inner model results specify the strength of relationships between one latent variable and other latent variables as defined in the MODEL command line. Any path between the latent variables, which does not show significant influences, is removed from further analysis. The criteria for the deletion of the manifest variables in the outer model and the deletion of the latent variables in the inner model are presented below.

For the outer model, there are five indices that can be used as criteria to reject or delete a manifest variable from a latent variable it reflects or forms, namely weight, loading, communality, redundancy, and tolerance.

Weight indicates the strength of the regression type relationship between MVs and LVs with the inward mode. Keeves and Sellin (1997) suggested that the relationship between a manifest variable and its corresponding LV with the inward mode could be considered to be significant if the value of the weight wass equal to or larger than 0.10.

Loading indicates the strength of the factor analytic type relationship between MVs and LVs with the outward mode. Sellin and Keeves (1997) suggested that the relationship between a manifest variable and its corresponding LV with the outward mode was considered significant if the value of the loading was equal to or larger than 0.40.

Communality indicates the strength of the outer model and is calculated as the squared correlation between MVs and their corresponding LVs (Sellin, 1989). The strength of the outer model is measured by the average of communalities (Falk, 1987) which is considered to be significantly strong if the average communality value is greater than 0.30.

Redundancy indicates "the joint predictive power of inner model and outer model relationships as estimated for a given data set" (Sellin, 1989). Tolerance indicates the possibility of seriously damaging multicollinearity within the corresponding block of MVs. Sellin (1989) suggested that a tolerance value of 0.50 or higher indicated possible multicollinearity within the block of MVs. These effects would only be damaging for the formative mode and not for the reflective mode.

For the inner model, there are four indices that can be used as the criteria to delete a path or relationship in the model, namely, beta, correlation, tolerance, and R-square. Beta indicates the path coefficient associated with the direct effect of a LV on another LV, which it influences. Sellin (1989) suggested that a beta coefficient of 0.07 or greater was considered to be significant in large samples or 0.10 for small samples. Correlation indicates a product-moment correlation between a given predictor LV and the dependent LV (Sellin, 1989). A change in sign between the beta coefficient and the correlation coefficient indicates the existence of a suppressor effect which should be carefully examined, and, in general, the relationship removed from the analysis (Keeves, 1997). R-squared indicates the predictive strength of the inner model relationships, which also indicates the variance explained for each endogenous variable.

The statistical test of significance is not provided in the results of the PLSPATH analysis. Lietz (1995, p. 153) argued that "it is left to the researchers to determine possible misspecification of the model" rather than relying on the tests of statistical significance. However, where an estimated coefficient is more that twice the value of its jackknife standard error, the coefficient can be considered to be statistically significant at approximately the five per cent level of probability.

The Use of AMOS Program for Confirmatory Factor Analysis and Single Level Path Analysis

Structural equation modelling (SEM) examines a series of dependence relationships simultaneously. It is particularly useful when one dependent variable becomes an independent variable in subsequent dependence relationships. This set of relationships, each with dependent and independent variables, is the basis of structural equation modelling (Hair et al., 1995). The best known structural equation modelling technique is LISREL but this study used AMOS (Analysis of Moment Structure). Amos's default method of computing parameter estimates is maximum likelihood. According to Arbuckle and Wothke (1999) Amos provides the following methods for estimating structural equation models:

(a) maximum likelihood,

(b) unweighted least square,

(c) generalised least square,

(d) Browne's asymtotically distribution free criterion, and

(e) scale free least squares.

When confronted with missing data, Amos performs a full information maximum likelihood imputation instead of relying on the mean imputation, listwise deletion or pairwise deletion.

There are two main assumptions in structural equation modelling. First, observations must be independent. Second, the observed variables must meet certain distributional requirements. It will suffice if the observed variables have a multivariate normal distribution (Arbuckle & Wothke, 1999). There is another, more general situation to apply maximum likelihood estimation.

If some exogenous variables are fixed (i.e., they are either known beforehand or measured without error) their distribution may have any shape, provided that:

> (a) for any value pattern of the fixed variables, the remaining (random) variables have a (conditional) normal distribution;
>
> (b) the (conditional) variance-covariance matrix of the random variables is the same for every pattern of the fixed variables; and
>
> (c) the (conditional) expected values of the random variable depend linearly on the values of the fixed variables.
>
> (Arbuckle & Wothke, 1999, p. 78)

Hair et al. (1995, p. 15) added that SEM is characterised by two basic components: (a) the structural model and (b) the measurement model. The structural model is called the 'path' model, which relates independent to dependent variables. In such situations, theory, prior experience, or other guidelines allow the researcher to distinguish which independent variables predict each dependent variable. The measurement model allows the researcher to use several variables (indicators) for a single independent or dependent variable. In SEM there are two kind of variable: (a) observed and (b) latent (unobserved variable).

AMOS 4 provides two ways to control the program: Amos Basic and Amos Graphics. Amos Basic is the macro workhorse for simplifying many specialised modelling tasks. Other object oriented programming language such as Visual Basic or C++ can also be used to control Amos Graphics. Amos graphics has a graphical interface for model specification.

Amos can read data in various database formats, such as Comma delimited ASCII, SPSS files, Dbase, Microsoft Excel, Microsoft Foxpro, Lotus 1-2-3 files, and Microsoft Access.

Specifying the Model / Draw Path Diagram

Path diagram can be drawn quite easily using the drawing tools in AMOS. Observed variables are drawn as boxes, and unobserved or latent variable are drawn in circles or ellipses. The error term in the diagram is drawn as a latent error.

The causal relationships are pictured by single headed arrows, and covariances that exist among variables are drawn as double headed arrows. When a variable has no single headed arrow pointing to it and only has single headed arrows departing from it, it is called an 'exogenous' variable. Otherwise, it is called an 'endogenous' variable.

Trimming the Model

When AMOS has completed the calculations, there are three options for viewing the output: text output, table (spreadsheet) output, or graphic output for both standardised and unstandardised models.

Critical ratios (CRs) and modification indices (MIs) are two criteria that are used to improve the models. The critical ratio is an observation on a random variable that has an approximate standard normal distribution. The critical ratio is obtained by dividing the estimate by its standard error. Thus, using the significance level of 0.05, any critical ratio that exceeds 1.96 in magnitude would be called significant (Arbuckle & Wothke, 1999). Modification indices, on the other hand, suggest ways of improving a model by increasing the number of parameters, so that the chi-square statistic decreases faster than the degrees of freedom. However, Arbuckle and Wothke (1995) have argued that in trying to improve upon a model, a modification must only be considered if it is makes theoretical or common sense. Modification indices alone should not be used exclusively as a guide in trimming the model.

The Use of Mplus 2.0 for Multilevel Path Modelling

It has already been pointed that the data collected in this study included not only the information on variables gathered at the employee level but also on questions regarding the characteristics of each organisation involved in the study. In addition, there are also some district characteristics collected through various secondary data sources. Hence the data files contain information obtained at three different levels, namely individual level, organisational level, and district level. Models of IT adoption might be developed from theory that incorporate certain organisation and district variables which might influence each phase of IT adoption processes. The examination of such models is undoubtedly of particular interest, yet severe problems arise from the inclusion of data that are obtained at different levels into one model.

According to Keeves and Cheung (1990), five separate issues seem to arise in single level analyses carried out using PLSPATH and AMOS. They are:

(a) problems of aggregation of data from a lower to a higher level;

(b) problems of disaggregation of data from a higher to a lower level;

(c) specification errors which arise when a variable measured at the lower level is permitted to account for variance that is more properly associated with the higher level such as the climatic conditions in the classroom;

(d) specification errors which arise when a variable measured at the higher level is not permitted to account for variance with which it is associated at the lower level, such as the variability of the regression slopes between groups; and

(e) problems associated with the estimation of errors which arise with measures obtained under conditions involving two or more levels of sampling and measurement.

Consequently, multilevel analyses were needed in order to obtain satisfactory results. In this study, two level models were analysed using MPLUS (ver. 2). Initially, two Level-1 models were defined based on the combined results of PLSPATH and AMOS. One model was for the initiators and the other one was for the non-initiators. The models were then trimmed using the critical ratios and modification indices in a similar way to AMOS trimming procedures. Once the Level-1 models were finalised, Level-2 models were defined based on PLSPATH organisational level results. The Level-2 models, then, were trimmed based on critical ratios. Latent variables that were estimated to have significant correlations were tested for inclusion in the model. These procedures were repeated until stable final results were obtained.

The single level analyses results from PLSPATH and AMOS at the individual level were then compared with the within groups model results from MPLUS. For organisational level analyses, single level analyses results from PLSPATH were compared with between groups model results from MPLUS. An attempt to do a single level analysis at the organisational level using AMOS was unsuccessful due to the small sample size at the organisational level.

At the individual level, the first two analyses (PLSPATH and AMOS) were done under the assumption the units were independent of each other. This type of analysis is commonly referred to as 'between students overall' (Keeves & Sellin, 1988). In this type of analysis, the data from different groups are pooled and a single analysis is carried out between all employees in the total sample. While for MPLUS analysis, using a two level model analysis, involves the employment of 'between students within groups' type of analysis at the micro level or Level-1. In this analysis, the measures for each student are substracted from the group mean and thus the deviation values from the group means are employed. Moreover, the data for all groups are pooled for a combined analysis (Keeves & Sellin, 1988).

In general, the 'between students overall' analysis will provide more variance to be explained. This will influence the R-square values. The variance comparison among 'between student overall', 'pooled between students within groups', and 'between groups' are presented in Table 7.3. Furthermore, the significant testing for the 'between student overall' ignores the fact that the samples come from a cluster sample design. The errors for the path coefficients obtained from this analysis for variables that have been disaggregated are commonly underestimates. As a result, significant path coefficients are more likely to be found. For the 'between groups analyses', both PLSPATH and MPLUS analysis were done using the between groups type of analysis. In these analyses, the individual level data were aggregated to the group level, and the group level data were then added to the model. However, the estimates obtained using PLSPATH suffer from aggregation bias, while the MPLUS estimates are appropriate ones.

Table 7.2. Partitioning of variance

Type of Analysis		Sum of Squares
between students overall	Due to regression	t_1
	Residual	T_1
	Total	$t_1+T_1 = t_2 + T_2 + t_3 + T_3$
between groups	Due to regression	t_2
	Residual	T_2
	Total	$t_2 + T_2$
pooled between students within groups	Due to regression	t_3
	Residual	T_3
	Total	$t_3 + T_3$

Adapted from Keeves and Sellin (1988, p. 694).

The Use of HLM Program for Hierarchical Linear Modelling

Hierarchical linear modelling (HLM) or multilevel modelling represents an attempt to take into consideration the hierarchical nature of the multilevel data that are collected. The aim is to overcome the problems associated with single-level procedures such as partial least squares path analysis or structural equation modelling where data obtained at different levels have to be either aggregated or disaggregated before they can be analysed. In the aggregation process, information is lost because the variance of lower level variables, which often represent a considerable amount of the overall variance, is reduced. The disaggregation process also leads to a violation of the assumption of the independence of observations because the same value is assigned to all members in one group.

Even though the procedures of two-level path analyses using MPLUS take into consideration the hierarchical nature of the data and prove to be more valid and meaningful compared to single-level analyses using PLSPATH or AMOS (Darmawan, 2001), these procedures are still unable to estimate the interaction effects across levels. In seeking an explanation of such effects, another technique was employed, which is called the hierarchical linear modelling (abbreviated as HLM) technique (Bryk, Raudenbush, & Congdon, 1996).

Thus, HLM is employed to: (a) improve the estimation of individual effects; (b) model cross-level effects; and (c) partition variance-covariance components across levels of analysis in order to apply significance tests more appropriately (Bryk & Raudenbush, 1992).

The main assumptions underlying HLM are also those of normality and linearity for both the structural and random part of the model. In terms of the structural part, inferences based on standard linear models require a properly specified model where the outcome is a linear function of the regression coefficients. In terms of the random part, it assumes independent errors with equal variance. Standard hypothesis tests also require that the errors are normally distributed (Bryk & Raudenbush, 1992).

Among the technical difficulties associated with the use of HLM is that HLM does not allow the construction of latent variables. This problem can be solved by combining observed variables into constructs outside HLM using principal components analysis as well as regression analysis. Furthermore, HLM does not permit the modelling of indirect effects between variables. This would mean that complex path models such those presented in Chapter Five currently could not be examined in one analysis. Examination of such models would require a stepwise procedure on a sequence of independent HLM runs. First, effects of all predicting variables on the outcome variable (e.g. user performance) would be estimated. In each subsequent run, one predicting variable would be specified as the outcome variable. The order in which the predicting variables were specified as the outcome variables would be based on their position in the model. Results from the independent runs would then have to be collated to indicate the way in which variables operated through other constructs to influence later variables in the model. However, this procedure would be very cumbersome, and consequently, other techniques that allow such analysis should be considered (e.g. by using MPLUS or STREAMS that allow the analysis of indirect effects as well as direct effects). Furthermore, there would be no guarantee using HLM that the combination of several separate and stepped solutions would form an optimal solution since they are not analysed simultaneously, as is undertaken in PLSPATH and AMOS.

Model Building

Data analysis by means of the HLM program typically involves three stages: (a) construction of the sufficient statistics matrices (SSM) file, (b) execution of analysis based on the SSM file, and (c) evaluation of fitted model based on a residual file (Bryk et al., 1996)

The SSM file is constructed from raw data. For HLM/2L, two raw data files are required as input: a Level-1 file and a Level-2 file. The two files are linked by a common Level-2 unit ID. For HLM/3L, a third file. a Level 3 file, is required. Once the SSM file is constructed, all subsequent analyses are computed using the SSM file as input.

The next step is to specify the model. For a two level HLM analysis, model specification has three steps: (a) specifying the Level-1 model, which defines a set of Level-1 coefficients to be computed for each Level-2 unit, (b) specifying a Level-2 structural model to predict each of the Level-1 coefficients, and (c) specifying the Level-1 coefficients to be considered as random.

Model Trimming

First, an examination of reliability estimates for random coefficients reveals whether the decision to treat an effect as random should be reconsidered. Low reliability (i.e. below 0.05) estimates of a relationships indicate that there is too much error associated with the relationships. Hence, low reliability should be taken as an indication of the need to treat an effect as fixed. However, it has to be kept in mind that interaction effects, whereby a Level-2 variable influences the effect of a Level-1 predictor of the outcome variable can only be examined where the Level-1 effect is considered to be random, and the introduction of cross level and other effects frequently raises an estimated relationship to an acceptable level.

Furthermore, HLM/2L and HLM/3L provide estimates of the proportion of variance associated with each level in a table of ‘Final estimation of variance components’. Comparisons between these figures for a particular model with figures for a so-called fully-unconditional model can provide an indication of the amount of variance explained by the predictor variables at each level (Bryk & Raudenbush, 1992).

Probably the most interesting information is given in the table of ‘Final estimation of fixed effects’. Estimation of the gamma (γ) coefficients can be interpreted as metric path coefficients. Examination of the corresponding t-ratio provides an indication of the significance of the gamma coefficient. A $|$t-ratio$|$ below 2.00 with a p-value in excess of 0.05 has been used as an appropriate cut-off point and the corresponding effect should be removed from the analysis.

In HLM analysis, deviance is used to compare the goodness-of-fit between models. Thus a fit test is a comparative one, involving a reduction in deviance because the estimation is not a least squares estimation but a maximum likelihood estimation. A comparison between the variance components of what is considered to represent the final model, which has been refined on the basis of interim results, and the variance components of the fully unconditional model, which provides estimates of variance available to be explained, reveal the exploratory power of the final model.

8

Data Preparation and Preliminary Analysis

Data Preparation

Standard statistical methods were developed to analyse rectangular data sets. The rows of the data matrix represented cases, and the columns represented the variables measured for each case. Before any further analysis was done, it was necessary to evaluate the data. The data screening procedures were conducted through an examination of the basic descriptive statistics and the frequency distributions (Kline, 1998).

Missing Values

Chapter Seven explains the methods of data analyses, including the imputation of missing values as published in Darmawan (2002a). In this study the percentage of missing values for each item is less than 15 per cent, which is still acceptable (Kline, 1998). The items that have the proportions of missing values greater than 20 per cent were dropped from further analyses. Three open-ended items namely A_APP (additional applications available), AAPPUS (additional applications used), ATKSSU (additional tasks supported) were dropped from further quantitative analysis due to their high proportion of non-responses (84.3%, 85.5%, and 88.9% respectively). For the remaining items, multiple imputation methods were employed. The incomplete dataset was imputed five times by using NORM program. In order to produce a single complete dataset to be used in the subsequent analysis, the five plausible datasets were averaged.

Test for Normality of Data

Before continuing with further analysis, it is also desirable to evaluate whether each variable is normally distributed. Skewness and kurtosis are two characteristics of a distribution that indicate whether the data are normal or non-normal. In normally distributed sample scores, the value of skewness and kurtosis are close to zero. An alternative to significance tests of univariate skewness and kurtosis indexes is to interpret their absolute values, but there are few clear guidelines about how much non-normality is problematic As a working guide, the absolute values of skewness and kurtosis that still can be accepted are <3 and <8 respectively (Kline, 1998). Other graphical methods can also be used to examine the normality of the data distribution such as: (a) histogram - by fitting a normal curve to check how closely each distribution resembles the normal curve; and, (b) normal probability plots (Q-Q plot) - where each observed value is plotted against its expected value from the normal distribution. None of the items has a value for skewness that is more than 3 and for kurtosis more than 8. Therefore, the items can be considered to be normally distributed to an adequate degree for further analysis (Kline, 1998).

Validity and Reliability

Validity

Here, validity is a characteristic of the measures or scores. The validity of a score is a descriptive term used in relation to a measure that indicates how accurately the recorded values reflect the concepts being measured (Sekaran, 1992). Also validity assesses the extent to which the scores obtained from a scale that measure what the scale is supposed to measure not something else (Pallant, 2001). There are three types of validity: content validity, criterion-related validity, and construct validity.

Content validity implies that the measures include an adequate and representative set of items that would tap the concept. Face validity is a basic, and a very minimum, index of content validity (Sekaran, 1992). In this study, face validity for the instrument was achieved through pre-testing and pilot testing of the instruments. Also, the extensive literature review process through which the list of items for measuring the constructs was derived lent adequate credibility to meeting the requirement of content validity.

Criterion-related validity refers primarily to concurrent and predictive validity. The differences between concurrent and predictive validity are essentially a matter of timing, predictive referring to the future, and concurrent referring to the present. Isaac and Michael (1995, p. 129) provide the following definition in relation to criterion-related validity: “Criterion-related validity is demonstrated by comparing the test scores with one or more external variables considered to provide a direct measure of the characteristic or behavior in question” (see also Stanwick, 1999).

Hence the scores from the test in question are compared to an external criterion. Indeed, there can be more than one external criterion. However, one of the major difficulties associated with the determination of criterion-related validity is finding a suitable criterion (see also Stanwick, 1999). Therefore, criterion-related validity is not undertaken in this study. Instead, this study uses construct validity to assess the measures.

Essentially, construct validity testifies to how well the results obtained from the use of the measure fit the theories around which the study is designed. Construct validity is usually verified through factor analytic techniques examining whether the items representing a particular construct have high factor loadings on one construct and low loadings on all other constructs (Stevens, 1996). All the items representing one or more of the research constructs belonging to each domain (e.g. all five constructs - type, size, complexity, centralisation, formalisation - belonging to the organisational factors domain) were subjected to exploratory factor analysis (EFA) using principal component analysis. Because the items used many different scales, for simplicity, the standard scores were calculated in SPSS beforehand (Joreskog & Sorbom, 1979). In this study, three different rotations - varimax, quartimax, and oblimin were employed and compared. As discussed earlier in Chapter Five, there are nine relevant domains - environmental factors, organisational factors, technological factors, human factors, initiation, adoption, utilisation, user satisfaction, and user performance. Four commonly employed decision rules for the identification of factors are followed in this case (Stevens, 1996):

a) retain only those factors whose eigenvalues are greater than 1;

b) retain only those items with a minimum factor loading of 0.40;

c) if any item has loadings of more than 0.40 on more than 2 factors, drop it from further consideration; and

d) drop single item factors as retaining them is neither appropriate nor parsimonious.

The constructs derived from the principal component factor analysis using the above procedure are presented in Appendix A, which indicate the extracted factors and also the labels that are provided for them. The three rotations produce the same number of factors for all domains except for Satisfaction items. In this case, both varimax and oblimin rotations group the items into four factors while a quartimax rotation produces only three factors.

Reliability

The reliability of measurement indicates the stability and consistency with which the scores obtained from an instrument are measuring the concept (Sekaran, 1992). In other words, the reliability of a measure indicates how free it is from random error (Pallant, 2001). Furthermore, Pallant (2001) stated that two frequently used indicators of a measure's reliability are test-retest (also referred to as 'temporal stability') and internal consistency. The test-retest reliability of a measure is assessed by administering it to the same people, on two different occasions, and calculating the correlation between the two set of scores obtained. High test-retest correlations indicate more reliable measurement. The second aspect of reliability that can be assessed is internal consistency. This consistency is the degree to which the items that are used in the measurement process are all measuring the same underlying attribute. In this study, the internal consistency reliability of the measures is assessed by the Cronbach alpha coefficient. The factors extracted from the exploratory factor analysis were also subjected to reliability checks for further refinement. The results of this analysis are presented in Table 8.1.

Cluster Analysis

It can be seen from Table 8.1 that EXTEN has a low Cronbach Alpha coefficient, therefore it could well be dropped. However, before any attempt to drop was taken, it was considered advisable to examine other possible alternative arrangements for grouping the items. For this purpose, cluster analyses were undertaken.

All the items representing one or more of the research constructs belonging to each domain were subjected to cluster analysis using Average Linkage (Between Groups) analysis. The result for the ADOPTION construct is presented in Figure 8.1, while the results for the other constructs are presented in Appendix B.

Table 8.1 Cronbach Alpha Coefficients

Scale	Description	Cronbach Alpha	
RSIZE	District size	0.99	
SOCEC	Socio-economic level	0.97	
SUFAC	Supporting facilities	0.97	
Overall environmental items		**0.81**	
TYPE	Organisational type	-	
OSIZE	Organisational size	0.75	
COMPLEX	Organisational complexity	0.98	
		Before Adoption	**After Adoption**
CENTRAL	Centralisation	0.80	0.82
FORMAL	Formalisation	0.83	0.86
Overall organisational items		**0.75**	
BELIEF	Beliefs	0.74	0.77
OBSERV	Observability	0.86	0.91
COMPA	Compatibility	0.88	0.81
COMPLEX	Complexity	0.73	0.53
RELAD	Relative Advantages	0.93	0.87
Overall technological items		**0.87**	
ANX	Anxiety	0.89	0.88
ORIGIN	Originator	0.92	0.92
SYSTEM	System oriented	0.84	0.82
RULE	Rule oriented	0.90	0.87
CONSERV	Conservatism	0.85	0.83
FITTIN	Fitter-in	0.89	0.89
GENDER	Gender	-	
AGE	Age	-	
EDUC	Educational level	-	
COMCH	Communication channel	-	
Overall human items		**0.80**	
NEEDPULL	Need pull	0.96	
TECHPUSH	Technology push	0.95	
SOCPRESS	Social pressure	0.94	
Overall initiation items		**0.97**	
COMMIT	Commitment	0.83	
EXTEN	Extensiveness	0.18	
Overall adoption items		**0.69**	
PASUSE	Passive Usage	0.71	
ACTUSE	Active Usage	0.70	
Overall utilisation items		**0.69**	
ITADEQ	IT adequacy	0.85	
SYSSAT	System Adequacy	0.93	
VENSAT	Vendor Satisfaction	0.91	
TRASAT	Training Satisfaction	0.90	
Overall four factors satisfaction items		**0.94**	
SYSSAT	System Satisfaction	0.94	
VENSAT	Vendor Satisfaction	0.91	
TRASAT	Training Satisfaction	0.90	
Overall three factors satisfaction items		**0.93**	
PERFORMANCE (3 composite items)		**0.90**	
Overall items		**0.92**	

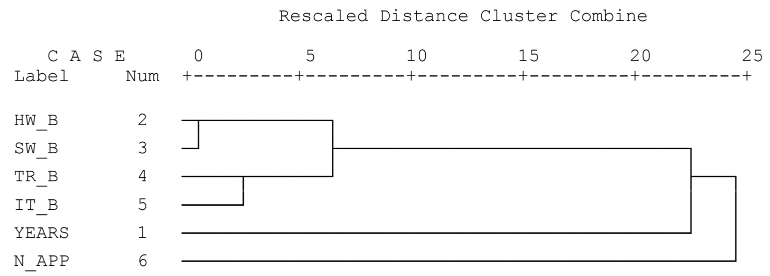

Figure 8.1 Cluster Analysis for Adoption

The results of cluster analysis confirmed the results of exploratory factor analysis. All analyses - cluster analysis, EFA with varimax rotation, EFA with quartimax rotation, and EFA with oblimin rotation produced the same results for all the domains except for the adoption, satisfaction, and performance domains. The environmental items formed three factors: (a) district size, (b) socio economic level, and (c) supporting facilities. The organisational items could be grouped into four factors: (a) organisation's size, (b) level of centralisation, (c) level of formalisation, and (d) level of IT complexity. In addition to these four factors extracted from the analyses, the fifth factor, namely organisational type (OTYPE) accommodated the three types of government agencies in Bali.

The technological items were grouped into five factors: (a) belief, (b) observability, (c) compatibility, (d) complexity, and (e) relative advantage. The items used to tap the construct of trialability were highly correlated with observability items. In both the EFA and cluster analyses, these items were forming a single factor, which was called 'observability'. Compatibility items, however, gave rise to two different factors. The work compatibility and previous experience compatibility fitted nicely into a single factor, which was labelled 'compatibility'. Items related to personal values and beliefs compatibility were grouped into a factor called 'belief'.

The attitudinal items within the human factors domain gave rise to six factors: (a) anxiety, (b) originator, (c) system oriented, (d) rule oriented, (e) fitter in, and (f) conservatism. In addition to these six factors, four variables were added namely (a) gender, (b) age, (c) level of education, and (d) communication channel.

It can be seen from the cluster analysis results, that these additional variables, for both the organisational factors domain and human factors domain, are confirmed to be separate factors.

Initiation items were grouped into three factors: (a) need pull, (b) technology push, and (c) social pressures. From the factor analysis, all three rotations confirmed that the adoption items fell into two factors: (a) level of commitment and (b) extensiveness. However, the second factor, extensiveness, had a very low reliability coefficient. Further examination using cluster analysis, as can be seen in Figure 8.1, suggested that extensiveness should be divided into two separate factors, because the two items that formed the factor had a low correlation. All analyses confirmed that utilisation items could be grouped into two factors: (a) passive usage and (b) active usage. The result of cluster analysis for the satisfaction domain confirmed the results of the varimax and oblimin rotations. The items could be grouped into four factors: (a) IT adequacy, (b) system satisfaction, (c) vendor satisfaction, and (d) training satisfaction. For the performance items, although all EFA rotations confirmed the single factor for performance, the cluster analysis gave a more detailed picture. These items could be grouped into three factors: (a) efficiency, (b) effectiveness, and (c) appropriateness.

Confirmatory Factor Analysis

In order to compare various structural models obtained from the exploratory factor analyses and cluster analyses, a series of structural equation models were tested with the help of confirmatory factor analysis using AMOS (ver. 4.0). This analysis was also used to examine the possibility of employing second order factor models to simplify further the overall models. By using this type of analysis, factor structures derived from EFA and cluster analyses could be compared with a one factor model and a second order factor model for attitudes toward change, initiation, adoption, utilisation, user satisfaction, and user performance. Other domains that already had a simple factor structure, such as environment factors, organisational factors, technological factors, and part of the human factors were not tested with CFA.

Therefore the EFA results that had been confirmed by cluster analysis results were, then, used for the subsequent analyses. From the CFA analysis, higher level factor models were chosen for attitude toward change, initiation, adoption, satisfaction and performance. The standardised results for CFA analysis are presented in Appendix C.

Table 8.2 Model Comparison

No	**Model**	**χ^2/DF**	**GFI**	**AGFI**	**RMSEA**
1	One Factor Model of Attitude Toward Change	23.29	0.47	0.39	0.153
2	Five Factors Model of Attitude Toward Change	5.19	0.86	0.82	0.066
3	Second Order Factor Model of Attitude Toward Change	5.31	0.85	0.82	0.064
4*	Higher Level Factor Model of Attitude Toward Change	1.29	0.99	0.99	0.017
5	One Factor Model of Initiation	4.22	0.97	0.91	0.083
6	Three Factors Model of Initiation	1.92	0.98	0.96	0.046
7	Second Order Factor Model of Initiation	1.99	0.98	0.96	0.046
8*	Higher Level Factor Model of Initiation	-	1.00	-	-
9	Two Factors Model of Adoption	5.11	0.99	0.96	0.066
10	Second Order Factor Model of Adoption	5.11	0.99	0.97	0.066
11*	Higher Level Factor Model of Adoption	-	1.00	-	-
12	One Factor Model of Usage	1.77	0.99	0.99	0.028
13*	Two Factors Model of Usage	2.49	0.99	0.98	0.039
14	Second Order Factor Model of Usage	3.30	0.99	0.97	0.042
15	Three Factors Model of Satisfaction	4.85	0.90	0.88	0.063
16	Four Factors Model of Satisfaction	4.13	0.92	0.90	0.057
17*	Second Order Factor Model of Satisfaction	4.73	0.91	0.88	0.062
18	Third Order Factor Model of Satisfaction	4.14	0.92	0.90	0.057
19	One Factor Model of Performance	8.21	0.94	0.90	0.087
20	Three Factors Model of Performance	4.43	0.97	0.95	0.060
21*	Second Order Factor Model of Performance	4.43	0.97	0.95	0.060

Note: * used for the subsequent analysis.

Table 8.3 Final Factor Structures

Factors	Description	Manifest Variables	Loading	Remark
Environmental Factors				
RSIZE	District size	AREA	0.98	Land area
		POPU	1.00	Population
		ULEV	0.99	Upper level government support
SOCEC	Socio economic level	INCO	0.94	Per capita income
		REVC	0.99	Revenue/capita
		SCBC	0.97	SC budget/capita
		BUDC	0.94	Total budget/capita
SUFAC	Supporting facilities	ITSU	0.99	IT supplier /area
		ITSE	0.99	IT service/area
		ITTR	0.99	IT Training/area
		TELC	0.88	Telecommunication/capita
Organisational Factors				
TYPE	Organisation's type	DECE	Dummy	Decentralised agency
		DECO	Dummy	Deconcentrated agency
		ENTR	Dummy	Enterprise type agency
OSIZE	Organisation's size	NEMP	0.70	Total employee
		VLEV	0.81	Vertical level
		HLEV	0.88	Horizontal level
OCOMPLEX	Organisational complexity	EMIT	0.95	Total employee with IT skills
		ITSK	0.97	IT skill
		ITEX	0.98	IT expertise
CENTRAL	Level of centralisation	CEN1	0.82	Level of centralisation item1
		CEN2	0.81	Level of centralisation item2
		CEN3	0.75	Level of centralisation item3
		CEN4	0.78	Level of centralisation item4
FORMAL	Level of formalisation	FOR1	0.87	Level of formalisation item1
		FOR2	0.90	Level of formalisation item2
		FOR3	0.82	Level of formalisation item3
Technological Factors / Attributes of the Innovation				
BELIEF	Belief	RDST	0.72	Reduce staff
		RDCO	0.69	Reduce cost
		CMJO	0.58	Create more jobs
		ISPL	0.75	Isolate people
		COLI	0.56	Control our lives
RELAD	Relative advantage	INPR	0.71	Increase productivity
		INEF	0.85	Increase effectiveness
		INAV	0.86	Increase availability
		INTI	0.88	Increase timeliness
		EACC	0.89	Easy to access
		SOBT	0.89	Speed to obtain
COMPA	Compatibility	WSCO	0.58	Work aspects compatibility
		ALCO	0.75	All aspects compatibility
		PRCO	0.56	Previous exp. compatibility
COMPLEX	Complexity	DIUN	0.86	Difficult to understand
		DIUS	0.84	Difficult to use

Table 8.3 Final Factor Structures (continued)

Factors	Description	Manifest Variables	Loading	Remark
OBSERV	Observability	SMVE	0.76	Small version availability
		MODU	0.79	Modular design
		TRYO	0.82	Chance to try out
		SEPR	0.75	See presentation & Demo
Human Factors				
GENDER	Gender	SEX	1.00	Sex of respondent
AGE	Age	YEAR	1.00	Age in year
EDUC	Education	DEGREE	1.00	Level of education
COMCH	Communication channel	FCH	Dummy	Formal channel
		ICH	Dummy	Informal channel
		WCH	Dummy	Written material
		DCH	Dummy	Don't know
ANX	Anxiety	ANX1	0.75	Anxiety item1
		ANX2	0.84	Anxiety item2
		ANX3	0.87	Anxiety item3
		ANX4	0.88	Anxiety item4
		ANX5	0.81	Anxiety item5
ATTD	Attitudes toward change	ORIG	0.71	Originator
		RULE	0.69	Rule oriented
		CONS	0.65	Conservative
		SYST	0.70	System oriented
		FITTIN	0.71	Fitter in
IT Adoption and Implementation Processes				
INIT	Initiation	NEED	0.45	Need pull
		TECH	0.89	Technology push
		SOCPRESS	0.39	Social pressure
ADOP	Adoption	SPEED	0.55	Speed of adoption
		COMMIT	0.25	Level of commitment
		EXTEN	0.31	Extensiveness
PASUSE	Passive usage	INPAU	0.57	Intensity of passive usage
		FRINU	0.88	Frequency of indirect usage
		FRPAU	0.55	Frequency of passive usage
ACTUSE	Active usage	INACU	0.94	Intensity of active usage
		FRDIU	0.57	Frequency of direct usage
		APPUS	0.46	Number of applications used
		TKSSU	0.38	Number of tasks supported
SATIS	User satisfaction	ITSAT	0.47	IT satisfaction
		SYSSAT	0.44	System satisfaction
		VENSAT	0.92	Vendor satisfaction
		TRASAT	0.89	Training satisfaction
PERFOR	User performance	EFFI	0.92	Efficiency
		EFFE	0.97	Effectiveness
		APPR	0.96	Appropriateness

The maximum likelihood estimations (MLE) for unstandardised and standardised values of the regression weights and the corresponding critical ratios were estimated. The first step was to examine the measurement models. For the measurement models, all factor loadings should be greater or equal to 0.4. The next step was to assess the goodness of fit of the models. Chi-square divided by the number of degrees of freedom was used as the goodness of fit indicator. A value of the ratio of a chi-square to the number of degrees of freedom which is less then 5 can be considered adequate for a large model (Al-Gahtani and King 1999). Other criterion are the goodness of fit index (GFI) and the adjusted goodness of fit index (AGFI), which approach unity the better the model fits the data. A fourth criterion is the root mean squares of error approximation (RMSEA), and values close to zero indicate a good model fit. The goodness of fit of these models is presented in Table 8.2.

The best model for each domain is chosen to be used in the subsequent analysis by considering factor loadings for each manifest variable in each model and the fitting indexes for each model. Consequently, principal component scores were calculated for the first order factors. These scores were then treated as manifest variables for the second order factors in the subsequent analyses. In addition, two-factor model of usage is chosen to be used, namely passive usage and active usage. The final factor structure along with the loadings can be seen in Table 8.3. These factors were, then, used in subsequent analyses.

The loadings presented in Table 8.3 were taken from CFA results for attitudes toward change, initiation, adoption, utilisation, user satisfaction, and user performance factors. The remaining factor loadings were taken from varimax rotation results in EFA analysis.

Summary

The collection of data in Indonesia encountered major problems associated with the sampling design and the data collecting process. In the sampling design process, some agencies chosen for the samples refused to participate since these agencies did not have any computers installed in their offices. In the data collecting process, some other difficulties were faced. Even though questionnaire forms were sent out one month in advance, some agencies were still not ready at the agreed collecting time. Some of them argued that the person in charge of handling this matter was not in the office at that time, while some others said that the questionnaire forms were missing.

However, by employing a combination of collecting techniques, collecting the completed forms personally on three consecutive occasions and finally asking the remaining responses to be sent through mail, a relatively high level of return rate was achieved.

Once the data were entered, data screening procedures were employed. First, the missing value pattern was examined. The multiple imputation methods were employed to replace the missing values. The incomplete dataset was imputed five times by using the NORM program. In order to produce a single complete dataset to be used in the subsequent analysis, the five plausible datasets were averaged. Second, the normality of the data was assessed by examining the skewness and kurtosis of each variable. None of the items had a value for skewness that was more than 3 and for kurtosis more than 8 (Kline, 1998). Therefore, the items could be considered to be normally distributed.

The next step was to check the validity and reliability of all constructs. A series of preliminary analyses was undertaken for this purpose. First, all domains were subjected to exploratory factor analysis using SPSS with three different rotations (varimax, quartimax and oblimin). A reliability check using the Cronbach Alpha coefficient, was conducted for this preliminary grouping. Most of the factors had a reasonably high coefficient except for EXTEN that had a low Cronbach Alpha coefficient. Before a decision to drop this factor was made, a series of cluster analyses was done. All the items representing one or more of the research constructs belonging to each domain were subjected to cluster analysis using Average Linkage (Between Groups) analysis. The results of the cluster analyses confirmed the results of the exploratory factor analyses. All analyses - cluster analysis, EFA with varimax rotation, EFA with quartimax rotation, and EFA with oblimin rotation produced the same results for all the domains except for the Adoption, Satisfaction, and Performance domains. In order to compare various structural models obtained from the exploratory factor analysis and cluster analysis, a series of structural equation models were tested with the help of confirmatory factor analysis using AMOS (ver. 4.0). This analysis was also used to examine the possibility of employing second order factor models to simplify further the overall models.

9

Demographic and Descriptive Information

In this chapter, demographic information on respondents, respondents' perception of IT attributes and IT adoption and implementation processes are described and the background data from the organisational level and the district level are discussed. These results are an essential part of the preparation of the subsequent analyses. The descriptive results in this chapter are generated using SPSS and WesVarPC. Moreover, in order to supplement the findings of the questionnaire, the responses of the subjects of the interviews are subject to content analysis.

In addition, some analyses to examine between-group differences, which were undertaken using the WesVarPC computer package developed by Brick et al. (1996), are also presented in this chapter. The WesVarPC program can be used for the testing of significance of multilevel data. Since the data in this study are clearly multilevel, the use of WesVarPC to analyse the between-group differences in this chapter is considered necessary. In this analysis, the difference between estimates is regarded as being significant if the five per cent level of significance is attained. This means that if the value of the probability from the WesVarPC output (prob>|t|) is smaller than 0.05 for a difference, then the difference is considered to be significant. In addition, the effect sizes were calculated in order to provide more information on the magnitude of the differences[8]

Demographic Information on Respondents

In this study, 957 respondents participated in the survey. In addition, 29 participants were involved in the interview sessions. They came from 153 organisations across all regions of Bali. Figure 9.1 and Figure 9.2 show survey respondents' distributions according to their gender and age. From the total of 957 respondents, 589 (62%) were male. This is typical of the Indonesian work force (Darma, 1998).

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[8] For more information on how to calculate the size effect see Chapter Seven.

In terms of age, the largest group of respondents was those between the ages of 31-40 years (41%). The second and the third largest groups in the study were employees in the age group 41-50 years (27%) and the age group 21-30 years (25%) respectively. In total, 93 per cent of the respondents were in the age group range 21-50 years.

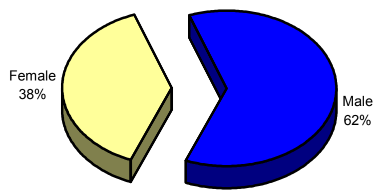


Figure 9.1 Gender of Respondents

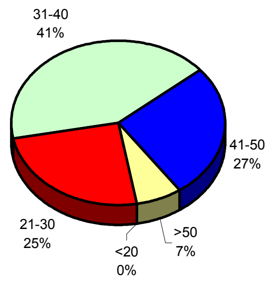


Figure 9.2 Age of Respondents

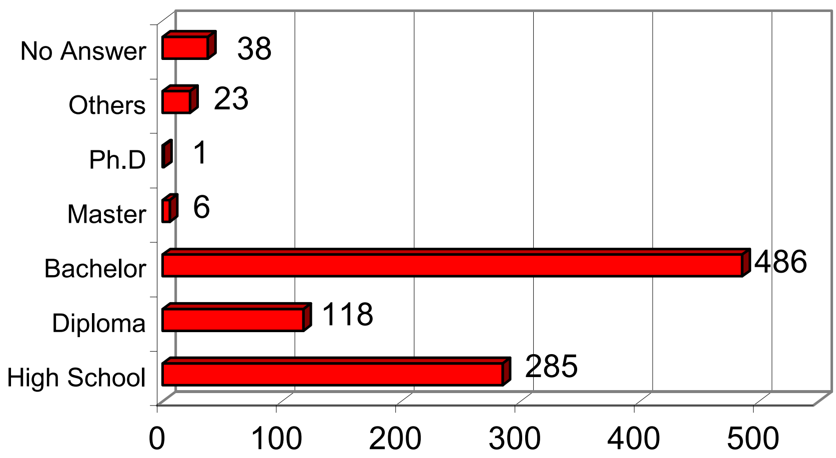


Figure 9.3 Educational Levels of Respondents

Figure 9.3 provides information on the educational level of the respondents. Almost two-thirds of the government employees who participated in this survey (66.2%) had at least a tertiary diploma or a university degree. About 30 per cent had only completed their high school education.

Table 9.1 presents the respondents' distribution in terms of computer training and computer experience. Almost one-third of them (33%), 204 male and 110 female respondents, had not completed any training. Most of the respondents had attended some sort of software training (67%). A small number of respondents (5%), 35 male and 11 female respondents, had had the experience of attending hardware training. Moreover, only 2.5 per cent of the total respondents had experience in both forms of training.

Even though almost two-thirds of respondents had experienced either software or hardware training, the levels of expertise of these respondents were still relatively low. It is shown in Figure 9.4 that among the respondents most (93%) were computer operators. Only five per cent and two per cent had any experience as a programmer or a systems analyst respectively.

Table 9.1 Respondents Distribution According to Their Computer Training and Gender

		Hardware					
Gender	**Software**	**No**	**%**	**Yes**	**%**	**Total**	**%**
Male	No	204	21.3	18	1.9	222	23.2
	Yes	350	36.6	17	1.8	367	38.3
Female	No	110	11.5	4	0.4	114	11.9
	Yes	247	25.8	7	0.7	254	26.5
Total		911	95.2	46	4.8	957	100.0

Figure 9.5 shows that more than half of the questionnaires were completed by staff members (51%), while most of the remaining (44%) were completed by mid- or lower level managers, and only five per cent were completed by the top level managers in the organisations.

Table 9.2 shows the distribution of respondents according to their work experience. Usually, government employees hold permanent contracts. Mostly they only resign their jobs when they reach the retirement age, which is 50 years of age for the low-level staff member. For the high rank staff members, their retirement age increases according to seniority. In terms of work experience, 21 per cent of the respondents had worked between 6-10 years, 19 per cent, 17 per cent, and 16 per cent of them had worked for 11-15 years, 2-5 years, and 16-20 years respectively.

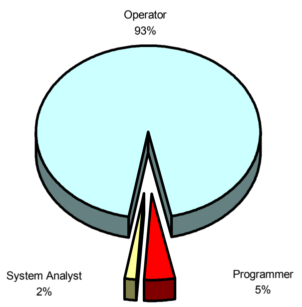


Figure 9.4 IT Expertise of Respondents

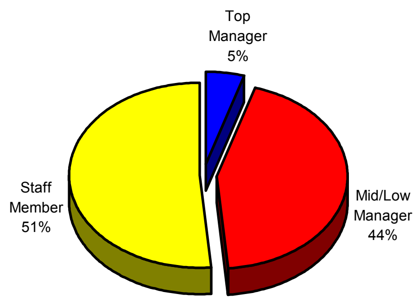


Figure 9.5 Positions of Respondents

Table 9.2 Respondents Distribution According to Their Work Experience

Work Experience (years)	Frequency	Per cent
0 – 1	78	8.2
2 – 5	164	17.1
6 – 10	202	21.1
11 – 15	181	18.9
16 – 20	148	15.5
21 – 25	80	8.4
< 25	48	5.0
Total	901	94.1
No Answer	56	5.9
Total	957	100.0

The respondents in this study came from organisations of a wide variety of sizes as presented in Table 9.3. The largest proportion (27%) of the respondents was from agencies whose total number of employees was between 51 and 100. Almost two-thirds (62%) of them were from relatively large organisations with the total number of employees being greater than 50. Less than one per cent of the respondents came from small organisations with the total number of employees being less than 10.

Table 9.3 Respondents Distribution According to Their Organisation's Size

Number of Staff	Frequency	Per cent
<= 10	5	0.5
11 – 20	101	10.6
21 – 30	107	11.2
31 – 50	149	15.6
51 – 75	260	27.2
76 – 100	143	14.9
< 100	192	20.1
Total	957	100.0

Furthermore, Table 9.4 shows the employees' profile by gender and position. It is interesting to observe that more than three-quarters (76%) of top managers involved in this study were male.

These male top managers made up six per cent (35 respondents) of total male respondents, while only three per cent (11 respondents) of total female respondents were in the top positions. The ratio of males to females in the top positions was around 3:1. For the middle level positions, around two-thirds of middle level managers involved in this study were male, and the other one-third of respondents were female. The ratio of males to females for these positions was 2:1. Meanwhile, for the low level positions, the staff members, the ratio was almost 1:1. These proportions were similar to the employee profiles of European telecommunications companies by gender reported by Mitter (1993). She found that top management positions were mainly for men, while middle management positions were held by approximately equal proportions of men and women.

Table 9.4 Crosstabulation of Position by Gender

Position		Gender		Total
		Male	Female	
Top Manager	N	35	11	46
	% within position	76.1%	23.9%	100.0%
	% within gender	6.0%	3.0%	4.8%
Middle Manager	N	279	137	416
	% within position	67.1%	32.9%	100.0%
	% within gender	47.6%	37.4%	43.7%
Staff Member	N	272	218	490
	% within position	55.5%	44.5%	100.0%
	% within gender	46.4%	59.6%	51.5%
Total	N	586	366	952
	% within position	61.6%	38.4%	100.0%
	% within gender	100.0%	100.0%	100.0%
Missing Data				5

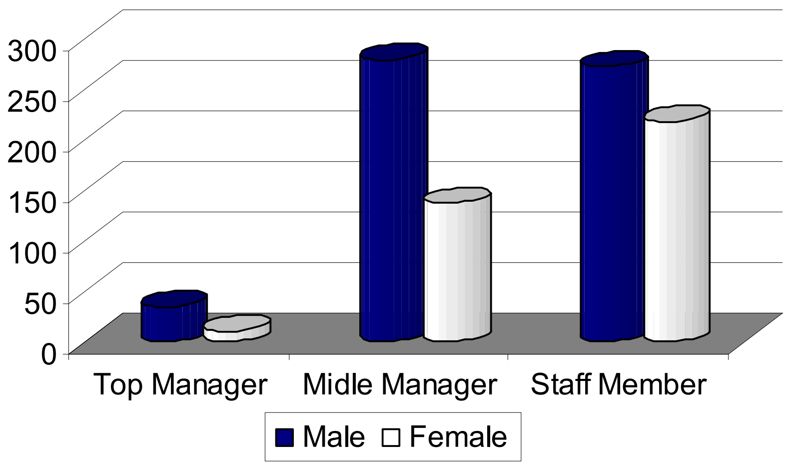


Figure 9.6 Respondents' Profile by Gender and Position

Moreover, for the low level staff Mitter (1993) found that technical and engineering positions were mainly for men and low-level office positions were mainly for women.

In terms of their educational level, as presented in Table 9.5, the proportions of male and female respondents were similar. Among the male and female groups of respondents, almost 30 per cent of respondents in each group had completed high school (32% for male and 30% for female); approximately 13 per cent of each gender group held diplomas; more than a half the respondents in each group had finished their undergraduate degrees (52% for male and 55% for female); and less than one per cent of respondent in each group had completed their post-graduate degrees.

Figure 9.7 shows the distribution of respondents according to their involvement in the initiation stage.

Table 9.5 Crosstabulation of Education by Gender

Education		Gender		Total
		Male	Female	
High School	Count	181	104	285
	% within gender	31.9%	29.5%	31.0%
Diploma	Count	72	46	118
	% within gender	12.7%	13.1%	12.8%
Under Graduate	Count	292	194	486
	% within gender	51.5%	55.1%	52.9%
Master	Count	4	2	6
	% within gender	.7%	.6%	.7%
Doctor	Count	1		1
	% within gender	.2%		.1%
Others	Count	17	6	23
	% within gender	3.0%	1.7%	2.5%
Total	Count	567	352	919
	% within gender	100.0%	100.0%	100.0%
Missing Data				38

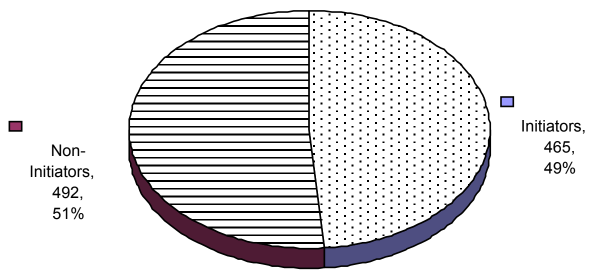


Figure 9.7 Involvement of Respondents in the Initiation Stage

Those employees who were involved in this stage were categorised as the 'initiators'. Moreover, those employees who were not involved in this stage were called the 'non-initiators'. The proportions of the initiators and the non-initiators were almost similar. From among those respondents, 965 employees (49%) were involved in the initiation stage and 492 employees (51%) were not involved in the initiation stage.

Figure 9.8 shows the distribution of employees with different levels of IT skills which range from word processing to programming in the sampled organisations. The skills have been sorted in ascending order based on the total number of employees reported to be familiar with these skills. The most frequently reported skills were word processing and spread sheeting. Six hundred and seventy two and 617 employees respectively were reported to possess the skills of word processing and spread sheeting. Among the employees in those organisations, 168 employees were reported to have the ability to deal with graphical design. It was also found that 89 employees had access to the internet. Only a small number of employees was identified to be familiar with database, statistics, GIS, programming language and scheduling packages.

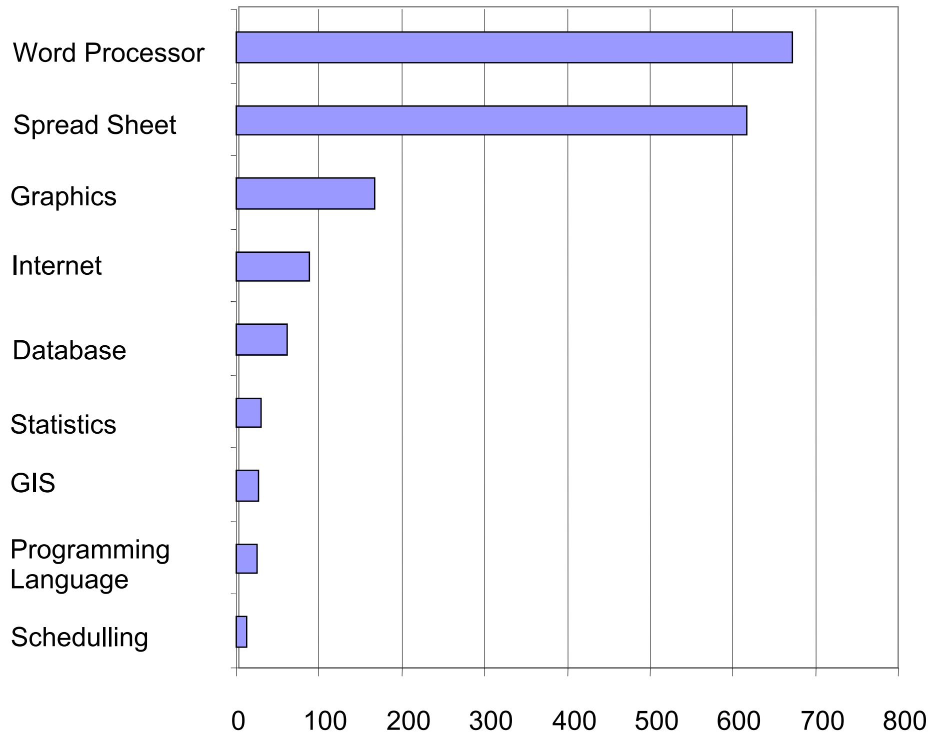


Figure 9.8 Total Number of Employees with Various IT Skills

Respondents' Anxiety and Attitudes toward Change

In addition to obtaining information on gender, age, education and other demographic data of respondents, two constructs were used to measure the attitudinal dimension of human factors, namely attitudes toward change, and computer-related anxiety of the administrators and other organisational personnel who might potentially have been direct or indirect users of the technology.

In order to measure the perceived computer related anxiety, respondents were asked to what extent they agreed to five statements as explained in Chapter Five. The responses are presented in Table 9.6. It can be seen in Table 9.6 that some degree of computer related anxiety existed both among the initiators and the non-initiators. Around 50 per cent to 60 per cent of respondents reported low to moderate levels of anxiety. Overall, the apprehensiveness about IT, confusion with IT jargon, as well as other concerns related to IT usage (fear, avoidance), were expressed more by the non-initiator respondents. These results are consistent with the interview findings. Almost half of the interviewees (about 48%) said that a feeling of anxiety existed, especially at the beginning. Furthermore they argued that when the employees started to use computers and became familiar with the technology, the level of anxiety decreased[9]. Only 17 per cent of the interviewees felt confident with the technology.

[9] From interviews conducted by the researcher from August to November 1999, as part of the field study.

Table 9.6 Anxiety Items

	Not at all		Very Low		Low		Moderate		High		Very High	
Score	**0**		**1**		**2**		**3**		**4**		**5**	
Items	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Feel apprehensive about using computers												
Initiators	50	11	103	22	112	24	101	22	85	18	14	3
Non Initiators	59	12	77	16	147	30	107	22	86	17	16	3
Total	109	11	180	19	259	27	208	22	171	18	30	3
Unfamiliar with computers												
Initiators	94	20	93	20	114	25	100	22	55	12	9	2
Non Initiators	79	16	103	21	140	28	96	20	61	12	13	3
Total	172	18	196	21	254	27	196	21	116	12	22	2
Do not understand the computer terminology												
Initiators	97	21	72	15	86	18	108	23	73	16	29	6
Non Initiators	84	17	53	11	161	33	99	20	57	12	38	8
Total	181	19	125	13	247	26	207	22	130	14	67	7
Afraid to damage the computers												
Initiators	53	11	86	18	99	21	116	25	95	20	16	3
Non Initiators	49	10	71	14	140	28	121	25	89	18	22	4
Total	102	11	157	16	239	25	237	25	184	19	38	4
Fear of making mistake that can not be corrected												
Initiators	81	17	95	20	104	22	97	21	67	14	21	5
Non Initiators	63	13	78	16	150	30	101	21	72	15	28	6
Total	144	15	173	18	254	27	198	21	139	15	49	5

The average principal component scores for items associated with anxiety and attitudes toward change scales for non-initiators and initiators are shown in Tables 9.7 and 9.8 and are plotted in Figures 9.9 (a) and 9.9 (b). Even though the effects of gender on the level of anxiety among respondents were mixed and non-significant, it is worth mentioning that for the non-initiators, higher levels of anxiety were expressed by female respondents, while for the initiators, the opposite was true.

In terms of attitudes toward change, the initiators, overall, expressed more positive attitudes toward change. In both groups, initiators and non-initiators, higher positive attitudes toward IT were expressed by male respondents. The results of the analysis in Table 7.8 indicate that the average score of initiators who are male is significantly higher than the average score of both non-initiators who are males ($t = 2.23$, $p = 0.03$) and females ($t = 3.52$, $p = 0.00$), with effect sizes of 0.23 and 0.35 respectively, which indicate that the magnitude of the differences are small.

The majority (about 80 %) of the interviewees, who were mainly initiators, assessed themselves as having positive attitudes toward change. However, from the interview results it was found that, in the words of one interviewee, most employees had “positive attitudes toward change but low efforts to make the changes happened”.

Table 9.7 Comparing Anxiety by Gender and Group

Group	Est.	SE	SD	Effsize	t	prob>|t|	N	Effsamp
Female Initiator (FI)	-0.06	0.09	0.94				168	109.65
Male Initiator (MI)	-0.02	0.08	1.03				297	157.76
Female Non-Initiator (FN)	0.09	0.06	0.80				237	205.73
Male Non-Initiator (MN)	-0.01	0.08	1.16				255	208.72
Group Differences								
FI-MI	-0.04	0.11		-0.04	-0.33	0.75		
FI-FN	-0.14	0.11		-0.16	-1.33	0.18		
FI-MN	-0.04	0.12		-0.04	-0.38	0.70		
MI-FN	-0.11	0.10		-0.12	-1.09	0.28		
MI-MN	-0.01	0.11		-0.01	-0.08	0.94		
FN-MN	0.10	0.09		0.10	1.10	0.27		

Table 9.8 Comparing Attitudes toward Change by Gender and Group

Group	Est.	SE	SD	Effsize	t	Prob>|t|	N	Effsamp
Female Initiators (FI)	0.01	0.09	0.97				168	110.48
Male Initiators (MI)	0.17	0.07	0.96				297	212.74
Female Non-Initiators (FN)	-0.17	0.08	1.01				237	155.45
Male Non-Initiators (MN)	-0.05	0.08	1.04				255	160.08
Group Differences								
FI-MI	-0.17	0.10		-0.18	-1.67	0.10		
FI-FN	0.17	0.12		0.17	1.41	0.16		
FI-MN	0.06	0.12		0.06	0.48	0.63		
MI-FN*	0.34	0.10		0.35	3.52	0.00		
MI-MN*	0.23	0.10		0.23	2.23	0.03		
FN-MN	-0.11	0.10		-0.11	-1.13	0.26		

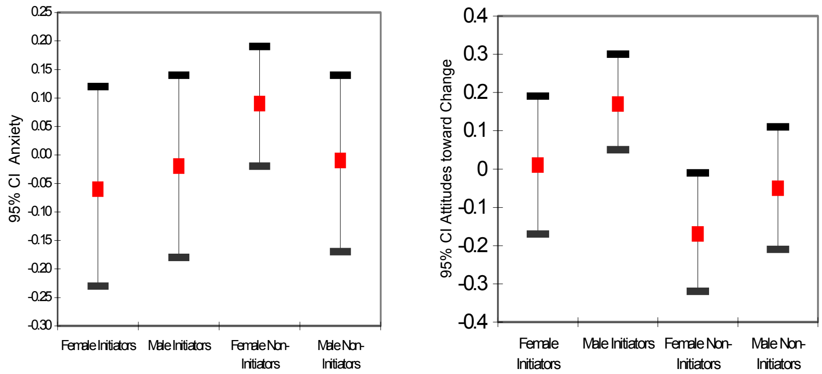
Note: * Significant difference

Some of the reasons for this phenomenon were elaborated by one of the interviewees:

> There is no warranty that those who perform their job professionally will receive appropriate incentives. Let's say, for example, that somebody wants to be professional, however, their career paths are not clear. Therefore, the problem is how to create a system where those who are professional can be appreciated proportionally.[10]

Previous studies also suggest that effective practices are more likely to be adopted if a supportive institutional and policy environment exists. Learning and experimentation are more likely to take place if persons involved with the new technology are given the training, incentives, and user-support needed to make successful use of the technology (Hanna, 1991).

[10] Interview conducted on 27 September 1999. Translated from *Bahasa Indonesia*



(a) Anxiety (b) Attitudes toward Change

Figure 9.9 Levels of Attitudes toward IT for Initiators and Non-Initiators by Gender

Respondents' Perceptions of IT Attributes

Perceptual dimensions are yet other potential factors in influencing the success of IT implementation. Factor structures for this dimension have been analysed and are discussed in Chapter Eight. For the perceptual dimension, five variables are used in this study, namely belief consistency, compatibility, relative advantage, complexity, and observability. Principal component scores were calculated in SPSS for each of these scales and the average scores and between group differences were calculated using WesVarPC. The results are presented in Tables 9.9 and 9.10. The average scores are plotted in Figure 9.10.

The results in Tables 9.9 and 9.10 indicate that the average principal component scores of belief consistency for female respondents in both groups tend to be lower than for males.

However, the difference is significant only for the initiators (t=-2.59, p = 0.01) with an effect size of –0.33 which indicates that the magnitude of the difference is small. In addition, non-initiators' belief scores are lower for both male and female respondents when compared to the initiators.

Belief scores for males in the initiators group are significantly higher than for both males (t=3.42, p = 0.00, with a small effect size of 0.36) and females (t = 4.40, p = 0.00, with a medium effect size of 0.53) in the non-initiators group. These results suggest that male initiators had a higher level of belief in the need for information technology and its utility. Male respondents in the initiators group were more convinced that the information technology would have possible drawbacks and negative consequences that might result from reliance on information technology. They appeared to see the potential cost saving in adopting such technology in terms of reducing the number of staff members required and reducing the operational cost.

Table 9.9 Respondents' Perception of IT Attributes

Group		Est.	StdErr	SD	N	Eff_Samp
Belief						
Female Initiators	(FI)	-0.04	0.09	0.83	168	86.23
Male Initiators	(MI)	0.28	0.09	1.09	297	142.72
Female Non-Initiators	(FN)	-0.21	0.07	0.78	237	123.20
Male Non-Initiators	(MN)	-0.11	0.08	1.10	255	174.42
Compatibility						
Female Initiators	(FI)	0.07	0.10	0.98	168	98.64
Male Initiators	(MI)	0.15	0.08	0.98	297	152.65
Female Non-Initiators	(FN)	-0.17	0.09	1.06	237	133.02
Male Non-Initiators	(MN)	-0.06	0.07	0.96	255	186.89
Complexity						
Female Initiators	(FI)	0.05	0.08	0.87	168	118.43
Male Initiators	(MI)	-0.02	0.08	0.99	297	164.31
Female Non-Initiators	(FN)	0.22	0.06	0.85	237	177.01
Male Non-Initiators	(MN)	-0.22	0.09	1.16	255	170.52
Observability						
Female Initiators	(FI)	-0.04	0.10	0.90	168	77.39
Male Initiators	(MI)	0.15	0.08	1.09	297	169.82
Female Non-Initiators	(FN)	-0.23	0.06	0.78	237	147.51
Male Non-Initiators	(MN)	0.06	0.09	1.10	255	143.88
Relative Advantage						
Female Initiators	(FI)	0.06	0.10	0.84	168	76.92
Male Initiators	(MI)	-0.09	0.09	1.01	297	139.13
Female Non-Initiators	(FN)	0.31	0.09	0.93	237	105.81
Male Non-Initiators	(MN)	-0.22	0.09	1.08	255	152.77

However, they also had greater perceptions of the technology as a possible threat to the processes of socialisation within the organisation. They seemed to perceive IT as a tool that might isolate people and control their lives. Moreover, non-initiators were more concerned about job security. They apparently perceived the technology could take over their jobs.

For the level of perceived compatibility of the technology, the majority of the interviewees (almost 70%) regarded the technology as compatible with their work styles and previous experiences[11]. In addition, there is a consistent pattern where the non-initiators perceived the technology to be less compatible with their work style compared to the initiators. However, most of the differences are not big enough to be significant in both groups. The only difference that is found to be statistically significant is between male initiators and female non-initiators (t = 2.59, p = 0.01) with the effect size of 0.31 which indicates that the magnitude of the difference is small.

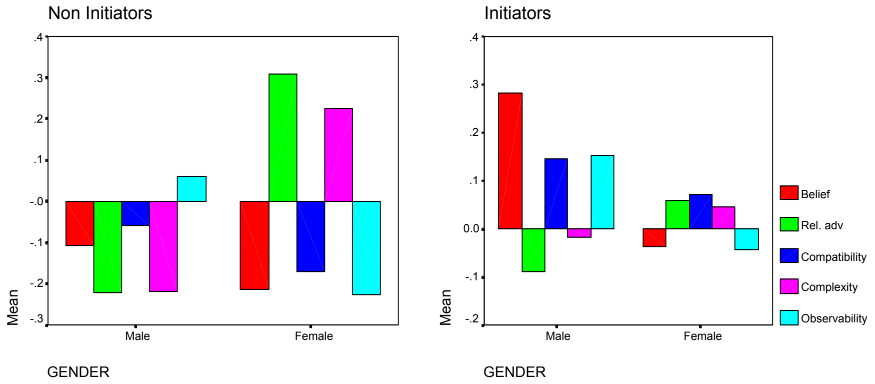
[11] From interviews conducted between August and November 1999, as part of the field study.

Table 9.10 Comparing Perception of IT Attributes

Differences	Est.	StdErr	EffSize	t	PROB>|t|
Belief					
FI-MI*	-0.32	0.12	-0.33	-2.59	0.01
FI-FN	0.18	0.11	0.22	1.61	0.11
FI-MN	0.07	0.11	0.07	0.61	0.55
MI-FN*	0.50	0.11	0.53	4.40	0.00
MI-MN*	0.39	0.11	0.36	3.42	0.00
FN-MN	-0.11	0.09	-0.12	-1.22	0.22
Compatibility					
FI-MI	-0.07	0.12	-0.07	-0.61	0.54
FI-FN	0.24	0.13	0.24	1.89	0.06
FI-MN	0.13	0.11	0.13	1.14	0.26
MI-FN*	0.32	0.12	0.31	2.59	0.01
MI-MN	0.20	0.11	0.21	1.95	0.06
FN-MN	-0.11	0.10	-0.11	-1.09	0.28
Complexity					
FI-MI	0.06	0.11	0.06	0.60	0.55
FI-FN	-0.18	0.10	-0.21	-1.75	0.08
FI-MN*	0.26	0.12	0.25	2.29	0.02
MI-FN*	-0.24	0.09	-0.26	-2.59	0.01
MI-MN	0.20	0.11	0.19	1.82	0.07
FN-MN*	0.44	0.11	0.43	4.16	0.00
Observability					
FI-MI	-0.19	0.13	-0.19	-1.49	0.14
FI-FN	0.18	0.12	0.21	1.55	0.12
FI-MN	-0.10	0.13	-0.10	-0.80	0.43
MI-FN*	0.38	0.11	0.40	3.46	0.00
MI-MN	0.09	0.12	0.08	0.76	0.45
FN-MN*	-0.29	0.10	-0.30	-2.95	0.00
Relative Advantage					
FI-MI	0.15	0.12	0.16	1.25	0.21
FI-FN	-0.25	0.13	-0.28	-1.94	0.05
FI-MN*	0.28	0.12	0.29	2.33	0.02
MI-FN*	-0.40	0.12	-0.41	-3.22	0.00
MI-MN	0.13	0.12	0.12	1.14	0.26
FN-MN*	0.53	0.12	0.53	4.49	0.00

Note: * Significant difference

Results of the inquiry into perceived complexity of information technology reveal that less than a quarter of the interviewees (around 22%) did not perceive the technology to be difficult to some degree. In addition, another quarter of the interviewees perceived the technology to be difficult but learnable. The survey results, as presented in Table 9.11, also reveal that the technology was seen to be slightly harder to understand (mean = 2.34) than to use (mean = 2.10). Language barrier was one of the reasons as elaborated by one interviewee who said that "The English which is widely used as the instructional language for computer programs is hard to understand"[12]. Overall, the survey results show that IT was perceived as moderately difficult rather than very difficult.



(a) Non-Initiators (b) Initiators

Figure 9.10 Average Scores of Perceptual Dimensions

Responses from non-initiators who are female are significantly higher than male respondents for both non-initiators (t = 4.16, p = 0.00) and initiators (t = 2.59, p = 0.01) groups. Even though responses from female initiators are also slightly higher than their male counterparts, the difference is not significant. However, their scores are significantly higher than for male non-initiators (t = 2.29, p = 0.02). These results suggest that female non-initiators perceived the technology to be more difficult, followed by female initiators, male initiators, and finally male non-initiators who perceived the technology to be less difficult. All of these differences are of small sizes since their effect sizes are less than 0.50

In terms of the level of exposure to the technology before the adoption processes took place, male initiators experienced the highest level of exposure followed by the male respondents from the non-initiators group, female respondents from the initiators group, and female respondents from the non-initiators group. The scores of female respondents from the non-initiators group are significantly below the scores of male respondents for both initiators (t = 3.46, p = 0.00) and non-initiators (t = 2.95, p = 0.00). The magnitudes of these differences are small since their effect sizes are less than 0.50.

In addition, the interview results reveal that most of the decisions to adopt the technology were reported to be centrally made and some of the technologies that were available at the district level agencies were provided and acquired by their upper level management, either at the provincial level or at the national level[13]. Consequently, the chance to be exposed to the technology before adoption and the effect of this level of exposure on adoption and implementation was low.

[12] From the interview conducted on 3 August 1999, as part of the field study.
[13] From the interviews conducted between August and November 1999, as part of the field study.

Table 9.11 Descriptive Statistics of Perceptual Items

Items	Min	Max	Initiators (n=465)		Non-Initiators (n=492)	
			Mean	StdDev	Mean	StdDev
Belief						
Reduce staff	0	5	1.70	1.24	1.45	1.13
Reduce cost	0	5	2.03	1.28	1.64	1.17
Create more job	0	5	1.87	1.11	1.70	1.06
Isolate people	0	5	1.71	1.15	1.52	1.07
Control our life	0	5	1.74	1.19	1.42	1.02
Compatibility						
Work style compatibility	0	5	2.24	1.30	1.91	1.32
All aspect compatibility	0	5	2.33	1.20	2.05	1.24
Previous experience compatibility	0	5	2.02	1.21	1.84	1.21
Complexity						
Difficult to understand	0	5	2.34	1.17	2.50	1.35
Difficult to use	0	5	2.10	1.18	1.92	1.24
Observability						
Small version availability	0	5	1.92	1.11	1.80	1.09
Modularity	0	5	2.02	1.17	1.87	1.10
Trialability	0	5	1.94	1.09	1.76	1.04
Demonstration	0	5	2.02	1.15	1.88	1.10
Relative Advantage						
Increase productivity	0	5	2.87	1.17	2.91	1.26
Increase efficiency	0	5	2.93	1.11	3.01	1.27
Increase availability	0	5	2.69	1.27	2.65	1.35
Increase timeliness	0	5	2.63	1.25	2.85	1.29
Ease of access	0	5	2.70	1.31	2.79	1.37
Speed to obtain	0	5	2.70	1.27	2.77	1.37

Both target groups of respondents, initiators and non-initiators, were moderate in their perception of most potential benefits that could be achieved through utilisation of the technology, as can be seen from Table 9.11. These expected benefits range from informational benefits in terms of information availability, timeliness, accessibility, and speed to obtain the information, to productivity benefits and effectiveness. These results are consistent with the findings from interview sessions. Most of the interviewees (almost 90%) agreed with the potential benefits of IT[14]. In addition the survey results also reveal that there is a pattern for both groups where female respondents had higher expectations. Their expectations were above the average, while male responses were consistently below average. The differences were more apparent in the non-initiators group. The scores for female respondents from the non-initiators group are significantly higher than for male respondents in both initiators (t = 3.22, p = 0.00) and non-initiators (t = 4.49, p = 0.00) groups. The effect sizes of 0.41 and 0.53 respectively indicate that the magnitudes of the differences are between small to medium sizes.

[14] From the interviews conducted between August and November 1999, as part of the fields study.

Perceived Success of IT Adoption and implementation processes

In this study a four-phase IT adoption and implementation model is proposed, namely initiation phase, adoption phase, implementation phase and evaluation phase. The success of implementation phase is measured by the level of IT usage, either passively or actively, and user satisfaction. Perceived user performance is employed in this study to evaluate the impacts of IT on user performance.

Most of the interviewees reported that they perceived the need for technology at the initiation stage. These needs measured the extent to which the respondents realised the potential benefits of IT, the recent advances in hardware, system architecture and software, as well as social pressures that came from vendors, community, and upper level management. Some of the reasons given for adopting the technology were "huge data volume", "ease of use", "speed", "practical", "better storage", "automate the routine jobs", "cheap", "user friendly", "transparent", "better results", and "simplified procedures". However, one of the interviewees said that "the use of computers is not so effective yet, since most of the time the computers are used for typing purposes only"[15]. This result seems to be in agreement with previous research which indicates that institutions in developing countries are mostly at the first stage of IT utilisation (Hanna, 1991). Hanna (1991) has argued that institutions go through several stages in learning to apply IT. First, they automate administrative functions, such as budgeting and billing, to improve efficiency. Second, they improve information for decision-making processes to increase flexibility and effectiveness; and finally, they create new products and services and craft new relationships with clients. Most institutions in developing countries are at the first stage and some are entering the second. Only the most advanced organisations are at the third stage (Hanna, 1991).

In addition to the perceived needs for the technology, the recent development in IT including the current advances in computer and telecommunication technologies and the availability of the technologies in the market place were also reported to have some roles in the IT adoption process. However, some of the interviewers agreed that the magnitude of the effect was not very large since there were some financial limitations to the acquisition of the new technology.

Moreover, the social pressures that they experienced came from the upper level management due to the centralised nature of the system rather than from the community and vendors.

In terms of the level of IT adoption, most of the interviewees (almost 75%) agreed that the ratio of IT investment (in hardware, software, and training) to overall budget in their organisations was still considered to be small[16]. The limited financial resource was one of the reasons given. One of the interviewees also revealed that the "staff members are reluctant to attend the training"[17]. Lack of proper incentives for those who were willing to increase skills might have been one reason behind this result as pointed out earlier by one of the interviewees.

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[15] From the interviews conducted between August and November 1999, as part of the fields study.
[16] From the interviews conducted between August and November 1999, as part of the fields study.
[17] From the interview conducted on 6 September 1999

Moreover, most of the interviewees (91%) assessed the level of IT usage in their organisation as 'highly utilised'. However, one of the interviewees commented that "the level of IT usage depends on the nature of the department"[18]. Technical and accounting departments as well as those departments that dealt with routine jobs were some examples of departments with high levels of usage that were revealed in the interview sessions.

In this study, nine scales were used to measure the level of user satisfaction, namely hardware, software, training, vendor support, content, accuracy, format, ease of use, and timeliness. Most of the interviewees were satisfied with the technology except in two scales. They were generally not satisfied with the level of training or with the level of vendor support. As some argued that centrally appointed vendors, which were usually located in Jakarta, had failed to deliver the promised support services[19]. This could be regarded as a significant demotivating influence even for those with positive attitudes towards change.

In order to assess the impact of IT on user performance, the respondents were asked whether IT was an appropriate technology which could increase their efficiency and effectiveness in performing their job. Most of the interviewees agreed with this statement[20].

In addition to the interview findings, the survey results also revealed an interesting pattern. The average principal component scores for each scale are presented in Table 9.12 and are plotted in Figure 9.11. The results for the testing of differences are presented in Table 9.13.

For initiators, on the one hand, female respondents reported less pressure to adopt the technology ($t = 3.98$, $p = 0.00$). They perceived less need to adopt the technology to increase organisational performance. In addition, they also perceived less impact of IT on their performance ($t = 2.19$, $p = 0.03$). For the level of adoption and the level of utilisation either passively or actively as well as the level of satisfaction, there was no significant difference between males and females in this group. However, female initiators' scores on passive usage were significantly higher than male non-initiators' scores ($t = 2.50$, $p = 0.1$). In addition, male initiators reported a significantly higher level of passive usage when compared to both male non-initiators ($t = 3.47$, $p = 0.00$) and female non-initiators ($t = 2.04$, $p = 0.04$).

In addition to having higher levels of passive usage, initiators, in general, also reported higher levels of active usage. Female initiators reported the highest level of active usage. Their scores are significantly higher than for both male ($t = 3.09$, $p = 0.00$) and female ($t = 2.70$, $p = 0.01$) non-initiators.

For non-initiators, on the other hand, female employees in this group tended to perceive lower levels of satisfaction when compared to both male ($t = 2.11$, $p = 0.04$) and female ($t = 2.06$, $p = 0.04$) initiators. Moreover, female non-initiators also perceived less impact of IT on their performance.

All of these significant differences are of small sizes since their effect sizes are less than 0.50 except for the gender difference at the initiation phase. At this stage, the

[18] From the interview conducted on 6 September 1999.
[19] From the interviews conducted between August and November 1999, as part of the fields study.
[20] From the interviews conducted between August and November 1999, as part of the fields study.

magnitude of the difference between males and females in perceiving the needs for the technology is medium with an effect size of 0.71.

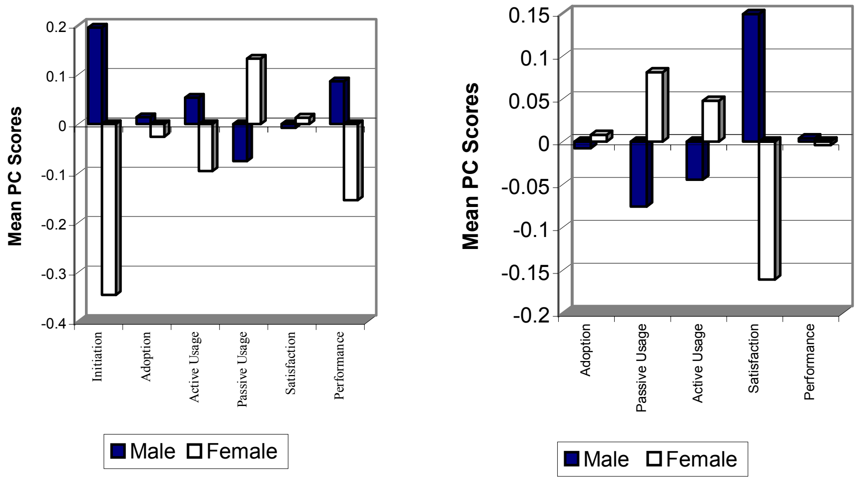
Table 9.12 Respondents' Perception of IT Adoption Process

Group		Est.	StdErr	SD	N	Eff_Samp
Initiation						
Male Initiators	(MI)	-0.14	0.11	0.64	297	102.15
Female Initiators	(FI)	-0.78	0.14	1.13	168	68.63
Adoption						
Female Initiators	(FI)	-0.04	0.12	0.89	168	57.92
Male Initiators	(MI)	0.00	0.11	1.05	297	93.00
Female Non-Initiators	(FN)	0.02	0.07	0.77	237	113.21
Male Non-Initiators	(MN)	0.01	0.15	1.18	255	58.76
Passive Usage						
Female Initiators	(FI)	0.05	0.08	0.91	168	129.00
Male Initiators	(MI)	0.19	0.09	1.04	297	136.55
Female Non-Initiators	(FN)	-0.05	0.09	0.96	237	118.77
Male Non-Initiators	(MN)	-0.21	0.08	1.01	255	178.54
Active Usage						
Female Initiators	(FI)	0.28	0.11	1.01	168	79.82
Male Initiators	(MI)	0.06	0.10	1.02	297	109.56
Female Non-Initiators	(FN)	-0.09	0.08	0.83	237	113.33
Male Non-Initiators	(MN)	-0.18	0.11	1.07	255	99.82
User Satisfaction						
Female Initiators	(FI)	0.13	0.09	1.01	168	132.42
Male Initiators	(MI)	0.10	0.07	0.87	297	160.31
Female Non-Initiators	(FN)	-0.11	0.08	0.92	237	123.20
Male Non-Initiators	(MN)	-0.10	0.11	1.17	255	119.67
User Performance						
Female Initiators	(FI)	-0.06	0.10	1.10	168	130.77
Male Initiators	(MI)	0.18	0.06	0.91	297	210.74
Female Non-Initiators	(FN)	-0.25	0.08	0.93	237	137.36
Male Non-Initiators	(MN)	0.06	0.10	1.05	255	115.26

Table 9.13 Comparing Perceived IT Adoption Process

Differences	Est.	StdErr	EffSize	T	Prob>|t|
Initiation					
FI-MI*	-0.65	0.16	-0.71	-3.98	0.00
Adoption					
FI-MI	-0.05	0.13	-0.05	-0.36	0.72
FI-FN	-0.07	0.13	-0.08	-0.52	0.60
FI-MN	-0.05	0.18	-0.05	-0.30	0.77
MI-FN	-0.02	0.11	-0.02	-0.18	0.86
MI-MN	0.00	0.15	0.00	-0.03	0.98
FN-MN	0.02	0.14	0.02	0.11	0.91
Passive Usage					
FI-MI	-0.15	0.11	-0.15	-1.31	0.19
FI-FN	0.10	0.12	0.11	0.89	0.38
FI-MN*	0.25	0.10	0.26	2.50	0.01
MI-FN*	0.25	0.12	0.25	2.04	0.04
MI-MN*	0.40	0.12	0.39	3.47	0.00
FN-MN	0.15	0.10	0.15	1.44	0.15
Active Usage					
FI-MI	0.21	0.14	0.21	1.52	0.13
FI-FN*	0.36	0.13	0.39	2.70	0.01
FI-MN*	0.45	0.15	0.43	3.09	0.00
MI-FN	0.15	0.11	0.16	1.30	0.19
MI-MN	0.24	0.13	0.23	1.88	0.06
FN-MN	0.09	0.11	0.09	0.83	0.41
User Satisfaction					
FI-MI	0.03	0.10	0.03	0.27	0.78
FI-FN*	0.24	0.11	0.25	2.06	0.04
FI-MN	0.22	0.14	0.20	1.63	0.10
MI-FN*	0.21	0.10	0.23	2.11	0.04
MI-MN	0.20	0.11	0.19	1.75	0.08
FN-MN	-0.01	0.11	-0.01	-0.10	0.92
User Performance					
FI-MI*	-0.24	0.11	-0.24	-2.19	0.03
FI-FN	0.19	0.12	0.19	1.68	0.09
FI-MN	-0.12	0.13	-0.11	-0.88	0.38
MI-FN*	0.43	0.10	0.47	4.53	0.00
MI-MN	0.12	0.11	0.12	1.07	0.29
FN-MN*	-0.31	0.12	-0.31	-2.68	0.01

Note: * Significant difference



(a) Initiators (b) Non-Initiators

Note: No Initiation Stage for the Non-Initiators group

Figure 9.11 Levels of Reported Initiation, Adoption, Usage, User Satisfaction and User Performance

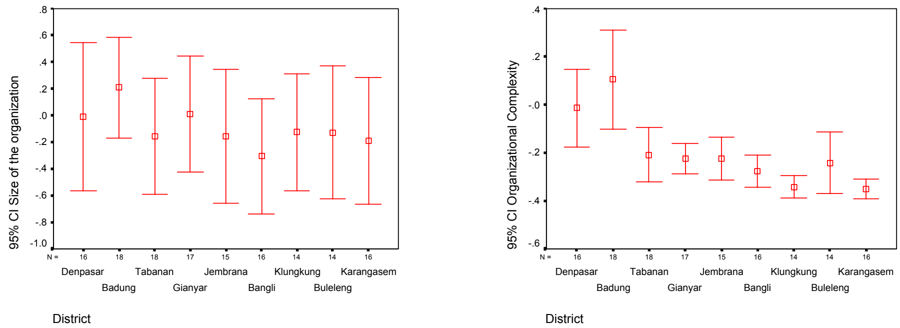
Organisational Background Characteristics

Five constructs were used to reflect the organisational characteristics, namely size, type, complexity (the level of IT expertise), the level of centralisation and the level of formalisation. In total, 153 organisations were involved in this study. Of these, 76 organisations were decentralised agencies; 55 organisations were deconcentrated agencies; and the remaining 22 organisations were state owned enterprises (SOEs). The total number of agencies that were operating at the district level was 144. The remaining nine agencies operated at the provincial level. The descriptive statistics for items that were used to measure an organisation's size and complexity are presented in Table 9.14. Only agencies that were operating at the district level are presented in this table.

Table 9.14 Descriptive Statistics of Organisational Characteristics at District Level

	N	Minimum	Maximum	Mean	Std. Deviation
Total employees	144	2	252	62.98	46.34
Vertical level	144	2	4	2.94	.39
Horizontal level	144	2	10	5.18	1.54
Total employees with IT skills	144	1	36	7.57	6.16
% of Employees with IT Skill	144	1	67	16	13
Valid N (listwise)	144				

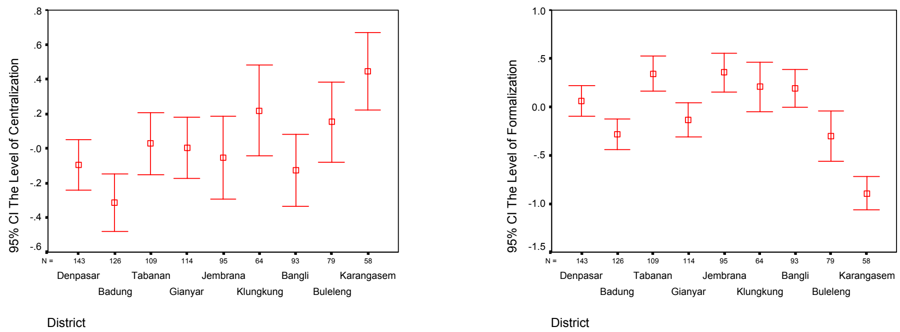
It can be seen in Table 9.14 that the average proportion of employees with IT skills in these organisations was quite low (16%). In order to compare the spread of organisational size and complexity across all districts in Bali, two error-bar plots were generated in SPSS and are presented in Figures 9.12 (a) and 9.12 (b). The sizes of organisations involved in this study were not significantly different from one district to another. The average size of organisations in Badung was slightly larger than the others. However, in terms of IT expertise available in these organisations, Badung was noticeably higher than the others, followed by Denpasar.



(a) Size (b) Complexity

Figure 9.12 Size and Complexity of Organisations across all Districts in Bali

The average principal component scores for centralisation and formalisation are plotted in Figure 9.13. Responding employees in Karangasem, on average, reported the highest perceived level of centralisation. However, in contrast, they reported the lowest perceived level of formalisation.



(a) Centralisation (b) Formalisation

Figure 9.13 Average Levels of Centralisation and Formalisation of Organisations across all Districts in Bali

District Background Characteristics

The functional need for IT in local government might be related to the size and socio-economic status of the community. In addition, the level of support from upper-level government and the availability of supporting facilities might also be potential factors in influencing the levels of IT adoption in certain regions. In Chapter Eight, it has been discussed that in this study, the size of a district was measured by its land area, number of population, and upper-level government support. The level of socio-economic status of the community in a district was reflected by per capita income and other organisational resources available including local revenues per capita, technology budget per capita, and total budget per capita. Moreover, the availability of supporting facilities in a district was measured by the number of IT related services and offices, such as hardware and software suppliers, computer service related offices, and computer training institutions, at the district level.

The relative comparisons of each item used to reflect districts' characteristics are presented in Figure 9.14. Principal component scores were calculated for district size (SIZE), socio-economic status (SOCEC) and the availability of supporting facilities (SUFAC). These scores are plotted by district and are presented in Figure 9.15.

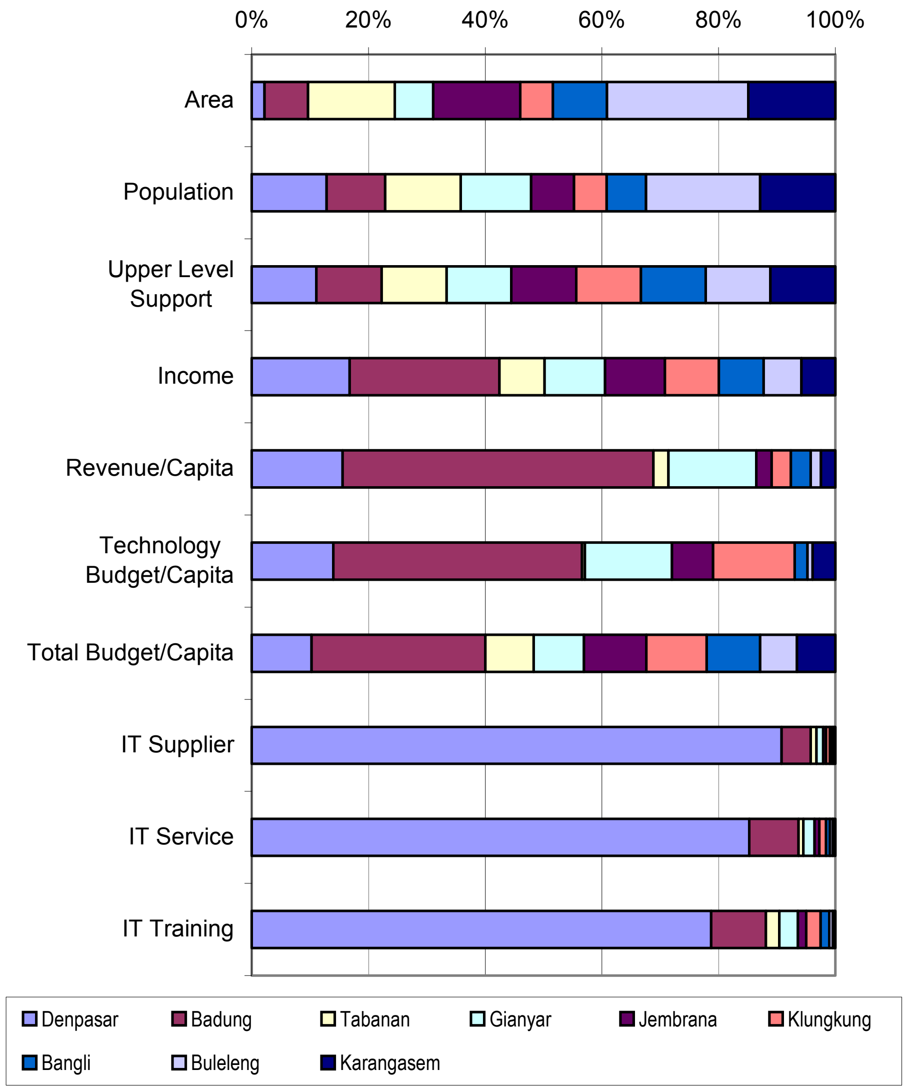


Figure 9.14 Districts' Background Characteristics

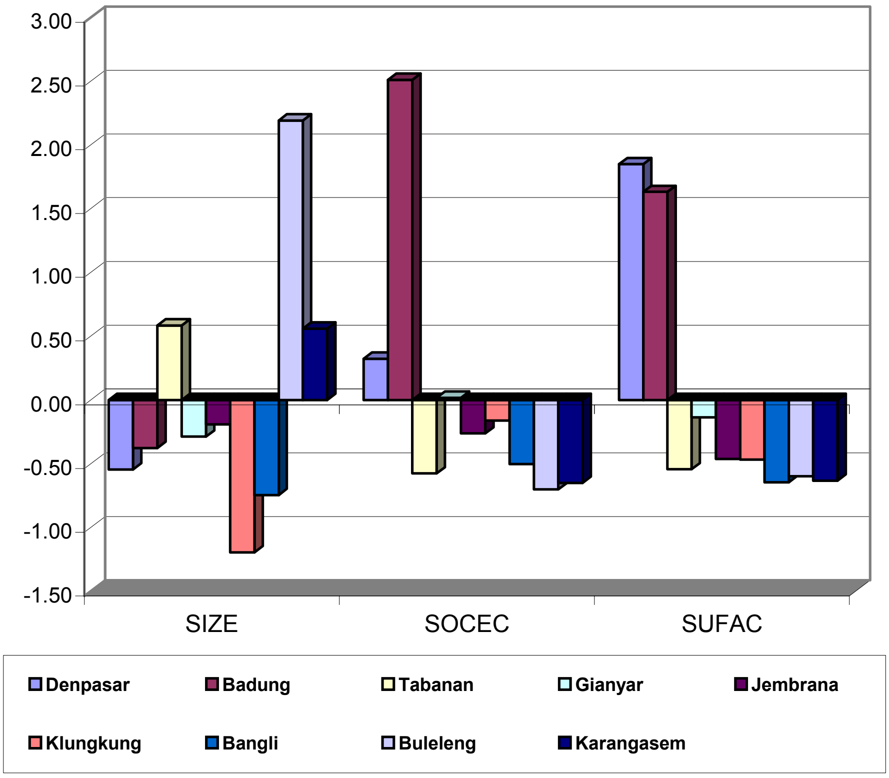


Figure 9.15 Districts' Background Indices

Summary

The results presented in this chapter show the distribution of respondents according to their gender, age, education, and position. Almost two-thirds of the respondents were males. Most of the respondents were between the ages of 31-40 years (41%). In terms of respondents' educational levels, almost two-thirds (66%) of them had at least a tertiary diploma or a university degree. In addition of the respondents, the ratio of males to females for top-level managers was around 3:1 and the ratios for middle-level and low-level positions were almost 2:1 and 1:1 respectively.

The responses both from the survey and interview indicate that some degree of computer related anxiety existed, especially at the beginning. Positive attitudes toward change were also expressed by respondents with male initiators among those who reported the most positive attitudes.

In addition, male initiators also appeared to report greater perception of the potential cost saving in adopting the technology in terms of reducing the number of staff members required and reducing the operational cost as well as the potential drawbacks and negative consequences that might result from reliance on the technology.

Furthermore, there is also a pattern where the non-initiators perceived the technology to be less compatible with their work style compared to the initiators. Other patterns also emerge from this study. Some of them are: (a) female respondents perceived the technology to be more difficult as well as reporting higher expectations of the technology, and (b) male respondents tended to have higher levels of exposure to the technology and perceived higher levels of impact of IT on their performance.

During the initiation stage, female initiators expressed less pressure to adopt the technology compared to their male counterparts. Initiators, both males and females, also reported having higher levels of usage, both actively and passively, compared to respondents from the non-initiators group. In addition, the initiators reported higher levels of satisfaction.

In addition, organisational and environmental characteristics are also discussed in this chapter. In general, employees with IT skills were mostly available in Badung and Denpasar. Most of the supporting facilities, such as computer vendors and service facilities, were also located in Denpasar followed by Badung. In addition, Badung had the highest economic status. The results of these descriptive and t-test analyses provide a basis for the subsequent analyses.

10

Multi-Level Path Modelling

Introduction

In the present study, models of individual level as well as organisational level factors influencing each step of IT adoption have been developed based upon the findings of previous studies[21].

Models of IT adoption have been advanced from theory that incorporate not only variables at the individual level, but also certain organisational and district variables that might influence each phase of IT adoption processes. The examination of such models is undoubtedly of particular interest, yet problems arise from the inclusion of data that were obtained at different levels into one model. It has already been pointed out that the data collected in this study included not only information on variables gathered at the employee level but also information on questions regarding the characteristics of each organisation involved in the study. In addition, there are also some characteristics of districts collected from various secondary data sources. Hence, the data files contain information obtained at three different levels, namely the individual level, the organisational level, and the district level.

Two methods that are commonly employed when data are combined from two or more levels into single-level analysis are: (a) the aggregation of data collected at the lower level (e.g. individual) to the higher level (e.g. organisation); or (b) the disaggregation of higher level data to the lower level, for example by assigning organisation-level data to each individual employee. Both techniques, aggregation and disaggregation, quite typically introduce bias, meaning an over- or under-estimation of the magnitude of effects associated with variables that are aggregated or disaggregated as well as incorrect error estimations.

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[21] For further details see Chapter Five

Preliminary Analyses

It has been argued that single-level analyses in which some of the predictor LVs and the criterion LV have been formed by aggregation or disaggregation are accompanied by biases. Only by undertaking multi-level analyses can these biases be reduced. According to Keeves and Cheung (1990), five separate issues would seem to arise in single level analyses. They are discussed in Chapter Seven.

Since the nature of the data was hierarchical, multilevel analyses were required in order to obtain meaningful results. However, fitting a two-level path model was not an easy task, especially when the model contained a large number of variables. Consequently, it was considered necessary to conduct a series of preliminary analyses. The purpose of carrying out these analyses was to obtain information on latent variables that should be examined more rigorously in the multilevel analyses, as well as to tease out the possibility of the causal influence of the hypothesised explanatory variables through their direct and indirect effects as proposed in the path models at both individual and organisational levels.

Therefore, the data in this study were analysed using two different approaches: single-level and multi-level analyses. Three different statistical packages were used in this study. The exploratory single-level path analyses were carried out using PLSPATH 3.01 (Sellin, 1989) at both the individual and organisational levels. The results of these analyses were then tested using AMOS (Arbuckle & Wothke, 1999). However, AMOS analyses can only be undertaken at the individual level. An attempt to carry out a single level analysis at the organisational level using AMOS was unsuccessful due to the small sample size at this level. By using PLSPATH and AMOS results as guidance, two-level models were developed and further analysed with MPLUS 2.01 (Muthén & Muthén, 1998).

In building up these two-level models, initially level-1 models were defined based on the combined results of PLSPATH and AMOS. The models were then trimmed based on the critical ratios and modification indices in a similar way to AMOS trimming procedures. Once the level-1 models were finalised, level-2 models were defined based on PLSPATH organisational level results. The level-2 models were, then, trimmed using critical ratios. Latent variables that were estimated to have significant correlations were tested for inclusion in the model. These procedures were repeated until final results were obtained.

The uses of these three programs are discussed in Chapter Seven. Darmawan (2001, 2002e) provides detailed discussion of the comparison between single-level path analysis using PLSPATH and AMOS and multi-level path analysis using MPLUS 2.01. In this chapter, only the results of multi-level path analysis using MPLUS 2.01 are presented.

In this multi-level path analysis, only two levels of analysis were conducted, namely the individual level and the organisational level. The data from the third level, district level data, were disaggregated to the organisational level data. The district level analysis was not undertaken because of the small number of third level units (9) and the limitations of multilevel analysis available in MPLUS that only allowed two-level models to be estimated. Consequently, there was still some unavoidable disaggregation bias in the results. In order to overcome this limitation, another technique called a 'three-level hierarchical linear modelling (HLM)' procedure was employed. In this three-level HLM procedure the direct effects of various factors at the three different levels on the criterion, as well as the interaction effects that may occur between these factors in influencing the criterion can be estimated and the results are discussed in the next chapter.

In all models, both the unstandardised and the standardised coefficients are presented. The relative magnitudes of the standardised coefficients were used as an indication of the relative importance of the variables with which they were associated. By choosing these coefficients, the strengths of these relationships were comparable within the model since they were scale-free indices (Pedhazur, 1997). However, according to Pedhazur (1997), these standardised coefficients reflect not only the presumed effect of the variable with which they are associated but also the variance and the covariance of the variables included in the model, as well as the variance of the variables not included in the model and subsumed under the error term. Because these factors may vary from one population to another, these standardised coefficients are sample-specific and therefore can not be used for the purpose of generalisations across settings and populations. In other words, these coefficients are not comparable across models.

On the other hand, the unstandardised coefficients remain fairly stable across populations. However, according to Pedhazur (1997), there are three problems that may arise with these coefficients:

a) their magnitudes depend on the units used in the measurement of given variables;

b) many of the measures used in social research are not on an interval scale; and

c) when the reliabilities of the measures of independent variables differ across samples, comparisons of such coefficients may lead to erroneous conclusions.

It is recommended to use the standardised coefficients when comparing the effects of different variables within a single population and to use the unstandardised coefficients when the effects of the same variables are compared across populations. Consequently, for the purpose of this study, both standardised and unstandardised path coefficients are reported.

Individual Level Models

The models of individual level factors influencing IT adoption processes, which were advanced in Chapter Five, indicate that there are 17 latent variables hypothesised to be involved in the adoption processes for the initiators model. They are gender of employee (SEX), age of employee (AGE), highest education completed (EDUC), communication channel (COMCH), computer related anxiety (ANXTY), attitudes toward change (ATTID), beliefs consistency (BELIF), relative advantage of IT (RELAD), compatibility (COMPA), observability (OBSER), complexity (COMPL), initiation (INITI), adoption (ADOPT), passive usage (PAUSE), active usage (ACUSE), user satisfaction (SATIS) and user performance (PERF). For the non-initiators, the number of variables involved in the model is 16. One variable, initiation, was excluded from the model because the people in this group were not involved at the initiation stage. The other variables remained the same. The variables used in these models are presented in Table 10.1. Where reference is made to variable used in MPLUS analyses reported in this chapter, variable names for latent variables (LVs) are given in uppercase. Variable names for manifest variables (MVs) are given in italics.

Another problem in employing these two-level analyses is that MPLUS does not allow any of the dependent variables in the structural model to be measured using a categorical scale. However, in practice, MPLUS sometimes prevents any categorical dependent variable being included not only in the structural model but also in the measurement model.

Table 10.1 Variables in the Individual Level Models

Latent Variables	**Description**	**Manifest Variables**	**Description**
SEX	Gender of Employee	gender	1=Male, 2= Female
AGE	Age of employee	agec	Age in years
EDUC	Level of Education	degree	Level of education
COMCH	Communication channel	comch	A principal component score of 4 categorical dummy variables
BELIF	Beliefs Consistency	rdst	Reduce staff
		rdco	Reduce cost
		cmjo	Create more jobs
		Ispl	Isolate people
		coli	Control our live
OBSER	Observability	smve	Small version
		modu	Modularity
		tryo	Try out
		sepr	See presentation
COMPL	Complexity	diun	Difficulty in understanding
		dius	Difficulty in using
COMPA	Compatibility	wsco	Work aspects compatibility
		alco	All aspects compatibility
		prco	Previous experience compatibility
RELAD	Relative advantage	inpr	Increase productivity
		inef	Increase efficiency
		inav	Increase availability
		inti	Increase timeliness
		eacc	Essay to access
		sobt	Speed to obtain
ANXTY	Computer related anxiety	anx1	Anxiety item 1
		anx2	Anxiety item 2
		anx3	Anxiety item 3
		anx4	Anxiety item 4
		anx5	Anxiety item 5
ATTID	Attitudes toward change	orig	Originator
		rule	Rule oriented
		cons	Conservatism
		syst	System oriented
		fitt	Fitter in
[a] INITI	Initiation	need	Need pull
		tech	Technology push
		socp	Social pressures
ADOPT	Adoption	adopt	A principal component score of 3 manifest variables
PAUSE	Passive usage	inpa	Intensity of passive usage
		frin	Frequency of indirect usage
		frpa	Frequency of passive usage
ACUSE	Active usage	inac	Intensity of active usage
		frdi	Frequency of direct usage
		appu	Application used
		tsku	Tasks supported
SATIS	Satisfaction	itsa	IT satisfaction
		syss	System satisfaction
		vens	Vendor satisfaction
		tras	Training satisfaction
PERFM	Performance	effi	Efficiency
		effe	Effectiveness
		appr	Appropriateness

Note [a]: Latent Variable INITI along with its three MVs is only included in the initiators model.

As a result, when an attempt was made to include SEX as a latent variable measured by a single manifest variable *gender* in an outward mode in which *gender* was declared as a categorical variable, MPLUS failed to fit the model.

Alternatively, SEX can be included in the structural model as an exogenous observed variable without forming a latent variable. In other words, SEX is declared to be a manifest variable with no associated latent variable. This alternative was chosen to allow the model to be fitted.

The same problem was also faced by COMCH, which was originally treated as a latent variable measured by four dummy variables in PLSPATH and AMOS analyses. To overcome this problem, a principal component score was calculated and the variable treated as a continuous measure.

Different problems also arose when ADOPT was treated as a latent variable reflected by three observed variables, namely speed of adoption (*speed*), the level of commitment (*commit*), and the level of extensiveness (*extent*). The best result that was obtained was that the factor loadings for these three MVs could only be estimated at the organisational level. MPLUS failed to estimate the standardised and fully standardised coefficients at the individual level because all of the MVs' residual variances were greater than one. Any attempt to fix the variances resulted in non-converging iterations. Finally, an alternative solution, which was to compute a principal component score for ADOPT, was undertaken and used for the subsequent analyses.

In the path models, all these variables, except for SEX, COMCH, and ADOPT, are treated as latent variables (LVs), each of them containing or formed out of one or more manifest variables (MVs). Therefore, in the examination of the initiators model, there are 14 LVs and 52 MVs; and in the non-initiators model, there are 13 LVs and 49 MVs. The results of the MPLUS analyses in this section are reported in two parts. The first part reports the results for the measurement model, which relates the MVs to the corresponding LVs and examines the strength of relationship between MVs and their corresponding LVs (Tabachnick & Fidell, 1996). The second part reports the results for the structural model, which examines the strength of relationship between one LV and other LVs (Tabachnick & Fidell, 1996).

Measurement Models

The strength of the relationships between MVs and their corresponding LVs were assessed in the MPLUS program with several indices. Table 10.2 presents the measurement model results for individual level factors influencing IT adoption processes for both initiators and non-initiators providing five indices that were recorded for examining the strength of the relationships between MVs and their corresponding LVs.

The first index is the 'estimates' (Est.), which indicates the strength of relationships in the outward mode. These estimates are accompanied by their standard errors (SE), which indicate the variability of the estimates. The third index is the 'critical ratio' obtained by dividing the estimate by its standard error (Est./SE). Using a significance level of 0.05, any critical ratio that exceeds 1.96 in magnitude is considered significant (Arbuckle & Wothke, 1999).

MPLUS also provides two types of standardised coefficients. The first type is shown under the heading 'Std' in Table 10.2. These coefficients are standardised using the variances of the continuous latent variables.

Table 10.2 Individual Level Factors: Measurement Model Results

Variables	Non Initiators					Initiators				
	Est.	**SE**	**Est./SE**	**Std**	**StdYX**	**Est.**	**SE**	**Est./SE**	**Std**	**StdYX**
AGE by										
year	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
EDUC by										
degree	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.01	1.00
COMCH by										
comc	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.01	1.00
BELIF by										
rdst	0.87	0.09	10.00	0.59	0.56	0.70	0.08	8.83	0.54	0.52
rdco	0.93	0.09	10.15	0.63	0.57	0.76	0.08	9.13	0.58	0.53
cmjo	1.04	0.09	11.88	0.70	0.70	0.82	0.08	10.06	0.63	0.58
ispl	1.01	0.09	11.61	0.68	0.67	0.83	0.08	10.30	0.64	0.61
coli	1.00	0.00	0.00	0.68	0.70	1.00	0.00	0.00	0.77	0.73
OBSER by										
smve	1.07	0.07	16.48	0.82	0.78	0.96	0.05	18.79	0.84	0.83
modu	1.09	0.06	17.60	0.84	0.82	0.99	0.06	16.74	0.87	0.78
tryo	1.00	0.00	0.00	0.77	0.79	1.00	0.00	0.00	0.88	0.84
sepr	0.87	0.06	14.17	0.67	0.67	0.93	0.05	17.37	0.82	0.78
COMPL by										
diun	1.00	0.00	0.00	0.90	0.80	0.82	0.08	10.82	0.78	0.73
dius	1.17	0.10	12.32	1.05	0.89	1.00	0.00	0.00	0.96	0.86
COMPA by										
Wsco	1.00	0.00	0.00	1.03	0.87	1.00	0.00	0.00	1.07	0.88
Alco	0.96	0.04	23.61	0.99	0.89	0.99	0.04	25.92	1.06	0.94
Prco	0.91	0.05	19.80	0.94	0.80	0.84	0.05	18.44	0.90	0.75
RELAD by										
inpr	0.78	0.06	13.41	0.69	0.65	0.63	0.05	13.05	0.62	0.61
inef	1.00	0.05	18.64	0.88	0.85	0.74	0.04	17.10	0.73	0.74
inav	1.18	0.06	20.01	1.04	0.90	0.91	0.04	20.49	0.89	0.83
inti	0.99	0.04	25.08	0.88	0.83	1.00	0.04	23.12	0.98	0.91
eacc	1.00	0.00	0.00	0.88	0.79	1.00	0.00	0.00	0.98	0.85
sobt	0.97	0.03	31.56	0.86	0.77	0.89	0.03	26.72	0.88	0.82
ANXTY by										
anx1	0.71	0.04	17.64	0.88	0.69	0.58	0.06	10.17	0.65	0.51
anx2	0.80	0.04	22.15	1.00	0.78	0.78	0.05	14.72	0.88	0.69
anx3	0.91	0.03	27.94	1.13	0.88	0.87	0.05	18.86	0.97	0.82
anx4	1.00	0.00	0.00	1.24	0.93	1.00	0.00	0.00	1.12	0.89
anx5	0.92	0.04	23.79	1.15	0.83	0.98	0.05	18.49	1.09	0.81
ATTID by										
fitt	0.82	0.08	10.80	0.54	0.59	0.90	0.08	11.72	0.63	0.66
orig	1.07	0.08	13.77	0.71	0.79	0.87	0.07	12.08	0.61	0.70
syst	1.00	0.00	0.00	0.66	0.77	1.00	0.00	0.00	0.71	0.77

continued

Table 8.2 Individual Level Factors: Measurement Model Results (continued)

Variables	Non Initiators					Initiators				
	Est.	**SE**	**Est./SE**	**Std**	**StdYX**	**Est.**	**SE**	**Est./SE**	**Std**	**StdYX**
rule	0.88	0.08	11.22	0.58	0.61	0.81	0.07	11.03	0.57	0.63
ons	0.85	0.07	11.55	0.56	0.64	0.68	0.07	9.72	0.48	0.56
INITI by										
need						0.67	0.14	4.71	0.35	0.40
tech						1.00	0.00	0.00	0.53	0.59
socp						0.68	0.16	4.38	0.36	0.35
PAUSE by										
inpa	0.81	0.08	10.60	0.61	0.51	0.60	0.09	6.85	0.69	0.54
frin	1.00	0.00	0.00	0.76	0.60	1.00	0.00	0.00	1.16	0.93
frpa	1.62	0.23	7.22	1.23	0.91	0.53	0.08	6.50	0.61	0.49
ACUSE by										
inac	1.00	0.00	0.00	0.69	0.64	1.00	0.00	0.00	0.88	0.74
frdi	1.45	0.14	10.10	1.00	0.77	1.16	0.13	9.04	1.02	0.77
appu	0.61	0.10	6.34	0.42	0.38	0.41	0.08	4.93	0.36	0.30
tsku	0.92	0.17	5.58	0.63	0.33	0.73	0.15	4.95	0.64	0.29
SATIS by										
itsa	1.02	0.06	16.86	0.77	0.86	0.91	0.07	13.71	0.63	0.76
syss	1.00	0.00	0.00	0.75	0.87	1.00	0.00	0.00	0.69	0.84
vens	0.49	0.06	8.56	0.36	0.44	0.59	0.07	8.45	0.41	0.47
tras	0.38	0.06	6.70	0.29	0.35	0.51	0.07	7.05	0.35	0.39
PERFM by										
effi	1.05	0.05	21.06	0.75	0.87	0.96	0.03	28.11	0.84	0.91
effe	1.00	0.05	19.94	0.71	0.83	0.93	0.04	23.68	0.81	0.84
appr	1.00	0.00	0.00	0.71	0.86	1.00	0.00	0.00	0.87	0.92

Note: SEX, COMCH, and ADOPT are treated as MVs. Consequently, they are not presented in this Measurement Model.

The second type is shown under the heading 'StdYX'. These coefficients are standardised using the variance of the continuous latent variables as well as the background and outcome variables (Muthén & Muthén, 1998). For the purpose of this study, StdYX results were used in the following discussion. The strength of a relationship between MVs and their corresponding LVs in the outward mode was considered significant if the value of the loadings was equal to or larger than 0.30 (Pedhazur 1997, p. 910).

Sex of Employee (SEX)

In the model, the SEX variable was an observed variable included in the structural model as an exogenous variable. Obviously this variable was dichotomous, with male entered as 1 and female as 2.

Age of Employee (AGE)

The age of employee (AGE) as a latent variable was also formed out of a single manifest variable, namely *year*. In the model, the AGE variable was reflected by a single indicator.

Highest Education Completed (EDUC)

The highest education completed (EDUC) was also reflected by a single indicator namely, *degree*.

Communication Channel (COMCH)

Communication channel (COMCH) as a construct was originally reflected in the model by four manifest variables, which were not mutually exclusive, namely formal channel (*fch*), informal channel (*ich*), written material (*wch*) and a variable 'don't know' (*dch*) which had a value of 1 for those who at least had one of the three channels, and the value of 0 for those who answered do not know or did not give any answer. Therefore, the LV COMCH was drawn in the path diagram in the outward mode with four MVs. However, in this analysis, a principal component score was calculated to overcome the MPLUS limitation, which does not allow any dependent variable to be measured in a manner that involves a categorical scale.

Beliefs Consistency (BELIF)

Five MVs were reflected by the beliefs consistency (BELIF) construct, namely reduce staff (*rdst*), reduce cost (*rdco*), create more job (*cmjo*), isolate people (*ispl*), and control our lives (*coli*). The size of the loadings, which were 0.52, 0.53, 0.58, 0.61, 0.73 respectively for initiators and 0.56, 0.57, 0.70, 0.67, 0.70 respectively for non-initiators, indicate that these MVs were strong reflectors of this construct.

Observability (OBSER)

The possibility of installing a small version of the system (*smve*), modularity of the technology (*modu*), the opportunity to try the technology beforehand (*tryo*), and the chance to see a demonstration and presentation of the technology (*sepr*) were four reflectors of the observability (OBSER) construct. For initiators, the four MVs had reasonably high loadings which ranged between 0.78 and 0.84. These coefficients indicate that they were strong reflectors of the construct. Similar results were also found for the non-initiators. However, the order of the MVs in terms of their contribution or strength was different.

For initiators, the strongest reflector was the opportunity to try the technology beforehand (*tryo)* and the weakest reflector was the modularity of the technology *(modu).* While for non-initiators, the modularity of the technology *(modu)* was the strongest reflector and the weakest reflector was the chance to see a demonstration and presentation of the technology (*sepr*). This could be related to the fact that for initiators, having a chance to try the technology before adopting was more important in ensuring the intended result than the incremental installation capability of the technology. While for non-initiators, who were actually the end users, incremental installation gave them more chance to learn how to use the technology and they rarely had a chance to see the presentation and demonstration of the technology since these occasions were usually for the decision makers.

Complexity (COMPL)

Complexity (COMPL) was reflected by only two MVs, namely, difficulty in understanding (*diun*) and difficulty in using (*dius*). As an outward latent construct, *compl* was strongly reflected by these two MVs with the loadings of 0.73 and 0.86 respectively for initiators and 0.80, 0.89 respectively for non-initiators. Both initiators and non-initiators perceived difficulty in using the technology to be the stronger reflector of complexity compared with difficulty in understanding the technology.

Compatibility (COMPA)

Compatibility (COMPA) was reflected by work aspects compatibility (*wsco*), all aspects compatibility (*alco*), and previous experience compatibility (*prco*). These three MVs had high loadings of 0.88, 0.94, and 0.75 respectively for initiators and 0.87, 0.89, 0.80 respectively for non-initiators, indicating that this construct was strongly reflected by the three MVs. Factor structure patterns were similar for both groups.

Relative Advantage of IT (RELAD)

The perceived relative advantage of information technology (RELAD) was an outward mode latent variable reflected by six MVs, namely increase productivity (*inpr*), increase efficiency (*inef*), increase availability (*inav*), increase timeliness (*inti*), ease to access (*eacc*), and increase speed to obtain (*sobt*). The strongest reflector of this construct for the initiators was increase timeliness (*inti*) with the loadings of 0.91 and for non initiators was increase availability (*inav*) with the loading of 0.92. The weakest reflector was increase productivity (*inpr)* with the loadings of 0.61 and 0.65 for initiators and non-initiators respectively. These results suggest that middle to upper level management was more concerned with the timeliness of the information, whereas the lower level staff members were more concerned with the availability of the information that could make their job easier.

Anxiety (ANXTY)

Computer related anxiety (ANXTY) was an outward mode latent variable reflected by five MVs, namely feel apprehensive about computer (*anx1*), afraid to damage it (*anx2*), unfamiliar with computer (*anx3*), fear of making mistakes (*anx4*), and computer terminology sounds like confusing jargon (*anx5*). The loadings for *anx1, anx2, anx3, anx4,* and *anx5* were 0.51, 0.69, 0.82, 0.89, 0.81 and 0.58, 0.78, 0.87, 1.00, 0.98 respectively for initiators and non-initiators, which indicated quite satisfactory loadings.

Attitudes toward Change (ATTID)

In a similar way to anxiety, attitudes toward change (ATTID) was also reflected by five MVs namely originator (*orig*), rule oriented (*rule*), conservatism (*cons*), system oriented (*syst*), and fitter-in (*fitt*). These five MVs were composite scores calculated using a principal component method and the way in which these MVs were formed is given in Chapter Eight. The loadings for these MVs were quite satisfactory: 0.66, 0.70, 0.77, 0.63, and 0.56 respectively for initiators, and 0.54, 0.71, 0.66, 0.58, and 0.56 respectively for non-initiators.

Initiation (INITI)

The level of pressure at the initiation stage (INITI) was reflected by three MVs, namely need pull (*need*), technology push (*tech*), and social pressure (*socp*). These three MVs were composite scores calculated as principal component scores of multiple observed variables as explained in Chapter Eight. Technology push was the strongest reflector with the loading of 0.59 followed by need pull (0.40) and social pressure (0.35). This construct applied only to the initiators group since the respondents in this group were those who were actually involved in the initiation stage, whereas the respondents in the other group were not.

Adoption (ADOPT)

The level of IT adoption (ADOPT) was included in the model as an endogenous observed variable using its principal component score.

Passive Usage (PAUSE)

Passive usage (PAUSE) was reflected by three MVs, namely intensity of passive usage (*inpa*), frequency of indirect usage (*frin*), and frequency of passive usage (*frpa*). Frequency of indirect usage was the strongest reflector of this construct (0.93) for the initiators. This result suggests that most of the middle to upper level management staff members were using the technology indirectly. The coefficients for *inpa* and *frpa* were 0.54 and 0.49 respectively. For non-initiators, frequency of passive usage (*frpa*) was the strongest reflector (0.91), whereas the coefficients for *inpa* and *frin* were 0.51 and 0.60 respectively.

Active Usage (ACUSE)

Active usage (ACUSE) as an outward latent construct was reflected by four MVs, namely, intensity of active usage (*inac*), frequency of direct usage (*frdi*), the number of applications used (*appu*), and the number of tasks supported (*tsku*). For both groups, a*ppu* and *tsku* were weak reflectors of active usage with loadings of 0.30 and 0.29 respectively for initiators and 0.38 and 0.33 respectively for non-initiators. *Inac* and *frdi*, on the other hand, were both stronger reflectors of the construct with their loadings well above 0.4. However, to maintain the comparability of subsequent analyses, these weak MVs were not dropped.

User Satisfaction (SATIS)

User satisfaction (SATIS) was reflected by four MVs, namely, vendor satisfaction (*vens*), training satisfaction (*tras*), IT satisfaction (*itsa*), and system performance satisfaction (*syss*). The sizes of the loadings were 0.76, 0.84, 0.47, and 0.39 respectively for initiators, and 0.86, 0.87, 0.44, and 0.35 respectively for non-initiators. These values suggest that both IT satisfaction and system performance satisfaction were strong reflectors of the construct, whereas the vendor satisfaction and training satisfaction were considered to be less important.

User Performance (PERFM)

The impact of IT on user performance (PERFM) was reflected by the impact of IT in terms of efficiency (*effi*), effectiveness (*effe*), and appropriateness (*appr*). The user performance construct was reflected strongly by these three MVs for both groups. They had high loadings of 0.91, 0.84, 0.92 respectively for initiators and 0.87, 0.83, 0.86 respectively for non-initiators.

The next section presents a discussion of results for the structural model, which is also called the inner model.

Structural Models

The MPLUS structural model results at the individual level are presented in Table 10.3. This table presents the structural model results for individual level factors influencing IT adoption processes for both initiators and non-initiators providing five indices that are recorded for examining the strength of the relationships among LVs.

The first index given is the estimates (Est.) that indicate the unstandardised path coefficients. These estimates are accompanied by their standard errors (SE), which indicate the variability of the estimates. The third index is the critical ratio obtained by dividing the estimate by its standard error (Est./SE). Using a significance level of 0.05, any critical ratio that exceeds 1.96 in magnitude is considered significant (Muthén & Muthén, 1998).

MPLUS also provides two types of standardised path coefficients. The first type is shown under the heading 'Std'. These coefficients are standardised using the variances of the continuous latent variables. The second type is shown under the heading 'StdYX'. These coefficients are standardised using the variance of the continuous latent variables as well as the background and outcome variables (Muthén & Muthén, 1998).

In the following discussion, both unstandardised and standardised coefficients are reported in brackets, in which the unstandardised coefficients come first and then followed by the standardised coefficients.

IT Impact on User Performance (PERFM)

By observing the impact of IT on perceived user performance (PERFM) in terms of efficiency (EFFI), effectiveness (EFFE), and appropriateness (APPR), it was found for the initiators that male employees reported a greater impact of IT on their performance (SEX, -0.23, -0.12). Moreover, the younger employees seemed to feel the same way (AGE, -2.42, -0.11). Satisfaction worked in a positive way (SATIS, 10.93, 0.61). A higher level of satisfaction appeared to lead to a higher level of performance. This was true for both groups. In addition, for the non-initiators, compatibility (COMPA, 0.12, 0.17), attitudes toward change (ATTID, 0.17, 0.15), and active usage (ACUSE, 0.23, 0.22) were found to have positive effects on perceived performance. A higher level of compatibility was likely to associate with a higher level of perceived impact of IT on performance. Similar associations were also true for the relationship between the attitudes toward change and perceived impact of IT on performance as well as the relationship between the level of passive usage and perceived impact of IT on performance. In contrast, relative advantage had a negative effect on performance (RELAD, -0.13, -0.16). This result could be interpreted in the terms that the greater the respondents perceived the relative advantage of the technology, the less they seemed to feel the impact of the technology on their performance. In other words, the more they expected that the technology might deliver the benefits, the less they appeared to feel the technology fulfils their expectations.

User Satisfaction (SATIS)

For the initiators, computer related anxiety (ANXTY), initiation (INITI), and active usage (ACUSE) had positive effects on user satisfaction. The more they reported the need for the technology (INITI, 0.46, 0.36), combined with a higher level of anxiety (ANXTY, 0.09, 0.14) and a higher level of active usage (ACUSE, 0.05, 0.36), the greater the increase in the level of user satisfaction.

Table 10.3 Individual Level Factors: Structural Model Results

Variables	Non Initiators					Initiators				
	Est.	**SE**	**Est./SE**	**Std**	**StdYX**	**Est.**	**SE**	**Est./SE**	**Std**	**StdYX**
PERFM ON			$R^2 = 0.49$					$R^2 = 0.41$		
SEX						-0.23	0.09	-2.61	-0.27	-0.12
AGE						-0.09	0.04	-2.42	-0.11	-0.11
COMPA	0.12	0.04	3.16	0.17	0.17					
RELAD	-0.13	0.04	-2.93	-0.16	-0.16					
ATTID	0.17	0.05	3.03	0.15	0.15					
ACUSE	0.23	0.06	3.72	0.22	0.22					
SATIS	0.46	0.06	8.13	0.49	0.49	0.76	0.07	10.93	0.61	0.61
SATIS ON			$R^2 = 0.26$					$R^2 = 0.30$		
SEX	-0.22	0.08	-2.77	-0.29	-0.14					
RELAD	-0.08	0.05	-1.65	-0.09	-0.09					
ANXTY						0.09	0.04	2.54	0.14	0.14
ATTID	0.21	0.06	3.39	0.19	0.19					
INITI						0.46	0.11	4.16	0.36	0.36
PAUSE	0.17	0.06	2.67	0.17	0.17					
ACUSE	0.37	0.08	4.71	0.34	0.34	0.28	0.05	5.61	0.36	0.36
ACUSE ON			$R^2 = 0.34$					$R^2 = 0.11$		
AGE	-0.21	0.04	-5.37	-0.31	-0.31	-0.24	0.05	-4.47	-0.27	-0.27
OBSER	0.10	0.05	1.91	0.11	0.11					
PAUSE	0.39	0.06	6.10	0.43	0.43	0.11	0.05	2.20	0.14	0.14
ADOPT	0.23	0.07	3.31	0.34	0.18	0.22	0.08	2.65	0.25	0.16
PAUSE ON			$R^2 = 0.06$					$R^2 = 0.05$		
SEX	0.25	0.10	2.64	0.33	0.16					
AGE						0.11	0.06	1.79	0.10	0.10
OBSER	0.25	0.07	3.42	0.26	0.26					
COMPL						0.24	0.07	3.37	0.20	0.20
RELAD	-0.14	0.06	-2.28	-0.16	-0.16					
ADOPT ON								$R^2 = 0.04$		
INITI						0.22	0.09	2.56	0.12	0.19
INITI ON								$R^2 = 0.31$		
SEX						-0.25	0.09	-2.81	-0.46	-0.20
COMPL						0.22	0.05	4.46	0.40	0.40
ATTID						0.17	0.06	2.67	0.22	0.22
ATTID ON			R2 = 0.17					R2 = 0.18		
COMCH	0.07	0.04	2.04	0.11	0.11	0.12	0.04	3.24	0.17	0.17
OBSER	0.30	0.05	5.82	0.34	0.34					
COMPA						0.20	0.04	5.10	0.30	0.30
COMPL						0.14	0.05	3.02	0.19	0.19
ANXTY	0.07	0.03	2.40	0.13	0.13					
ANXTY ON			$R^2 = 0.18$					$R^2 = 0.11$		
BELIF	0.38	0.12	3.24	0.21	0.21					
COMPL	0.53	0.08	6.51	0.39	0.39	0.39	0.07	5.56	0.34	0.34
COMPA	-0.19	0.08	-2.51	-0.16	-0.16					

continued

Table 10.3 Individual Level Factors: Structural Model Results (continued)

Variables	Non Initiators					Initiators				
	Est.	SE	Est./SE	Std	StdYX	Est.	SE	Est./S.E.	Std	StdYX
ANXTY ON			$R^2 = 0.18$					$R^2 = 0.11$		
BELIF	0.38	0.12	3.24	0.21	0.21					
COMPL	0.53	0.08	6.51	0.39	0.39	0.39	0.07	5.56	0.34	0.34
COMPA	-0.19	0.08	-2.51	-0.16	-0.16					
RELAD ON			$R^2 = 0.33$					$R^2 = 0.38$		
SEX	0.36	0.09	4.06	0.40	0.20					
OBSER	0.40	0.08	5.26	0.35	0.35	0.33	0.07	4.92	0.30	0.30
COMPA	0.25	0.06	4.45	0.29	0.29	0.37	0.06	6.78	0.40	0.40
COMPA ON			$R^2 = 0.39$					$R^2 = 0.40$		
BELIF	0.34	0.10	3.33	0.23	0.23	0.41	0.11	3.74	0.29	0.29
OBSER	0.53	0.10	5.21	0.39	0.39	0.45	0.09	5.03	0.37	0.37
COMPL	0.14	0.07	2.17	0.12	0.12					
COMPL ON			$R^2 = 0.25$					$R^2 = 0.29$		
SEX	0.24	0.10	2.48	0.27	0.13					
BELIF						0.66	0.08	8.18	0.53	0.53
OBSER	0.60	0.07	8.15	0.51	0.51					
OBSER ON			$R^2 = 0.37$					$R^2 = 0.45$		
SEX	-0.16	0.08	-2.12	-0.21	-0.10					
BELIF	0.66	0.07	9.18	0.58	0.58	0.76	0.08	10.09	0.67	0.67
BELIF ON			$R^2 = 0.02$					$R^2 = 0.02$		
SEX	-0.19	0.08	-2.39	-0.28	-0.14	-0.26	0.10	-2.56	-0.34	-0.14
COMCH ON								$R^2 = 0.02$		
EDUC						0.12	0.05	2.33	0.12	0.12
EDUC ON								$R^2 = 0.02$		
AGE						0.13	0.05	2.45	0.13	0.13

An interesting result in this analysis was that the more they reported being anxious about the technology the more they reported being satisfied with it. For non-initiators, positive effects were found from attitudes toward change (ATTID, 0.21, 0.19), the level of passive usage (PAUSE, 0.17, 0.17), and the level of active usage (ACUSE, 0.37, 0.34) as were expected. The members of this group were actually the end-users of the technology. Thus, a positive effect of active usage as well as passive usage appeared as expected. Negative effects were found for relative advantage (RELAD, -0.08, -0.09) and gender (SEX, -0.22, -0.14). These relationships indicate that female employees and employees who have higher perceptions of the relative advantage of the technology reported being less satisfied with the technology.

Active Usage (ACUSE)

For active usage, adoption and passive usage were found to increase the level of active usage for both non-initiators (ADOPT, 0.23, 0.18; PAUSE, 0.39, 0.43) and initiators (ADOPT, 0.22, 0.16; PAUSE, 0.11, 0.14). The effect of age on active usage was found to operate in the opposite way for both non-initiators (AGE, -0.21, -0.31) and initiators (AGE, -0.24, -0.27). In other words, younger employees tended to report that they used the technology more actively. Observability had a positive effect on active usage only for the non-initiators group (OBSER, 0.10, 0.11).

Passive Usage (PAUSE)

For non-initiators in this study, females tended to be passive users (SEX, 0.25, 0.16). Observability also had a positive effect on passive usage (OBSER, 0.25, 0.26). In contrast, perceived relative advantages had a negative effect on passive usage in this group (RELAD, -0.14, -0.16). It appears that the less the non-initiators reported they perceived the relative advantages of the technology the more they tended to be passive users. For initiators, age (AGE, 0.11, 0.10) and complexity (COMPL, 0.07, 0.20) had positive effects on passive usage as expected. Older employees and employees who perceived the technology to be difficult tended to be passive users.

Adoption (ADOPT)

In the initiators model, the level of adoption was only influenced by initiation (INITI, 0.22, 0.19). This result suggests that a high level of initiation stage, which means that a high perception of pressures for the technology, was likely to be associated with a high level of adoption.

Initiation (INITI)

Initiation as a latent variable only appears in the initiators model. This is due to the fact that only this group was involved in the initiation stage. Adoption, on the other hand, appears in both models. However, in the non-initiators model, adoption is an exogenous variable.

On the one hand, gender had negative effects on initiation (SEX, -0.25, -0.20). This result indicated that female employees perceived less pressure to adopt the technology. On the other hand, complexity (COMPL, 0.22, 0.40) and attitudes toward change (ATTID, 0.17, 0.22) had positive effects on initiation. The effect of attitude was as expected. However, the positive effect of complexity on initiation was surprising. Therefore a further careful analysis by taking into account cross-level interactions needed to be undertaken.

Attitudes toward Change (ATTID)

Attitudes toward change (ATTID), on the other hand, was affected by communication channels (COMCH, 0.12, 0.17), complexity (COMPL, 0.14, 0.19) and compatibility (COMPA, 0.20, 0.30) for initiators, and by communication channels (COMCH, 0.07, 0.11), observability (OBSER, 0.30, 0.34), and anxiety (ANXTY, 0.07, 0.13) for non-initiators. All relationships were positive relationships. The effects of complexity for initiators and anxiety for non-initiators were rather more surprising. It was expected that, the more complex they perceived the technology, the less they wanted to use it. The same logical approach also applied for the effects of anxiety. The more they reported to feel anxious about the technology, the less they tended to use it. In other words, negative associations were expected. However, this study revealed the opposite results. This finding indicates that non-initiators perceived the technology as a challenge rather than a deterrent.

Compatibility (COMPA)

Extent of past experiences with computer use was expected to contribute significantly to the adoption processes. Beliefs consistency (BELIF, 0.41, 0.29) and observability (OBSER, 0.45, 0.37) had direct effects on compatibility for initiators; while beliefs consistency (BELIF, 0.34, 0.23), observability (0.53, 0.39), and complexity

(COMPL, 0.14, 0.12) were found to have direct effects on compatibility for non-initiators.

Complexity (COMPL)

Employees are likely to estimate the complexity of information technology (COMPL), consciously or subconsciously by comparing it with the current practice or technology used. The complexity is associated with difficulty in understanding and using the new technology. It was found in this study that gender (SEX, 0.24, 0.13) and observability (OBSER 0.60, 0.51) had direct effects on complexity for non-initiators, while only the beliefs consistency (BELIF, 0.66, 0.53) had a direct effect on complexity for initiators. These results suggest that for non-initiators, female employees and employees with higher needs to be exposed to IT perceived the technology to be more complex.

Observability (OBSER)

The scores of beliefs consistency, on the one hand, had direct effects on the reported need to be exposed to the technology (OBSER) before adopting it. The more consistent the employees' perceptions of the existing beliefs the higher their tendency to report being wanting to be exposed to the technology. This was surprising as it was expected that the more consistent their perceptions with the existing beliefs the less they would need to be exposed before actually adopting the technology. One possible reason for this expectation was that if respondents' perceptions of the technology were consistent with the existing beliefs, they would tend to take the technology for granted. However, the results of this study suggest that the relationship worked in the opposite direction. This kind of relationship applied for both initiators (BELIF, 0.76, 0.67) and non-initiators (BELIF, 0.66, 0.58). Gender, on the other hand, had negative direct effects only for the non-initiators group (SEX, -0.16, -0.10). The negative coefficient might be interpreted in the terms that the male employees seemed to have a greater need to be exposed to the technology.

Beliefs Consistency (BELIF)

If the technology were perceived as consistent with the employees' existing values and beliefs regarding the technology, it would be more likely to have positive effects on the IT adoption processes. It was found in these analyses that beliefs consistency (BELIF) was influenced by gender for both initiators (SEX, -0.26, -0.14) and non-initiators (SEX, -0.19, -0.14) groups. Male employees' perceptions were more consistent with the existing beliefs regarding the technology then female employees' perceptions.

Communication Channel (COMCH)

Education (EDUC, 0.12, 0.12) influenced positively communication channels used by the initiators and had no effect on non-initiators' communication channels. This result suggests that, for initiators, more educated employees had more communication channels.

The level of Education (EDUC)

For initiators, on the one hand, it would seem that the highest level of education completed (EDUC) was influenced positively by age (AGE, 0.13, 0.13). It seemed that older employees had higher qualifications. For non-initiators, on the other hand, none of the variables in the model would seem to influence their level of education.

Organisational Level Models

In the initiators model, there are 14 LVs hypothesised to influence the IT adoption processes in the structural model, namely: the level of centralisation and formalisation in the organisation (CENTRAL), age of employee (AGE_2), highest education completed (EDUC_2*),* communication channel (COMCH_2), anxiety (ANXTY_*2*), attitudes toward change (ATTID_2), beliefs consistency (BELIF_2), relative advantage of IT (RELAD_2), compatibility (COMPA_2), observability (OBSER_2), complexity (COMPL_2), initiation (INITI_2), passive usage (PAUSE_2), active usage (ACUSE_2), user satisfaction (SATIS_2) and user performance (PERFM_2).

In addition, there are eight MVs included in the structural model as well, namely: the size of the district (*rsize*), socio-economic level of the district (*socec*), the number of supporting facilities available in the district (*sufac*), the type of the organisation (*otype*), the size of the organisation (*osize*), the level of organisation complexity in term of IT skill and expertise (*ocom*), sex of employee (*sex_2)* and adoption (*adopt_2).* Consequently in total, there are 22 variables involved in the structural model for initiators. The number of MVs in the measurement model is 56.

For the non-initiators, the total number of variables involved in the structural model is 21. One variable, initiation (INITI), was excluded from the previous model because the people in this group were not involved in the initiation stage. Consequently, three MVs, which are the reflectors of initiation, were also dropped. The remaining variables are the same. The number of MVs in the measurement model is 53.

For the purpose of the MPLUS analyses, all MVs were recorded at the individual level. Higher-level variables should be disaggregated to the individual level. As a result, only one data file was needed. When an MPLUS analysis was run, it automatically computed the second-level observed variables according to the cluster variable provided. For certain variables that only operated at the organisational level, such as organisational characteristics, the command BETWEEN would be needed to allow them to be included only in the organisational level model.

The variables used in these models are presented in Table 10.4. The first three constructs in the table, district size (*rsize*), socio-economic level of the district (*socec*), and supporting facilities (*sufac*), are district's characteristics. So, they are district level data that have been disaggregated to the organisational level. While organisation type (*otype*), organisation size (*osize*), and organisation complexity (*ocom*) are organisational characteristics; the remainder are individual responses and characteristics that have been aggregated to the organisational level. These variables reflect the average climate in each organisation. MPLUS uses the same variable names for all MVs at both levels. However, for the purpose of this study, the names for MVs at the organisational level have the prefix *m_xxxx*.

The results of the MPLUS analyses in this section are reported in two parts. The first part reports the results for the measurement model, which examines the strength of relationship between MVs and their corresponding LVs. The second part reports the results for the structural model, which examines the strength of relationships between one LV and other LVs. All indices at the organisational level are treated and presented in the same way as in the individual level discussion.

Table 10.4 Variables in the Organisational Models

Latent Variables	Description	Manifest Variables	Description
RSIZE	District size	*rsize*	District size (Principal Component score)
SOCEC	Socio-economic level	*socec*	Socio-economic level (Principal Component score)
SUFAC	Supporting facilities	*sufac*	Supporting facilities (Principal Component score)
OSIZE	Organisational size	*osize*	Organisational size (Principal Component score)
OTYPE	Organisational type	*type*	Organisational type (Principal Component score)
OCOM	Organisational complexity	*ocom*	Organisational complexity (Principal Component score)
CENTRAL	Level of centralisation	*m_cen1*	Centralisation item 1
		m_cen2	Centralisation item 2
		m_cen3	Centralisation item 3
		m_cen4	Centralisation item 4
SEX_2	Gender of employee	*m_gender*	1=Male, 2= Female
AGE_2	Age of employee	*m_agec*	Age in years
EDUC_2	Level of education	*m_degree*	Level of education
COMCH_2	Communication channel	*m_comc*	Communication channel
BELIF_2	Beliefs consistency	*m_rdst*	Reduce staff
		m_rdco	Reduce cost
		m_cmjo	Create more jobs
		m_ispl	Isolate people
		m_coli	Control our live
OBSER_2	Observability	*m_smve*	Small version
		m_modu	Modularity
		m_tryo	Try out
		m_sepr	See presentation
COMPL_2	Complexity	*m_diun*	Difficulty in understanding
		m_dius	Difficulty in using
COMPA_2	Compatibility	*m_wsco*	Work aspects compatibility
		m_alco	All aspects compatibility
		m_prco	Previous experience compatibility
RELAD_2	Relative advantage	*m_inpr*	Increase productivity
		m_inef	Increase efficiency
		m_inav	Increase availability
		m_inti	Increase timeliness
		m_eacc	Essay to access
		m_sobt	Speed to obtain
ANXTY_2	Computer related anxiety	*m_anx1*	Anxiety item 1
		m_anx2	Anxiety item 2
		m_anx3	Anxiety item 3
		m_anx4	Anxiety item 4
		m_anx5	Anxiety item 5

continued

Table 10.4 Variables in the Organisational Models

Latent Variables	Description	Manifest Variables	Description
ATTID_2	Attitudes toward change	*m_orig*	Originator
		m_rule	Rule oriented
		m_cons	Conservatism
		m_syst	System oriented
		m_fitt	Fitter in
INITI_2	Initiation	*m_need*	Need pull
		m_tech	Technology push
		m_socp	Social pressures
ADOPT_2	Adoption	*m_adopt*	Adoption
PAUSE_2	Passive usage	*m_inpa*	Intensity of passive usage
		m_frin	Frequency of indirect usage
		m_frpa	Frequency of passive usage
ACUSE_2	Active usage	*m_inac*	Intensity of active usage
		m_frdi	Frequency of direct usage
		m_appu	Application used
		m_tsku	Tasks supported
SATIS_2	Satisfaction	*m_itsa*	IT satisfaction
		m_syss	System satisfaction
		m_vens	Vendor satisfaction
		m_tras	Training satisfaction
PERFM_2	Performance	*m_effi*	Efficiency
		m_effe	Effectiveness
		m_appr	Appropriateness

Note: Latent Variable INITI_2 along with its three MVs is only included in the initiators model.

For the structural model discussion, both unstandardised and standardised coefficients are reported in brackets, in which unstandardised coefficients come first and then followed by standardised coefficients. Table 10.5 present the measurement model results for organisational level factors influencing IT adoption processes for both initiators and non-initiators providing five indices that are recorded for examining the strength of the relationships between MVs and their corresponding LVs.

Measurement Models

Centralisation (CENTRAL)

At the organisational level, the aggregated manifest variables associated with the centralisation (CENTRAL) and formalisation (FORMAL) constructs were highly correlated. Consequently, any attempt to bring them together into the model failed and the formalisation construct had to be dropped from the model. Moreover, the loadings of *m_cen3* for non-initiators and *m_cen4* for initiators were below 0.3. These coefficients indicated that these indicators were very weak reflectors of the construct.

Age of Employee (AGE_2)

The age of employee (AGE-2) as a latent variable was formed out of a single manifest variable, namely *m_agec*. In the model, the AGE_2 variable was reflected by a single indicator and the value of its loading was 1.00 (unity).

Highest Education Completed (EDUC_2)

The highest education completed (EDUC_2) was also reflected by a single indicator namely, *m_degree*. The value of its loading was 1.00 (unity).

Communication Channel (COMCH_2)

The communication channel (COMCH_2) was also reflected by a single indicator namely, *m_comc*. The value of its loading was 1.00 (unity).

Beliefs Consistency (BELIF_2)

Five MVs reflected the construct of beliefs consistency (BELIF_2), namely reduce staff (*m_rdst*), reduce cost (*m_rdco*), create more jobs (*m_cmjo*), isolate people (*m_ispl*), and control our lives (*m_coli*). The size of the factor loadings, which were 0.70, 0.63, 0.24, 0.0.04, -0.21 respectively for non-initiators and 0.61, 1.00, 0.32, 0.13, 0.39 respectively for initiators, indicated that only reduce staff (*m_rdst*) and reduce cost (*m_rdco*) were strong reflectors of this construct. However, the other manifest variables, which might be drooped since they contribute little to the LV, were kept in the model to maintain comparability with the individual level model. These results suggest that at the organisational level, on average, people were more concerned about these two MVs.

Observability (OBSER_2)

The possibility of installing a small version of the system (*m_smve*), modularity of the technology (*m_modu*), the opportunity to try the technology beforehand (*m_tryo*), and the chance to see demonstration and presentation of the technology (*m_sepr*) were the four reflectors of the observability (OBSER_2) construct. For initiators, on one hand, three MVs had moderate to high factor loadings which range between 0.69 and 0.87 and one MV, modularity (*m_modu*), had a very low loading of 0.15. These results indicate that on average in the organisation, people perceived modularity as a less important reflector. For non-initiators, on the other hand, all MVs were found to be strong reflectors of the construct.

Complexity (COMPL_2)

Complexity (COMPL_2) was reflected by only two MVs namely, difficulty in understanding (*m_diun*) and difficulty in using (*m_dius*). As an outward latent construct, COMPL_2 was strongly reflected by these two MVs with the factor loadings of 0.55 and 0.70 respectively for initiators and 0.40, 0.62 respectively for non-initiators. Both initiators and non-initiators perceived difficulty in using the technology the stronger reflector of complexity compared to difficulty in understanding the technology.

Compatibility (COMPA_2)

Compatibility (COMPA_2) was reflected by work aspects compatibility (*m_wsco*), all aspects compatibility (*m_alco*), and previous experience compatibility (*m_prco*). These three MVs had high factor loadings (0.97, 0.91, and 0.47 respectively for initiators and 1.00, 0.97, 0.83 respectively for non-initiators) indicated that this construct was strongly reflected by the three MVs. Factor structure patterns were similar for both groups.

Table 10.5 Organisational Level Factors: Measurement Model Results

Variables	Non Initiators					Initiators				
	Est.	**S.E.**	**Est./S.E.**	**Std**	**StdYX**	**Est.**	**S.E.**	**Est./S.E.**	**Std**	**StdYX**
CENTRAL by										
m_cen1	0.53	0.15	3.45	0.27	0.53	1.00	0.00	0.00	0.63	1.00
m_cen2	0.28	0.13	2.12	0.15	0.36	0.41	0.11	3.72	0.25	0.46
m_cen3	-0.25	0.17	-1.45	-0.13	-0.26	0.67	0.10	6.66	0.42	0.69
m_cen4	1.00	0.00	0.00	0.52	0.87	0.21	0.11	2.00	0.13	0.29
AGE_2 by										
m_agec	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
EDUC_2 by										
m_degree	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
COMCH_2 by										
m_comc	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00
BELIF_2 by										
m_rdst	1.00	0.00	0.00	0.28	0.70	0.49	0.08	6.01	0.45	0.61
m_rdco	1.00	0.00	0.00	0.28	0.63	1.00	0.00	0.00	0.91	1.00
m_cmjo	0.28	0.15	1.91	0.08	0.24	0.10	0.06	1.59	0.09	0.32
m_ispl	0.04	0.15	0.29	0.01	0.04	0.07	0.08	0.90	0.06	0.13
m_coli	-0.23	0.16	-1.46	-0.06	-0.21	0.23	0.08	3.06	0.21	0.39
OBSER_2 by										
m_smve	0.42	0.12	3.63	0.19	0.71	0.80	0.17	4.64	0.29	0.69
m_modu	0.85	0.11	7.60	0.39	1.00	0.40	0.34	1.19	0.15	0.15
m_tryo	0.53	0.11	4.70	0.24	0.73	0.78	0.15	5.13	0.29	0.87
m_sepr	1.00	0.00	0.00	0.46	1.00	1.00	0.00	0.00	0.37	0.80
COMPL_2 by										
m_diun	1.00	0.00	0.00	0.28	0.40	1.00	0.00	0.00	0.27	0.55
m_dius	1.00	0.00	0.00	0.28	0.62	1.00	0.00	0.00	0.27	0.70
COMPA_2 by										
m_wsco	1.13	0.10	11.86	0.60	1.00	1.00	0.00	0.00	0.63	0.97
m_alco	1.00	0.00	0.00	0.54	0.97	0.69	0.07	10.17	0.43	0.91
m_prco	0.49	0.10	5.02	0.26	0.83	0.15	0.09	1.58	0.09	0.47
RELAD_2 by										
m_inpr	0.68	0.09	7.57	0.50	0.77	0.77	0.10	7.48	0.49	0.86
m_inef	0.85	0.07	11.94	0.63	0.92	0.71	0.08	8.41	0.45	0.90
m_inav	0.89	0.06	14.50	0.66	1.00	1.00	0.00	0.00	0.63	0.95
m_inti	0.90	0.06	15.74	0.66	0.96	0.79	0.09	8.47	0.50	0.81
m_eacc	0.98	0.05	21.90	0.72	0.97	0.93	0.09	10.80	0.59	0.98
m_sobt	1.00	0.00	0.00	0.74	1.00	0.96	0.10	10.10	0.61	0.93
ANXTY_2 by										
m_anx1	0.23	0.33	0.69	0.05	0.16	0.42	0.10	4.07	0.33	0.70
m_anx2	1.62	0.43	3.81	0.37	1.00	0.57	0.10	5.95	0.45	0.85
m_anx3	1.00	0.00	0.00	0.23	0.67	0.83	0.12	7.06	0.64	0.76
m_anx4	1.61	0.38	4.23	0.37	0.87	0.84	0.12	7.23	0.65	0.77
m_anx5	0.03	0.41	0.08	0.01	0.02	1.00	0.00	0.00	0.78	0.94

continued

Table 10.5 Organisational Level Factors: Measurement Model Results (continued)

Variables	Non Initiators					Initiators				
	Est.	S.E.	Est./S.E.	Std	StdYX	Est.	S.E.	Est./S.E.	Std	StdYX
ANXTY_2 by										
m_anx1	0.23	0.33	0.69	0.05	0.16	0.42	0.10	4.07	0.33	0.70
m_anx2	1.62	0.43	3.81	0.37	1.00	0.57	0.10	5.95	0.45	0.85
m_anx3	1.00	0.00	0.00	0.23	0.67	0.83	0.12	7.06	0.64	0.76
m_anx4	1.61	0.38	4.23	0.37	0.87	0.84	0.12	7.23	0.65	0.77
m_anx5	0.03	0.41	0.08	0.01	0.02	1.00	0.00	0.00	0.78	0.94
ATTID_2 by										
m_fitt	0.89	0.24	3.75	0.22	0.66	1.00	0.00	0.00	0.31	0.88
m_orig	0.62	0.30	2.07	0.15	0.29	0.65	0.28	2.36	0.20	0.34
m_syst	0.84	0.30	2.78	0.21	0.39	0.51	0.19	2.70	0.16	0.57
m_rule	1.00	0.00	0.00	0.25	0.81	0.53	0.28	1.92	0.16	0.29
m_cons	1.77	0.44	4.01	0.44	0.75	0.50	0.27	1.82	0.15	0.27
INITI_2 by										
m_need						0.45	0.09	4.95	0.37	0.56
m_tech						1.00	0.00	0.00	0.83	0.84
m_socp						0.92	0.10	8.90	0.76	0.94
PAUSE_2 by										
m_inpa	1.00	0.00	0.00	0.48	1.00	1.00	0.00	0.00	0.44	0.67
m_frin	0.41	0.17	2.48	0.20	0.40	1.25	0.26	4.78	0.55	0.84
m_frpa	0.61	0.20	3.07	0.29	0.43	1.31	0.30	4.30	0.58	0.84
ACUSE_2 by										
m_inac	0.56	0.07	8.42	0.55	0.86	0.46	0.04	10.54	0.77	0.88
m_frdi	0.32	0.08	4.22	0.31	0.53	0.28	0.04	6.60	0.46	0.81
m_appu	1.00	0.00	0.00	0.98	0.90	1.00	0.00	0.00	1.65	0.98
m_tsku	0.83	0.12	7.02	0.81	0.78	0.89	0.07	12.39	1.47	0.96
SATIS_2 by										
m_itsa	0.71	0.09	8.39	0.36	0.77	0.77	0.09	8.55	0.41	0.83
m_syss	1.00	0.00	0.00	0.51	1.00	1.00	0.00	0.00	0.54	0.96
m_vens	0.82	0.11	7.28	0.42	0.77	-0.21	0.13	-1.64	-0.11	-0.24
m_tras	0.74	0.12	6.32	0.38	0.71	0.10	0.11	0.86	0.05	0.14
PERFM_2 by										
m_effi	0.86	0.09	9.91	0.41	0.86	1.00	0.00	0.00	0.40	0.91
m_effe	0.83	0.09	8.98	0.40	0.82	0.14	0.11	1.32	0.06	0.39
m_appr	1.00	0.00	0.00	1.00	0.95	0.97	0.09	11.35	0.39	0.91

Relative Advantage of IT (RELAD_2)

The perceived relative advantage of information technology (RELAD_2) was an outward mode latent variable reflected by six MVs, namely increased productivity (*m_inpr*), increased efficiency (*m_inef*), increased availability (*m_inav*), increased timeliness (*m_inti*), ease to access (*m_eacc*), and increased speed to obtain (*m_sobt*). For both groups, all MVs were strong reflectors of the construct with the loadings ranging from 0.81 to 0.98 for initiators and from 0.77 to 1.00 for non-initiators.

Anxiety (ANXTY_2)

Computer related anxiety (ANXTY_2) was an outward model latent variable reflected by five MVs, namely feel apprehensive about computer (*m_anx1*), afraid to damage it (*m_anx2*), unfamiliar with computer (*m_anx3*), fear of making mistakes (*m_anx4*), and computer terminology sounds like confusing jargon (*m_anx5*). The factor loading *for m_anx1, m_anx2, m_anx3, m_anx4,* and *m_anx5* were 0.70, 0.85, 0.76, 0.77, 0.94 and 0.16, 1.00, 0.67, 0.87, 0.02 respectively for initiators and non-initiators, which indicated quite satisfactory loadings for initiators with the exceptions of *m_anx1* and *m_anx5* for non-initiators.

Attitudes toward change (ATTID_2)

In a similar way to anxiety, attitudes toward change (ATTID_2) was also reflected by five MVs namely originator (*m_orig*), rule oriented (*m_rule*), conservatism (*m_cons*), system oriented (*m_syst*), and fitter-in (*m_fitt*). These five MVs were composite scores calculated using a principal component method. The way in which these MVs were formed is given in Chapter Eight. At the organisational level, it was found that originator (*m_orig*) was not significant for either group. In addition, rule oriented (*rule*) and conservatism (*cons*) were also not significant for initiators.

Initiation (INITI_2)

The level of pressure at the initiation stage (INITI_2) was reflected by three MVs, namely need pull (*m_need*), technology push (*m_tech*), and social pressure (*m_socp*). These three MVs were composite scores calculated as principal component scores of multiple observed variables as explained in Chapter Eight. Social pressure was the strongest reflector with the factor loading of 0.94 followed by technology pull (0.84) and need pull (0.56). These results were interesting. They indicated that at the organisational level, the highest pressure at the initiation stage came from the social pressures, either pressures from the upper level authority, customer, or vendor. Whereas need pull was found to be the weakest reflector of this construct, which suggested that the initiation stage was less dependent on the needs. This construct applied only to the initiators group since the respondents in this group were those employees who were actually involved in the initiation stage while the respondents in the other group were not.

Passive Usage (PAUSE_2)

Passive usage (PAUSE_2) was also reflected by three MVs, namely intensity of passive usage (*m_inpa*), frequency of indirect usage (*m_frin*), and frequency of passive usage (*m_frpa*). *M_frin* and *m_frpa* were strong reflectors of passive usage for initiators with the factor loadings of 0.84, whereas *m_inpa* was found to be the strongest reflector of this construct for non-initiators.

Active Usage (ACUSE_2)

Active usage (ACUSE_2) as an outward latent construct was reflected by four MVs, namely intensity of active usage (*m_inac*), frequency of direct usage (*m_frdi*), the number of applications used (*m_appu*), and the number of tasks supported (*m_tsku*). For initiators, a*ppuse* and *tskuse* were both strong reflectors of active usage with factor loadings of 0.98 and 0.96 respectively. For non-initiators, the number of applications used (*appuse*) was the strongest reflector.

User Satisfaction (SATIS_2)

User satisfaction (SATIS_2) was reflected by four MVs, namely vendor satisfaction (*m_vens*), training satisfaction (*m_tras*), IT satisfaction (*m_itsa*), and system performance satisfaction (*m_syss*). The sizes of the factor loadings indicate that vendor satisfaction and training satisfaction were not strong reflectors of the construct for initiators.

User Performance (PERFM_2).

The impact of IT on user performance (PERFM_2) was reflected by the impact of IT in terms of efficiency (*m_effi*), effectiveness (*m_effe*), and appropriateness (*m_appr*). The user performance construct was reflected strongly by these three MVs for both groups. They had high factor loadings of 0.91, 0.39, 0.91 respectively for initiators and 0.86, 0.82, 0.95 respectively for non-initiators. The only low loading was 0.39 for the *m_effe* in the initiators model. This result indicates that at the organisational level, middle to high-level management staff members, on average, perceived the technology to have a low impact on their effectiveness.

Structural Models

Separate MPLUS analyses were carried out for initiators and non-initiators and the structural model results for organisational level factors influencing each phase of IT adoption and implementation for both groups are presented in Table 10.6. The indices for the inner model results are calculated only for the endogenous latent variables that are the latent variables, which have arrows pointing to the latent variables concerned. In the following discussion, both unstandardised and standardised coefficients are reported in brackets, in which unstandardised coefficients come first and then followed by standardised coefficients.

IT Impact on User Performance (PERFM_2)

It was found in this study that for the initiators, communication channels (COMCH_2, -0.14, -0.35) and satisfaction (SATIS_2, 0.58, 0.78) were affecting user performance (PERFM_2). A high level of satisfaction, as expected, appeared to correlate with a high perception of IT impact on performance. In contrast, greater usage of communication channels had negative effects on user performance.

This relationship can be interpreted in terms that in the organisations where employees in the initiators group communicated their ideas regarding IT widely they tended to report less impact of the technology on their performance.

However, communication channels (COMCH_2, 0.09, 0.19) were also found to work in the opposite way for the non-initiators. This result suggests that for low level staff members, the actual end users, the more they communicated, the more they reported the impact of IT on their performance.

In addition, for non-initiators, anxiety (ANXTY_2, -1.34, -0.64) was found to have negative effects on performance, and attitudes toward change (ATTID_2, 1.26, 0.65) operated in the opposite direction.

Table 10.6 Organisational Level Factors: Structural Model Results

Variables	Non Initiators					Initiators				
	Est.	**S.E.**	**Est./S.E.**	**Std**	**StdYX**	**Est.**	**S.E.**	**Est./S.E.**	**Std**	**StdYX**
PERFM_2 ON			R^2=0.90					R^2=1.00		
COMCH_2	0.09	0.04	2.19	0.19	0.19	-0.14	0.04	-3.13	-0.35	-0.35
ATTID_2	1.26	0.39	3.24	0.65	0.65					
ANXTY_2	-1.34	0.51	-2.64	-0.64	-0.64					
SATIS_2						0.58	0.10	5.99	0.78	0.78
SATIS_2 ON			R^2=1.00					R^2=0.68		
COMPL_2	-0.46	0.32	-1.43	-0.25	-0.25					
ATTID_2	1.58	0.42	3.76	0.76	0.76					
PAUSE_2	0.49	0.14	3.49	0.46	0.46					
INITI_2						0.54	0.08	7.09	0.82	0.82
ADOPT	0.26	0.05	5.22	0.50	0.42					
ACUSE_2 ON			R^2=0.86					R^2=0.90		
RSIZE	0.89	0.09	9.95	0.91	0.85	0.26	0.09	2.81	0.16	0.17
OTYPE						0.40	0.13	3.19	0.24	0.18
OSIZE	-0.46	0.07	-6.28	-0.44	-0.44					
AGE_2	-0.29	0.10	-2.92	-0.29	-0.29					
COMCH_2						1.45	0.11	13.37	0.88	0.88
ADOPT	0.19	0.09	2.15	0.20	0.17					
PAUSE_2	0.77	0.26	2.94	0.37	0.37					
PAUSE_2 ON			R^2=0.53					R^2=1.00		
OCOM						0.10	0.05	2.20	0.27	0.27
SEX_2	0.54	0.15	3.62	1.12	0.51					
AGE_2	0.25	0.07	3.79	0.51	0.51					
COMPL_2						1.30	0.48	2.70	0.81	0.81
ATTID_2						0.69	0.31	2.26	0.49	0.49
ADOPT ON								R^2=0.41		
OCOM						0.14	0.06	2.27	0.14	0.19
COMCH_2						0.61	0.11	5.50	0.61	0.71
RELAD_2						0.17	0.15	1.10	0.17	0.13
INITI_2						0.45	0.15	3.06	0.45	0.44
INITI_2 ON								R^2=1.00		
OBSER_2						1.64	0.38	4.33	0.73	0.73
RELAD_2						-0.86	0.16	-5.22	-0.66	-0.66
ATTID_2						1.05	0.38	2.75	0.39	0.39
ATTID_2 ON			R^2=0.09					R^2=0.44		
OCOM	0.07	0.03	2.34	0.31	0.31					
COMPA_2						0.33	0.09	3.71	0.66	0.66
ANXTY_2 ON								R^2=0.21		
COMCH_2						-0.36	0.10	-3.71	-0.46	-0.46

continued

Table 10.6 Organisational Level Factors: Structural Model Results (continued)

Variables	Non Initiators					Initiators				
	Est.	S.E.	Est./S.E.	Std	StdYX	Est.	S.E.	Est./S.E.	Std	StdYX
RELAD_2 ON			R^2=0.78					R^2=0.51		
OCOM	-0.14	0.06	-2.28	-0.18	-0.18					
SEX_2	0.62	0.15	4.18	0.85	0.39	1.34	0.25	5.39	2.12	0.69
CENTRAL	0.79	0.22	3.50	0.55	0.55					
OBSER_2	1.05	0.22	4.86	0.65	0.65	0.94	0.28	3.34	0.55	0.55
COMPL_2 ON			R^2=0.34					R^2=0.20		
SEX_2	0.36	0.13	2.65	1.28	0.59					
AGE_2						0.12	0.05	2.60	0.45	0.45
COMPA_2 ON			R^2=0.40					R^2=0.78		
SUFAC	0.16	0.06	2.65	0.26	0.26					
EDUC_2						-0.55	0.07	-8.29	-0.88	-0.88
OBSER_2	0.65	0.17	3.91	0.55	0.55					
OBSER_2 ON			R^2=0.17					R^2=0.36		
SOCEC	0.17	0.05	3.69	0.37	0.41	-0.19	0.05	-4.27	-0.52	-0.60
BELIF_2 ON			R^2=1.00					R^2=0.64		
RSIZE	0.15	0.04	3.48	0.54	0.50					
OCOM						0.11	0.06	1.68	0.13	0.13
EDUC_2	-0.21	0.04	-4.66	-0.74	-0.74	-0.75	0.08	-9.33	-0.83	-0.83
COMCH_2 ON			R^2=0.03							
RSIZE	0.19	0.11	1.76	0.18	0.17					
OCOM ON			R^2=0.66					R^2=0.67		
RSIZE	0.73	0.06	12.13	0.73	0.68	0.68	0.06	10.84	0.68	0.64
SOCEC	0.12	0.05	2.67	0.12	0.14					
OSIZE	0.26	0.06	4.31	0.26	0.24	0.34	0.07	5.13	0.34	0.30
CENTRAL ON			R^2=0.25					R^2=0.52		
SOCE	-0.23	0.05	-4.31	-0.44	-0.50	-0.39	0.05	-7.38	-0.63	-0.72
OSIZE ON			R^2=0.17					R^2=0.23		
RSIZE	0.37	0.08	4.53	0.37	0.37	0.40	0.08	5.18	0.40	0.42
SOCEC						0.18	0.07	2.49	0.18	0.20
OTYPE	0.20	0.11	1.91	0.20	0.15					
SUFAC ON			R^2=0.06							
SOCEC	0.19	0.07	2.89	0.19	0.25					

User Satisfaction (SATIS_2)

For the initiators, initiation had positive effects on user satisfaction. The more they felt the pressures for adopting the technology (INITI, 0.54, 0.82) the higher their level of satisfaction (SATIS_2). For non-initiators, positive effects were found from attitudes toward change (ATTID_2, 1.58, 0.76), the level of adoption (ADOPT, 0.26, 0.42), and the level of passive usage (PASUSE_2, 0.49, 0.46). These coefficients suggest that the more, on average, the employees in an organisation were willing to change the more they reported being satisfied with the technology. A higher level of adoption and a higher level of passive usage also correlated with a higher level of satisfaction.

However, complexity (COMPL, -0.46, -0.25) had a negative effect on satisfaction. This negative coefficient indicates that employees were less satisfied when they perceived the technology to be more complex.

Active Usage (ACUSE_2)

District size increased the level of active usage accordingly for both non-initiators (RSIZE, 0.89, 0.85) and initiators (RSIZE, 0.26, 0.17). For initiators, in addition, organisational type (OTYPE, 0.40, 0.18) and communication channels (COMCH_2, 1.45, 0.88) had positive effects on active usage, whereas for non-initiators, organisational size (OSIZE, -0.46, -0.44) had a negative effect. This may be related to the observation that for large organisations it could be expected that the average active usage in the organisation was lower. Many low-level staff members had limited opportunities to use the technology actively due to the limited amount of technology available for them to use. However, it was also found that for the non-initiators, a high level of average passive usage (PASUSE, 0.77, 0.37) and a higher level of adoption (ADOPT_2, 0.19, 0.17) in an organisation appeared to correlate with a higher level of average active usage. Moreover, employees in an organisation where the proportion of younger employees (AGE_2, -0.29, -0.29) was higher tended to have a higher level of active usage.

Passive Usage (PAUSE_2)

For non-initiators, employees in organisations where the proportions of female employees were higher (SEX_2, 0.54, 0.51) tended to have a higher level of passive usage. A similar effect also was found in organisations that had higher proportions of older employees (AGE_2, 0.25, 0.51). For initiators, organisational complexity (OCOM, 0.10, 0.27), complexity (COMPL_2, 1.30, 0.81), and attitudes toward change (ATTID_2, 0.69, 0.49) acted on passive usage in positive ways. These results suggest that employees in organisations that had more IT expertise tended to have a higher level of passive usage. In addition, employees in organisations where most of their employees perceived the technology to be complex had a higher level of passive usage.

Adoption (ADOPT_2)

Adoption appears in both initiators and non-initiators models. However, in the non-initiators model, adoption is an exogenous variable.

For initiators in the adoption phase, organisation complexity (OCOM, 0.14, 0.19), communication channel (COMCH_20.61, 0.71), relative advantages (RELAD_2, 0.17, 0.13) and initiation (INITI_2, 0.45, 0.44) had positive effects as expected. The more IT expertise in the organisations, the more the organisations tended to adopt the technology. In addition, communication channels also contributed to the level of adoption. The more extensively the employees in an organisation communicated the idea of using the technology, the more likely the organisations were to adopt the technology. Moreover, the higher the average perception of employees regarding the benefits of IT in an organisation, the higher the level of adoption in that particular organisation. A similar pattern also appeared for the effect of initiation on adoption.

Initiation (INITI_2)

Initiation (INITI_2) as a latent variable only appears in the initiators model, because only people in this group were involved in the initiation stage.

Relative advantage (RELAD_2, -0.86, -0.66) had a negative effect on initiation, while observability (OBSER, 1.64, 0.73) and attitudes toward change (ATTID_2, 1.05, 0.39) had positive effects on initiation. It was surprising to observe that relative advantage had a negative effect on initiation. The opposite relationship was expected. On the other hand, observability and attitudes toward change had positive effects on initiation. The effects of observability and attitude were as expected.

Attitudes toward change (ATTID_2)

The average attitude towards change (ATTID_2) in an organisation was affected by average perceptions of compatibility (COMPA_2, 0.33, 0.66) for the initiators, and by organisational complexity (OCOM, 0.07, 0.31) for the non-initiators. All relationships were positive relationships as expected.

Computer Related Anxiety (ANXTY_2)

Individual characteristics and perceptions are believed to contribute to the attitudinal dimensions. In this study it was found among the initiators that average computer related anxiety was affected directly by the level of communication channels possessed (COMCH_2, -0.36, -0.46). People in the responding organisations that communicated more appeared to feel less anxious about the technology.

Relative Advantage (RELAD_2)

The technology has to offer clear benefits to the organisational members in order to be adopted. In this study, the average perceived relative advantages of the technology in an organisation seemed to be affected by gender (SEX, 1.34, 0.69) and observability (OBSER, 0.94, 0.55) for initiators, and by the level of centralisation (CENTRAL, 0.79, 0.55), organisational complexity (OCOM, -0.14, -0.18), gender (SEX_2, 0.62, 0.39), and observability (OBSER_2, 1.05, 0.65) for non-initiators in positive ways except for the organisational complexity. These coefficients can be interpreted in the terms that organisations with a higher proportion of female employees had higher average perception of the relative advantages of the technology in both initiators and non-initiators groups. Where there were more female employees using IT in a particular organisation, employees in that organisation believed that the technology delivered greater benefits over the previous practices. It was also interesting to observe that the more IT expertise available in an organisation, the less the average perception of relative advantages of the technology. This result suggests that those employees who had IT expertise were the ones who realised not only the potential of the technology but also the difficulties and limitations they face in trying to deliver the benefits of the technology, which, in turn, had an effect on other employees' perceptions.

Compatibility (COMPA_2)

Extent of the past experiences with computer use is expected to contribute significantly to the adoption processes. Educational level (EDUC_2, -0.55, -0.88) had direct effects on compatibility for initiators, whereas supporting facilities available (SUFAC, 0.16, 0.26) and observability (OBSER, 0.65, 0.55) were found to have direct effects on compatibility for non-initiators. Interestingly, respondents in a responding organisation with higher average educational levels in the initiators group reported feeling less compatible with the technology. One possible reason for this relationship was that the higher the educational levels of the employees, the more they had been exposed to the technology. Consequently the more they were aware of the vast change in the technology. The later technology could be very much different from earlier forms. Another possible explanation was that the higher the educational levels of the employees, the more complex the tasks that they had to carry out. The limited technology resources that were available made them appeared to feel less compatible with the technology.

Complexity (COMPL_2)

Employees are likely to estimate the complexity of information technology, consciously or subconsciously comparing it with the current practice or technology used. The complexity is associated with difficulty in understanding and using the technology. At the organisational level, it was found in this study that gender (SEX_2, 0.36, 0.59) had direct effects on complexity for the non-initiators group. Respondents in organisations that had more female employees using IT perceived the technology to be more complex, whereas age (AGE_2, 0.12, 0.45) was found to have positive effects on complexity in the initiators group only. This finding can be interpreted that, on average, respondents in the organisations that had older higher-level staff members perceived the technology to be more difficult.

Observability (OBSER_2)

Interesting results were recorded for the effects of socio-economic level (SOCEC) on the level of need to be exposed (OBSER_2). In the initiators model the relationship was negative (SOCEC, -0.19, -0.60). This result suggests that for initiators, employees in organisations located in less developed districts expressed greater need to be exposed while for non-initiators the relationship was the other way around (SOCEC, 0.17, 0.41).

Beliefs Consistency (BELIF_2)

It is assumed that if the technology were consistent with the employees' existing values and beliefs regarding the technology, it would be more likely to have positive effects on the IT adoption processes. It was found in these analyses that beliefs consistency (BELIF_2) was influenced by educational level for both initiators (EDUC_2, -0.75, -0.83) and non-initiators (EDUC_2, -0.21, -0.74). Less educated respondents perceptions were more consistent with the existing beliefs regarding the technology than those with a higher education. In addition, for the initiators, the higher the level of IT expertise in organisations (OCOM, 0.11, 0.13), the more consistent were respondents' perception with the existing beliefs regarding the technology. In addition, the district size (RSIZE, 0.15, 0.50) only influenced the level of beliefs consistency for the non-initiators positively.

Communication Channel (COMCH_2)

For non-initiators, on the one hand, it would seem that the way they communicated the ideas on IT was influenced positively by district size (RSIZE, 0.19, 0.17). For initiators, on the other hand, it would seem that none of the variables in the model influenced the average level of communication in each organisation.

Organisational Complexity (OCOM)

Organisational complexity is reflected by the number of employees with IT skills, the level of IT skills, and the level of IT expertise of employees in that particular organisation. It seems that the greater the size of an organisation the more likely it had a higher level of complexity in terms of IT expertise (OSIZE, 0.34, 0.30 for initiators; and 0.26, 0.24 for non-initiators). Socio-economic level of the district was also found to be a significant factor influencing organisational complexity in the non-initiators model (SOCEC, 0.12, 0.14). One possible reason for this might be the fact that skilled employees were more likely to be available and have been employed in the more developed districts.

Centralisation (CENTRAL)

It was interesting that in both models, the higher the socio-economic level of a district the less the degree of centralisation (SOCEC, -0.39, -0.72 for initiators; and –0.23, -0.50 for non-initiators). This situation might be due to the fact that more developed districts usually had higher socio-economic levels. With a larger budget available, combined with a more dynamic corporate culture, organisations in those districts experienced less centralised systems.

Organisational Size (OSIZE)

It was also found in the initiators model that the size of the organisation was positively correlated with district size and socio-economic level of the district. The effect of district size was quite strong (RSIZE, 0.40, 0.42) while the socio-economic level had a moderate effect (SOCEC, 0.18, 0.20). In the non-initiators model, it was found that the type of the organisation and district size had positive relationship with the size of the organisation (OTYPE, 0.20, 0.15 and RSIZE, 0.37, 0.37).

Supporting Facilities (SUFAC)

From the structural model results for non-initiators, it was found that the availability of supporting facilities was positively correlated with the socio-economic level of the district. The higher the socio-economic level of a district, the more supporting facilities it had (SOCEC, 0.19, 0.25).

The relationships between MVs and corresponding LVs and among LVs for both individual level factors and organisational factors influencing each phase of IT adoption and implementation are presented in Figure 10.1 for initiators and Figure 10.2 for non-initiators. These two figures represent the relationships at both the individual level and the organisational level. All MVs and LVs are available at both levels, except for variables that only apply at the organisational level, namely, RSIZE, SOCEC, SUFAC, OTYPE, OSIZE, and OCOM. These variables are district and organisational characteristics. There are three types of arrows in the figures, the red arrows represent relationships that operate at the individual level only, the blue arrows represent relationships that operate at the organisational level only, and the green arrows represent relationships that operate at both levels. Red figures represent coefficients at the individual level, and blue figures represent coefficients at the organisational levels.

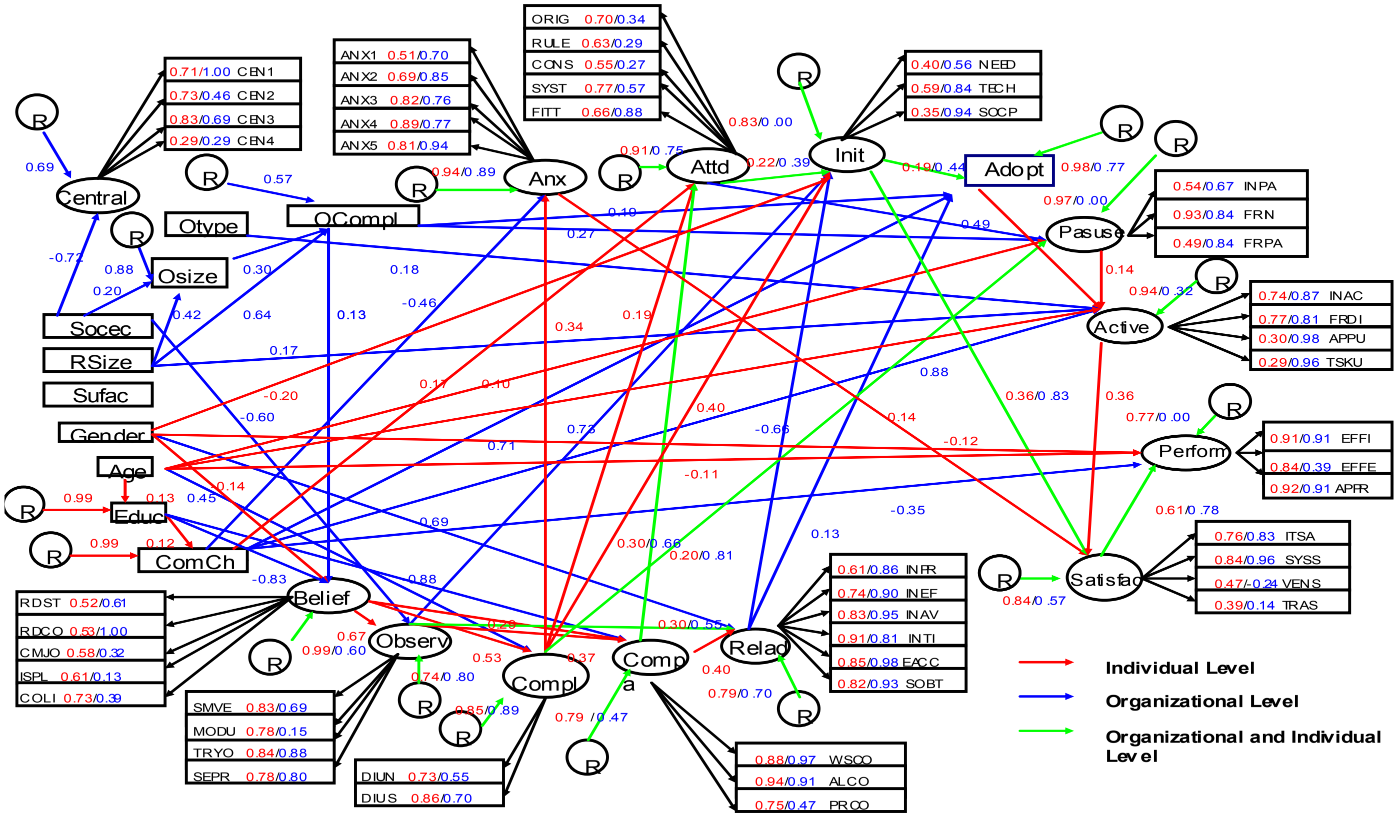

Figure 10.1 Initiators Model

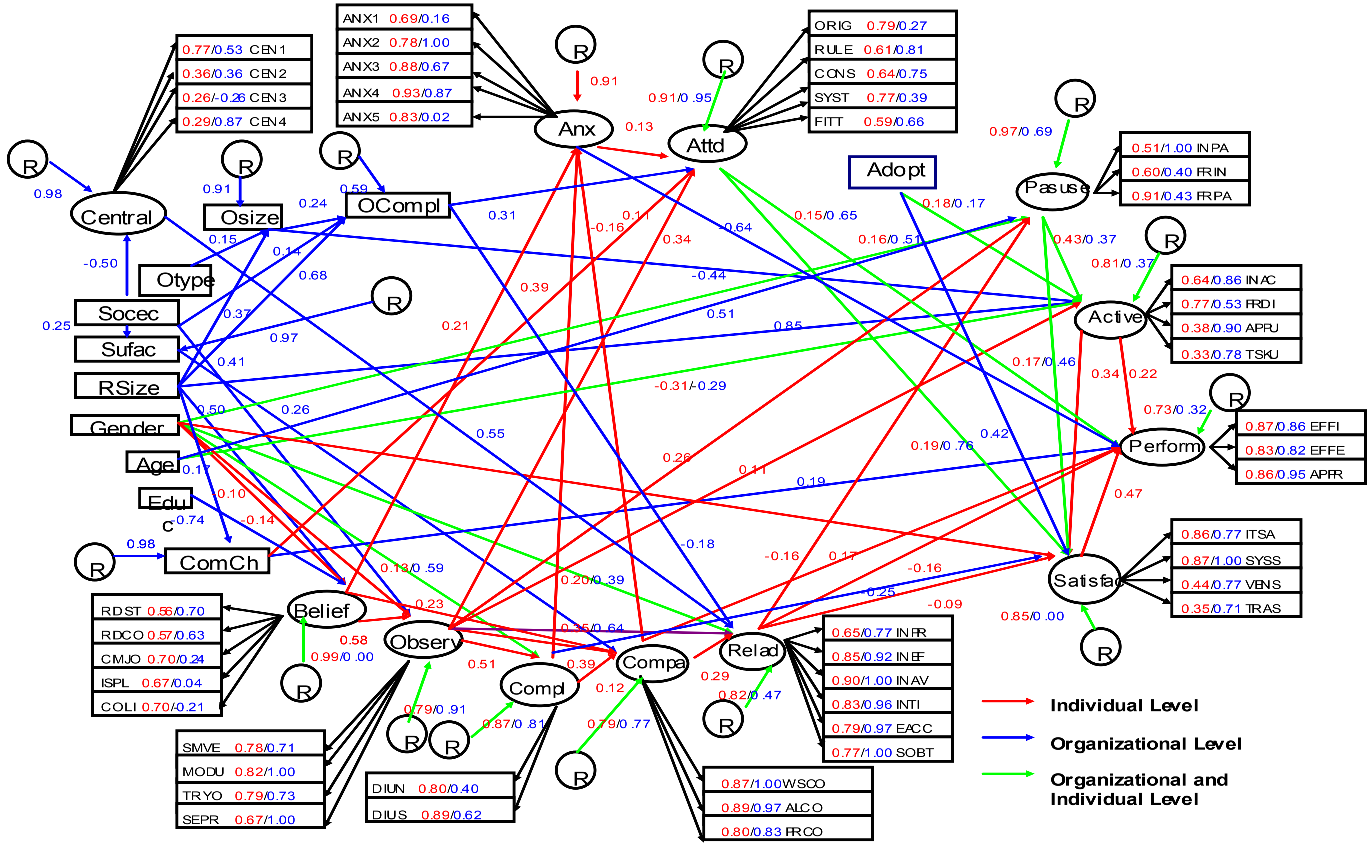

Figure 10.2 Non-Initiators Model

The variances for variables in what are referred to as 'between' and 'within' models are found in sample statistics output of MPLUS 2.01. They are the diagonals of the covariance matrix. However, the values for the between model have been multiplied by the average cluster size for that particular model. Therefore, in order to obtain the variance available for the between model observed variables, the values obtained from the covariance matrix should be divided by the average cluster size for that particular model.

After the variances for all observed variables at both levels were calculated, the total variance available to be explained at both levels for each variable was the sum of the variance for the within model and the variance for the between model. By using these total variance values, the proportions of variance available at each level for each observed variable were calculated. Moreover, the R-squared values for observed variables and latent variables were used to estimate the proportion of variance that was explained by the model for each variable. The partitions of variance for all MVs and LVs are presented in Table 10.7.

One purpose of this study is to identify facilitators and inhibitors for each phase of the IT adoption processes. In order to be able to identify which variables were slowing down the adoption processes, and which variables were fostering the adoption processes, summary results are presented in Table 10.8 and Table 10.9 for individual level and organisational level models respectively. In addition to the direct effects, the effects that are represented by a direct link between a predictor variable and the criterion variable, those tables also provide information on the indirect effects, the effects that are operating indirectly through one or more mediating variables. The indirect effects that are shown in the table are only the significant indirect effects, those with indirect coefficients of 0.1 or higher that influence each phase of the IT adoption processes (Cohen, 1992).

At the individual level, most of the factors were facilitating the adoption processes. Even though age and gender were no longer considered to be important factors in the IT adoption processes in developed countries, it appeared in this study that these two factors seemed to be issues in developing countries.

Gender differences suggest that in a more traditional society, in this case Balinese society in particular, and Indonesian people in general, the Balinese people still had more traditional views in differentiating the roles of males and females. The age factor was also an interesting issue to address. This effect was partly due to the fact that, at least in this sample, older employees might be less educated and less motivated. In order to be able to specify why they were less motivated and how to overcome this problem, a further study is needed.

The effect of perceived relative advantages was surprising. It is assumed that perceived benefits of the technology will facilitate the adoption of IT. However, in this study it was found that the relationship was in the opposite direction. This result suggests that respondents in the sample organisations have high expectations of IT for delivering benefits. It seems that these high expectations were not fulfilled. In other words, IT was not perceived as delivering its promised benefits as expected. This paradox could be influenced by the stage of IT adoption and implementation in Bali's governmental agencies. Most of the agencies were still in the early stage in their effort to incorporate IT to support their daily operations. In this early stage, it is hard to expect that the full range of benefits will be obtained at the end of a costly investment in IT.

Table 10.7 Partitions of Variance

Latent Variables	Manifest Variables	Non-Initiators						Initiators					
		Variance Available				Variance Explained		Variance Available				Variance Explained	
		Within		Between		Within	Between	Within		Between		Within	Between
		Var.	%	Var.	%	%	%	Var.	%	Var.	%	%	%
RSIZE													
	rsize	0.84	100		0			1.05	100		0		
SOCEC													
	socec	1.27	100		0			0.84	100		0		
SUFAC													
	sufac	0.74	100		0	6		0.93	100		0		
OSIZE													
	osize	0.90	100		0	17		0.99	100		0	23	
OTYPE													
	type	0.52	100		0			0.51	100		0		
OCOM													
	ocom	0.99	100		0	66		1.21	100		0	67	
CENTRAL						25						52	
	cen1	0.65	36	1.15	64	29	59	0.62	34	1.19	66	100	51
	cen2	0.53	34	1.04	66	13	63	0.61	37	1.03	63	21	54
	cen3	0.60	38	0.97	62	7	51	0.63	39	0.99	61	47	68
	cen4	0.59	41	0.86	59	76	51	0.53	34	1.05	66	8	62
SEX													
	gender	0.27	53	0.24	47			0.12	40	0.19	60		
AGE													
	agec	1.20	38	1.99	62	100	100	1.04	33	2.11	67	100	100
EDUC													2
	degree	0.35	25	1.05	75	100	100	0.41	29	0.99	71	100	100
COMCH						3							1
	comc	0.53	46	0.64	54	100	100	0.33	27	0.90	73	100	100
BELIF						100	2					64	2
	rdst	0.53	34	1.01	66	50	32	0.78	43	1.02	57	38	27
	rdco	0.53	31	1.15	69	40	33	0.75	39	1.18	61	100	29
	cmjo	0.43	31	0.95	69	6	48	0.43	28	1.08	72	11	34
	ispl	0.47	34	0.93	66	0	45	0.55	34	1.05	66	2	38
	coli	0.42	34	0.83	66	4	50	0.65	39	1.03	61	15	53
OBSER						17	37					36	45
	smve	0.50	35	0.94	65	51	61	0.52	35	0.95	65	48	68
	modu	0.49	33	0.98	67	100	67	0.47	28	1.20	72	2	60
	tryo	0.44	34	0.86	66	53	62	0.43	29	1.03	71	75	70
	sepr	0.53	37	0.92	63	100	45	0.56	36	1.02	64	65	60
COMPL						34	25					20	28
	diun	0.90	42	1.25	58	16	64	0.54	33	1.12	67	30	53
	dius	0.54	28	1.36	72	39	79	0.50	29	1.20	71	48	75

continued

Table 10.7 Partitions of Variance (continued)

Latent Variables	Manifest Variables	Non-Initiators						Initiators					
		Variance Available				Variance Explained		Variance Available				Variance Explained	
		Within		Between		Within	Between	Within		Between		Within	Between
		Var.	%	Var.	%	%	%	Var.	%	Var.	%	%	%
COMPA						40	39					78	37
	wsco	0.80	38	1.29	62	100	76	0.67	33	1.36	67	95	78
	alco	0.70	38	1.13	62	94	79	0.59	34	1.13	66	82	88
	prco	0.59	33	1.20	67	69	64	0.51	28	1.28	72	23	57
RELAD						78	33					51	38
	inpr	0.77	41	1.10	59	59	42	0.63	39	0.98	61	74	37
	inef	0.84	44	1.05	56	85	72	0.55	38	0.90	62	82	55
	inav	0.86	40	1.31	60	100	82	0.79	42	1.10	58	90	70
	inti	0.86	44	1.09	56	93	69	0.75	41	1.10	59	66	83
	eacc	0.99	45	1.21	55	95	63	0.78	38	1.27	62	96	73
	sobt	0.95	43	1.25	57	100	60	0.82	44	1.06	56	87	67
ANXTY							18					21	11
	anx1	0.63	29	1.56	71	3	48	0.71	33	1.47	67	49	26
	anx2	0.54	25	1.65	75	100	60	0.75	33	1.54	67	72	47
	anx3	0.66	30	1.54	70	45	78	0.83	37	1.39	63	58	68
	anx4	0.64	27	1.73	73	75	87	0.89	36	1.61	64	59	78
	anx5	0.71	27	1.91	73	0	69	1.00	35	1.87	65	89	65
ATTID						9	17					44	18
	orig	0.54	41	0.77	59	8	62	0.31	29	0.77	71	12	49
	rule	0.36	29	0.88	71	66	38	0.38	32	0.81	68	8	40
	cons	0.55	41	0.79	59	57	40	0.25	25	0.77	75	7	31
	syst	0.50	41	0.72	59	15	59	0.34	30	0.80	70	32	59
	fitt	0.38	32	0.79	68	43	35	0.36	29	0.90	71	77	44
INITI												100	31
	need							0.62	45	0.76	55	31	16
	tech							0.99	55	0.79	45	71	35
	socp							0.77	42	1.07	58	88	12
ADOPT													
	adopt	0.79	73	0.30	27			0.72	65	0.39	35	41	4
PAUSE						53	6					100	5
	inpa	0.67	34	1.31	66	100	26	0.86	35	1.58	65	45	29
	frin	0.75	33	1.50	67	16	36	0.77	33	1.57	67	71	87
	frpa	0.92	34	1.80	66	19	82	0.84	35	1.53	65	71	24
ACUSE						86	34					90	11
	inac	0.89	45	1.09	55	74	41	0.94	40	1.41	60	77	55
	frdi	1.06	51	1.02	49	28	59	0.75	30	1.71	70	66	59
	appu	1.58	57	1.20	43	81	15	1.78	53	1.55	47	96	9
	tsku	2.11	35	3.83	65	61	11	2.61	35	4.95	65	92	8

continued

Table 10.7 Partitions of Variance (continued)

Latent Variables	Manifest Variables	Non-Initiators						Initiators					
		Variance Available				Variance Explained		Variance Available				Variance Explained	
		Within		Between		Within	Between	Within		Between		Within	Between
		Var.	%	Var.	%	%	%	Var.	%	Var.	%	%	%
SATIS						100	26					68	30
	itsa	0.54	43	0.73	57	60	73	0.41	39	0.66	61	69	58
	syss	0.54	43	0.70	57	100	75	0.43	39	0.67	61	92	70
	vens	0.54	45	0.66	55	60	19	0.44	38	0.71	62	6	22
	tras	0.51	44	0.66	56	50	12	0.39	33	0.79	67	2	15
PERFM						90	49					100	41
	effi	0.50	41	0.72	59	74	75	0.35	30	0.81	70	83	83
	effe	0.52	43	0.69	57	67	69	0.31	26	0.87	74	16	70
	appr	0.50	43	0.66	57	89	75	0.39	32	0.84	68	82	85

Table 10.8 Facilitators and Inhibitors at the Individual Level

	Initiators		Non-Initiators	
Criterion	**Facilitators**	**Inhibitors**	**Facilitators**	**Inhibitors**
Initiation				
Direct effect	Complexity, Attitude	Gender		
Indirect effect	Beliefs, Compatibility			
Adoption				
Direct effect	Initiation			
Indirect effect				
Passive Usage				.
Direct effect	Age, Complexity		Gender, Observability	Relative advantages
Indirect effect	Beliefs		Beliefs	
Active Usage				
Direct effect	Adoption, Passive Usage	Age	Anxiety, Adoption, Passive Usage	Age
Indirect effect			Observability	
User Satisfaction				
Direct effect	Anxiety, Initiation, Active usage		Attitude, Passive usage, Active usage	Gender, Relative advantages
Indirect effect	Complexity	Age		Age
Impact on Performance				
Direct effect	Satisfaction	Age, Gender	Compatibility, Attitude, Active Usage, Satisfaction	Relative advantages
Indirect effect	Anxiety, Initiation, Active usage			

Table 10.9 Facilitators and Inhibitors at the Organisational level

	Initiators		Non-Initiators	
Criterion	**Facilitators**	**Inhibitors**	**Facilitators**	**Inhibitors**
Initiation				
Direct effect	Observability, Attitude	Relative adv.		
Indirect effect	Compatibility	Socio- eco.		
Adoption				
Direct effect	Org. Complexity, Comm. Channel, Relative Adv., Initiation			
Indirect effect	District Size, Observability, Attitude	Relative adv.		
Passive Usage				.
Direct effect	Org. Complexity, Complexity, Attitude		Gender, Age	
Indirect effect	District size, Age, Compatibility	Education		
Active Usage				
Direct effect	District size, Org, Type, Comm. Channel		District Size, Adoption, Passive usage	Age, Org. Size,
Indirect effect			Gender	
User Satisfaction				
Direct effect	Initiation		Attitude, Adoption, Passive Usage	Complexity,
Indirect effect	Obervability, Attitude, Compatibility	Socio-Ec., Gender, Education, Observability Relative Adv.	Org. Complexity, District Size, Gender, Age	
Impact on Performance				
Direct effect	Satisfactionion	Comm. Channel	Comm. Channel, Attitude,	Anxiety
Indirect effect	Initiation, Observability, Attitude, Compatibility	Gender, Relative adv., Education	Org. Complexity, District Size	

A consistent and comprehensive policy needs to be formulated for the long-term processes in order to make sure of the success of the IT strategy.

At the organisational level, as aggregate measures which represent the climate of the organisations, perceived relative advantages and socio-economic level of the district seemed to inhibit a proper initiation stage. Perceived relative advantages were also found to be inhibitors in the subsequent phases for middle to upper management.

These effects suggest that the employees need to be provided with training, so that they can have a more consistent and comprehensive knowledge of IT. Through this re-education program, it is expected that the initiators would have a better understanding of the potential of IT as well as the limitations and difficulties that have to be overcome before the full benefits of IT could be experienced. Lower level staff members also need to be included in the program. This program could reduce their perception of IT complexity in terms of difficulty in understanding and difficulty in using the technology, as well as reducing their anxiety regarding the information technology that would seem to inhibit the adoption and implementation processes.

Summary

The preliminary single-level analyses at the individual level using PLSPATH and AMOS were undertaken with the assumption that each unit was independent to each other. In this type of analysis, the data from different groups were pooled and a single analysis was carried out between all employees in the total sample. The MPLUS analysis, using a two level model analysis, employed a so called ‘pooled between individuals within groups’ analysis at the individual level. In this analysis, the measures for each student were subtracted from the group mean and thus the deviation values from the group mean were employed. Moreover, the data for all groups were pooled for a combined analysis. In general, the ‘between individuals overall’ analysis provided more variance to be explained. This influenced the R-squared values that were recorded.

Furthermore, the examination in terms of the so called ‘between individuals overall’ ignored the fact that the samples came from a cluster sample design. Consequently, significance of the path coefficients obtained from these analyses could be considered to be overestimated. As a result, a greater number of significant path coefficients were found, with group level effects being confounded with individual level effects.

For the between group analyses, both the PLSPATH and the MPLUS analyses were employed using the between groups type of analysis. In these analyses, the individual level data were aggregated to the group level, and the group level data were then added to the model. Generally, the proportions of variance explained in the two methods of analyses were similar. However, the MPLUS results seemed to be simpler and more meaningful.

Nevertheless, no cross level interactions were estimated with MPLUS between the variables at the individual level and variables at the organisational level using Muthén and Muthén’s method (1998). Therefore a further examination using hierarchical linear modelling (HLM) (Raudenbush, Bryk, & Congdon, 2000) need to be carried out to examine the possible cross level interactions between the variables at the individual and the organisational levels that influenced the criterion variables of adoption and performance. These analyses are discussed in the next chapter.

11

Hierarchical Linear Modelling

Introduction

In the previous chapter, models of factors influencing IT adoption and implementation processes at the individual level and at the organisational level were analysed using MPLUS 2.01 (Muthén & Muthén, 1998). These analyses focused on the two-level path modelling where both levels were analysed at once to take into account the hierarchical nature of the data. The results reveal interesting patterns of the ways in which variables operated to have an impact on the IT adoption and implementation processes.

In the multilevel path modelling analyses explained in Chapter Ten, only two levels of analysis were conducted, namely the individual level and the organisational level analyses. The data from the third level, district level data, were disaggregated to the organisational level data. This step was caused by the limitation of MPLUS, which only allows two-level models to be estimated. For the single level analysis with PLSPATH and AMOS, the district level analysis was not undertaken because of the small number of level three units (9). Consequently, there was still some unavoidable disaggregation bias in the results. In addition, even though the results of two-level path analyses using MPLUS took into consideration the hierarchical nature of the data and proved to be more valid and meaningful compared to single-level analyses using PLSPATH or AMOS (Darmawan, 2001, 2002e), they still failed to show the interaction effects across levels.

In seeking an explanation of such effects, another technique called hierarchical linear modelling (HLM) technique was employed (Bryk & Raudenbush, 1992). Initially, a series of two-level HLM models which include two-level HLM model of: (a) adoption for initiators, (b) performance for initiators, and (c) performance for non-initiators was conducted. The results are discussed in details in Darmawan and Keeves (2002) and Darmawan (2002b, 2002c). However, these models also still failed to take into consideration the differences between districts.

Thus, the purpose of this chapter is to discuss the results of the analysis of factors influencing the processes using three-level hierarchical linear modelling (HLM) procedures. The use of these procedures makes it possible to analyse variables at three different levels simultaneously in order to find out the factors that affect the outcome variable (the dependent variable). These three levels include the individual level, the organisational level, and the district level. By using three-level HLM models, the disaggregation bias accompanying the two-level path models can be minimised. As a result, better estimates of district effects and district variance are expected along with more appropriate error terms in addition to the individual level effects and organisational level effects. Moreover, this approach not only provides the direct effects from various levels, but also the interaction effects between variables at three different levels, namely individual level, organisational level, and district level.

However, the HLM approach only allows one dependent variable to be analysed at any one time. Adoption and perceived impact of IT on user performance were selected to be the dependent variables with the assumption that IT adoption and implementation processes can also be broken down into two major stages (Zaltman et al., 1973). The first stage is the IT adoption at the organisational level which starts with the initiation process and ends with the decision to adopt the technology. This stage then followed by the second stage, the adoption at the individual level, which commences with the implementation process and ends with the evaluation process. It was, then, considered necessary to examine the end point of each of these major stages, namely the adoption phase and evaluation phase. In this study, only the initiators were involved at the organisational level adoption stage. At the individual level adoption, both initiators and non-initiators were involved. Therefore, for the three-level HLM analyses, three models were tested:

(a) adoption as the dependent variable for initiators;
(b) perceived performance as the dependent variable for initiators; and
(c) perceived performance as the dependent variable for non initiators.

Variables Used

As it is pointed out earlier, HLM does not currently allow the formation of latent variables. Hence, principal component scores were calculated for each construct involved in the models using SPSS 10. As a result, most variables were in standardised forms, which allowed the direct comparison of coefficients of variables within the model (Pedhazur, 1997), except for the unity mode variables, SEX and AGE. Variable SEX was a categorical variable within which male was coded as 1; and female was coded as 2. Variable AGE, on the other hand, was used to record employees' age in years.

Table 11.1 lists the individual level (or level-1 or micro-level) variables, the organisational level (or level-2 or meso-level), as well as the district level (or level-3 or macro-level) variables that were examined. Where reference was made to variables used in the HLM analyses reported in this chapter, variable names were given in uppercase.

Variables that were measured at level-1 and aggregated to the group level were assigned the suffix "_2". Variables that were measured at level-1 or level-2 and aggregated to the district level were assigned the suffix "_3" to facilitate identification. The aggregated variables were used to represent the organisational and district climates that may affect the outcome variable.

For the purpose of this study two outcome variables were examined, namely adoption and performance. Conceptual models for three-level HLM of factors influencing adoption and performance are shown in Figure 11.1 and Figure 11.2.

Table 11.1 List of Variables used in Three-Level HLM Models

Individual Level	Organisational Level	District Level	Description
Environmental/District Factors			
		RSIZE	District size
		SOCEC	Socio-economic level
		SUFAC	Supporting facilities
Organisational Factors			
	OSIZE	OSIZE_3	Organisational size
	TYPE	TYPE_3	Organisational type
	OCOM	OCOM_3	Organisational complexity
	CENTRAL	CENTRAL_3	Level of centralisation
Individual Factors			
SEX	SEX_2	SEX_3	Gender of employee
AGE	AGE_2	AGE_3	Age of employee
EDUC	EDUC_2	EDUC_3	Level of education
COMCH	COMCH_2	COMCH_3	Communication channel
BELIF	BELIF_2	BELIF_3	Belief consistency
OBSER	OBSER_2	OBSER_3	Observability
COMPL	COMPL_2	COMPL_3	Complexity
COMPA	COMPA_2	COMPA_3	Compatibility
RELAD	RELAD_2	RELAD_3	Relative advantage
ANXTY	ANXTY_2	ANXTY_3	Computer related anxiety
ATTID	ATTID_2	ATTID_3	Attitudes toward change
INITI	INITI_2	INITI_3	Initiation
ADOPT	ADOPT_2	ADOPT_3	Adoption
PAUSE	PAUSE_2	PAUSE_3	Passive usage
ACUSE	ACUSE_2	ACUSE_3	Active usage
SATIS	SATIS_2	SATIS_3	Satisfaction
PERFM	PERFM_2	PERFM_3	Performance

Three-level Model Results

It should be noted that in this section, the terms level-1, individual level, between employees level, and micro-level are employed interchangeably. The terms level-2, organisational level, between organisations level, and meso-level are used synonymously. Likewise, level-3, district level, between districts, and macro-level terms are used interchangeably.

Three-Level Model of Adoption for Initiators

The selection of variables for the three-level HLM analysis was based on the results of the PLSPATH, AMOS, and MPLUS analyses. The limitations of PLSPATH and AMOS as single level techniques were acknowledged. Therefore the MPLUS results were included in the model and exploratory analyses were also employed to find any other possible variables to be included in the model.

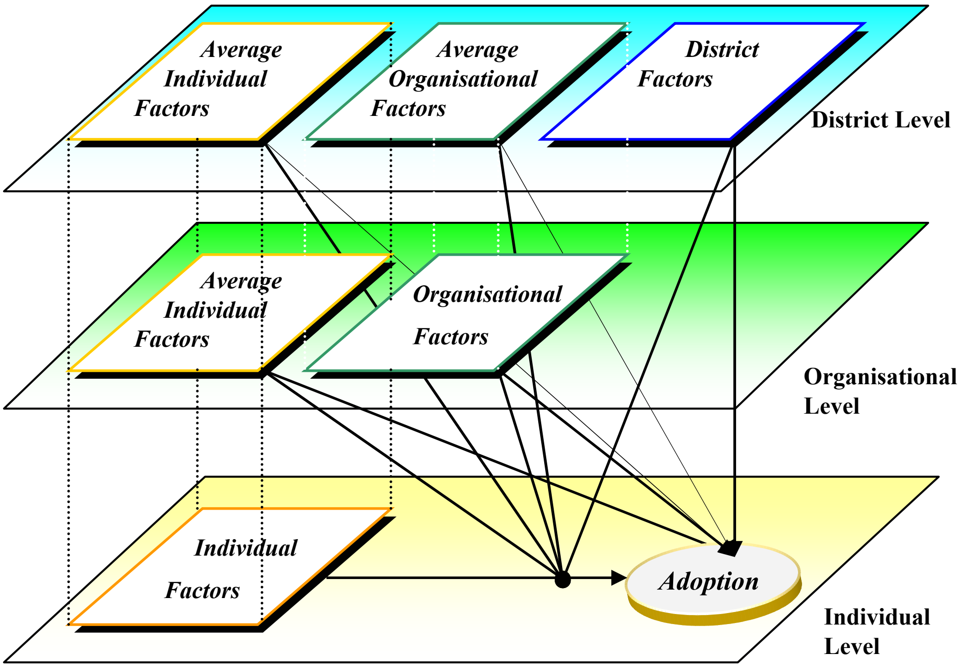

Figure 11.1 Three-Level Model of Adoption

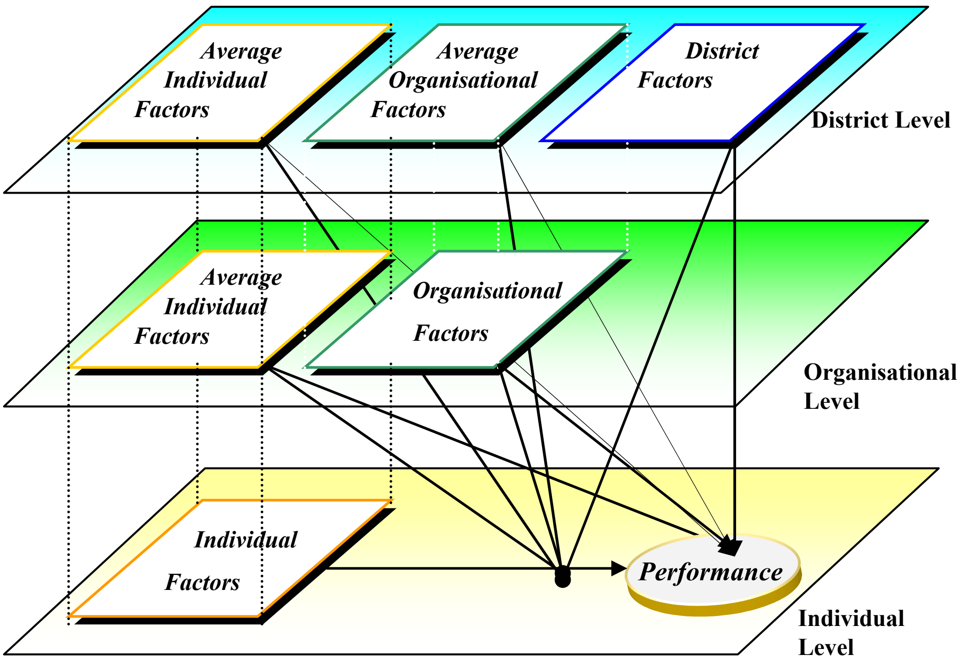

Figure 11.2 Three-Level Model of Performance

The analysis of the three-level HLM model was undertaken by first running the fully unconditional model to obtain the estimates of the amount of variance available to be explained in the model (Raudenbush, Bryk, & Congdon, 2000). An estimate in a fully unconditional model was obtained from a model without entering into the equation any individual level, organisational level, and district level variables. In other words, no predictors of the outcome variable were specified at any level.

This model represents how much variation in an outcome variable, in this case the adoption level, was allocated across the three different levels, namely individual, organisational, and district levels. Therefore, the fully unconditional model allowed the partitioning of the variance in the outcome variable at the three levels (Bryk & Raudenbush, 1992). The fully unconditional three-level model is specified by the following equations.

Level-1 Model. Perceived adoption level for each employee is modelled as a function of an organisational mean plus a random error:

$$Y_{ijk} = \pi_{0jk} + e_{ijk} \qquad [11.1]$$

where:

Y_{ijk} is the perceived adoption level of employee i in organisation j and district k;

π_{0jk} is the mean perceived adoption level of organisation j in district k; and

e_{ijk} is a random so-called 'employee effect', that is, the deviation of employee ijk's score from the organisation mean.

In the above equation, the level of IT adoption according to employee i in organisation j in district k is considered to be equivalent to the organisation mean plus a random error. In other words, the fully unconditional model assumes no differences in the IT adoption level perception between employees within districts at level-1. It is assumed that each level-1 error, e_{ij}, is normally distributed with a mean of zero and a constant level-1 variance, σ^2 (Bryk & Raudenbush, 1992).

The indices i, j, and k denote employee, organisation, and district where there are

$i = 1,2, \ldots, N_{jk}$ employees within organisation j in district k;

$j = 1,2,\ldots, J_k$ organisations within district k; and

$k = 1,2,\ldots,K$ districts.

Level-2 Model. Each organisation mean, π_{0jk}, is viewed as an outcome varying randomly around some district mean:

$$\pi_{0jk} = \beta_{00k} + r_{0jk} \qquad [11.2]$$

where:

π_{0jk} is the mean perceived adoption level in organisation j and district k;

β_{00k} is the mean adoption in district k; and

r_{0jk} is the random organisation effect, that is, the deviation of organisation jk's mean from the district mean.

In the level-2 equation, no predictors are specified that could contribute to explain differences between organisations; and the average adoption of an organisation is considered to be equivalent to the average adoption for that region plus random error.

It is assumed that the random effect associated with organisation *jk*, r_{0jk}, is normally distributed with the mean of zero and variance τ_π. Within each of the *K* districts, the variability between organisations is assumed the same.

Level 3 Model. The level-3 model represents the variability between districts. The district mean, β_{00k} , is viewed as varying randomly around a grand mean across all districts:

$$\beta_{00k} = \gamma_{000} + u_{00k} \quad [11.3]$$

where:

β_{00k} is the mean adoption in district *k;*

γ_{000} is the grand mean adoption across districts; and

u_{00k} is the random district effect, that is, the deviation of district *k*'s mean from the grand mean.

It is assumed that the random effect associated with district *k*, u_{00k}, is normally distributed with the mean of zero and variance τ_β.

Estimating the null model is a very useful preliminary step in a hierarchical analysis. It produces a point estimate and confidence interval for the grand mean, γ_{000}. Furthermore, it also provides information about the variability of the outcome variable at each level. The σ^2 parameter represents the individual level (level-1) variability, τ_π captures the organisational level (level-2) variability, and $\tau_{\beta\ g}$ gives the district level (level-3) variability (Bryk & Raudenbush, 1992). Furthermore, the null model allows the estimation of the proportions of variation that are within organisations, among organisations within districts, and among districts. That is,

$\sigma^2 / (\sigma^2 + \tau_\pi + \tau_\beta)$ is the proportion of variance within organisations; [11.4]

$\tau_\pi / (\sigma^2 + \tau_\pi + \tau_\beta)$ is the proportion if variance among organisations within districts; and [11.5]

$\tau_\beta / (\sigma^2 + \tau_\pi + \tau_\beta)$ is the proportion of variance among districts [11.6]

The reliability of the least squares estimated coefficients at two levels, organisations and districts. For each organisation *jk* at level-2, the reliability of an organisation sample mean for use in discrimination among organisations within the same districts is as follows:

$$\text{reliability } (\pi_{0jk}) = \tau_\pi / [\tau_\pi + \sigma^2 / n_{jk}] \quad [11.7]$$

For any district *k* at level-3, the reliability of the district's sample mean as an estimate of its true mean is calculated using the following formula:

$$\text{reliability } (\beta_{00k}) = \tau_\beta / [\tau_\beta + \{\Sigma (\tau_\pi + \sigma^2 / n_{jk})^{-1}\}^{-1}] \quad [11.8]$$

The average of these reliabilities across organisations (Equation 11.7) and districts (Equation 11.8) may be viewed as summary measures of reliability of the organisation and district means, respectively (Raudenbush et al., 2000). Whenever, a reliability value falls below 0.05, it is assumed that there is no random effect for that particular coefficient.

The HLM results for the null model are presented in Table 11.2. The partition of total variance into its three components is shown in Table 11.4. Part of the variability at each level can be explained or accounted for by measured variables at each level. Therefore, individual characteristics and perceptions, organisational characteristics, and district characteristics can be utilised as predictors. Furthermore, some of the relationships at the organisation and district levels may vary randomly among these units. Thus, the next step is to examine the conditional model and to build up the final model.

The hierarchical model that was examined was based on those results of PLSPATH, AMOS and MPLUS analysis. There were some limitations of PLSPATH and AMOS as a single-level technique. Therefore, the possibility of the misspecification of a hierarchical model based on those results cannot be ignored. However, little relevant research is available to serve as a sound theoretical and empirical basis for the specification of a hierarchical model. Because of the complexity of the model, PLSPATH, AMOS, and MPLUS results were considered to be an appropriate basis for the HLM analyses.

Table 11.2 Null Model Results: Three-Level Model of Adoption for Initiators

Final estimation of fixed effects:						
Fixed Effect		**Coefficient**	**Standard Error**	**T-ratio**	**Approx. d.f.**	**P-value**
For INTRCPT1, P0						
For INTRCPT2, B00						
INTRCPT3, G000		-0.03	0.11	-0.25	9	0.810
Final estimation of level-1 and level-2 variance components:						
Random Effect	**Reliability**	**Standard Deviation**	**Variance Component**	**df**	**Chi-square**	**P-value**
INTRCPT1, R0	0.811	0.77	0.59	107	513.3	0
level-1, E		0.62	0.39			
Final estimation of level-3 variance components:						
Random Effect	**Reliability**	**Standard Deviation**	**Variance Component**	**df**	**Chi-square**	**P-value**
INTRCPT1/INTRCPT2, U00	0.445	0.23	0.05	9	18.7	0.027
Statistics for current covariance components model						
Deviance		**1097.7**				
Number of estimated parameters		**4**				

In order to specify the level-1 model, variables that were found to influence the level of adoption directly at the individual level PLSPATH and AMOS analyses as well as the within model in MPLUS results were entered into the equation one by one according to the magnitude and statistical significance of path coefficients starting from the strongest path but without the organisational level predictors. Bryk and Raudenbush (1992) suggest that this step is necessary to examine how much of the variance is explained by individual level predictors. Results were then examined and those coefficients that were found not to be significant were removed from the model and the next potential variable was entered into the equation. The input was altered accordingly and the data reanalysed. These steps were repeated step by step until a final level-1 model with only significant effects was obtained. In each run, an exploratory analysis was also performed to check the possibility of each level-2 variable to be included in the model.

The next step was to enter organisational level variables into the equation. The organisational level variables were entered one by one according to their t-values shown in the exploratory analysis results. These steps were repeated step by step until a final level-2 model with only significant effects at both levels was obtained.

The last step was to enter district level variables into the equation. As with the organisational level variables, the district level variables were entered one by one according to their t-values shown in the exploratory analysis results. These steps were repeated until a final model with only significant effects at all three levels was obtained. After adding the significant level-2 and level-3 variables, the final model is specified by the following equations:

Level-1 Model

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}\,(\text{COMPL}) + e_{ijk} \qquad [11.9]$$

Level-2 Model

$$\pi_{0jk} = \beta_{00k} + \beta_{01k}\,(\text{COMPA\_2}) + \beta_{02k}\,(\text{INITI\_2}) + r_{0jk} \qquad [11.10a]$$

$$\pi_{1jk} = \beta_{10k} + \beta_{11k}\,(\text{INITI\_2}) + r_{1jk} \qquad [11.10b]$$

Level-3 Model

$$\beta_{00k} = \gamma_{000} + \gamma_{001}\,(\text{OCOM\_3}) + u_{00k} \qquad [11.11a]$$

$$\beta_{01k} = \gamma_{010} + u_{01k} \qquad [11.11b]$$

$$\beta_{02k} = \gamma_{020} + u_{02k} \qquad [11.11c]$$

$$\beta_{10k} = \gamma_{100} + u_{10k} \qquad [11.11d]$$

$$\beta_{11k} = \gamma_{110} \qquad [11.11e]$$

By substituting level-3 equations (Equations 11.11a to 11.11e) into level-2 equations (Equations 11.10a and 11.10b), level-2 equations are represented by:

$$\pi_{0jk} = \gamma_{000} + \gamma_{001}\,(\text{OCOM\_3}) + \gamma_{010}(\text{COMPA\_2}) + \gamma_{020}(\text{INITI\_2}) + u_{00k} + u_{01k}\,(\text{COMPA\_2}) + u_{02k}\,(\text{INITI\_2}) + r_{0jk} \qquad [11.12a]$$

$$\pi_{1jk} = \gamma_{100} + \gamma_{110}\,(\text{INITI\_2}) + u_{10k} + r_{1jk} \qquad [11.12b]$$

By substituting level-2 equations into the level-1 equation, the final model is represented by:

$$Y_{ijk} = \gamma_{000} + \gamma_{001}\,(\text{OCOM\_3}) + \gamma_{010}(\text{COMPA\_2}) + \gamma_{020}(\text{INITI\_2}) + \gamma_{100}(\text{COMPL}) + \gamma_{110}\,(\text{INITI\_2})\,(\text{COMPL}) + u_{00k} + u_{01k}\,(\text{COMPA\_2}) + u_{02k}\,(\text{INITI\_2}) + u_{10k}\,(\text{COMPL}) + r_{1jk}\,(\text{COMPL}) + r_{0jk} + e_{ijk} \qquad [11.13]$$

This equation illustrates that the adoption level may be viewed as a function of the overall intercept (γ_{000}), four main effects, one cross-level interaction effect, and a random error (u_{00k} + u_{01k} (COMPA_2) + u_{02k} (INITI_2) + u_{10k} (COMPL) + r_{1jk} (COMPL) + r_{0jk} + e_{ijk}). The four main effects are the direct effects from average complexity at level-3 (OCOM_3, γ_{001}), average compatibility at level-2 (COMPA_2, γ_{010}), average initiation at level-2 (INITI_2, γ_{020}), and perceived complexity (COMPL, γ_{100}). The cross-level interaction effect involves the interaction of INITI_2 with COMPL (γ_{110}). Table 11.3 shows that one level-1 variable had an effect on performance, namely COMPLEX. In addition, two level-2 variables influenced performance, all of them were variables aggregated from the individual level, namely, COMPA_2 and INIT_2; and one variable at level-3, OCOM_3, also influenced the average level of adoption. These relationships can be seen in Figure 11.3.

Table 11.3 Final Model Results: Three-Level Model of Adoption for Initiators

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, P0					
For INTRCPT2, B00					
INTRCPT3, G000	0.00	0.08	-0.05	8	0.960
OCOM_3, G001	0.26	0.09	2.85	8	0.022
For COMPA_2, B01					
INTRCPT3, G010	0.32	0.13	2.46	9	0.036
For INITI_2, B02					
INTRCPT3, G020	0.21	0.09	2.22	9	0.053
For COMPL slope, P1					
For INTRCPT2, B10					
INTRCPT3, G100	0.12	0.05	2.59	9	0.029
For INITI_2, B11					
INTRCPT3, G110	-0.17	0.06	-2.76	115	0.006

Final estimation of level-1 and level-2 variance components:

Random Effect	Reliability	Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1, R0	0.697	0.67	0.45	64	423.5	0.000
COMPL slope, R1	0.140	0.15	0.02	83	103.6	0.063
Level-1, E		0.59	0.35			

Final estimation of level-3 variance components:

Random Effect	Reliability	Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1/INTRCPT2, U00	0.174	0.12	0.01	8.0	10.2	0.249
INTRCPT1/ COMPA_2,U01	0.228	0.21	0.05	9.0	12.4	0.188
INTRCPT1/ INITI_2, U02	0.054	0.08	0.01	9.0	4.6	>.500
COMPL/INTRCPT2, U10	0.164	0.06	0.00	9.0	11.3	0.253

Statistics for current covariance components model

Deviance	**1049.10**
Number of estimated parameters	**20.00**

In general, a cross-level interaction effect relates three variables to one another, namely, the outcome variables, its level-1 predictor, and a level-2 variable that is considered to influence the effect of the level-1 predictor on the outcome variable. In order to illustrate the interaction effect and the detail, which could be obtained from HLM output, parts of the equations for the final model involving INITI_2 and COMPL are presented below with the remaining terms set to zero since neither INITI_2 or COMPL are involved and there is no loss in generality.

$$Y_{ijk} = \gamma_{000} + \gamma_{020}(\text{INITI\_2}) + \gamma_{100}(\text{COMPL}) + \gamma_{110}(\text{INITI\_2})(\text{COMPL}) + e_{ijk} \quad [11.14a]$$

where (see Table 11.3)

$\gamma_{000}= 0.00$, $\gamma_{020}= 0.21$, $\gamma_{100}= 0.12$, $\gamma_{110}= -0.17$

Hence :

Y_{ijk} = 0.21(INITI_2) + 0.12(COMPL) – 0.17(INITI_2)(COMPL)+ e_{ijk} [11.14b]

In order to provide a graphical presentation of this expression, coordinates were then calculated for organisations that were:

(a) one standard deviation above the average on COMPL and INITI_2 (i),
(b) one standard deviation above the average on COMPL and one standard deviation below the average on INITI _2 (ii),
(c) one standard deviation below the average on COMPL and one standard deviation above the average on INITI _2 (iii),
(d) one standard deviation below the average on COMPL and one standard deviation below the average on INITI _2 (iv),
(e) average on COMPL and one standard deviation above the average on INITI _2 (v),
(f) average on COMPL and one standard deviation below the average on INITI 2 (vi).

Consequently, the coordinates were:

(i) high initiation and high complexity (COMPL = 1; INITI _2 = 1)
Y (ADOPT) = 0.21(1) + 0.12(1) – 0.17(1)(1) = 0.16
(ii) high initiation and low complexity (COMPL = -1; INITI _2 = 1)
Y (ADOPT) = 0.21(1) + 0.12(-1) – 0.17(1)(-1) = 0.26
(iii) low initiation and high complexity (COMPL = 1; INITI _2 = -1)
Y (ADOPT) = 0.21(-1) + 0.12(1) – 0.17(-1)(1) = 0.08
(iv) low initiation and low complexity (COMPL = -1; INITI _2 = -1)
Y (ADOPT) = 0.21(-1) + 0.12(-1) – 0.17(-1)(-1) = -0.50
(v) average initiation and high complexity (COMPL = 1; INITI _2 = 0)
Y (ADOPT) = 0.21(0) + 0.12(1) – 0.17(0)(1) = 0.12
(vi) average initiation and low complexity (COMPL = -1; INITI _2 = 0)
Y (ADOPT) = 0.21(0) + 0.12(-1) – 0.17(0)(1) = -0.12

These coordinates were used to generate Figure 11.4. As can be seen in this figure that all three lines had different intercepts, since INITI_2 was also a predictor for the intercept. A similar procedure was employed to generate other cross-level interaction graphs.

When the difference between districts was considered, it was found that the impact of organisational complexity (OCOM_3, 0.26) was significant at the between district level. In this study the finding that there were significant differences between districts in relation to the level of organisational complexity may suggest that more affluent districts were found to be organisationally more complex; which means that the organisations would have higher levels of IT expertise, and consequently should have higher levels of adoption.

Even though the average effect of perceived complexity on adoption was positive (COMPL, 0.12), the result of three-level analysis also reveals that complexity had a negative effect on adoption when the pressure to adopt the technology at initiation stage (INITI_2) was high. It was possible that people get anxious and became more aware of the level of complexity of the technology and therefore the latter acted as a deterrent rather than as a motivator.

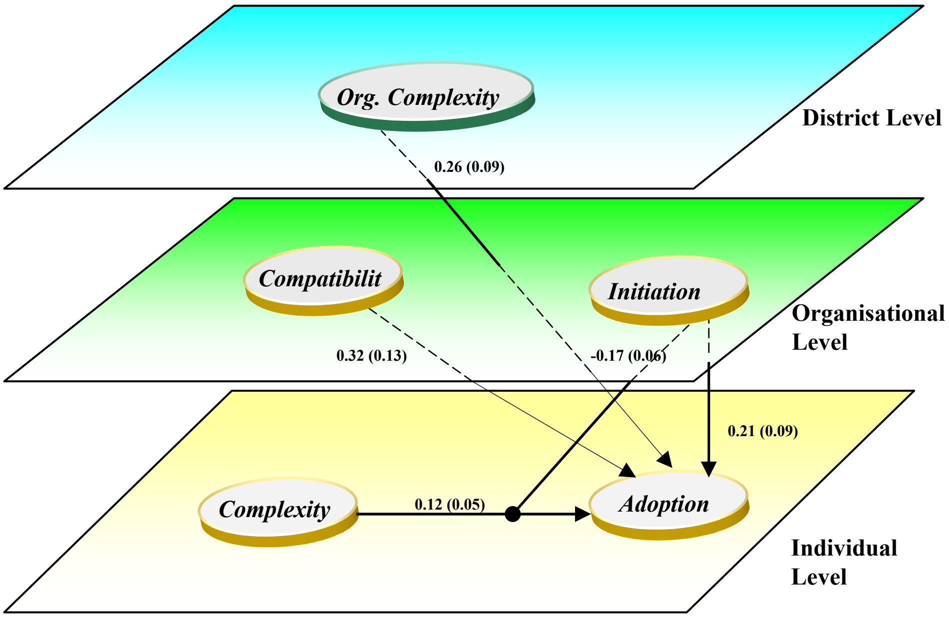

Figure 11.3 Three-Level Model of Adoption for Non-Initiators

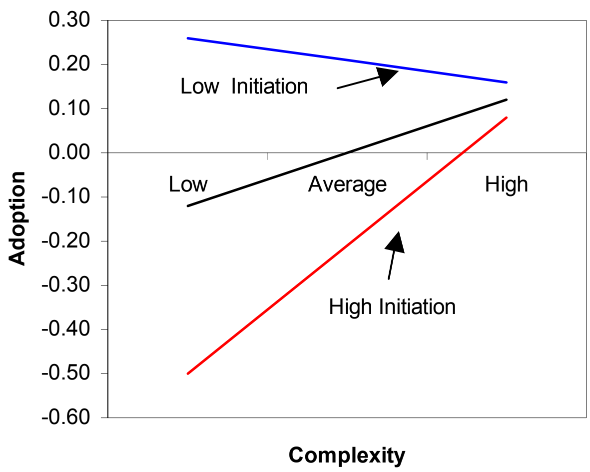

Figure 11.4 Interaction Effect of Average Initiation on the Slope of Complexity on Adoption

On the contrary, when the pressure was low, people seemed to consider the level of complexity as a challenge that motivated them to experiment with it and hence there could be a positive impact of complexity on adoption. This relationship is presented in Figure 11.4. In addition, the level of initiation also had a direct effect on adoption. The target organisations that had a high level of pressure at the initiation stage had higher levels of adoption. As expected, there was a significant and positive relationship between adoption and respondents' perception of the compatibility of the technology.

Table 11.4 Estimation of Variance Components: Adoption for Initiators

Model	Estimation of Variance components		
	between employee (n = 459)	**between organisation** (n = 117)	**between district** (n = 10)
fully unconditional model	0.39	0.65	0.07
final model	0.35	0.45	0.01
Variance at each level			
between employee	0.39 / (0.39 + 0.65 + 0.07) = 35%		
between organisation	0.65 / (0.39 + 0.65 + 0.07) = 59%		
between district	0.07 / (0.39 + 0.65 + 0.07) = 6%		
Proportion of variance explained by final model			
between employee	(0.39 - 0.35) / 0.39 = 0.53 = 10%		
between organisation	(0.65 - 0.45) / 0.65 = 0.76 = 31%		
between district	(0.07 - 0.01) / 0.07 = 0.87 = 86%		
Proportion of total available variance explained by final model			
(0.10 x 0.35) + (0.31 x 0.59) + (0.86 x 0.06) = 0.27 = 27%			

From the results of the analysis of the fully unconditional model which specified no predictors at any level, as outlined in the previous section, estimates of the variance in adoption which were available to be explained at each level were obtained and recorded in the first panel of Table 11.4. The calculation in the second panel of Table 11.4 shows that most of the variance (59%) was found between the responding organisations. Approximately one third (35%) of the variance was found between employees and only a small amount of variances (6%) occurred between districts.

The corresponding estimates of variance components in the final model indicate the extent to which the variance was reduced as a result of the inclusion of predictors of adoption at all three-level. The third panel of Table 11.4 gives the calculation to compute the variance that was explained by the final model at each level. It can be seen that the model explained most of the variance at level-3 (86%), which, however, represented only six per cent of the overall variance available to be explained. The model also explained almost one third of variance between organisations (31%) but only 10 per cent at the between employees level. When the variance explained at each level was considered in relation to the amount of variance available to be explained at that level, the total amount of variance explained by the model was 27 per cent. This is shown in the last row of Table 11.4. As can be seen in Tables 11.2 and 11.3, the deviance was reduced by 48.6 with an additional 16 degrees of freedom.

Three-Level Model of Perceived Performance for Initiators

Using the same procedures, the null model for three-level HLM of perceived performance for initiators was estimated first. The HLM results for the null model are presented in Table 11.5. The partition of total variance into its three components is shown in Table 11.7.

Table 11.5 Null Model Results: Three-Level Model of Performance for Initiators

Final estimation of fixed effects:						
Fixed Effect		**Coefficient**	**Std. Error**	**T-ratio**	**App. d.f.**	**P-value**
For INTRCPT1, P0						
For INTRCPT2, B00						
INTRCPT3, G000		0.01	0.07	0.10	9	0.922
Final estimation of level-1 and level-2 variance components:						
Random Effect	**Reliability**	**Standard Deviation**	**Variance Component**	**df**	**Chi-square**	**P-value**
INTRCPT1, R0	0.315	0.34	0.11	107	173.4	0.000
level-1, E		0.94	0.88			
Final estimation of level-3 variance components:						
Random Effect	**Reliability**	**Standard Deviation**	**Variance Component**	**df**	**Chi-square**	**P-value**
INTRCPT1/INTRCPT2, U00	0.261	0.11	0.01	9	13.8	0.129
Statistics for current covariance components model						
Deviance		**1307.6**				
Number of estimated parameters		**4**				

The next step was to estimate the final model. The final model is specified by the following equations:

Level-1 Model

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}(\text{SEX}) + \pi_{2jk}(\text{AGE}) + \pi_{3jk}(\text{INITI}) + \pi_{4jk}(\text{ACUSE}) + \pi_{5jk}(\text{SATIS}) + e_{ijk} \quad [11.15]$$

Level-2 Model

$$\pi_{0jk} = \beta_{00k} + \beta_{01k}(\text{COMCH\_2}) + r_{0jk} \quad [11.16a]$$

$$\pi_{1jk} = \beta_{10k} \quad [11.16b]$$

$$\pi_{2jk} = \beta_{20k} \quad [11.16c]$$

$$\pi_{3jk} = \beta_{30k} + \beta_{31k}(\text{SATIS\_2}) \quad [11.16d]$$

$$\pi_{4jk} = \beta_{40k} \quad [11.16e]$$

$$\pi_{5jk} = \beta_{50k} + \beta_{51k}(\text{COMPL\_2}) + \beta_{52k}(\text{ADOPT\_2}) + r_{5jk} \quad [11.16f]$$

Level-3 Model

$$\beta_{00k} = \gamma_{000} + u_{00k} \quad [11.17a]$$

$$\beta_{01k} = \gamma_{010} + u_{01k} \quad [11.17b]$$

$$\beta_{10k} = \gamma_{100} \quad [11.17c]$$

$$\beta_{20k} = \gamma_{200} \quad [11.17d]$$

$$\beta_{30k} = \gamma_{300} + u_{30k} \quad [11.18e]$$

$$\beta_{31k} = \gamma_{310} + u_{31k} \quad [11.18f]$$

$$\beta_{40k} = \gamma_{400} \quad [11.18g]$$

$$\beta_{50k} = \gamma_{500} + \gamma_{501}\,(\text{AGE\_3}) + u_{50k} \quad [11.18h]$$

$$\beta_{51k} = \gamma_{510} \quad [11.18i]$$

$$\beta_{52k} = \gamma_{520} \quad [11.19j]$$

By substituting level-3 equations (Eq. 11.18a to Eq. 11.18j) into the level-2 equations (Eq. 11.17a to 11.17f), the level-2 equations are represented by:

$$\pi_{0jk} = \gamma_{000} + \gamma_{010}(\text{COMCH\_2}) + u_{00k} + u_{01k}\,(\text{COMCH\_2}) + r_{0jk} \quad [11.20a]$$

$$\pi_{1jk} = \gamma_{100} \quad [11.20b]$$

$$\pi_{2jk} = \gamma_{200} \quad [11.20c]$$

$$\pi_{3jk} = \gamma_{300} + \gamma_{310}(\text{SATIS\_2}) + u_{30k} + u_{31k}\,(\text{SATIS\_2}) \quad [11.20d]$$

$$\pi_{4jk} = \gamma_{400} \quad [11.20e]$$

$$\pi_{5jk} = \gamma_{500} + \gamma_{501}\,(\text{AGE\_3}) + \gamma_{510}\,(\text{COMPL\_2}) + \gamma_{520}\,(\text{ADOPT\_2}) + u_{50k} + r_{5jk} \quad [11.20f]$$

By substituting level-2 equations (Eq. 11.20a to Eq. 11.20f) into the level-1 equation (Eq. 11.15), the final model is represented by:

$$\begin{aligned} Y_{ijk} = {} & \gamma_{000} + \gamma_{010}(\text{COMCH\_2}) + \gamma_{100}(\text{SEX}) + \gamma_{200}(\text{AGE}) + \gamma_{300}(\text{INITI}) + \gamma_{400}(\text{ACUSE}) \\ & + \gamma_{500}(\text{SATIS}) + \gamma_{310}(\text{SATIS\_2})(\text{INITI}) + \gamma_{501}(\text{AGE\_3})(\text{SATIS}) \\ & + \gamma_{510}(\text{COMPL\_2})(\text{SATIS}) + \gamma_{520}(\text{ADOPT\_2})(\text{SATIS}) \\ & + u_{00k} + u_{01k}\,(\text{COMCH\_2}) + u_{30k}(\text{INITI}) + u_{31k}\,(\text{SATIS\_2})(\text{INITI}) \\ & + u_{50k}(\text{SATIS}) + r_{0jk} + r_{5jk}(\text{SATIS}) + e_{ijk} \end{aligned} \quad [11.21]$$

This equation illustrates that the impact of IT on user performance for initiators may be viewed as a function of the overall intercept (γ_{000}), six main effects, four cross-level interaction effects, and a random error ($u_{00k} + u_{01k}$ (COMCH_2) + u_{30k}(INITI)+ u_{31k} (SATIS_2)(INITI)+ u_{50k}(SATIS)+ $r_{0jk} + r_{5jk}$(SATIS)+ e_{ijk}). The six main effects are the direct effects from average communication channel at level-2 (COMCH_2, γ_{010}), gender of employee (SEX, γ_{100}), age of employee (AGE, γ_{200}), the level of initiation (INITI, γ_{300}), active usage (ACUSE, γ_{400}), and user satisfaction (SATIS, γ_{500}). The four cross-level interaction effects involve SATIS_2 and INITI (γ_{310}), AGE_3 and SATIS (γ_{501}), COMPL_2 and SATIS (γ_{510}), and ADOPT_2 and SATIS (γ_{520}).

The results of final model presented in Table 11.6 show that five level-1 variables had an effect on performance, namely SEX, AGE, INITI, ACUSE and SATIS. In addition, one level-2 variable influenced performance, namely COMCH_2, which was aggregated from the individual level. In addition, SATIS_2 interacted with initiation in influencing performance, whereas COMPL_2, ADOPT_2, and AGE_3 interacted with satisfaction slope. These relationships can also be seen in Figure 11.5.

Table 11.6 Final Model Results: Three-Level Model of Performance for Initiators

Final estimation of fixed effects:

Fixed Effect	Coefficient	Std. Error	T-ratio	App. d.f.	P-value
For INTRCPT1, P0					
For INTRCPT2, B00					
INTRCPT3, G000	0.33	0.11	2.92	9	0.018
For COMCH_2, B01					
INTRCPT3, G010	-0.22	0.08	-2.77	9	0.022
For SEX slope, P1					
For INTRCPT2, B10					
INTRCPT3, G100	-0.23	0.08	-3.02	454	0.003
For AGE slope, P2					
For INTRCPT2, B20					
INTRCPT3, G200	-0.02	0.00	-3.22	454	0.002
For INITI slope, P3					
For INTRCPT2, B30					
INTRCPT3, G300	0.17	0.04	3.87	9	0.004
For SATIS_2, B31					
INTRCPT3, G310	-0.21	0.07	-2.90	9	0.018
For ACUSE slope, P4					
For INTRCPT2, B40					
INTRCPT3, G400	0.14	0.04	3.41	454	0.001
For SATIS slope, P5					
For INTRCPT2, B50					
INTRCPT3, G500	0.41	0.05	7.86	8	0.000
AGE_3, G501	-0.08	0.03	-2.51	8	0.036
For COMPL_2, B51					
INTRCPT3, G510	-0.22	0.08	-2.75	114	0.006
For ADOPT_2, B52					
INTRCPT3, G520	0.16	0.06	2.48	114	0.013

Final estimation of level-1 and level-2 variance components:

Random Effect	Reliability	Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1, R0	0.091	0.14	0.02	75	109.8	0.006
SATIS slope, R5	0.219	0.28	0.08	83	148.0	0.000
level-1, E		0.71	0.50			

Final estimation of level-3 variance components:

Random Effect	Reliability	Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1/INTRCPT2, U00	0.204	0.07	0.01	9	12.5	0.187
INTRCPT1/ COMCH_2, U01	0.181	0.11	0.01	9	8.5	>.500
INITI/INTRCPT2, U30	0.067	0.04	0.00	9	9.9	0.360
INITI/ SATIS_2, U31	0.149	0.09	0.01	9	14.6	0.102
SATIS/INTRCPT2, U50	0.068	0.04	0.00	8	12.4	0.134

Statistics for current covariance components model

Deviance	**1066.60**
Number of estimated parameters	**30.00**

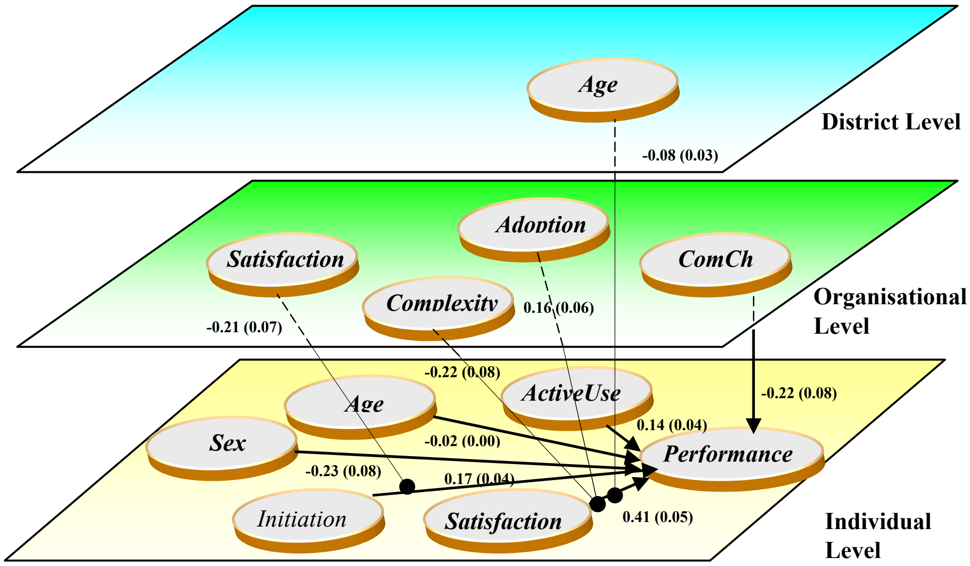

Figure 11.5 Three-Level Model of Performance for Initiators

For the impact of technology on user performance, it seems that as far as the middle to upper level staff members (initiators) were concerned, the level of need for the technology as an indicator of the initiation stage (INIT, 0.17) had positive impacts on their performance. It was expected that since such group members were in a better position to estimate the usefulness of the technology thus their levels of motivation were matched with their levels of performance.

In addition, the level of satisfaction with IT (SATIS, 0.41) and the level of active usage (ACTIVE, 0.14) were positively correlated with performance. Gender had a negative effect on performance, which means that female employees reported less impact of IT on their performance. Moreover, younger employees reported higher impact of IT on their performance (AGE, -0.02). However, the magnitude of the effect was very small since the performance scores were standardised while the age scores were not.

Some other interesting results were the interaction effects of level-2 and level-3 variables on the slopes of level-1 predictors. The average satisfaction of employees in organisations (SATIS_2, -0.21) had a negative effect of on the slope of initiation on performance (INIT, 0.17). It has been mentioned earlier that on average, initiation had a positive effect on user performance. However, the magnitude of the effect varied across organisations. It depended on the extent to which the initiators, on average, in an organisation were satisfied with the technology. The more easily the initiators were satisfied with the technology in organisations, the higher the magnitude of the effect of initiation on performance. When the initiators reported they were highly satisfied with the technology, the more readily they perceived the need for the technology in the initiation stage, and the less they seemed to feel the impact of IT on their performance. These relationships are presented in Figure 11.6.

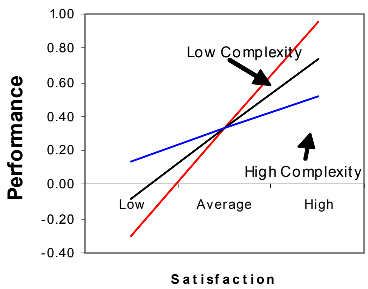

Figure 11.6 Interaction Effect of Average Satisfaction on Initiation Slope

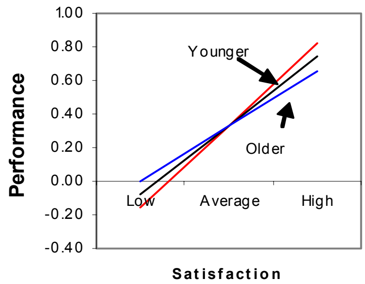

Figure 11.7 Interaction Effect of Average Adoption on Satisfaction Slope

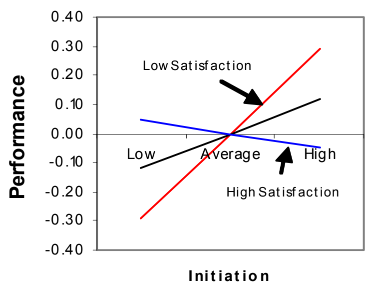

Figure 11.8 Interaction Effect of Average Complexity on Satisfaction Slope

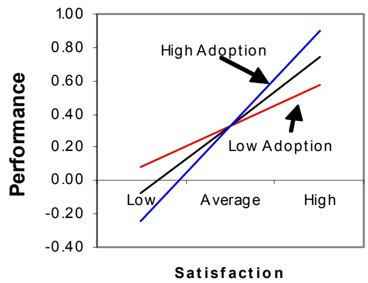

Figure 11.9 Interaction Effect of Average Age on Satisfaction Slope

For the effect of satisfaction on performance, it was found that the magnitude increased in accordance with the level of adoption. In organisations that had a high level of adoption, the effect of satisfaction on performance was stronger. This effect is presented in Figure 11.7.

On the contrary, the effect of average perception on IT complexity in organisations had a negative effect on the magnitude of satisfaction effect on performance. In the sample organisations in which on average the initiators perceived the technology to be more complex, the effect of satisfaction on performance was weaker as can be seen in Figure 11.8. In addition, a level-3 variable that represents the average age of initiators at the district level (AGE_3, -0.08) was also found to influence the magnitude of satisfaction effect on performance. In a district where the proportion of younger initiators was high, the effect of satisfaction on performance was found to be stronger as presented in Figure 11.9.

From the results of the analysis of the fully unconditional model which specified no predictors at any level, as outlined in the previous section, estimates of the variance in adoption which were available to be explained at each level were obtained and recorded in the first panel of Table 11.7. The calculation in the second panel of Table 11.7 shows that most of the variance (58%) was found between organisations.

Approximately one third (31%) of the variance was found between employees and only a small amount of variance (11%) occurred between districts

The corresponding estimates of variance components in the final model indicate the extent to which the variance was reduced as a result of the inclusion of predictors of adoption at all three levels.

Table 11.7 Estimation of Variance Components: Performance for Initiators

Model	Estimation of Variance components between employee (n = 459)	between organisation (n = 117)	between district (n = 10)
fully unconditional model	0.56	0.30	0.11
final model	0.50	0.02	0.07
Variance at each level			
between employee	0.56 / (0.56 + 0.30 + 0.11) = 58%		
between organisation	0.30 / (0.56 + 0.30 + 0.11) = 31%		
between district	0.11 / (0.56 + 0.30 + 0.11) = 11%		
Proportion of variance explained by final model			
between employee	(0.56 - 0.50) / 0.56 = 0.11 = 11%		
between organisation	(0.30 - 0.02) / 0.30 = 0.93 = 93%		
between district	(0.11 - 0.07) / 0.11 = 0.36 = 36%		
Proportion of total available variance explained by final model			
(0.11 x 0.58) + (0.93 x 0.31) + (0.36 x 0.11) = 0.39 = 39%			

The third panel of Table 11.7 gives the calculation to compute the variance that was explained by the final model at each level. It can be seen that the model explained most of the variance at level-2 (93%), which represented almost one third of the overall variance available to be explained. The model also explained almost one third of variance between employees (36%) but only 11 per cent at the between district level. When the variance explained at each level was considered in relation to the amount of variance available to be explained at that level, the total amount of variance explained by the model was 39 per cent. The deviance was also reduced by 241 with an additional 26 degrees of freedom.

Three-Level Model of Performance for Non-Initiators

Using the same procedures, the null model for three-level HLM of performance for non-initiators was estimated first. The HLM results for the null model were presented in Table 11.8. The partitioning of total variance into its three components is shown in Table 11.10.

The next step was to estimate the final model. The final model is specified by the following equations:

Level-1 Model

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}(\text{RELAD}) + \pi_{2jk}(\text{ATTID}) + \pi_{3jk}(\text{ACUSE}) + \pi_{4jk}(\text{SATIS}) + e_{ijk} \quad [11.22]$$

Level-2 Model

$$\pi_{0jk} = \beta_{00k} + r_{0jk} \quad [11.23a]$$

$$\pi_{1jk} = \beta_{10k} + r_{1jk} \quad [11.23b]$$

$$\pi_{2jk} = \beta_{20k} + \beta_{21k}(\text{PERFM\_2}) + r_{2jk} \quad [11.23c]$$

$$\pi_{3jk} = \beta_{30k} + r_{3jk} \quad [11.23d]$$

$$\pi_{4jk} = \beta_{40k} + \beta_{41k}(\text{COMPA\_2}) + r_{4jk} \quad [11.23e]$$

Level-3 Model

$$\beta_{00k} = \gamma_{000} + u_{00k} \quad [11.23a]$$

$$\beta_{10k} = \gamma_{100} + \gamma_{101}(\text{OBSER\_3}) + u_{10k} \quad [11.23b]$$

$$\beta_{20k} = \gamma_{200} + \gamma_{201}(\text{RELAD\_3}) + u_{20k} \quad [11.23c]$$

$$\beta_{21k} = \gamma_{210} + u_{21k} \quad [11.23d]$$

$$\beta_{30k} = \gamma_{300} + u_{30k} \quad [11.23e]$$

$$\beta_{40k} = \gamma_{400} + u_{50k} \quad [11.23f]$$

$$\beta_{41k} = \gamma_{410} \quad [11.23g]$$

By substituting the level-3 equations (Eq. 11.23a to Eq. 11.23g) into the level-2 equations (Eq. 11.22a to Eq. 11.22e), the level-2 equations are represented by:

$$\pi_{0jk} = \gamma_{000} + u_{00k} + r_{0jk} \quad [11.24a]$$

$$\pi_{1jk} = \gamma_{100} + \gamma_{101}(\text{OBSER\_3}) + u_{10k} + r_{1jk} \quad [11.24b]$$

$$\pi_{2jk} = \gamma_{200} + \gamma_{201}(\text{RELAD\_3}) + \gamma_{210}(\text{PERFM\_2}) + u_{20k} + u_{21k}(\text{PERFM\_2}) + r_{2jk} \quad [11.24c]$$

$$\pi_{3jk} = \gamma_{300} + u_{30k} + r_{3jk} \quad [11.24d]$$

$$\pi_{4jk} = \gamma_{400} + \gamma_{410}(\text{COMPA\_2}) + u_{50k} + r_{4jk} \quad [11.24e]$$

By substituting the level-2 equations (Eq. 11.24a to Eq. 11.24e) into the level-1 equation (Eq. 11.22), the final model is represented by:

$$\begin{aligned} Y_{ijk} = {} & \gamma_{000} + \gamma_{100}(\text{RELAD}) + \gamma_{200}(\text{ATTID}) + \gamma_{300}(\text{ACUSE}) + \gamma_{400}(\text{SATIS}) \\ & + \gamma_{101}(\text{OBSER\_3})(\text{RELAD}) + \gamma_{201}(\text{RELAD\_3})(\text{ATTID}) \\ & + \gamma_{210}(\text{PERFM\_2})(\text{ATTID}) + \gamma_{410}(\text{COMPA\_2})(\text{SATIS}) \\ & + u_{00k} + u_{10k}(\text{RELAD}) + u_{20k}(\text{ATTID}) + {}_{21k}(\text{PERFM\_2})(\text{ATTID}) \\ & + u_{30k}(\text{ACUSE}) + u_{50k}(\text{SATIS}) + r_{0jk} + r_{1jk}(\text{RELAD}) + r_{2jk}(\text{ATTID}) \\ & + r_{3jk}(\text{ACUSE}) + r_{4jk}(\text{SATIS}) + e_{ijk} \end{aligned} \quad [11.25]$$

This equation illustrates that the impact of IT on user performance for non-initiators may be viewed as a function of the overall intercept (γ_{000}), four main effects, four cross-level interaction effects, and a random error (u_{00k} + u_{10k}(RELAD) + u_{20k}(ATTID)+ ${}_{21k}$(PERFM_2)(ATTID) + u_{30k}(ACUSE) + u_{50k}(SATIS)+ r_{0jk} + r_{1jk}(RELAD)+ r_{2jk}(ATTID) + r_{3jk}(ACUSE) + r_{4jk}(SATIS)+e_{ijk}). The four main effects are the direct effects from average perceived relative advantages (relad, γ_{100}), attitude toward change (ATTID, γ_{200}), active usage (ACUSE, γ_{300}), and the level of user satisfaction (SATIS, γ_{400}). The four cross-level interaction effects involve OBSER_3 and RELAD (γ_{101}), RELAD_3 and ATTID (γ_{201}), PERFM_2 and ATTID (γ_{210}), and COMPA_2 and SATIS (γ_{410}).

The results for the final models presented in Table 11.9 show that four level-1 variables had an effect on performance, namely RELAD, ATTID, ACUSE and SATIS. In addition, two level-2 variables influenced slope of predictors in influencing performance at level-1, all of them were variables aggregated from the individual level, namely, PERFM_2 and COMPA_2; and there also two other level-3 variables involved in the model, all of them were variables aggregated from the individual level, namely, OBSER_3 and RELAD_3. These relationships can be seen in Figure 11.10.

Table 11.8 Null Model Results: Three-Level Model of Performance for Non-Initiators

Final estimation of fixed effects:						
Fixed Effect		**Coefficient**	**Standard Error**	**T-ratio**	**App. d.f.**	**P-value**
For INTRCPT1, P0						
For INTRCPT2, B00						
INTRCPT3, G000		-0.03	0.10	-0.35	9	0.737
Final estimation of level-1 and level-2 variance components:						
Random Effect	**Reliability**	**Standard Deviation**	**Variance Component**	**df**	**Chi-square**	**P-value**
INTRCPT1, R0	0.58	0.54	0.29	117.00	272.9	0.000
level-1, E		0.81	0.66			
Final estimation of level-3 variance components:						
Random Effect	**Reliability**	**Standard Deviation**	**Variance Component**	**df**	**Chi-square**	**P-value**
INTRCPT1/INTRCPT2, U00	0.606	0.25	0.06	9.00	25.1	0.003
Statistics for current covariance components model						
Deviance		**1304.6**				
Number of estimated parameters		**4**				

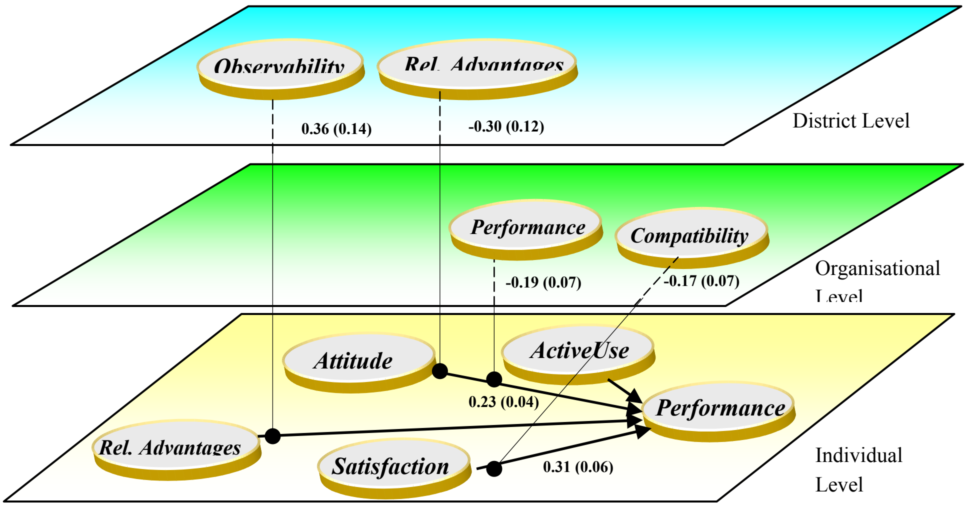

Figure 11.10 Three-Level Model of Performance for Non-Initiators

Table 11.9 Final Model Results: Three-Level Model of Performance for Non-Initiators

Final estimation of fixed effects:					
Fixed Effect	**Coefficient**	**Std.Error**	**T-ratio**	**App.d.f.**	**P-value**
For INTRCPT1, P0					
For INTRCPT2, B00					
INTRCPT3, G000	0.07	0.05	1.34	9	0.212
For RELAD slope, P1					
For INTRCPT2, B10					
INTRCPT3, G100	-0.18	0.04	-4.02	8	0.004
OBSER_3, G101	0.36	0.14	2.64	8	0.030
For ATTID slope, P2					
For INTRCPT2, B20					
INTRCPT3, G200	0.23	0.04	5.51	8	0.000
RELAD_3, G201	-0.30	0.12	-2.52	8	0.036
For PERFM_2, B21					
INTRCPT3, G210	-0.19	0.07	-2.65	9	0.027
For ACUSE slope, P3					
For INTRCPT2, B30					
INTRCPT3, G300	0.17	0.04	3.85	9	0.005
For SATIS slope, P4					
For INTRCPT2, B40					
INTRCPT3, G400	0.31	0.06	5.00	9	0.000
For COMPA_2, B41					
INTRCPT3, G410	-0.17	0.07	-2.44	125	0.015

Final estimation of level-1 and level-2 variance components:						
Random Effect	**Reliability**	**Standard Deviation**	**Variance Component**	**df**	**Chi-square**	**P-value**
INTRCPT1, R0	0.084	0.23	0.06	38	56.9	0.025
RELAD slope, R1	0.080	0.20	0.04	38	32.7	>.500
ATTID slope, R2	0.067	0.16	0.03	28	22.8	>.500
ACUSE slope, R3	0.075	0.19	0.04	38	35.6	>.500
SATIS slope, R4	0.132	0.32	0.11	37	41.1	0.295
Level-1, E		0.55	0.31			

Final estimation of level-3 variance components:						
Random Effect	**Reliability**	**Standard Deviation**	**Variance Component**	**df**	**Chi-square**	**P-value**
INTRCPT1/INTRCPT2, U00	0.320	0.10	0.01	9	15.6	0.076
RELAD/INTRCPT2, U10	0.138	0.05	0.00	8	6.9	>.500
ATTID/INTRCPT2, U20	0.148	0.06	0.00	8	10.5	0.233
ATTID/PERFM_2, U21	0.314	0.14	0.02	9	17.7	0.038
ACUSE/INTRCPT2, U30	0.046	0.03	0.00	9	5.7	>.500
SATIS/INTRCPT2, U40	0.253	0.10	0.01	9	8.2	>.500

Statistics for current covariance components model	
Deviance	**1009.8**
Number of estimated parameters	**46**

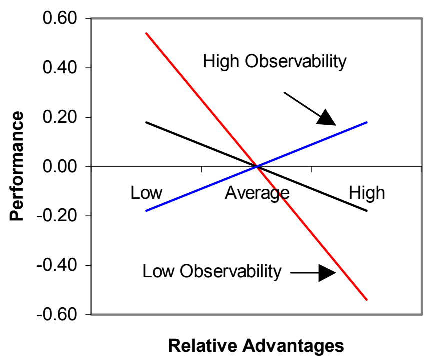

Figure 11.11 Interaction Effect of Average Observability on Relative Advantages Slope

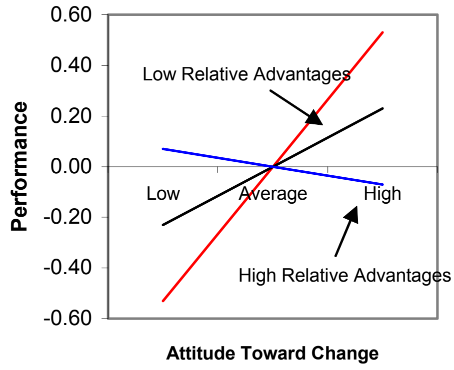

Figure 11.12 Interaction Effect of Average Relative Advantages on Attitude

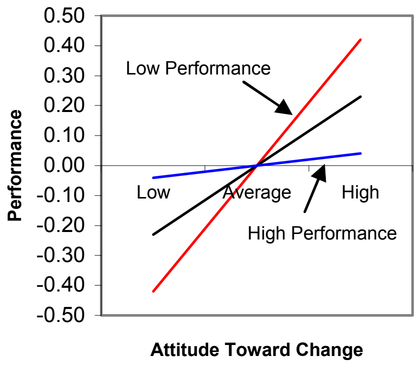

Figure 11.13 Interaction Effect of Average Performance on Attitude Slope

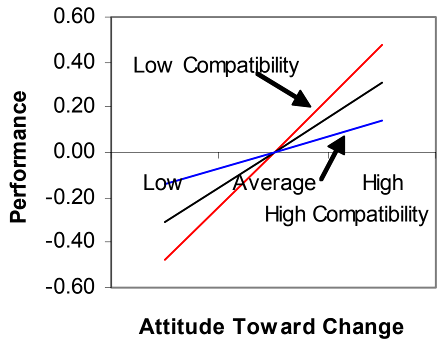

Figure 11.14 Interaction Effect of Average Compatibility on Attitude Slope

The positive coefficients indicated that employees with positive attitude (ATTID, 0.23), more active usage (ACTIVE, 0.17) or higher satisfaction (SATIS, 0.31) appeared to perceive higher impacts of IT on their performance. The positive coefficient of attitude suggests that employees with positive attitudes toward change perceived the technology to have more impact on their performance.

A similar pattern was also found for the level of active usage. The more the employees used the technology, the more they found the technology to have an impact on their performance. This was also true for employees' satisfaction regarding the technology. The more they were reported to be satisfied with the technology, the more likely they perceived the impact of technology on their performance. In contrast, the negative coefficients show that employees who perceived a lower relative advantage of the technology (RELAD, -0.18) perceived higher impacts of IT on their performance. In other words, the lower their expectation, the higher they perceived the impact of IT on their performance.

However, the magnitude of these effects across organisations and across districts was influenced by the average condition in a particular organisation or district. It was found in this study that employees in a district that had high average observability reported the positive effect of relative advantage on their performance. In a district that had low average observability, a negative effect of relative advantage on their performance was reported. These relationships are presented in Figure 11.11.

The average perception on the relative advantages of the technology at district level was also found to interact with employees' attitudes toward change in influencing their performance. Employees in a district that had a high average perception of relative advantage reported a negative effect of attitude on their performance. In a district that had a low average perception of relative advantage, a positive effect of attitude on their performance was reported. These relationships are presented in Figure 11.12.

Two organisational environment variables, the aggregate of individual responses at the organisational level, also interacted with the level-1 variables. In organisations where average performance levels were low, the effects of attitudes toward change were stronger; while in organisations where average performance levels were high, the effects of attitudes toward change on performance were weaker. These relationships suggest that in organisations where most employees had a high level of performance, attitudes toward change only had a small effect in explaining their performance differences. However, in organisations where most employees had a low level of performance, attitudes toward change did have a substantial effect in explaining their performance differences. These relationships are presented in Figure 11.13. In addition, the average compatibility at the organisational level would also seem to influence the magnitude of the effect of satisfaction on performance. In organisations where, on average, employees perceived the technology to be less compatible with their work styles, the effect of user satisfaction on user performance was stronger and vice versa as presented in Figure 11.14.

Table 11.10 Estimation of Variance Components - Performance for Non-Initiators

Model	Estimation of Variance components between employee (n = 459)	between organisation (n = 117)	between district (n = 10)
fully unconditional model	0.66	0.25	0.08
final model	0.31	0.06	0.01
Variance at each level			
between employee	0.66 / (0.66 + 0.25 + 0.08) = 67%		
between organisation	0.25 / (0.66 + 0.25 + 0.08) = 25%		
between district	0.08 / (0.66 + 0.25 + 0.08) = 8%		
Proportion of variance explained by final model			
between employee	(0.66 - 0.31) / 0.66 = 0.53 = 53%		
between organisation	(0.25 - 0.06) / 0.25 = 0.76 = 76%		
between district	(0.08 - 0.01) / 0.08 = 0.87 = 87%		
Proportion of total available variance explained by final model			
(0.53 x 0.67) + (0.76 x 0.25) + (0.87 x 0.08) = 0.61 = 61%			

From the results of the analysis of the fully unconditional model which specified no predictors at any level, as outlined in the previous section, estimates of the variance in adoption which were available to be explained at each level were obtained and recorded in the first panel of Table 11.10. The calculations in the second panel of Table 11.10 show that most of the variance (67%) was found between individuals.

Approximately one fourth (25%) of the variance was found between organisations and only a small amount of variances (8%) occurred between districts. The corresponding estimates of variance components in the final model indicate the extent to which the variance has been reduced as a result of the inclusion of predictors of adoption at all three levels. The third panel of Table 11.10 gives the calculations involved in computing the variance that was explained by the final model at each level.

Table 11.11 Summary Table

Level 1	**Level 2**	**Level 3**	**Initiators**	**Non-Initiator**
Adoption				
Intercept			0.00	
	Initiation		0.21	
	Compatibility		0.32	
		Org. Complexity	0.26	
Complexity			0.12	
	Initiation		-0.17	
Variance Explained				
Level-1			11%	
Level-2			31%	
Level 3			86%	
Performance				
Intercept			0.34	0.07
	Com. Channel		-0.22	
Relative advantage				-0.18
		Observability		0.36
Sex			-0.23	
Age			-0.02	
Attitude				0.23
	Performance			-0.19
		Relative advantage		-0.30
Initiation			0.17	
	Satisfaction		-0.21	
Active usage			0.14	0.17
Satisfaction			0.41	0.31
	Complexity		-0.22	
	Compatibility			-0.17
	Adoption		0.16	
		Age	-0.08	
Variance Explained				
Level-1			11%	53%
Level-2			93%	76%
Level 3			36%	87%

It can be seen that the model explained most of the variance at level-2 (76%), which represented one fourth of the overall variance available to be explained. The model also explained more than a half of variance between employees (53%) and 87 per cent at the between district level. When the variance explained at each level was considered in relation to the amount of variance available to be explained at that level, the total amount of variance explained by the model was 61 per cent. This is shown in the last row of Table 11.10. As can also be seen in Tables 11.8 and 11.9, the deviance was reduced by 294.8 with an additional 40 degrees of freedom. The summary for the three models can be seen in Table 11.11 and Table 11.12

Summary

In this chapter, three-level analyses were undertaken for three different models. Adoption can be viewed as the outcome of the IT adoption processes at the organisational level. However, only initiators were involved in these phases. Therefore there was no adoption model for non-initiators. Performance, on the other hand, can be seen as the final outcome of the IT adoption processes at the individual level. Both initiators and non-initiators were involved in these phases. Therefore, two different models of performance, namely, the three-level HLM models of performance for initiators and for non-initiators, were able to be analysed. By undertaking these HLM analyses, cross level interaction effects can be examined in addition to the direct effects.

These results, then, can be used to further understanding of the relationships between variables in affecting each phase of the IT adoption processes. In addition to identifying various potential factors that may affect each phase of the IT adoption processes, it is also interesting to find out how employees' attitudes and perceptions as well as the structural dimensions change before and after IT adoption processes. Therefore, the next chapter discusses the change of structural, attitudinal and IT perceptions before and after IT adoption processes.

12

The Change of Structural, Perceptual and Attitudinal Dimensions

Introduction

This chapter provides an empirical assessment of the impact of IT implementation processes on the sampled end users. In particular, this chapter discusses the changes in these end users' perceptions of the structural dimensions (namely, the level of centralisation and formalisation), the changes in end users' perceptions on IT attributes (namely, belief consistency, compatibility, relative advantage, complexity, and observability), and the changes in end users' attitudes toward IT (namely, attitudes toward change and computer related anxiety). This study examines both direct changes produced by these constructs and their indirect changes through IT implementation processes.

In this study, IT implementation is looked at from three angles: IT usage, user satisfaction, and user performance. IT usage and user satisfaction are considered to be the two major factors that impact on the success of an IT implementation (Kim, Suh, & Lee, 1998). They have been noted as indicators of IT acceptance by a number of studies (Al-Gahtani & King, 1999; Baroudi, Olson, & Ives, 1986; Gelderman, 1998; Mahmood, 1995; Taylor & Todd, 1995b). IT usage and user satisfaction, in turn, are thought to have an impact on performance (Gelderman, 1998; Goodhue & Thompson, 1995; Woodroof & Kasper, 1998).

This chapter focuses on end users' perceptions of organisational structure, end users' perceptions of the attributes of IT, and end users' attitudes toward IT before the IT implementation, as well as how these perceptions and attitudes change after the IT implementation. For the purpose of this study, a conceptual model for the change of structural, perception and attitudinal dimensions in information technology implementation processes is shown in Figure 12.1.

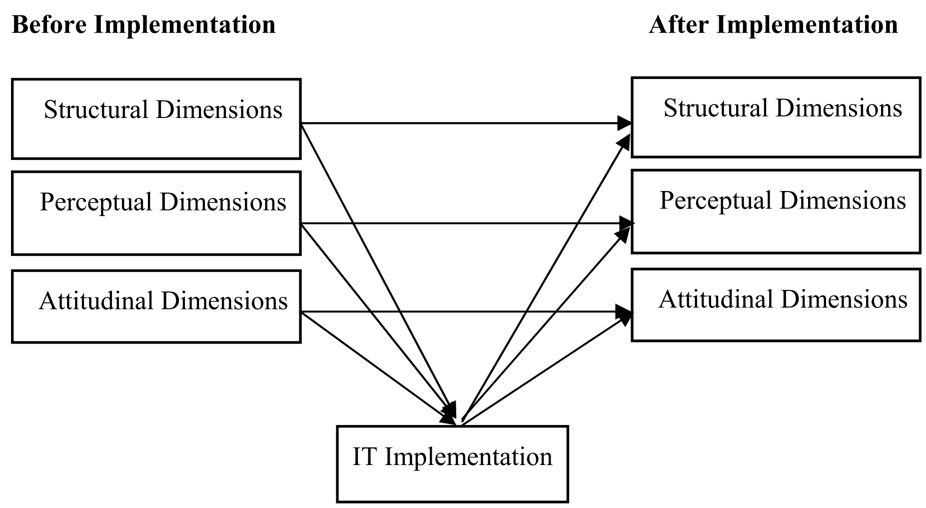

Figure 12.1 Conceptual Model of the Effects of IT Implementation

Variables in the Models

The major dimensions studied in previous research studies under the category of structural dimensions have been centralisation, formalisation, organisational complexity, organisational size, and organisational type. Among these five variables, organisational complexity, organisational size, and organisational type relate to the organisational characteristics. These three variables were measured once. The other two variables, centralisation and formalisation are employees' perceptions on aspects of the organisational cultures in their organisations. On the questionnaire, employees were asked to scale their perceptions on the items relating to these two constructs for both before the adoption and after the adoption. Therefore paired responses were available for these items.

Perceptual and attitudinal dimensions are yet other potential factors in determining the success of IT implementation. Factor structures for both dimensions have been analysed and discussed in Chapter Eight. For the perceptual dimension, five variables were included in the model, namely belief consistency, compatibility, relative advantage, complexity, and observability. Meanwhile, for the attitudinal dimension, two variables are used in this study, namely computer related anxiety and attitude toward change. In the questionnaire, responding employees were asked to scale their perceptions on the items relating to these constructs for both before the adoption and after the adoption. Therefore paired responses were also available for these items.

Since there were paired responses for these nine constructs, it was possible to examine both direct changes produced by these constructs and their indirect changes through IT implementation processes as mediating variables.

For the purpose of this change analysis, IT implementation is looked at from three angles: IT usage, user satisfaction, and perceived user performance. IT usage is frequently used as a surrogate for evaluating IT success and has occupied a central role in IT implementation research. IT usage has been noted as an indicator of IT acceptance (Gelderman, 1998), reflecting the interaction of IT with the users. Most studies have argued that IT usage is one of the primary variables that affects an individual's performance (Gelderman, 1998; Goodhue & Thompson, 1995;

Woodroof & Kasper, 1998). In this study, the level of active usage is used to reflect the IT usage.

Another dimension, which is regarded to be a major factor in measuring implementation success, is user satisfaction with the technology performance. User satisfaction reflects the interaction of IT with users. Many researchers have found that user satisfaction has a positive association with IT usage (Al-Gahtani & King, 1999; Baroudi et al., 1986; Gelderman, 1998; Khalil & Elkordy, 1999; Kim et al., 1998; Mahmood, 1995).

Because the impacts of IT on organisations are so pervasive, it is useful to define the two domains of IT impacts. There are, first, impacts of IT on collectivities, such as the work group, the department, the organisation, or even the society, and, second, the impacts of IT on individuals. This study focuses on the second domain, the impacts of IT on individuals. Particularly, this study concentrates on employees who work in governmental agencies. These impacts are considered in terms of efficiency, effectiveness, and appropriateness (Kahen, 1995; Sharp, 1996, 1998). DeLone and McLean (1992) in their study showed that user satisfaction affects user performance. Their findings are also supported by Gelderman (1998), who reported that the relationship between user satisfaction and user performance is significant.

Table 12.1 lists the structural variables, perceptual variables, and attitudinal variables, as well as the mediating variables that were examined. Variables that capture employees' perception of various constructs before the adoption of the technology were assigned the suffix "_b". Variables that measure employees' perception of various constructs after the adoption of the technology were assigned the suffix "_a" to facilitate identification.

Table 12.1 Variables Used

Description	**Notation**	
Paired Variables	**Before Adoption**	**After Adoption**
Level of Centralisation	central_b	central_a
Level of Formalisation	formal_b	formal_a
Belief Consistency	belief_b	belief_a
Compatibility	compa_b	compa_a
Relative Advantages	relad_b	relad_a
Complexity	complex_b	complex_a
Observability	observ_b	observ_a
Computer Related Anxiety	anxiety_b	anxiety_a
Attitudes Toward Change	attitude_b	attitude_a
Mediating Variables	**Notation**	
IT Usage	usage	
User Satisfaction	satisfaction	
Perceived User Performance	performance	

From these theoretical perspectives, the research model shown in Figure 12.1 was further developed for the change of structural, perceptual and attitudinal dimensions in information technology implementation processes as shown in Figure 12.2.

Testing of Models

The data collected were analysed using SPSS ver.10 (Norusis, 1994), WesVarPC (Brick, Broene, James, & Severynse, 1996) and AMOS ver. 4.01 (Arbuckle & Wothke, 1999). SPSS and WesVarPC were mainly used to undertake univariate and bivariate analyses. While AMOS was used to model the change and to explain the structure or pattern among a set of latent (unobserved or theoretical) variables, each is measured by one or more manifest (observed or empirical) variables. A series of analyses in which all respondents were treated as a single group were undertaken. The results of these combined group analyses were presented in Darmawan (2000, 2002d). In this chapter, respondents were divided into two separate groups, the initiators and the non-initiators. Separate analyses were employed for each group to examine whether there was any difference in the structural, IT attributes, and attitudinal dimension change mechanism between the two groups.

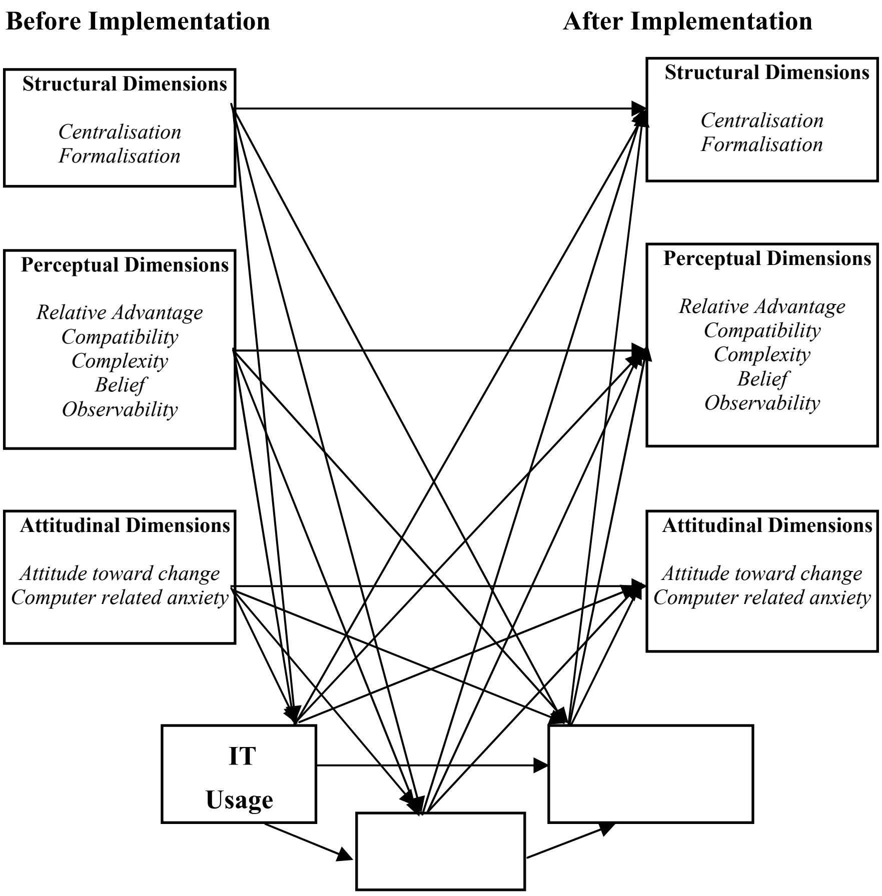

Figure 12.2 Extended Research Model of the Effects of IT Implementation

Paired Sample t-test with SPSS and WesVarPC

In order to test the change in each item used, a paired sample t-test was employed using SPSS and WesVarPC. Each item was measured on a scale that ranges from not at all (0) to very high (5). Most of the items changed significantly (with |t-value| >

1.96 or $p<0.05$) except for items CEN1, CEN4, DIUS, ATTD5, and ATTD14 for the non-initiators group. For the initiators group, only DIUS and ATTD14 were found to be non-significant. In order to determine the size of the change whether it was small, medium or large, an effect size index was used. According to Cohen (1992), the effect size (ES) for the difference between independent means (d) is expressed in units of the within population standard deviation; and the lower boundaries for the small, medium, and large ESs are d=0.20, 0.50, and 0.80. The changes of the mean values for each domain are summarised in Table 12.2. The complete paired sample t-test results are presented in Appendix B.

Table 12.2 Differences between Paired Item Means

No	Constructs	Change Description	
		Initiators	Non-Initiators
1	Centralisation	4 items: small significant increase	1item : small non-significant increase 2 items: small significant increase 1 item : small non-significant decrease
2	Formalisation	3 item : small significant increase	3 item : small significant increase
3	Belief Consistency	5 items: small significant increase	4 items: small significant increase 1 items: medium significant increase
4	Relative Advantage	5 items: medium significant increase	3 items: small significant increase 2 items: medium significant increase
5	Compatibility	3 items: medium significant increase	1 items: medium significant increase 2 items: large significant increase
6	Complexity	1item : small non-significant increase 1 item: small significant increase	2 items: small significant increase
7	Observability	4 items: medium significant increase	2 items: small significant increase 2 items: medium significant increase
8	Attitudes Toward Change	1 item: small non-significant increase 31 items: small significant increase	32 items: small significant increase
9	Computer Related Anxiety	5 items: small significant decrease	5 items: small significant decrease

Change Mechanism

A series of further analyses to explore the nature of changes was undertaken using AMOS ver.4.01. In order to reduce the number of variables in the model, the 32-item measure for the attitudes toward change were grouped into five factors in accordance with the factor analysis results. A principal component score for each of these five factors was then calculated.

It is difficult to trim a complex model. Therefore, in order to develop a more detailed model that fits the data, three sub models namely: (a) structural dimensions change model, (b) IT perception dimensions change model, and (c) attitudinal dimensions change model were examined. These three results were then used as baselines in developing combined models. In addition, to simplify further the models, two higher-level models were examined. These analyses are discussed in the following sections.

In the first step, the maximum likelihood estimations (MLE) for unstandardised and standardised values of the path coefficients and the corresponding critical ratios were estimated using AMOS 4. Critical ratios (CRs) and modification indices (MIs) were two criteria used to improve the models. The critical ratio is an observation on a random variable that has an approximate standard normal distribution. The critical ratio is obtained by dividing the estimate by its standard error (Arbuckle & Wothke, 1999). Thus, using a significance level of 0.05, any critical ratios that exceed 1.96 in magnitude would be called significant (Arbuckle & Wothke, 1999). Modification indices, on the other hand, suggest ways of improving a model by increasing the number of parameters, so that the chi-square statistic decreases faster than the degrees of freedom. However, Arbuckle and Wothke (1999) argue that in trying to improve upon a model, a modification must only be considered if it makes theoretical or common sense. Consequently, modification indices alone should not be used exclusively as a guide.

The next step was to assess the goodness of fit of the model. Chi-square divided by the number of degrees of freedom was used as the goodness of fit indicator. A value of the ratio of a chi-square to the number of degrees of freedom which is less then five can be considered adequate for a large model (Al-Gahtani & King, 1999). Other criteria are the goodness of fit index (GFI) and the adjusted goodness of fit index (AGFI). The closer these values are to unity the better the model fits the data. A third criterion is the root mean square error of approximation (RMSEA). This is a measure of the average of the residual variances and covariances, and values close to zero indicate a good model fit, with values less than 0.07 having adequate fit, and less than 0.05 having highly satisfactory fit.

Structural Dimension Change Model

Diagrammatic representation of the final structural change models can be seen in Fig. 12.3 for the initiators and Figure 12.4 for the non-initiators. Since the paired error terms represent the unique term of the same indicator on two different measurement occasions, it may indeed be reasonable to assume that they were correlated over time. In this case, all paired error terms correlations for formalisation were found to be significant, but not for centralisation.

In addition, the correlations between error terms (indicated by 'e') were found to be stronger in initiators model (e11-e14, 0.63; e10-e13, 0.53; e9-e12, 0.38) than in the non-initiators model (e11-e14, 0.19; e10-e13, 0.16; e9-e12, 0.31). All factor loadings were well above 0.4 except for the variable CEN1_A. The values of GFI and AGFI of 0.634, 1.000 respectively for the initiators and 0.619 and 1.000 respectively for the non-initiators indicated that these models fitted the data reasonably well. The path coefficients are presented in Table 12.3.

It can be seen in Fig. 12.3 and Table 12.3, that IT usage was affected by both centralisation and formalisation for the initiators only. The level of centralisation before implementation had a negative effect on IT usage (-0.35). This result suggests that the higher the level of centralisation, the lower the level of IT usage. The level of formalisation, however, operated in the opposite direction (0.38). For the non-initiators, none of the variables in the model influenced the level of IT usage

IT implementation processes, in turn, affected the levels of centralisation and formalisation after implementation. The level of formalisation after implementation was mainly influenced by formalisation before implementation with the standardised path coefficients of 0.52 and 0.81 respectively for initiators and non-initiators. The levels of centralisation after implementation also affected the final level of formalisation negatively.

In other words, the more centralised the systems became, the less formalised the procedures would be. Furthermore, there was no influence from the mediating variables. For centralisation after implementation, the levels of centralisation before adoption still played a major role. The path coefficients were 0.26 and 0.15 for initiators and non-initiators respectively. In addition, there were also influences from the mediating variables. There were negative effects of IT usage on centralisation after implementation with the path coefficients of –0.21 and –0.19 respectively for initiator and non-initiators. These relationships suggest that active usage of IT decreased the level of centralisation in the organisations in Bali included in the study.

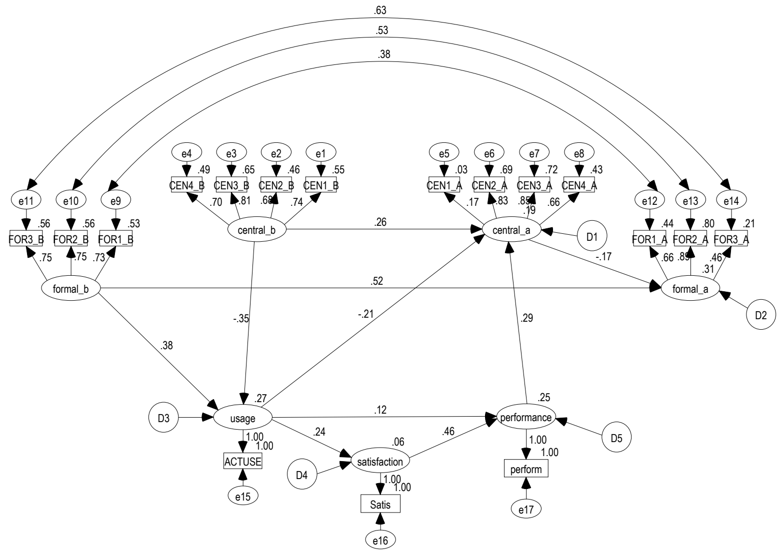

Figure 12.3 Structural Dimension Change Model for Initiators

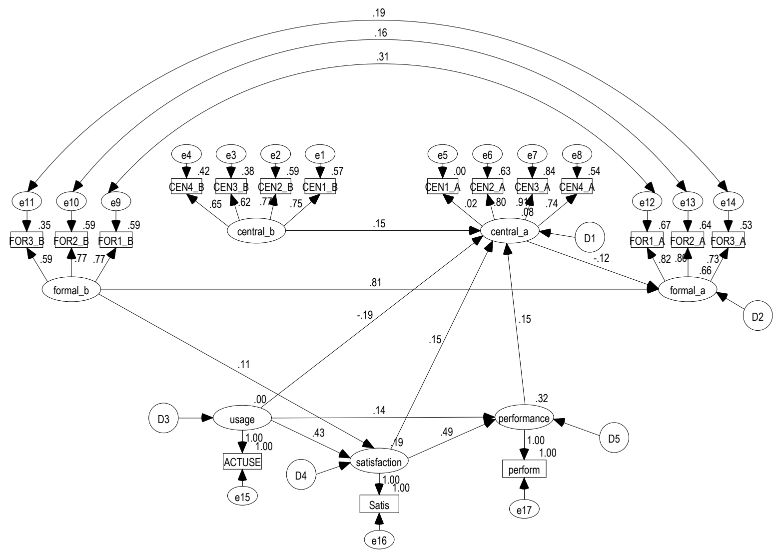

Figure 12.4 Structural Dimension Change Model for Non-Initiators

Table 12.3 Path Coefficients for Structural Dimension Change Models

Criterion	Predictor	Initiators		Non Initiators	
		UnStd (SE)	**Std**	**UnStd (SE)**	**Std**
IT Implementation					
IT Usage			$R^2 = 0.27$		
	Centralisation	-0.51 (0.07)	-0.35	-	-
	Formalisation	0.49 (0.06)	0.38	-	-
User Satisfaction			$R^2 = 0.06$		$R^2 = 0.19$
	Formalisation	-	-	0.14 (0.06)	0.11
	IT Usage	0.20 (0.04)	0.25	0.47 (0.05)	0.43
User Performance			$R^2 = 0.25$		$R^2 = 0.32$
	IT Usage	0.10 (0.04)	0.12	0.15 (0.04)	0.14
	User Satisfaction	0.49 (0.04)	0.46	0.47 (0.04)	0.49
After Adoption					
Centralisation After			$R^2 = 0.19$		$R^2 = 0.08$
	Centralisation Before	0.22 (0.05)	0.26	0.16 (0.06)	0.15
	IT Usage	-0.12 (0.03)	-0.21	-0.15 (0.04)	-0.19
	User Satisfaction	-	-	0.11 (0.04)	0.15
	User Performance	0.20 (0.04)	0.29	0.12 (0.04)	0.15
Formalisation After			$R^2 = 0.31$		$R^2 = 0.66$
	Formalisation Before	0.53 (0.05)	0.52	0.91 (0.07)	0.81
	Centralisation After	-0.23 (0.06)	-0.17	-0.16 (0.05)	-0.12

User performance, however, operated in the opposite direction with the path coefficients of 0.29 and 0.15 respectively for initiator and non-initiators. User satisfaction was only operating in the non-initiators model with the path coefficient of 0.15. The variances explained (R^2) for the endogenous variables for both groups were presented in brackets with the values for the initiators model coming first and for the non-initiators model following as follows: IT usage (0.27, 0.00), user satisfaction (0.06, 0.19), user performance (0.25, 0.32), centralisation after (0.19, 0.08), and formalisation after (0.31, 0.66).

Perceptual Dimension Change Model

A diagrammatic representation of the final IT attribute dimensions change model is presented in Figure 12.5 and Figure 12.6 for initiators and non-initiators respectively. By allowing the paired error terms to be correlated, the model fitted the data better. The values of χ^2/DF ratio, GFI, AGFI, and RMSEA of 2.824, 0.824, 0.790, and 0.063 respectively for initiators and 3.625, 0.790, 0.756, 0.073 respectively for non-initiators indicate that these models fitted the data adequately well. All the factor loadings were well above the cut-off point of 0.4. These loadings indicated that all observed variables were good measures of the corresponding latent variables. The path coefficients for the structural model are presented in Table 12.4. In this model, all latent variables before implementation were allowed to correlate. The results are discussed in the following section with the standardised path coefficients presented in brackets. Normal type is used for the initiators' standardised path coefficients and italic type is used for the non-initiators' standardised path coefficients.

It can be seen both numerically in Table 12.4 and graphically in Figure 12.5 and Figure 12.6 that the level of IT usage (USAGE) was influenced by employees' beliefs consistency before implementation (BELIEF_B, 0.16, *0.29*). The more consistent their beliefs with the technology, the higher was their level of IT usage. IT usage, in turn, affected the level of user satisfaction (USAGE, 0.20, *0.36*). In addition, responding employees' belief before implementation was operating only in the non-initiators model (BELIEF_B, *0.21*), while employees' perception of IT complexity before implementation was only found to be significant in the initiators model (COMPLEX_B, 0.23).

Furthermore, employees' perceptions on the impact of IT on their performance (PERFORMANCE) were influenced by user satisfaction (SATISFACTION, 0.45, *0.47*), IT usage (USAGE, 0.11, *0.15*), and compatibility before implementation (COMPA_B, 0.11, 0.20) in positive ways. Relative advantage before implementation (RELAD_B, -0.16, *-0.20*) was working in the opposite direction. The higher employees' expectation on IT the less they seemed to feel the impact of IT on their performance.

It can also be seen in the model that belief after implementation (BELIEF_A) was influenced directly by belief before implementation (BELIEF_B, 0.89, *0.89*) and relative advantage before (RELAD_B, -0.43, *-0.40*). These coefficients indicate that employees' belief after adoption was highly correlated with their belief before the implementation.

Observability after implementation (OBSERV_A) was influenced directly by observability before implementation (OBSERV_B, 0.37, *0.64*), belief before implementation (BELIEF_B, 0.37, for initiators only) and relative advantages (RELAD_B, -0.48, *-0.38*). In addition, there were indirect effects through the level of IT usage (USAGE,-0.16, for initiators only) and user performance (PERFORMANCE, 0.26, *0.31*). The negative coefficient for IT usage suggests that the more the employees had a chance to use the technology actively, the less they reported feeling the need to be exposed to the new technology before they adopt the technology.

Compatibility after implementation (COMPA_A) was influenced directly by compatibility before implementation (COMPA_B, 0.12, for initiators only) and complexity before implementation (COMPLEX_B, *0.29*, for non-initiators only). The effect of compatibility before on compatibility after implementation suggests that for the initiators medium size changes had occurred, while for the non-initiators, it might be expected that medium to large size changes had occurred.

In addition, user performance also acted as a mediating variable. The higher the level of IT impact on user performance the higher the employees seemed to feel compatible with the new technology (PERFORMANCE, 0.22, *0.20*). Beliefs consistency (BELIEF_A, 0.34, *0.30*) and observability (OBSERV_A, 0.23, *0.14*) after implementation were also found to have significant effects on compatibility after implementation. For the level of complexity after implementation, complexity before adoption was the only variable found to be significant for both groups (COMPLEX_B, 0.55, *0.81*).

The large path coefficients suggest that complexity after implementation was highly correlated with complexity before adoption. There were no indirect effects through mediating variables. In other words, it could be expected that there were only small changes for this construct.

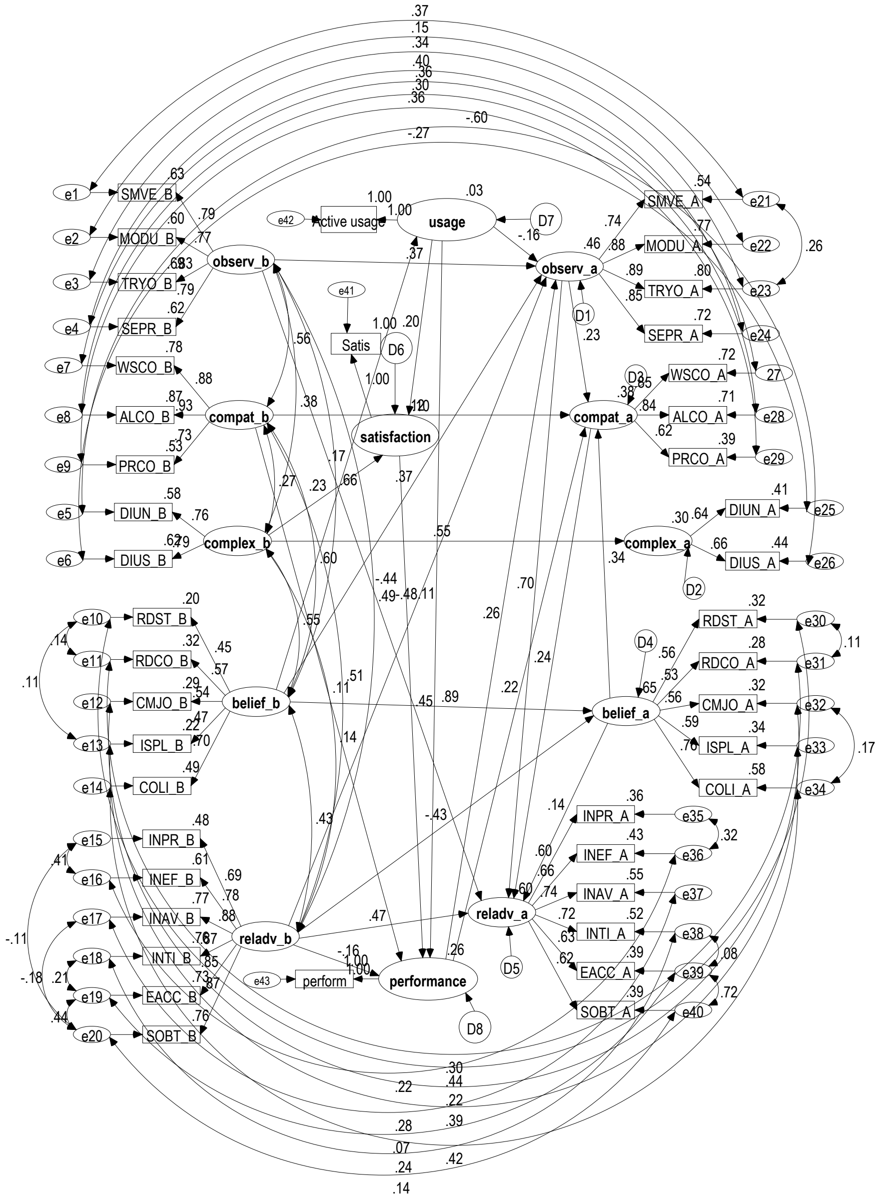

Figure 12.5 Perceptual Dimension Change Model for Initiators

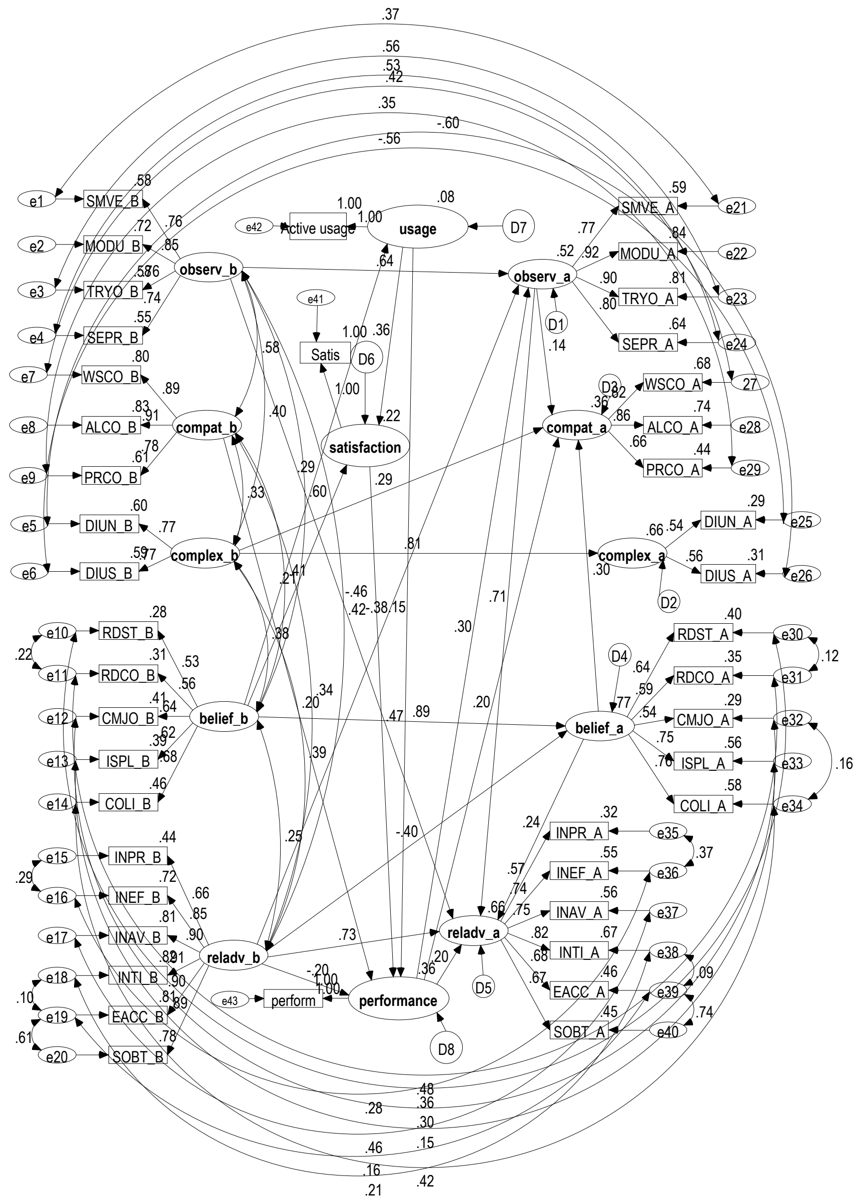

Figure 12.6 Perceptual Dimension Change Model for Non-Initiators

Table 12.4 Path Coefficients for Perceptual Dimension Change Models

Criterion	Predictors	Initiators			Non-Initiators		
		UnStd	(SE)	Std	UnStd	(SE)	Std
IT Implementation							
IT Usage				R^2 = 0.03			R^2 = 0.09
	Belief Before	0.32	(0.11)	0.16	0.42	(0.07)	0.29
User Satisfaction				R^2 = 0.10			R^2 = 0.22
	Belief Before				0.33	(0.08)	0.21
	Complex Before	0.23	(0.05)	0.23			
	IT Usage	0.18	(0.04)	0.20	0.40	(0.05)	0.36
User Performance				R^2 = 0.26			R^2 = 0.36
	Compatibility Before	0.09	(0.04)	0.11	0.18	(0.04)	0.20
	Rel. Adv. Before	-0.15	(0.05)	-0.16	-0.17	(0.03)	-0.20
	IT Usage	0.11	(0.04)	0.11	0.15	(0.04)	0.15
	User Satisfaction	0.49	(0.04)	0.45	0.44	(0.04)	0.47
After Adoption							
Belief After				R^2 = 0.65			R^2 = 0.77
	Belief Before	1.15	(0.13)	0.89	1.22	(0.10)	0.89
	Rel. Adv. Before	-0.28	(0.04)	-0.43	-0.32	(0.03)	-0.40
Observability After				R^2 = 0.46			R^2 = 0.52
	IT Usage	-0.16	(0.04)	-0.16			
	User Performance	0.28	(0.04)	0.26	0.31	(0.04)	0.31
	Belief Before	0.72	(0.15)	0.37			
	Observability Before	0.42	(0.08)	0.37	0.78	(0.06)	0.64
	Rel. Adv. Before	-0.46	(0.05)	-0.48	-0.34	(0.04)	-0.38
Compatibility After				R^2 = 0.38			R^2 = 0.36
	Compatibility Before	0.09	(0.04)	0.12			
	User Performance	0.20	(0.04)	0.22	0.17	(0.04)	0.20
	Complexity Before				0.25	(0.04)	0.29
	Belief After	0.43	(0.08)	0.34	0.27	(0.05)	0.30
	Observability After	0.19	(0.05)	0.23	0.11	(0.04)	0.14
Complexity After				R^2 = 0.31			R^2 = 0.66
	Complexity Before	0.46	(0.06)	0.55	0.51	(0.06)	0.81
Rel. Adv. After				R^2 = 0.60			R^2 = 0.66
	Rel. Adv. Before	0.32	(0.04)	0.47	0.56	(0.04)	0.73
	User Performance				0.18	(0.04)	0.20
	Observability Before	-0.35	(0.06)	-0.44	-0.49	(0.07)	-0.46
	Belief After	0.15	(0.07)	0.14	0.24	(0.05)	0.24
	Observability After	0.49	(0.07)	0.74	0.62	(0.05)	0.71
	Compatibility After	0.19	(0.05)	0.24			

The large path coefficients suggest that complexity after implementation was highly correlated with complexity before adoption. There were no indirect effects through mediating variables. In other words, it could be expected that there were only small changes for this construct.

Employees' perception of the relative advantages of the technology after implementation (RELAD_A) was strongly influenced by their perception of the relative advantages of the technology before implementation (RELAD_B, 0.47, *0.73*).

In addition, observability before implementation (OBSERV_B, -0.44, *-0.46*) also contributed with significant negative effects.

These negative coefficients suggest that for both groups, the more they expressed the need to be exposed before the implementation, the lower their perceptions of the relative advantages of the technology after implementation. User performance, as a mediating variable, only had an effect in the non-initiators model (PERFORMANCE, *0.20*).

Furthermore, the level of belief after implementation (BELIEF_A, 0.14, 0.24), observability after implementation (OBSERV_A, 0.74, *0.71*) also had significant effects on employees' perception of the relative advantages of the technology after implementation for both groups. While compatibility after implementation (COMPA_A, 0.24) was found to contribute in the initiators model only.

The variances explained (R2) for the endogenous variables were as follows: USAGE (0.03, 0.09), SATISFACTION (0.10, 0.22), PERFORMANCE (0.26, 0.36), BELIEF_A (0.65, 0.77), OBSERV_A (0.46, 0.52), COMPA_A (0.38, 0.36), COMPLEX_A (0.31, 0.66), RELAD_A (0.60, 0.66).

Attitudinal Dimension Change Model

The final attitudinal dimensions change models are given in Figure 12.7 and Figure 12.8 and the results are presented in Table 12.5. The values of χ^2/DF ratio, GFI, AGFI, and RMSEA were 2.613, 0.910, 0.880, and 0.059 respectively for initiators and 2,763, 0.907, 0.877, and 0.060 respectively for non-initiators. These indices indicate that both models fitted the data very well.

For the mediating variables, none of the predictor variables in the models seemed to influence IT usage. However, IT usage, in turn, had significant effects on user satisfaction (USAGE, 0.22, *0.41*). In addition, for user satisfaction, attitudes toward change before implementation (ATTITUDE_B, 0.12, *0.28*) were found to have positive effects in both groups. Moreover, the reported feeling of anxiety was found to have a positive effect in the initiators model only (ANXIETY_B, 0.13).

Both IT usage (USAGE, 0.10, *0.16*) and user satisfaction (SATISFACTION, 0.44, *0.41*) had significant effects on perceived user performance. These results indicate that the higher the level of IT usage, the higher the impact of IT on user performance. This kind of relationship was also true for user satisfaction. In addition, attitudes before implementation also contributed significantly (ATTITUDE_B, 0.13, *0.24*).

In addition, both after implementation variables, ATTITUDE_A and ANXIETY_A, were mainly influenced by their associated variables involving before implementation, ATTITUDE_B (0.61, *0.60*) and ANXIETY_B (0.47, *0.41*). These results suggest that only small changes had occurred for both constructs. The influences of the mediating variables were relatively small to medium. Attitudes after implementation (ATTITUDE_A) were influenced by user performance with the path coefficients of 0.26 and 0.28 for initiators and non-initiators respectively. These coefficients suggest that the greater employees perceived the technology to have a stronger impact on their performance the more positive their attitudes toward change. Anxiety after implementation (ANXIETY_A), on the other hand, was influenced negatively by IT usage with the path coefficients of -0.18 and -0.16 for initiators and non-initiators respectively. These results suggest that the greater the level of IT usage, the less anxious the users seemed to feel.

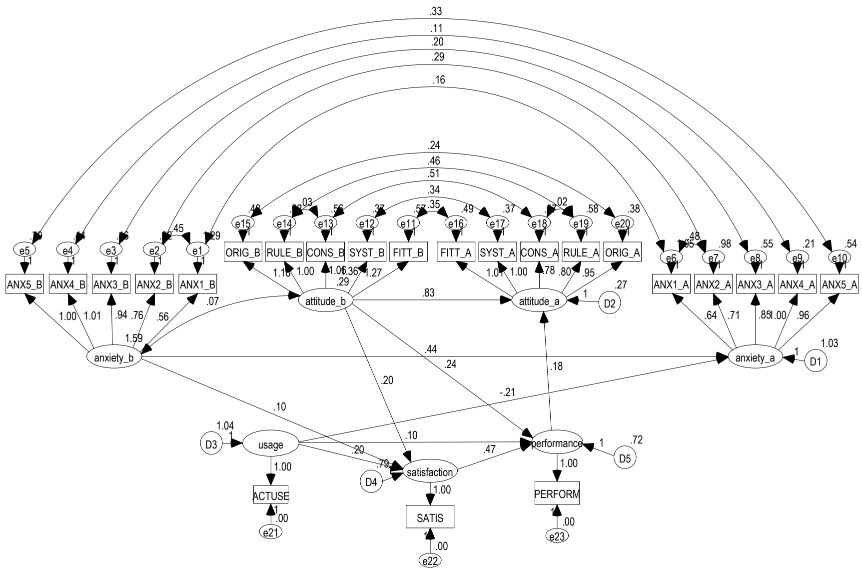

Figure 12.7 Attitudinal Dimension Change Model for Initiators

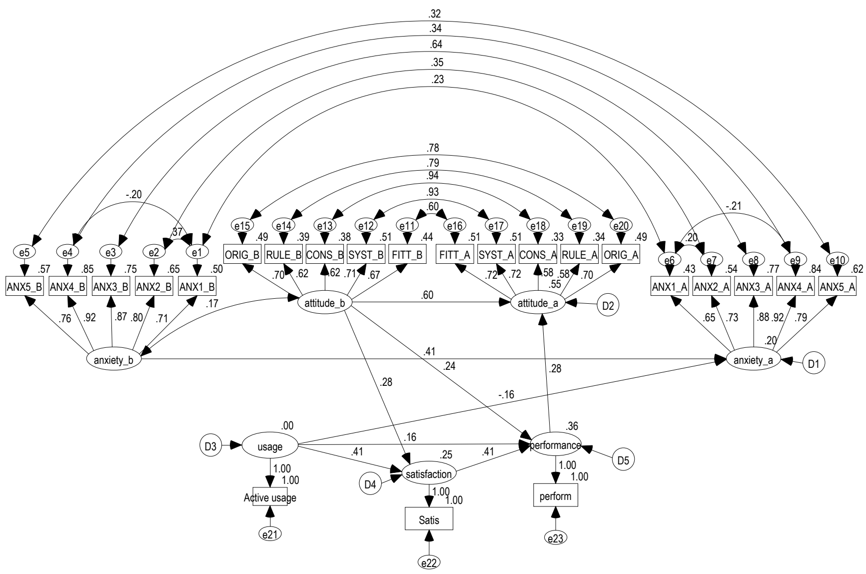

Figure 12.8 Attitudinal Dimension Change Model for Non-Initiators

Table 12.5 Path Coefficients for Attitudinal Dimension Change Models

Criterion	Predictor	Initiators			Non Initiators		
		UnStd	(SE)	Std	UnStd	(SE)	Std
IT Implementation							
IT Usage							
User Satisfaction				$R^2 = 0.08$			$R^2 = 0.25$
	Anxiety Before	0.10	(0.04)	0.13			
	Attitudes Before	0.20	(0.09)	0.12	0.49	(0.08)	0.28
	IT Usage	0.20	(0.04)	0.22	0.44	(0.04)	0.41
User Performance				$R^2 = 0.26$			$R^2 = 0.36$
	Attitudes Before	0.24	(0.08)	0.13	0.40	(0.07)	0.24
	IT Usage	0.10	(0.04)	0.10	0.16	(0.04)	0.16
	User Satisfaction	0.47	(0.04)	0.44	0.39	(0.04)	0.41
After Adoption							
Anxiety After				$R^2 = 0.26$			$R^2 = 0.20$
	Anxiety Before	0.44	(0.04)	0.47	0.39	(0.05)	0.41
	IT Usage	-0.21	(0.05)	-0.18	-0.17	(0.05)	-0.16
Attitudes After				$R^2 = 0.49$			$R^2 = 0.55$
	Attitudes Before	0.83	(0.08)	0.61	0.76	(0.07)	0.60
	User Performance	0.19	(0.03)	0.26	0.22	(0.03)	0.28

The variances explained (R^2) for endogenous variables were as follows: SATISFACTION (0.08, *0.25*), PERFORMANCE (0.26, *0.36*), ANXIETY_A (0.26, *0.20*), and ATTITUDE_A (0.49, *0.55*).

Combined Model

In order to obtain a complete picture, in which the components of the whole model interact with each other, these three sub models were combined into one model. Moreover, to simplify the model, a principal component score was extracted for each set of indicators. By combining the three sub models and allowing the exogenous variables to be correlated with each other, the final result was slightly different from the separated models as can be seen in Figure 12.9 and Figure 12.10 for initiators and non-initiators respectively. Using the same test criterion, the values of χ^2/DF ratio, GFI, AGFI, and RMSEA were 3.382, 0.910, 0.858, and 0.072 respectively for initiators and 2.605, 0.934, 0.890, 0.057 respectively for non-initiators indicate these models fitted the data well. Because all observed variables for each latent variable were combined to form a single principal component score, all latent variables were reflected by a single manifest variable in a unity mode. Consequently, the factor loading was unity for all of them.

It can be seen numerically in Table 12.6 or graphically in Figure 12.9 and Figure 12.10 that the level of IT usage (USAGE) was influenced by employees' beliefs consistency before implementation (BELIEF_B, 0.15, *0.10*). The more consistent their beliefs with the technology, the higher their level of IT usage. In addition, the observability before the implementation (OBSERV_B, *0.20*) was also found to affect the level of IT usage in a positive way for the non-initiators only. Compatibility (COMPA, 0.12) and anxiety (ANXIETY_B, -0.12) before implementation, on the other hand, were found to operate in the initiators model only. A higher level of compatibility seemed to increase the level of IT usage. This relationship was as expected. Anxiety, however, operated in the opposite way. If employees reported to feel more anxious about the technology, they tended to avoid using the technology. In other words, a higher level of anxiety decreased the level of IT usage.

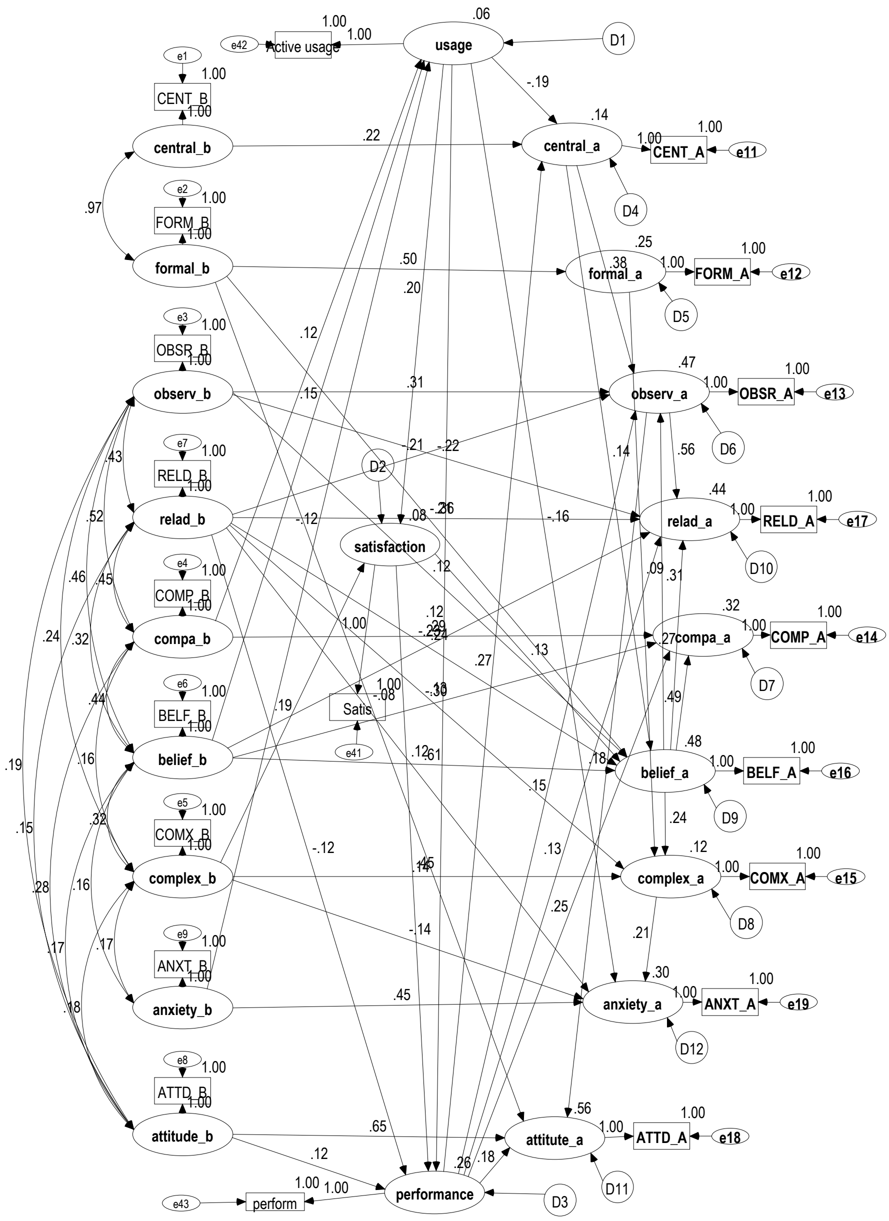

Figure 12.9 Combined Model for Initiators

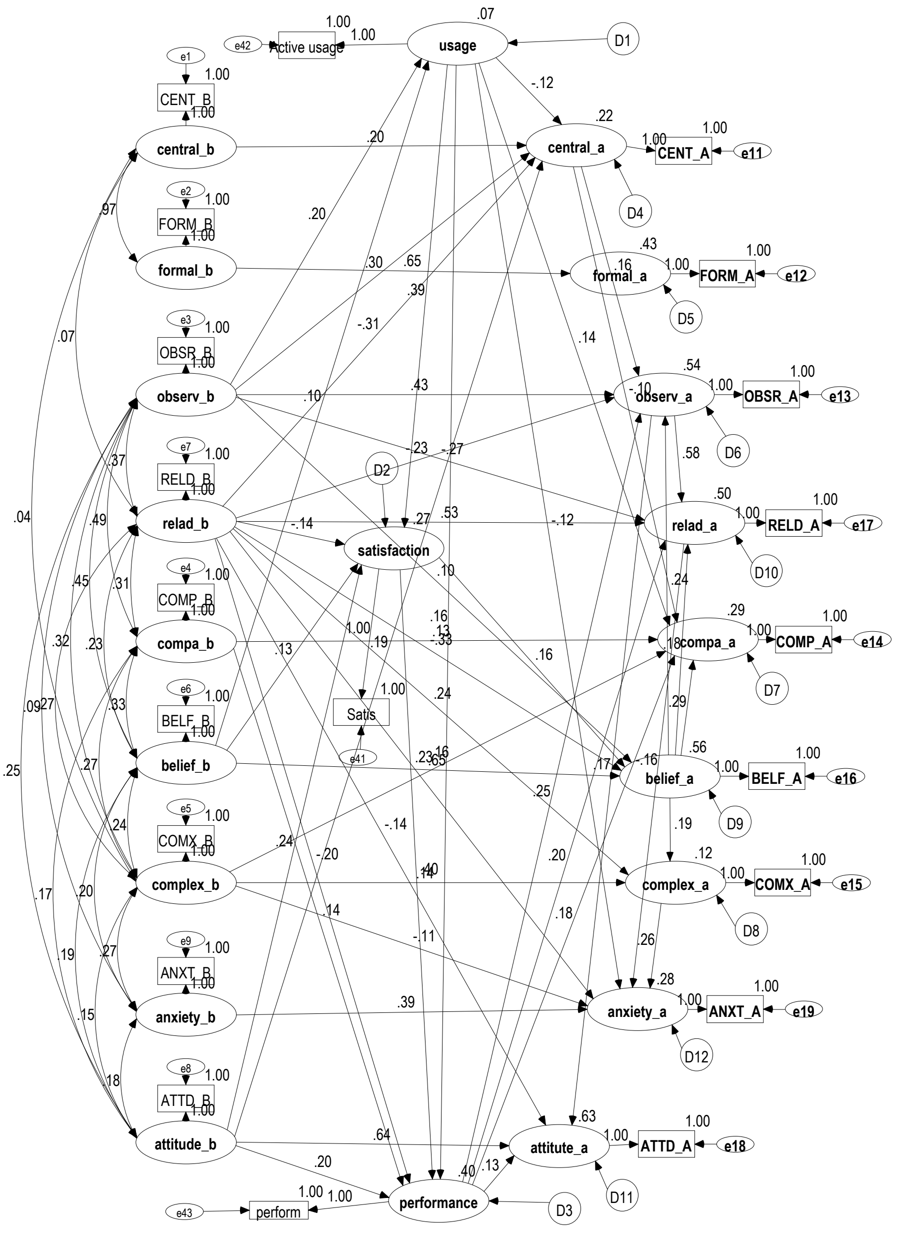

Figure 12.10 Combined Model for Non-Initiators

IT usage, in turn, affected the level of user satisfaction (USAGE, 0.20, *0.39*). The path coefficient for non-initiators was almost twice as strong as the path coefficient for initiators. This result seems to reflect the fact that the non-initiators were the actual users of the technology. Consequently, it is expected that the effect was stronger for the non-initiators. In addition, employees' belief (BELIEF_B, *0.13*), employees' perception of relative advantages of the technology (RELAD_B, *-0.14*), and employees' attitudes toward change (ATTITUDE_B, *0.24*) before implementation were operating only in the non-initiators model. The positive coefficients for BELIEF_B and ATTITUDE_B suggest that the more consistent employees' beliefs with the technology and the higher employees' attitudes toward change were associated with a higher level of satisfaction in using the technology.

The negative coefficient for relative advantage, however, indicates that a higher level of employees' perception of IT was associated with a lower level of user satisfaction. This relationship suggests that the higher employees' expectation on IT, the lower the level of satisfaction they experienced. Employees' perception of IT complexity before implementation was only found to be significant in the initiators model (COMPLEX_B, 0.19).

Furthermore, employees' perceptions of the impact of IT on their performance (PERFORMANCE) were influenced by user satisfaction (SATISFACTION, 0.45, *0.40*), IT usage (USAGE, 0.12, *0.16*), and attitudes before implementation (ATTITUDE_B, 0.12, 0.20) in positive ways. Relative advantage before implementation (RELAD_B, -0.12, *-0.20*) was working in the opposite direction. The higher employees' expectation of IT, it seems the less they appeared to feel the impact of IT on their performance. In addition, compatibility before implementation (COMPA_B, 0.14) was found to have a significant effect in the non-initiators model only. IT implementation processes along with structural, attitudinal, and IT attribute dimensions before implementation, in turn, seemed to affect structural, attitudinal, and IT attribute dimensions after implementation.

For centralisation after implementation, the levels of centralisation before adoption still played a major role. The path coefficients were 0.22 and 0.20 for initiators and non-initiators respectively. In addition, there were also influences from the mediating variables. There were negative effects of IT usage on centralisation after implementation with the path coefficients of –0.19 and –0.12 respectively for initiators and non-initiators. These relationships suggest that active usage of IT decreased the level of centralisation. User performance, however, operated in the opposite direction with the path coefficient of 0.27 for the initiators only. In addition, for non-initiators, observability (OBSERV_B, *0.30*), attitudes (ATTITUDE_B, *0.19*), and relative advantage (RELAD_B, -0.31) before implementation were also found to have significant effects on the level of centralisation after implementation.

The level of formalisation after implementation was only influenced by formalisation before implementation with the standardised path coefficients of 0.50 and 0.65 respectively for initiators and non-initiators. There was no influence from the mediating variables.

It can also be seen in the model that beliefs consistency after implementation (BELIEF_A) was influenced directly by beliefs consistency before implementation (BELIEF_B, 0.61, *0.65*), observability before implementation (OBSERV_B, 0.12, *0.10*), and relative advantage before implementation (RELAD_B, -0.24, *-0.33*). The level of formalisation before implementation (FORMAL_B, -0.21) and the level of centralisation after implementation (CENTRAL_A, 0.14) were only found to be significant in the initiators model. In addition, user satisfaction (SATISFAC, 0.13, *0.16*), as a mediating variable, was also found to have significant effects on beliefs consistency after implementation. Although there were effects from other variables, employees' belief consistency after adoption was highly correlated with their beliefs consistency before the implementation.

Table 12.6 Path Coefficients for Combined Models

Criterion	Predictor	Initiators			Non Initiators		
		UnStd	(SE)	Std	UnStd	(SE)	Std
IT Implementation							
IT Usage				$R^2 = 0.06$			$R^2 = 0.07$
	Belief Before	0.16	(0.05)	0.15	0.10	(0.05)	0.10
	Observability Before				0.21	(0.05)	0.20
	Compatibility Before	0.12	(0.05)	0.12			
	Anxiety Before	-0.13	(0.05)	-0.12			
User Satisfaction				$R^2 = 0.08$			$R^2 = 0.27$
	Belief Before				0.15	(0.05)	0.13
	Complexity Before	0.18	(0.04)	0.19			
	Rel. Adv Before				-0.14	(0.04)	-0.14
	Attitudes Before				0.25	(0.04)	0.24
	IT Usage	0.18	(0.04)	0.20	0.43	(0.04)	0.39
User Performance				$R^2 = 0.26$			$R^2 = 0.40$
	Compatibility Before				0.14	(0.04)	0.14
	Rel. Adv. Before	-0.13	(0.04)	-0.12	-0.19	(0.04)	-0.20
	Attitudes Before	0.13	(0.04)	0.12	0.20	(0.04)	0.20
	IT Usage	0.11	(0.04)	0.12	0.17	(0.04)	0.16
	User Satisfaction	0.48	(0.04)	0.45	0.38	(0.04)	0.40
After Adoption							
Centralisation After				$R^2 = 0.14$			$R^2 = 0.22$
	Centralisation Before	0.21	(0.04)	0.22	0.21	(0.04)	0.20
	Observability Before				0.31	(0.05)	0.30
	Attitudes Before				0.19	(0.04)	0.19
	Rel. Adv. Before				-0.30	(0.04)	-0.31
	IT Usage	-0.19	(0.04)	-0.19	-0.13	(0.04)	-0.12
	User Performance	0.27	(0.04)	0.27			
Formalisation After				$R^2 = 0.25$			$R^2 = 0.43$
	Formalisation Before	0.43	(0.03)	0.50	0.74	(0.04)	0.65
Belief After				$R^2 = 0.48$			$R^2 = 0.56$
	Belief Before	0.57	(0.04)	0.61	0.69	(0.04)	0.65
	Formalisation Before	-0.20	(0.03)	-0.21			
	Observability Before	0.11	(0.04)	0.12	0.11	(0.04)	0.10
	Rel. Adv. Before	-0.24	(0.04)	-0.24	-0.32	(0.03)	-0.33
	User Satisfaction	0.13	(0.04)	0.13	0.15	(0.03)	0.16
	Centralisation After	0.14	(0.03)	0.14			
Observability After				$R^2 = 0.48$			$R^2 = 0.54$
	Observability Before	0.28	(0.04)	0.31	0.44	(0.04)	0.43
	Rel. Adv. Before	-0.20	(0.04)	-0.21	-0.22	(0.04)	-0.23
	User Performance	0.14	(0.03)	0.15	0.25	(0.03)	0.25
	Centralisation After	0.35	(0.03)	0.38	0.16	(0.03)	0.16
	Belief After	0.30	(0.04)	0.31	0.24	(0.03)	0.24

Table 12.6 Path Coefficients for Combined Models (continued)

Criterion	Predictor	Initiators			Non Initiators		
		UnStd	(SE)	Std	UnStd	(SE)	Std
After Adoption							
Complexity After				$R^2 = 0.12$			$R^2 = 0.12$
	Complexity Before	0.15	(0.05)	0.14	0.13	(0.04)	0.14
	Rel. Adv. Before	0.14	(0.05)	0.13	0.22	(0.04)	0.24
	Formalisation After	0.11	(0.05)	0.09			
	Belief After	0.26	(0.05)	0.24	0.18	(0.04)	0.19
Compatibility After				$R^2 = 0.32$			$R^2 = 0.29$
	Compatibility Before	0.29	(0.04)	0.29	0.13	(0.04)	0.13
	Belief Before	-0.30	(0.05)	-0.30			
	Complexity Before				0.16	(0.04)	0.16
	IT Usage				0.14	(0.04)	0.14
	User Performance	0.25	(0.04)	0.25	0.18	(0.04)	0.18
	Centralisation After				-0.10	(0.04)	-0.10
	Belief After	0.52	(0.05)	0.49	0.29	(0.04)	0.29
Rel. Adv. After				$R^2 = 0.44$			$R^2 = 0.50$
	Rel. Adv. Before	0.34	(0.04)	0.36	0.52	(0.04)	0.53
	Belief Before	-0.21	(0.04)	-0.23			
	Observability Before	-0.20	(0.04)	-0.22	-0.30	(0.05)	-0.27
	Performance	0.12	(0.03)	0.13	0.21	(0.04)	0.20
	Belief After	0.27	(0.05)	0.28	0.19	(0.04)	0.18
	Observability After	0.55	(0.04)	0.56	0.61	(0.05)	0.58
Anxiety After				$R^2 = 0.30$			$R^2 = 0.28$
	Anxiety Before	0.47	(0.04)	0.45	0.37	(0.04)	0.39
	Complexity Before	-0.15	(0.04)	-0.14	-0.10	(0.04)	-0.11
	Rel. Adv. Before	0.13	(0.04)	0.12	0.20	(0.04)	0.23
	IT Usage	-0.16	(0.04)	-0.16	-0.12	(0.04)	-0.12
	Complexity After	0.21	(0.04)	0.21	0.26	(0.04)	0.26
	Rel. Adv. After				-0.14	(0.04)	-0.16
Attitudes After				$R^2 = 0.56$			$R^2 = 0.63$
	Attitudes Before	0.65	(0.03)	0.65	0.64	(0.03)	0.64
	Formalisation Before	-0.08	(0.03)	-0.08			
	Rel. Adv. Before				-0.14	(0.03)	-0.14
	User Performance	0.18	(0.03)	0.18	0.13	(0.03)	0.13
	Observability After	0.18	(0.03)	0.18	0.17	(0.03)	0.17

Observability after implementation (OBSERV_A) was influenced directly both by observability before implementation (OBSERV_B, 0.31, *0.43*) and relative advantages (RELAD_B, -0.21, *-0.23*). In addition, there were indirect effects through the level of user performance (PERFORMANCE, 0.15, *0.25*). The levels of centralisation (CENTRAL_A, 0.38, 0.16) and beliefs consistency (BELIEF_A, 0.31, 0.24) after implementation also influenced the extent of the need to be exposed before adopting the technology. The negative coefficient for relative advantages before implementation (RELAD_B) suggests that the greater the employees perceive the relative advantages of the technology to be, the less likely they reported the need to be exposed to the new technology before they adopt the technology.

For the level of complexity after implementation, complexity before adoption was found to be a significant predictor for both groups (COMPLEX_B, 0.14, *0.14*). Perceived relative advantages of the technology before implementation (RELAD_B, 0.13, *0.24*) and beliefs consistency after implementation (BELIEF_A, 0.24, *0.19*) were also found to have significant effects on perceived complexity of the technology after implementation. The level of formalisation, however, was only found to have a significant but small effect on perceived complexity of the technology after implementation for the initiators (FORMAL_A, 0.09). There were no indirect effects through mediating variables.

Compatibility after implementation (COMPA_A) was influenced directly by compatibility before implementation (COMPA_B, 0.29, 0.13) and beliefs consistency after implementation (BELIEF_A, 0.49, *0.29*) for both groups. The beliefs consistency before implementation (BELIEF_B, -0.30), however, was only found to have significant effect for the initiators. Complexity before implementation (COMPLEX_B, *0.16*) and the level of centralisation after implementation (CENTRAL_A, -*0.10*) were found to have significant effects for non-initiators only. The size of the effect of compatibility before on compatibility after implementation suggests that for the initiators medium sized changes have occurred, while for the non-initiators, it can be expected that medium to large sized changes have occurred. In addition, IT usage and user performance also acted as mediating variables. The higher the level of IT usage, the more the employees seemed to feel compatible with the technology. However, this relationship was only valid for initiators. User performance, on the other hand was operating in both models. The higher the level of IT impact on user performance, the greater the employees appeared to feel compatible with the new technology (PERFORMANCE, 0.25, *0.18*).

Employees' perception of the relative advantages of the technology after implementation (RELAD_A) was strongly influenced by their perception of the relative advantages of the technology before implementation (RELAD_B, 0.36, *0.53*). In addition, observability before implementation (OBSERV_B, -0.22, -*0.27*) also contributed significant effects negatively. These negative coefficients suggest that for both groups, the more they expressed the need to be exposed before the implementation, the lower their perceptions on the relative advantages of the technology after implementation. User performance, as a mediating variable, also had effects in both models (PERFORMANCE, 0.13, *0.20*). Furthermore, the effects of beliefs consistency after implementation (BELIEF_A) were 0.28, *0.18* for initiators and non-initiators respectively. Observability after implementation (OBSERV_A, 0.56, *0.58*) also had significant effects on employees' perception of the relative advantages of the technology after implementation for both groups. While beliefs consistency before implementation (BELIEF_B, -0.23) was found to contribute in the initiators model only.

For attitudinal dimensions after implementation, ANXIETY_A and ATTITUDE_A, both variables were mainly influenced by their associated measurements before implementation, ANXIETY_B (0.45, *0.39*) and ATTITUDE_B (0.65, *0.64*). These results suggest that only small changes have occurred for both constructs. In addition, complexity before implementation (COMPLEX_A, -0.14, -*0.11*), relative advantages before implementation (RELAD_B, 0.12, *0.23*), and complexity after implementation (COMPLEX_A, 0.21, *0.26*) were also found to have significant effects on the level of anxiety after implementation (ANXIETY_A) in both models. The effect of relative advantages after implementation (RELAD_A, -*0.16*), however, was only found to be significant for the non-initiators model. For attitudes after adoption (ATTITUDE_A), observability after implementation (OBSERV_A, 0.18, *0.17*) was also found to have significant effects in both models. The level of formalisation before implementation (FORMAL_B, -0.08) only had a small but significant effect in the initiators model. On the contrary, the variable relative advantages before implementation (RELAD_B, *-0.14*) only had a significant effect in the non-initiators model.

The influences of the mediating variables were relatively small to medium. Anxiety after implementation was influenced negatively by IT usage with the path coefficients of -0.16 and -0.12 for initiators and non-initiators respectively. These results suggest that the higher the level of IT usage, the less anxious the users reported to feel. Attitudes after implementation, on the other hand, were influenced by user performance with the path coefficients of 0.18 and 0.13 for initiators and non-initiators respectively.

Higher Level Model

In order to simplify the model even further, higher level models were built as can be seen in Figure 12.11 and Figure 12.12 for initiators and non-initiators respectively. Initially, an attempt to combine two structural dimensions (centralisation and formalisation), five IT perception dimensions (beliefs consistency, relative advantage, compatibility, complexity, and observability), and two attitudinal dimensions (attitudes toward change and computer related anxiety) into a higher level construct called structure, perception, and attitudes was made. However, the structural dimensions and attitudinal dimensions could not be combined due to their small correlations. Finally only the perception dimensions could be combined into the perception construct. The values of χ^2/DF ratio, GFI, AGFI, and RMSEA of 3.732, 0.895, 0.844 and 0.077 respectively for initiators and 4.554, 0.864, 0.807, and 0.085 for non-initiators indicate that these models fitted the data adequately.

It can be seen in Table 12.7 and in Figure 12.9 and Figure 12.10 that the level of IT usage (USAGE) was influenced by employees' perception of IT before implementation (PERCEPTION_B, 0.20, *0.28*). The higher their perceptions of the technology (in terms of beliefs consistency, observability, complexity, compatibility and relative advantages), the higher their level of IT usage. Anxiety before adoption (ANXIETY_B, -0.12), however, operated in the opposite way for the initiators only. If employees expressed higher level of anxiety about the technology, they tended to avoid using the technology. In other words, a higher level of anxiety decreased the level of IT usage.

IT usage, in turn, affected the level of user satisfaction (USAGE, 0.23, *0.40*). The path coefficient for non-initiators was almost twice as strong as the path coefficient for initiators. This result seems to reflect the fact that the non-initiators were the actual user of the technology. Consequently, it is expected that the effect was stronger for the non-initiators. In addition, employees' attitudes toward change (ATTITUDE_B, *0.25*) before implementation were operating only in the non-initiators model. The positive coefficient of ATTITUDE_B suggests that a higher level of employees' attitudes toward change was associated with a higher level of satisfaction in using the technology. The feeling of anxiety before implementation, on the other hand, was only found to be significant in the initiators model (ANXIETY_B, 0.13).

Furthermore, employees' perceptions of the impact of IT on their performance (PERFORMANCE) were influenced by user satisfaction (SATISFACTION, 0.45, *0.43*), IT usage (USAGE, 0.10, *0.15*), and attitudes before implementation

(ATTITUDE_B, 0.10, 0.20) in positive ways. IT implementation processes along with structural, attitudinal, and IT attribute dimensions before implementation, in turn, affected structural, attitudinal, and IT attribute dimensions after implementation. For centralisation after implementation, the levels of centralisation before adoption still played a major role. The path coefficients were 0.18 and 0.16 for initiators and non-initiators respectively. Furthermore, there were also influences from the mediating variables. There were negative effects of IT usage on centralisation after implementation with the path coefficients of –0.24 and –0.15 respectively for initiator and non-initiators.

These relationships suggest that active usage of IT decreased the level of centralisation. User performance, however, operated in the opposite direction with the path coefficients of 0.25 and 0.13 respectively for initiator and non-initiators. In addition, perception (PERCEPTION_B, 0.17, *0.12*) and attitudes (ATTITUDE_B, 0.18, *0.17*) before implementation were also found to have significant effect on the level of centralisation after implementation. Anxiety before implementation (ANXIETY_B, -0.10), however, was found to have a significant effect on the level of centralisation after implementation for the initiators only.

The level of formalisation after implementation was only influenced by formalisation before implementation with the standardised path coefficients of 0.50 and 0.65 respectively for initiators and non-initiators. There was no influence from the mediating variables.

It can also be seen in the model that employees' perceptions on IT after implementation (PERCEPTION_A) was influenced directly by their perceptions before implementation (PERCEPTION_B, 0.24, *0.51).* The level of formalisation before implementation (FORMAL_B, -0.22) and the level of centralisation after implementation (CENTRAL_A, 0.44) were only found to be significant in the initiators model. In addition, user satisfaction (SATISFAC, 0.13, *0.16*) and user performance (PERFORMANCE, 0.19, *0.27*), as mediating variables, were also found to have significant effects on perceptions after implementation in both the initiators and the non-initiators models. While IT usage (USAGE, -0.07) had a very small but significant negative effect on employees' perceptions after implementation in the initiators model only. Although there were effects from other variables, employees' perceptions on IT after adoption were highly influenced by their perceptions before the implementation.

For attitudinal dimensions after implementation, ANXIETY_A and ATTITUDE_A, both variables were mainly influenced by their associated measurements before implementation, ANXIETY_B (0.44, *0.39*) and ATTITUDE_B (0.66, *0.63*). These results suggest that only small changes have occurred for both constructs. These results were in concordance with the paired sample t-test results. In addition, perceptions before implementation (PERCEPTION_B, -0.14, *-0.11*) and attitudes before implementation (ATTITUDE_B, -0.12, *-0.19*) were also found to have significant effects on the level of anxiety after implementation (ANXIETY_A) in both models.

For attitudes after adoption (ATTITUDE_A), employees' perception after implementation (PERCEPTION_A, 0.26, *0.13*) was also found to have significant effects in both models. The level of centralisation before implementation (CENTRAL_B, -0.08) and employees' perceptions before implementation (PERCEPTION_B, -0.10) only had significant effects in the initiators model.

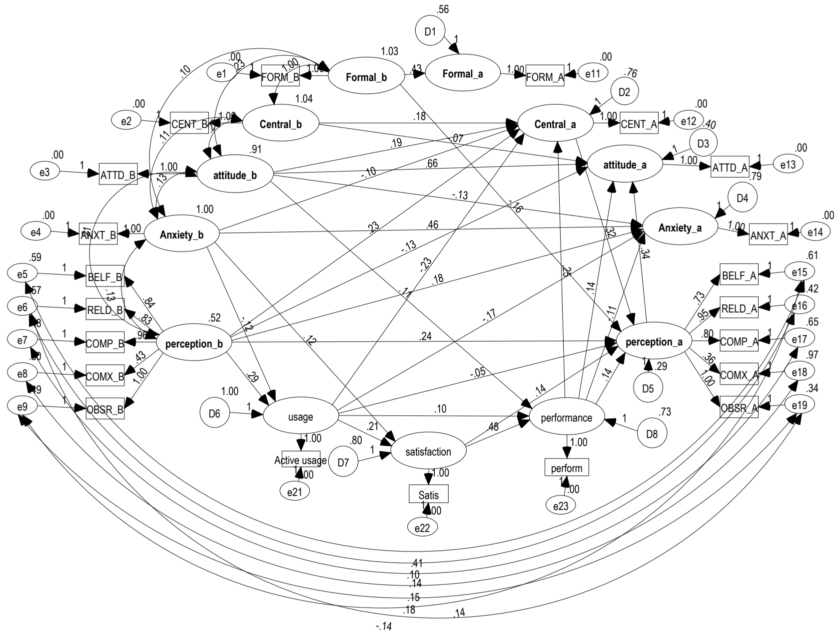

Figure 12.11 Higher Level Model for Initiators

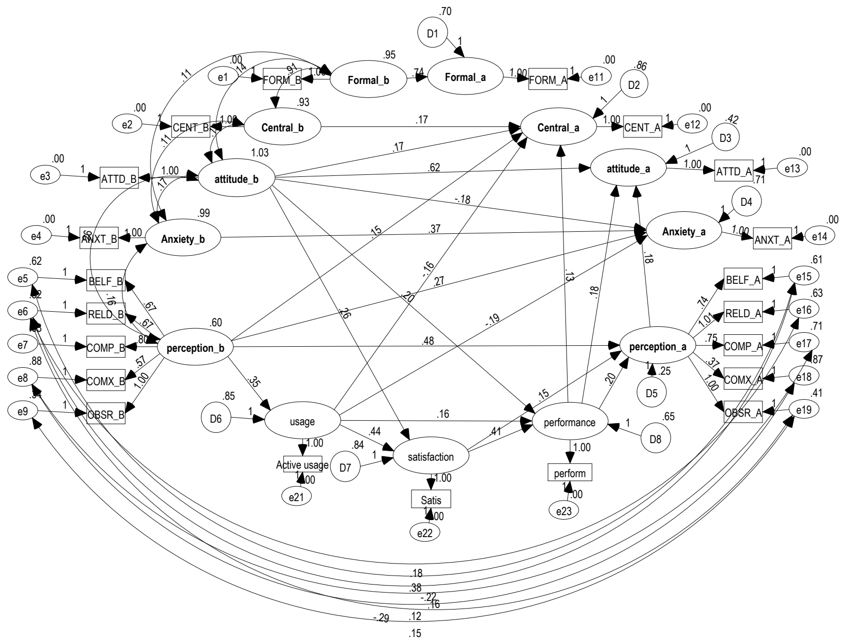

Figure 12.12 Higher Level Model for Non-Initiators

Table 12.7 Path Coefficients for Higher Level Models

Criterion	Predictor	Initiators			Non Initiators		
		UnStd	(SE)	Std	UnStd	(SE)	Std
IT Implementation							
IT Usage				$R^2 = 0.05$			$R^2 = 0.08$
	Perception Before	0.29	(0.07)	0.20	0.35	(0.06)	0.28
	Anxiety Before	-0.12	(0.05)	-0.12			
User Satisfaction				$R^2 = 0.07$			$R^2 = 0.25$
	Anxiety Before	0.12	(0.04)	0.13			
	Attitudes Before				0.26	(0.04)	0.25
	IT Usage	0.21	(0.04)	0.23	0.44	(0.04)	0.40
User Performance				$R^2 = 0.25$			$R^2 = 0.36$
	Attitudes Before	0.11	(0.04)	0.10	0.20	(0.04)	0.20
	IT Usage	0.10	(0.04)	0.10	0.16	(0.04)	0.15
	User Satisfaction	0.48	(0.04)	0.45	0.41	(0.04)	0.43
After Adoption							
Centralisation After				$R^2 = 0.21$			$R^2 = 0.13$
	Centralisation Before	0.18	(0.04)	0.18	0.17	(0.04)	0.16
	Perception Before	0.23	(0.07)	0.17	0.15	(0.07)	0.12
	Anxiety Before	-0.10	(0.04)	-0.10			
	Attitudes Before	0.19	(0.05)	0.18	0.17	(0.05)	0.17
	IT Usage	-0.23	(0.04)	-0.24	-0.16	(0.05)	-0.15
	User Performance	0.25	(0.04)	0.25	0.13	(0.05)	0.13
Formalisation After				$R^2 = 0.25$			$R^2 = 0.43$
	Formalisation Before	0.43	(0.03)	0.50	0.74	(0.04)	0.65
Perception After				$R^2 = 0.45$			$R^2 = 0.54$
	Perception Before	0.24	(0.05)	0.24	0.48	(0.05)	0.51
	Formalisation Before	-0.16	(0.03)	-0.22			
	IT Usage	-0.05	(0.03)	-0.07			
	User Satisfaction	0.14	(0.04)	0.17	0.15	(0.03)	0.22
	User Performance	0.14	(0.04)	0.19	0.20	(0.03)	0.27
	Centralisation After	0.32	(0.03)	0.44			
Anxiety After				$R^2 = 0.27$			$R^2 = 0.23$
	Anxiety Before	0.46	(0.04)	0.44	0.37	(0.04)	0.39
	Perception Before	0.18	(0.07)	0.13	0.27	(0.07)	0.22
	Attitudes Before	-0.13	(0.05)	-0.12	-0.18	(0.04)	-0.19
	IT Usage	-0.17	(0.04)	-0.16	-0.19	(0.04)	-0.19
	User Performance	-0.11	(0.04)	-0.11			
Attitudes After				$R^2 = 0.57$			$R^2 = 0.59$
	Attitudes Before	0.66	(0.03)	0.66	0.62	(0.03)	0.63
	Centralisation Before	-0.07	(0.03)	-0.08			
	Perception Before	-0.13	(0.05)	-0.10			
	User Performance	0.15	(0.03)	0.15	0.18	(0.04)	0.18
	Perception After	0.35	(0.05)	0.26	0.18	(0.05)	0.13

The influences of the mediating variables were relatively small to medium. Anxiety after implementation was influenced negatively by IT usage with the path coefficients of -0.16 and -0.19 for initiators and non-initiators respectively. These results suggest that the higher the level of IT usage, the less anxious the users became. A higher level of user performance (PEFORMANCE, -0.11) also had a similar effect but for the initiators only. Attitudes after implementation, on the other hand, were influenced by user performance with the path coefficients of 0.15 and 0.18 for initiators and non-initiators respectively.

The variances explained (R^2) for the endogenous variables were as follows: USAGE (0.05, 0.08), SATISFACTION (0.07, 0.25), PERFORMANCE (0.25, 0.36), CENTRAL_A (0.21, 0.13), FORMAL_A (0.25, 0.43), PERCEPTION_A (0.45, 0.54), ANXIETY_A (0.27, 0.23) and ATTITUDE_A (0.57, 0.59).

In order to compare the goodness of fit indices for all models, a summary table is produced as can be seen in Table 12.8.

Table 12.8 Model Comparison

No	Model	χ^2/DF	GFI	AGFI	RMSEA
	Structural Dimensions Change Model				
1	Initiators		0.634	1.000	
2	Non-Initiators		0.619	1.000	
	IT Perception Dimensions Change Model				
3	Initiators	2.824	0.824	0.790	0.063
4	Non-Initiators	3.625	0.790	0.756	0.073
	Attitudinal Dimensions Change Model				
5	Initiators	2.613	0.910	0.880	0.059
6	Non-Initiators	0.763	0.907	0.877	0.060
	Combined Model				
7	Initiators	3.382	0.910	0.858	0.072
8	Non-Initiators	2.605	0.934	0.890	0.057
	Higher Level Model				
9	Initiators	3.732	0.895	0.844	0.077
10	Non-Initiators	4.554	0.860	0.807	0.085

Summary

The results from these analyses provide three sub models, a combined model, a higher level model for predicting the change in structural dimensions, IT perception dimensions, and attitudinal perception both directly and indirectly though usage, satisfaction, and performance as mediating variables for each group, initiators' group and non-initiators' group. The three sub models, structural dimensions, IT perceptions dimensions, and attitudinal dimensions models, and the combined model fitted the data very well. Although the higher level model gave simpler explanations and fitted the data reasonably well, the combined model fitted the data slightly better.

The combined models show that formalisation, belief, and attitudes before implementation had large path coefficients on the corresponding after implementation latent variables, indicating that these paired constructs were highly correlated. It can be assumed that the after implementation constructs were highly influenced by the corresponding before implementation constructs. Therefore it can be inferred that a small change occurred between those paired constructs. The path coefficients of centralisation, observability, compatibility, relative advantage and anxiety indicate that they have experienced changes of medium size. The path coefficients of complexity were small. These indicate that large changes occurred. Although the values were slightly different, all models provided largely consistent results. Most of the relationships recorded were due to the direct effects of the initial measures while the indirect effects through usage, satisfaction, and performance showed only small influences.

The higher-level models show that centralisation and formalisation made no contribution to the IT implementation processes for both groups. These phenomena were partly due to the fact that most of the governmental agencies in Bali were experiencing a highly similar level of centralisation and formalisation. Employees' perception of IT, however, was found to have a significant effect on the level of IT usage for both groups. It was found that responding employees with positive attitudes toward IT reported to have higher levels of active usage. In addition, employees' perceptions of IT also affected the level of centralisation and the attitudinal dimensions after IT implementation processes for both groups. Moreover, IT usage had a positive effect on user satisfaction and user performance. The more the responding employees used the technology, the more they reported to feel satisfied with the technology and the greater they perceived the impact of IT on their performance. User satisfaction and user performance, in turn, had positive effects on perception after the implementation process. It is interesting to note that IT usage had a negative effect on the level of centralisation after the implementation process for both groups. This result indicates that the use of IT reduced the level of centralisation in the responding organisations. Although attitudes toward change had no effect on IT usage, it is shown that attitudes had a positive relationship with user satisfaction and user performance. These relationships indicate that responding employees with more positive attitudes toward IT were more satisfied with the technology and they also perceived greater impact of IT on their performance. Furthermore, anxiety had negative effects on IT usage for both groups. The more the responding employees fell anxious, the less they used the technology. However, once the users used the technology and fell satisfied with the technology, they became less anxious.

13

Testing of Propositions and Block Models

Testing of Propositions

In Chapter Five, following the discussion of the theoretical background to the study, propositions were advanced which guided the design and execution of the investigation. In subsequent analyses these general propositions were examined against the evidence obtained in the inquiry. Even though errors of measurement may have sometimes restricted the conclusions that could validly be drawn, it is appropriate to list these propositions and discuss briefly the findings from the analyses undertaken to test these propositions. The results of multilevel path analyses, HLM analyses, and change analyses have been reported in Chapter Ten, Eleven and Twelve. However, for the ease of reference some of these results are repeated in this chapter when testing these propositions.

In order to summarise the MPLUS results, the direct and indirect effects for initiators at the individual level are presented in Table 13.1. In a similar way, Tables 13.2, 13.3, and 13.4 present the direct and indirect effects for non-initiators at the individual level, the direct and indirect effects for initiators at the organisational level, and the direct and indirect effects for non-initiators at the organisational level respectively. The indirect effects were calculated by multiplying all path coefficients for each indirect path. As pointed out by Cohen (1992), for standardised regression coefficients to be regarded as small, medium, or large effects, the cut-off values for the coefficients are 0.10, 0.30, and 0.50 respectively. Therefore, only those paths that have indirect effects equal to or greater than 0.10 are presented in these tables. Those paths that have indirect effects less than 0.10 are regarded to be trivial and are not included in tables.

All paths that were found to be significant in MPLUS analyses are modelled in Figures 13.1 and 13.2 for initiators and non-initiators at the individual level and Figures 13.3 and 13.4 for initiators and non-initiators at the organisational level. Because of the complexity of the models, different colours are used to distinguish relationships that related to different propositions. At the individual level, red paths in Figure 13.1 and 13.2

are related to Proposition 1, and their corresponding path coefficients are presented in Tables 13.1 and 13.2. Blue paths in these two figures are related to Proposition 2, and their corresponding path coefficients are presented in Tables 13.1 and 13.2. In similar ways, green paths, orange paths, and violet paths are related to Propositions 3, 4, and 5 respectively. At the organisational level, different colours are also used to distinguish the paths in Figures 13.3 and 13.4. Red paths, pink paths, turquoise paths, blue paths, green paths, orange paths, and violet paths are associated with Propositions 6, 7, 8, 9, 10, 11, 12 respectively. The associated path coefficients for these paths are presented in Tables 13.3 and 13.4.

Effects of Individual Level Factors on IT Adoption Processes

Proposition 1

Employees' characteristics influence their perceptions; and, in turn, employees' characteristics and perceptions influence their attitudes toward IT of both initiators and non-initiators.

There were mixed results in the previous studies regarding the effects of individual characteristics on innovative behaviour. Some studies have argued that gender did not seem to be an important factor of innovative behaviour among people in organisations (Anderson, 1996; Baldridge & Burnham, 1975). In contrast, some other studies have found that gender was a significant factor in explaining differences in computer related anxiety and attitudes toward computers (Dambrit, Watkins-Malek, Marc Silling, Marshall, & Garver, 1985; Girloy & Desai, 1986). In the context of Bali in the present study, gender emerged as a key individual characteristic that had either direct or indirect effects on employee's perceptions of information technology for both initiators and non-initiators.

As has been explained in Chapter Nine, the scores of beliefs consistency of female respondents in both groups tended to be lower. These results suggest that male respondents had a higher level of beliefs consistency in the need for information technology and its utility. It seems that male respondents were more convinced that the information technology would have possible drawbacks and negative consequences that might result from reliance on information technology. They appeared to see potential cost saving in adopting such technology in terms of reducing the number of staff members required and reducing the operational costs. However, they also seemed to have greater perceptions of the technology as a possible threat to the process of socialisation. They perceived IT as a tool that might isolate people and control their lives. These were true for both initiators and non-initiators.

In addition, the interview results also reveal that most of the time the decisions to adopt the technology were centrally made. Also some of the technologies that were available at the district level agencies were provided and acquired by their upper level management[22]. Consequently, the observability of the technology or the chance to be exposed to the technology before adoption and the effect of this level of exposure on adoption and implementation was low.

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[22] From the interviews conducted between August and November 1999, as part of the field study.

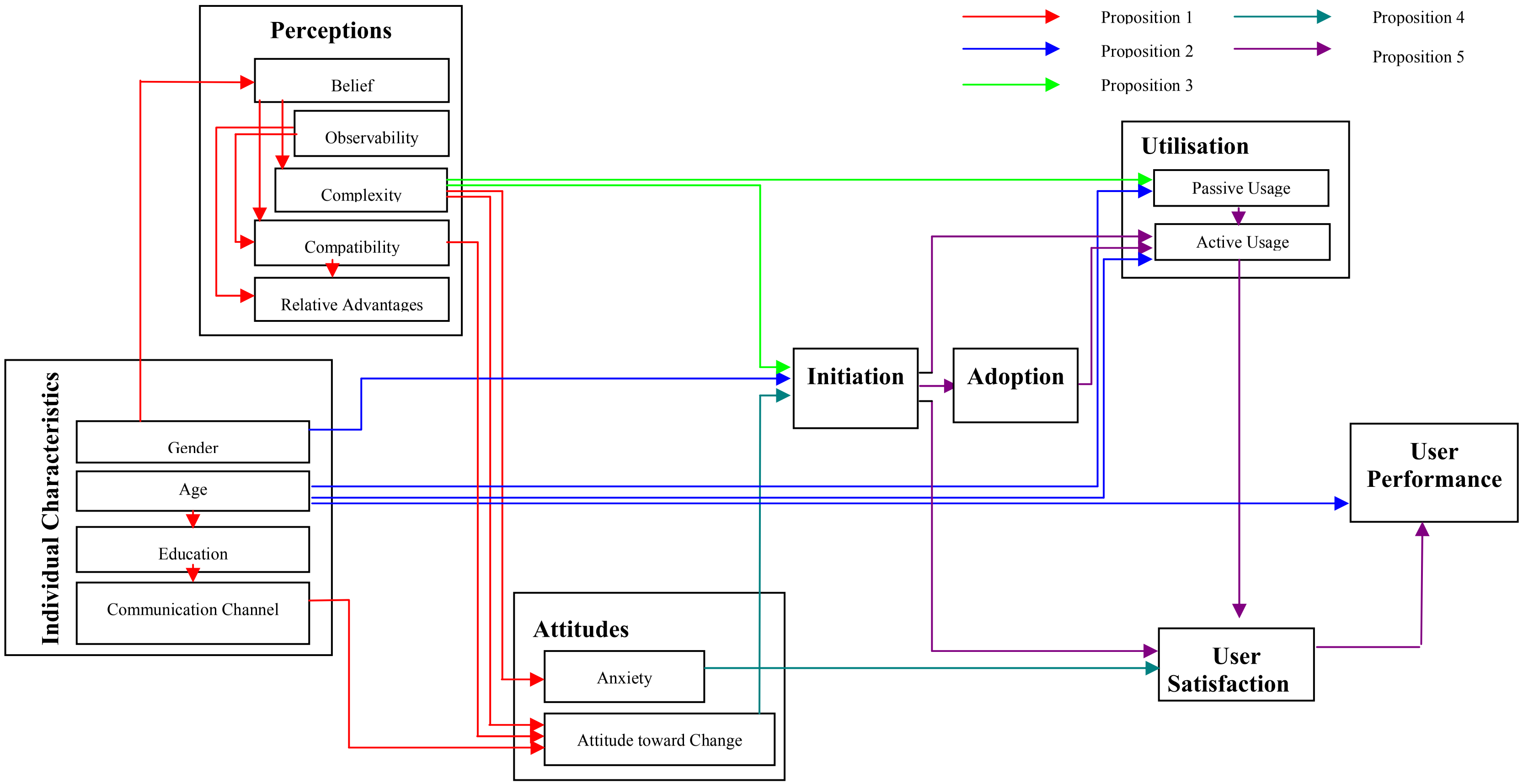

Figure 13.1 Individual Level Model for Initiators

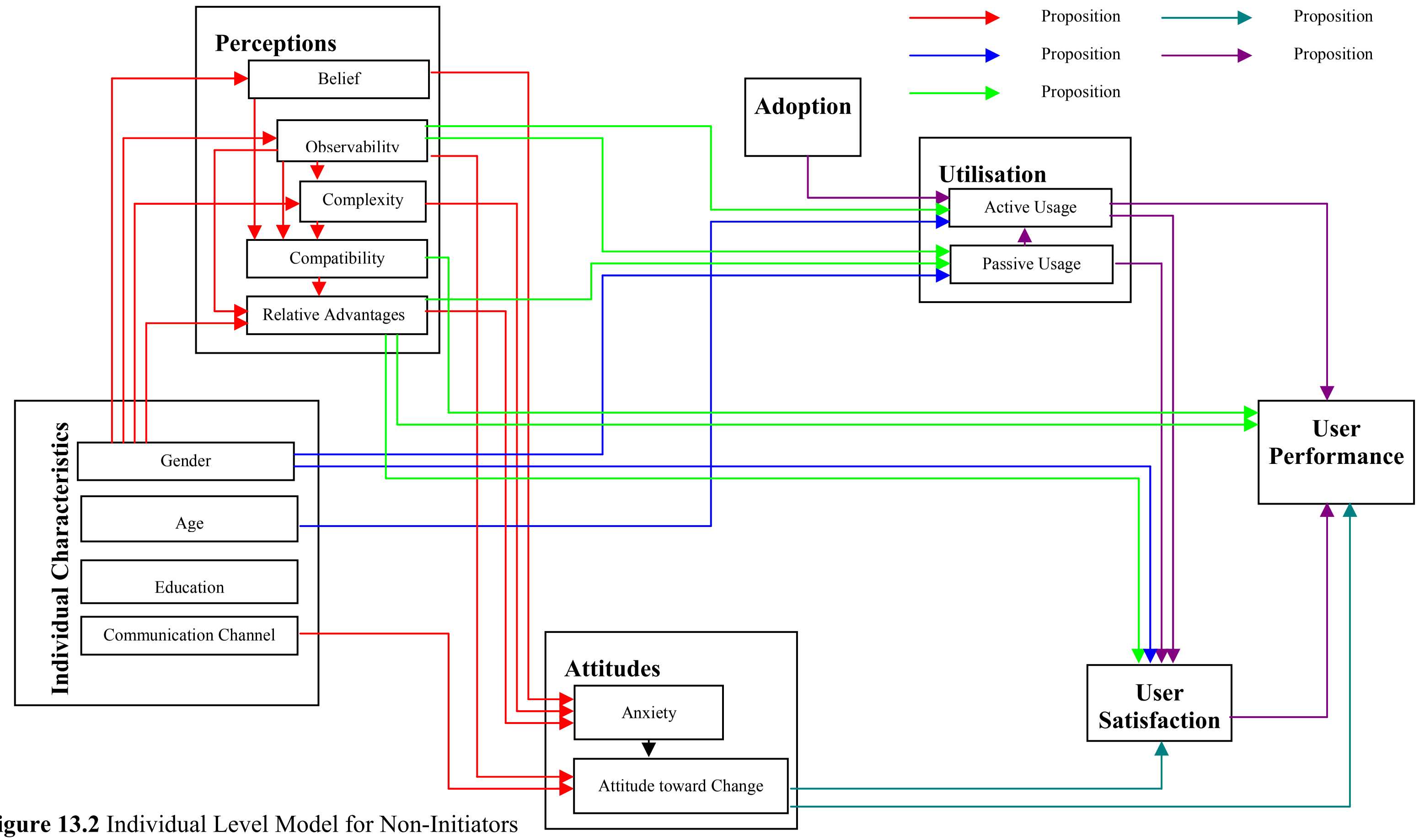

Figure 13.2 Individual Level Model for Non-Initiators

Table 13.1 Individual Direct and Indirect Effects for Initiators

Effects on / Initiators	Education	Communication	Belief	Observability	Complexity	Compatibility	Relative Advantage	Anxiety	Attitude	Initiation	Adoption	Passive Use	Active Use	User Satisfaction	User Performance
Direct Effects of															
Gender			-0.14							-0.20					-0.12
Age	0.13											0.20	-0.27		-0.11
Education		0.12													
Communication									0.17						
Belief				0.67	0.53	0.29									
Observability						0.37	0.30								
Complexity								0.34	0.19	0.40		0.20			
Compatibility							0.40		0.30						
Relative Advantage															
Anxiety														0.14	
Attitude										0.22					
Initiation											0.19			0.36	
Adoption													0.16		
Passive Use													0.14		
Active Use														0.36	
User Satisfaction															0.61

continued

Table 13.1 Individual Direct and Indirect Effects for Initiators (continued)

Initiators / Effects on	Education	Communication	Belief	Observability	Complexity	Compatibility	Relative Advantage	Anxiety	Attitude	Initiation	Adoption	Passive Use	Active Use	User Satisfaction	User Performance
Indirect Effects of															
Gender															
Age															
Education															
Communication Channel															
Belief						0.25	0.42	0.18	0.26	0.21		0.11		0.11	0.07
Observability							0.15		0.11						
Complexity														0.22	0.14
Compatibility															
Relative Advantage															
Anxiety															
Attitude															
Initiation															0.23
Adoption															
Passive Use															
Active Use															0.22
User Satisfaction															
Var. Explained (%)	2	2	2	45	29	40	38	11	18	31	4	5	11	30	41
Residual Path	0.99	0.99	0.99	0.74	0.84	0.77	0.79	0.94	0.91	0.83	0.98	0.97	0.94	0.84	0.77

Table 13.2 Individual Direct and Indirect Effects for Non-Initiators

Non-Initiators (Effect On)	Education	Communication	Belief	Observability	Complexity	Compatibility	Relative Advantage	Anxiety	Attitude	Initiation	Adoption	Passive Use	Active Use	User Satisfaction	User Performance
Direct Effects															
Gender			-0.14	-0.10	0.13		0.20					0.16		-0.14	
Age													-0.31		
Education															
Communication Channel									0.11						
Belief				0.58		0.23		0.21							
Observability					0.51	0.39	0.35		0.34			0.26	0.11		
Complexity						0.12		0.29							
Compatibility							0.29								0.17
Relative Advantage								-0.16				-0.16		-0.09	-0.16
Anxiety									0.13						
Attitude														0.19	0.15
Initiation															
Adoption													0.18		
Passive Use													0.43	0.17	
Active Use														0.34	0.22
User Satisfaction															0.49

Table 13.2 Individual Direct and Indirect Effects for Non-Initiators (continued)

Non-Initiators / Effect On	Education	Communica-tion	Belief	Observability	Complexity	Compatibility	Relative Advantage	Anxiety	Attitude	Initiation	Adoption	Passive Use	Active Use	User Satisfaction	User Performance
Indirect Effects															
Gender															-0.11
Age														-0.11	-0.20
Education															
Communication Channel															
Belief					0.30	0.26	0.35		0.23			0.10	0.10		
Observability							0.13							0.12	0.11
Complexity															
Compatibility															
Relative Advantage															
Anxiety															
Attitude															
Initiation															
Adoption															
Passive Use														0.15	0.15
Active Use															0.17
User Satisfaction															
Var. Explained (%)			2	37	25	39	33	18	17			6	34	26	49
Residual Path			0.99	0.79	0.87	0.78	0.82	0.91	0.91			0.97	0.81	0.86	0.71

However, there was a pattern found in the levels of exposure to the technology. Male initiators seemed to have experienced the highest level of exposure followed by the male respondents from the non-initiators group, female respondents from the initiators group, and female respondents from the non-initiators group. These results indicate that in both groups male employees seemed to have higher level of exposure. This indication may suggest that in the case of Bali there was either gender bias in selecting people for exposure to the technology or greater male interest in the area. This result could also be influenced by the gender imbalance, especially, in the management positions.

In terms of perceived relative advantages of the technology, both initiators and non-initiators were moderate in their perception on most potential benefits that could be achieved through utilisation of the technology[23]. These expected benefits ranged from informational benefits in terms of information availability, timeliness, accessibility, and speed to obtain the information, to productivity benefits and effectiveness. These results are consistent with the findings from interview sessions. Most of the interviewees (almost 90%) agreed with the potential benefits of IT[24].

In addition, the survey results also reveal that there was a pattern for both groups where female respondents expressed higher expectations.

Results of the inquiry into perceived complexity of information technology reveal that female non-initiators perceived the technology to be more difficult, followed by female initiators, male initiators, and finally male non-initiators who perceived the technology to be less difficult.

In addition to gender differences in respondents' perceptions regarding the technology, there were also associations among these perceptual variables. For initiators, on the one hand as presented in Table 13.1, responding employees' existing beliefs regarding the technology were found to have a positive correlation with the level of their exposure to the technology. The more they have been exposed to the technology the more they seemed to realise the potential of the technology as well as its drawbacks and negative consequences. Employees' perception of the potential benefits and the possible drawbacks were positively associated with their perception of the complexity of the technology and the compatibility of the technology with their work style.

For the non-initiators, on the other hand as presented in Table 13.2, their existing beliefs regarding the technology were found to have a positive association with their level of exposure and the perceived compatibility of the technology as well as positive indirect effects on their perceptions of the relative advantages of the technology.

It has been pointed out in Chapter Nine that computer related anxiety existed among both the initiators and the non-initiators. Even though gender effects on the level of anxiety among respondents were mixed and insignificant, it is worthy of mention that for the initiators, higher levels of anxiety were expressed by female respondents, while for the initiators, the opposite was true.

Rosen and Maguire (1990), in their meta-analysis of computer related anxiety research, reported that 25 statistical studies had found that females were more computer-phobic than males. However, their overall conclusion based on an analysis

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[23] For further details see Chapter Nine

[24] From the interviews conducted between August and November 1999, as part of the fields study.

of a further 13 non-quantitative studies was that the differences were slight (Rosen & Maguire, 1990). The results of this study do not support the contention that females in general exhibit higher levels of computer anxiety than males. This result is in keeping with the research by Igbaria and Parasuraman (1989) and Anderson (1996).

Furthermore, for the initiators, the levels of anxiety of the respondents were influenced by how they perceive the complexity of the technology. In general, the more complex the responding employees perceived the technology, the more they reported that they felt anxious about the technology. This association was also true for the non-initiators. In addition, for the non-initiators, respondents' levels of anxiety were also influenced by their beliefs consistency regarding the technology and their perception of the relative advantage of the technology. The higher their beliefs consistency regarding the technology, which was partly expressed in terms of the drawbacks and job security issues, the more anxious they became. Perceived relative advantage, on the contrary, had a negative effect on the level of anxiety. Those initiators who expressed higher expectations of the technology, might have been more eager to use the technology, which in turn, would decrease their anxiety regarding the use of the technology.

In terms of attitude toward change, respondents in the initiators group, overall, expressed more positive attitudes toward change. This result seems to agree with Baldridge and Burnham (1975), who said that administrative positions and roles did appear to have an impact on the involvement of an individual in the innovative process.

In this study it was found that attitude toward change was positively associated with communication channels, complexity and compatibility for initiators, and with communication channels, observability, and anxiety for non-initiators. The effect of communication channels was as expected. The more the respondents reported that they communicated about IT, either through formal contacts, informal contacts, or written materials, the more likely they had positive attitudes toward IT. This result supports the contention that communication channels have positive roles in creating knowledge of innovation and in forming and changing attitudes toward the new idea, influencing the decision to adopt or reject it (Huff, 1991).

The effects of compatibility and observability were also as expected. These results suggest that for the initiators, the more compatible they perceived the technology to be, the more likely they were to have positive attitudes toward the technology. Meanwhile, for the non-initiators, the more they have been exposed to the technology, the more likely they were to have positive attitudes toward IT. The effects of complexity for initiators and anxiety for non-initiators were rather more surprising. It was expected that, the more complex they perceived the new technology, the less they wanted to use it. The same logical approach also applied for the effects of anxiety that was the higher their level of anxiety, the less likely they wanted to adopt the technology (Igbaria & Parasuraman, 1989). However, this study revealed the opposite results. These findings indicate that non-initiators perceived the technology as a challenge rather than a deterrent. In addition, there was no effect of respondents' education and age to attitudes about computers as indicated by some other studies (Carey, 1988; Igbaria & Parasuraman, 1989).

Therefore, this first proposition was partly supported. Out of four dimensions used to capture individual characteristics, namely gender, age, educational level, and communication channels, in general, only gender was found to have significant effects on employees' perceptions of IT. Moreover, it was expected that individual characteristics and perceptions of IT influenced employees' attitude toward IT in terms of computer related anxiety and attitudes toward change. In this study, communication channel along with some perceptual dimensions, particularly employees' perceptions of IT complexity, had direct and indirect effects on employees' attitudes toward IT.

Proposition 2

Individual characteristics are associated with pressures at the initiation phase, levels of IT adoption, utilisation, user satisfaction, and user performance.

Individual characteristics play an important role in IT adoption and implementation in an organisation. The major dimensions considered are age, education, and communication channels (Anderson, 1996; Budic & Godschalk, 1996; Leonard-Barton, 1987; Peterson & Peterson, 1988; Rogers, 1983; Yoon, Guimaraes, & O'Neal, 1995). Previous studies of the diffusion of innovations have found early adopters of innovations are younger individuals with a higher level of education and with a more intensive communication pattern (Rogers, 1983; Rogers & Shoemaker, 1971). In contrast, Baldrige and Burnham (1975) reported that individual characteristics, such as sex, age, and personal attitudes did not seem to be important determinants of innovative behaviour among people in complex organisations.

Even though gender has not been identified to be a significant factor in most previous studies of IT adoption in the Western context (Anderson, 1996; Budic & Godschalk, 1996; Leonard-Barton, 1987; Peterson & Peterson, 1988; Rogers, 1983), it was found in this study that in the context of Bali, there were some significant differences between the two sexes with respect to the variables being examined. These results accord with the findings of Palvia and Palvia (1999), who examined the IT satisfaction of small-business users.

For initiators, on the one hand, female respondents reported less pressure to adopt the technology. They perceived less pressure to adopt the technology to increase organisational performance. In addition, they also perceived less impact of IT on their performance. For non-initiators, on the other hand, female employees tended to have higher levels of passive usage and reported feeling less satisfied with the technology.

With respect to age of employees, it was found that younger employees in both initiators and non-initiators groups tended to have higher levels of active usage. For the non-initiators, younger employees also had a lower level of passive usage. These findings support the previous studies regarding the effect of age on innovation adoption. Studies of the diffusion of innovations have found that early initiators of innovation are younger individuals (Rogers, 1983). For both groups, it was also found in this study that younger employees were more satisfied with the technology and perceived higher impact of IT on their performance. However, the effects of education level and communication channels on the IT adoption processes were not found to be significant in this study. These results are consistent with the findings from the interview sessions. More than half of the interviewees argued that younger employees are more responsive to the technology. However, some of them maintained that young employees sometimes get bored easily. Furthermore they said that it is not the age that matters but the perspective that they hold. Even though some of them agreed that a better education had positive effects, the more important factors could be their ability and a desire to learn[25].

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[25] From interviews conducted between August and November 1999, as part of the field study.

Therefore, this second proposition was also partly supported. For both initiators and non-initiators groups, only gender and age were found to have significant effects on IT adoption and implementation processes. The effects of education level and communication channels on the IT adoption and implementation processes were not found to be significant in this study.

Proposition 3

Employees' perceptions of IT attributes are associated with pressures at the initiation phase, levels of IT adoption, utilisation, user satisfaction, and user performance.

The innovation diffusion literature provides a set of innovation characteristics that may affect an individual's opinion of the innovation prior to adoption and may affect the rate at which innovations are adopted. By using Rogers' (1983) summary of the most important attributes of innovations as a starting point, five constructs were used in this study, namely: (a) relative advantage, (b) compatibility with existing operational practices, (c) compatibility with existing beliefs and values, (d) complexity, and (e) observability.

Relative advantage reflects the degree to which an innovation is perceived to be better than the idea it supersedes or in comparison with other competing alternatives (Rogers & Shoemaker, 1971). Positive associations have usually been expected or observed (Al-Gahtani & King, 1999; Budic & Godschalk, 1996; Ettlie & Vellenga, 1979; Iacovou, Benbasat, & Dexter, 1995; Panizzolo, 1998; Rogers, 1983; Tornatzky & Klein, 1982). However in this study, it was found that in the context of Bali's local government the opposite associations were found for non-initiators, except for the association between relative advantage and passive usage. Employees in the non-initiators group who perceived lower relative advantages of the technology tended to have a higher level of passive usage. These results suggest that the less they perceived the relative advantages of the technology the more they tended to be passive users. This relationship was expected. However, the expected positive relationship between perceived relative advantages of the technology and the level of active usage was not supported. There was no direct effect of perceived relative advantage on the active usage level for non-initiators. In addition, a higher level of perceived relative advantage of the technology was also associated with a lower level of satisfaction and a lower level of perceived impact of IT on their performance. These results suggest that a higher level of employees' expectation of the technology was associated with a lower level of employees' satisfaction regarding the technology and a lower level of perceived IT impact on user performance. These findings may also be interpreted to mean that the technology was not fully delivering its promised benefits in government agencies in Bali. There was no significant effect of perceived relative advantage on IT adoption processes for initiators.

Compatibility refers to the degree to which an innovation is perceived as being consistent with past experience and the need of the receivers (Rogers & Shoemaker, 1971). A greater degree of compatibility has generally been observed to generate a more favourable adoption attitude and behaviour (Al-Gahtani & King, 1999; Ettlie & Vellenga, 1979; Moore & Benbasat, 1991). In this study, however, it was only partly supported. There was no significant role of perceived compatibility of the technology on IT adoption processes for the initiators. It may be conjectured that some contribution to the absence of such effects may be made by Balinese conformism (*manut*), hierarchical orientation (*linggih*) and acceptance of authority or leadership (*nrima*). The only positive effect of compatibility found in this study was with perceived IT impact on user performance for the non-initiators. Employees in this group who perceived the technology to be more compatible with their work style expressed greater impact of IT on their performance.

The complexity of an innovation reflects the degree of relative difficulty experienced by users in understanding and using the innovation (Rogers & Shoemaker, 1971). Normally, it would be expected that negative effects of greater complexity would be observed as being caused by lack of adequate knowledge and skill in the adopting unit (Moore & Benbasat, 1991, 1996; Rogers & Shoemaker, 1971; Tornatzky & Klein, 1982). In this study, the opposite effects were found for initiators, while there was no significant effect observed for non-initiators. The positive effect of initiators' perceptions on IT complexity at the initiation stage was surprising. This could be an effect of initiators being more aware of IT potential from what they have read and learned about IT. In addition, this could also be based on their own experience which has been kept at a low level not only because limited resources available, but also because of remote detached decisions about IT in government and the lack of service operability because of centrally appointed vendors. Moreover, it may also be conjectured that some contribution to this readiness to adopt IT may be made by Balinese cooperation devotion (*ngayah*) and self-initiated industrious trait (*glitik*).

Beliefs consistency refers to the degree to which an innovation is perceived as being consistent with existing values and beliefs (Rogers & Shoemaker, 1971). A greater degree of consistency of beliefs has generally been observed to generate more favourable attitudes and behaviour towards adoption (Ettlie & Vellenga, 1979; Moore & Benbasat, 1991, 1996; Rogers, 1983; Rogers & Shoemaker, 1971). This proposition was not supported in this study. There was no significant direct effect found between and IT adoption processes for both groups. Consistency of beliefs only had positive indirect effects on the level of utilisation for non-initiators, and the level of initiation, passive usage, and user satisfaction for initiators.

Observability refers to the degree to which the results of an innovation are visible to others (Rogers & Shoemaker, 1971). The more visible the positive results of an innovation, the more likely the innovation is adopted quickly and implemented. In this study, observability also refers to the degree to which an innovation may be experimented with on a limited basis. Theoretically, innovation that can be tried on the instalment plan is adopted and implemented more often and more quickly than less trialable innovations. Even though More and Benbasat (1996) argued that demonstrability, visibility, and trialability were not found to be significant determinants of IT adoption and implementation, in this study it was found that observability had positive effects on the level of IT utilisation both passively and actively. Through these effects, observability influenced indirectly the level of user satisfaction and perceived impact of IT on user performance for non-initiators.

Proposition 4

Employees' attitudes toward IT are associated with pressures at the initiation phase, levels of IT adoption, utilisation, user satisfaction, and user performance.

Obviously, there have to be strong reasons for accepting and starting to use IT. By the same token, the reasons for not using the technology are equally worth studying. These can be considered as the inhibitor factors for innovation adoption. At the individual level, the most important attitudinal factors are attitude toward change (Al-Gahtani & King, 1999; Mohr, 1969; Peterson & Peterson, 1988) and the feeling of anxiety (Anderson, 1996; Igbaria & Parasuraman, 1989; Rosen & Maguire, 1990). Studies of the diffusion of innovations have found early adopters of innovations are individuals who are more open to change and less anxious about the technology (Rogers, 1983).

It was found in this study that for initiators, employees' attitude toward change had positive effects on initiation as expected. Through initiation as a mediating variable, it also indirectly affected the level of the satisfaction of initiators regarding the technology. However, the effect of anxiety was surprising. It was found in this study that the more the initiators felt anxious about the technology the more they felt satisfied with it after they use it. One possible reason for this result may be that the technology is not as difficult as they thought. Once they had a chance to use the technology, they seemed to realise that what they afraid of were no longer the case. For non-initiators, positive attitudes toward changes were associated with higher levels of user satisfaction and perceived impact of IT on user performance.

Proposition 5

Each phase of IT adoption and implementation processes has positive effects on the subsequent phases.

As stated earlier, the research model was a multiple mediator model. The success of the first phase of initiation affected adoption attitude. Likewise, it was expected that attitude in the adoption phase exerted mediating effects on the success of implementation. The degree of success of the implemented innovation was expected to play a major role in influencing the result of post-implementation evaluation.

For initiators, it was shown that more intense pressures at the initiation phase were positively associated with more positive adoption attitudes, a higher level of IT utilisation, and a higher level of user satisfaction. The higher the level of IT adoption, in turn, was found to be positively associated with the level of IT utilisation in both groups. The level of utilisation was, then, positively associated with the level of user satisfaction for both initiators and non-initiators. In addition for non-initiators, the level of passive usage was also positively associated with the perceived impact of IT on user performance. Finally, user satisfaction was found to be positively associated with the perceived impact of IT on user performance for both groups.

Most studies have argued that IT usage is one of the primary variables, which affects individuals' performance (Goodhue & Thompson, 1995; Mahmood, 1995). Another dimension, which is regarded to be a major factor in measuring implementation success, is user satisfaction. A number of researchers have found that user satisfaction has a positive association with the usage of IT (Baroudi, Olson, & Ives, 1986; Cheney, 1982; Doll & Torkzadeh, 1991; Gelderman, 1998; Khalil & Elkordy, 1999). DeLone and McLean (1992) in their study showed that user satisfaction also affects user performance. These relationships were supported by the findings in this study.

Effects of Organisational Characteristics and Climates

Most of the previous studies of innovation adoption were undertaken at the individual level, which meant that most of the analyses were undertaken by pooling all respondents into a single group and carried out through a 'between individuals overall' type of analysis. In this study a more advanced technique was employed by undertaking a two-level path modelling technique. This analysis employed a 'between individuals within groups' type of analysis. In this analysis, the measures for each individual were subtracted from the group mean and thus the deviation values from the group mean were employed. Moreover, the data for all groups were pooled for a combined analysis. In addition to more appropriate estimates at the individual level, this modelling technique also made it possible to examine the path model at the organisational level. By doing this, a between organisations type of analysis was carried out and the effects of organisational characteristics and climate on the average level of initiation, adoption, utilisation, user satisfaction and perceived user performance were examined.

However, the models developed in this study are exploratory in nature. Initially, all possible relationships based on a hypothesised sequence of events were examined. Finally, only the ones that were found to be significant were retained in the models. The final models, as simplified in Figures 13.3 and 13.4, were the models that best fitted the data. These models remain the best models to portray reality until better and stronger ones are developed.

In these two organisational level models, different colours are also used to distinguish the paths. Red paths, pink paths, turquoise paths, blue paths, green paths, orange paths, and violet paths are associated with propositions 6, 7, 8, 9, 10, 11, 12 respectively. The associated path coefficients for these paths, based on the MPLUS analyses, are presented in Tables 13.3 and 13.4, and considered further in the following discussion.

Proposition 6

District characteristics are associated with organisation characteristics; district and organisation characteristics along with average individual characteristics in organisations are associated with average perceptions of IT attributes; and, in turn, these factors affect the average attitudes toward IT in those organisations.

It was found in this study that two district characteristics, district size and socio-economic level of the district, had positive effects on organisational characteristics. District size was positively associated with the size of the organisations. It was expected that the size of organisations was greater in larger districts.

In addition, district size was also positively associated with organisational complexity in both initiators and non-initiators models. This relationship suggests that the spread of IT expertise was wider and the level of IT skill was higher in organisations located in larger districts. The level of socio-economic status of the district was found to have negative effects on the degree of centralisation in both groups. These results suggest that organisations in districts with a higher socio-economic level experienced a lower degree of centralisation. In addition, socio-economic level was also found to have positive effects on organisational size in the initiators model and on organisational complexity in the non-initiators model. These results suggest that organisations in a district with a higher socio-economic level appeared to be larger and had a greater spread of IT expertise.

With regard to average employees' perceptions of IT attributes in organisations, generally district characteristics, organisational characteristics (especially organisational complexity), and average individual characteristics (especially gender and education) had significant effects.

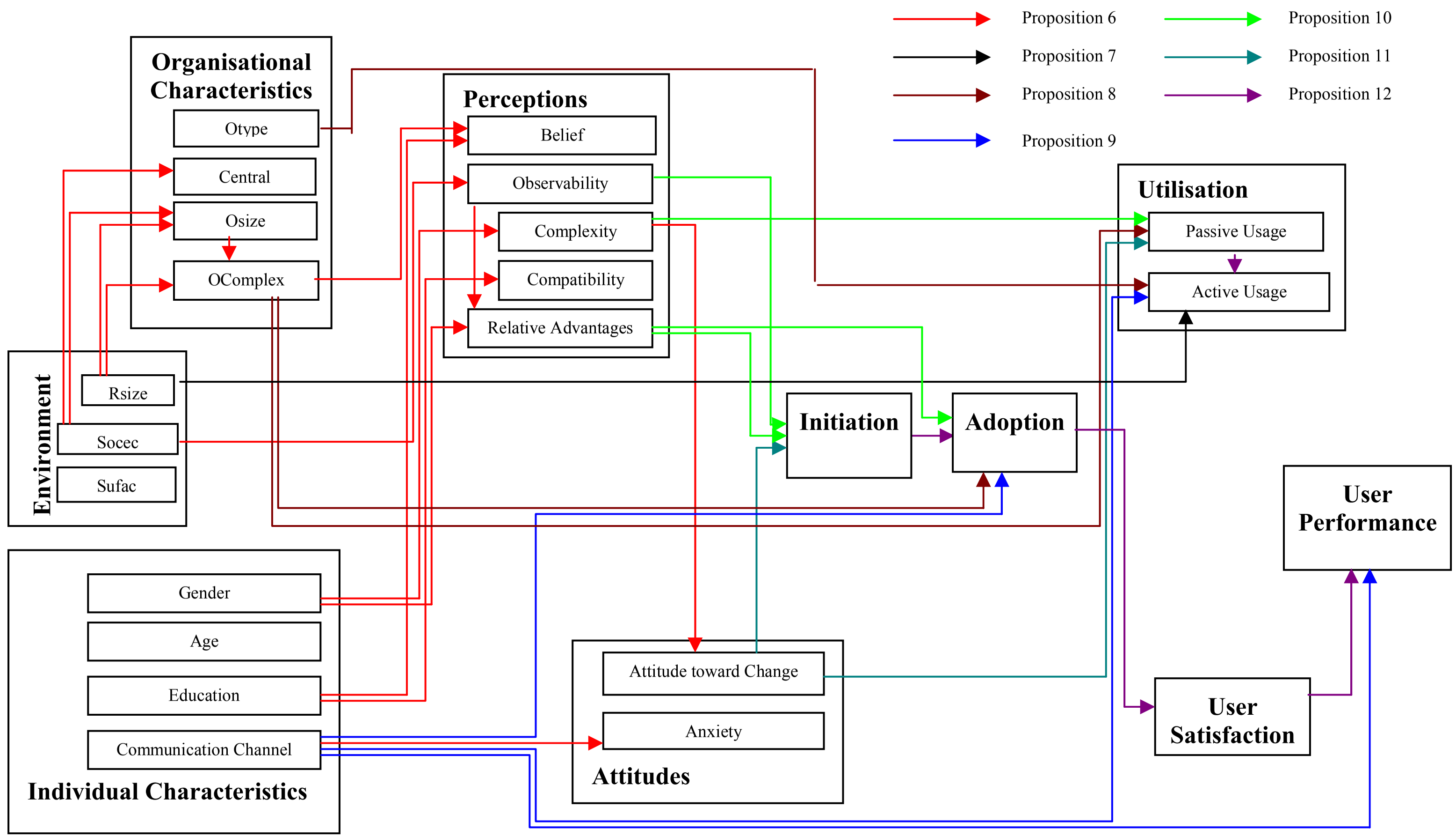

Figure 13.3 Organisational Level Model for Initiators

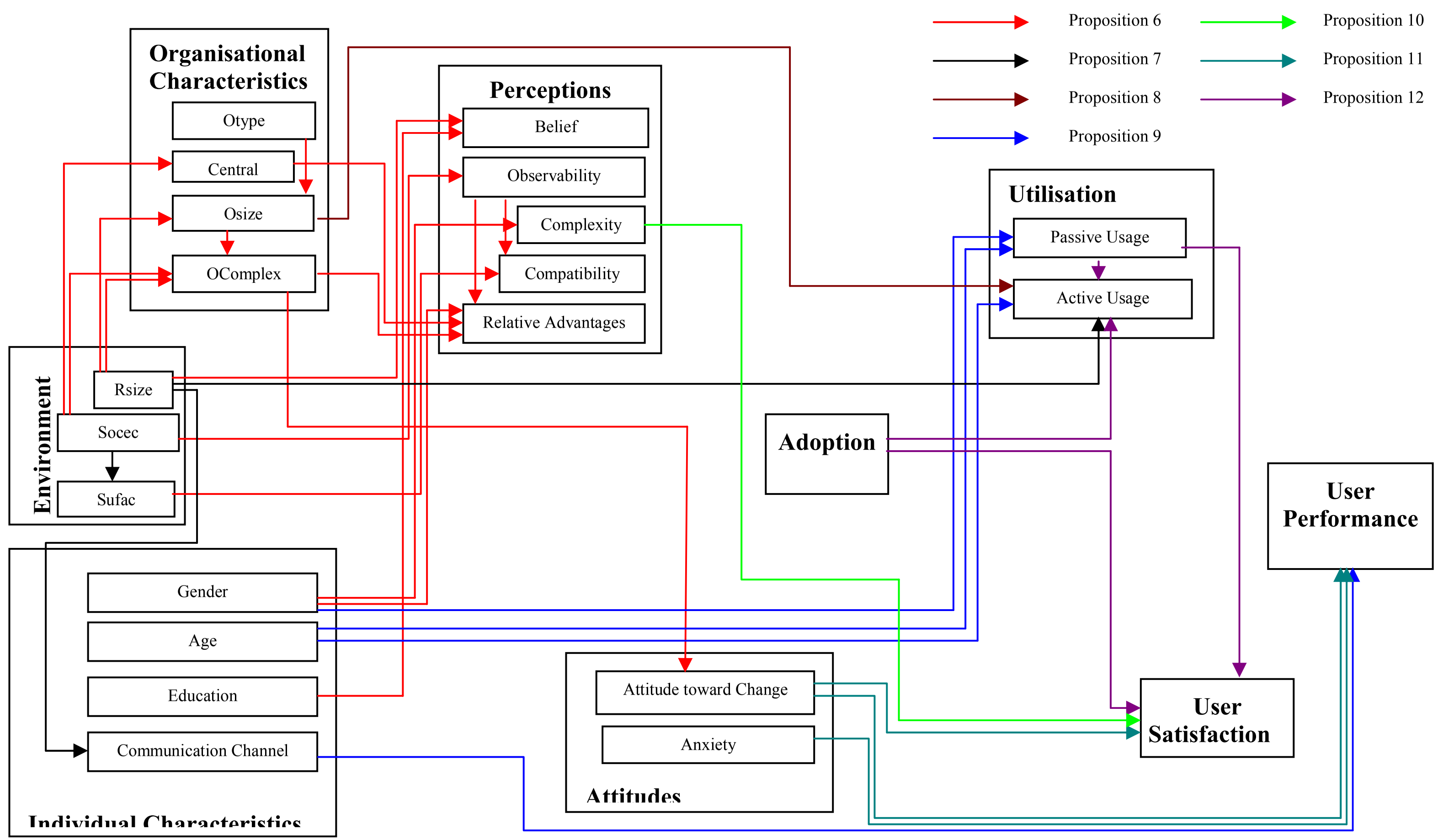

Figure 13.4 Organisational Level Model for Non-Initiators

Table 13.3 Organisational Direct and Indirect Effects for Initiators

Initiators	Supporting Facilities	Centralisa-tion	Organisational Size	Org.Com-plexity	Organisa-tional Type	Education	Comm. Channel	Belief	Observabi-lity	Complexity	Compatibi-lity	Relative Advantage	Anxiety	Attitudes	Initiation	Adoption	Passive Use	Active Use	Satisfaction	Performan-ce
Direct Effects of																				
District Size			0.42	0.64														0.17		
Socio-economic		-0.72							-0.60											
Supporting Facilities																				
Org. Type			0.20															0.18		
Centralisation																				
Org. Size				0.30																
Org. Complexity								0.13								0.19	0.27			
Gender										0.45		0.69								
Age																				
Education								-0.83			-0.88									
Communication													-0.46			0.71		0.88		-0.35
Belief																				
Observability												0.55			0.73					
Complexity																	0.81			
Compatibility														0.66						
Relative Advantage															-0.66	0.13				
Anxiety																				
Attitude															0.39		0.49			
Initiation																0.44				
Adoption																			0.82	
Passive Use																				
Active Use																				
User Satisfaction																				0.78

Table 13.3 Organisational Direct and Indirect Effects for Initiators (continued)

Initiators	Supporting Facilities	Centralisation	Organisational Size	Org.Com-plexity	Organisational Type	Education	Comm. Channel	Belief	Observabi-lity	Complexity	Compatibi-lity	Relative Advantage	Anxaiety	Attitudes	Initiation	Adoption	Passive Use	Active Use	Satisfaction	Performance
Indirect Effects																				
District Size				0.13				0.10								0.15	0.21		0.12	
Socio-economic												-0.33								
Supporting Facilities																				
Org. Type																				
Centralisation																				
Org. Size																				
Org. Complexity																			0.16	0.12
Gender															-0.46	-0.11	0.36			
Age																				
Education														-0.58	-0.23	-0.10	-0.28			
Communication																			0.58	0.45
Belief																				
Observability															-0.36	0.23			0.19	0.15
Complexity																				
Compatibility															0.26	0.11	0.32			
Relative Advantage																-0.29			-0.13	-0.10
Anxiety																				
Attitude																0.17			0.14	0.11
Initiation																			0.36	0.28
Adoption																				0.64
Passive Use																				
Active Use																				
User Satisfaction																				

Table 13.4 Organisational Direct and Indirect Effects for Non-Initiators

Non-Initiators	Supp. Facilities	Centrali-sation	Org. Size	Org. Compl.	Org. Type	Educatio n	Commun ication Channel	Belief	Observa-bility	Complexi -ty	Compati-bility	Relative Advanta-ge	Anxiety	Attitudes	Initiation	Adoption	Passive Use	Active Use	Satisfac-tion	Performa nce
Direct Effects of																				
District Size			0.37	0.68			0.17	0.50										0.85		
Socio-economic	0.25	-0.50		0.14					0.41											
Supporting Facilities											0.26									
Org. Type			0.15																	
Centralisation												0.55								
Org. Size				0.24														-0.44		
Org. Complexity												-0.18		0.31						
Gender										0.59		0.39					0.51			
Age																	0.51	-0.29		
Education								-0.74												
Communication																				0.19
Belief																				
Observability											0.55	0.65								
Complexity																			-0.25	
Compatibility																				
Relative Advantage																				
Anxiety																				-0.64
Attitude																			0.76	0.65
Initiation																				
Adoption																		0.17	0.42	
Passive Use																		0.37	0.46	
Active Use																				
User Satisfaction																				

Table 13.4 Organisational Direct and Indirect Effects for Non-Initiators (continued)

Non-Initiators	Supporting Facilities	Centralisation	Org. Size	Org. Complexity	Org. Type	Education	Communication Channel	Belief	Observability	Complexity	Compatibility	Relative Advantage	Anxiety	Attitudes	Initiation	Adoption	Passive Use	Active Use	Satisfaction	Performance
Indirect Effects of																				
District Size												-0.14		0.24				-0.16	0.18	
Socio-economic											0.29									
Supporting Facilities																				
Org. Type																				
Centralisation																				
Org. Size																				
Org. Complexity																			0.24	0.20
Gender																		0.19		
Age																		0.19	0.23	
Education																				
Communication																				
Belief																				
Observability																				
Complexity																				
Compatibility																				
Relative Advantage																				
Anxiety																				
Attitude																				
Initiation																				
Adoption																				
Passive Use																				
Active Use																				
User Satisfaction																				

In terms of beliefs consistency scores which refer to the levels of belief in the need for information technology and its utility as well as possible drawbacks and negative consequences that might result from reliance on information technology, it was found in these analyses that average beliefs consistency scores was influenced by the average educational level for both initiators and non-initiators. The average beliefs consistency scores were found to be higher in organisations where the average levels of education of responding employees were lower. In addition, for the initiators, a higher average level of IT expertise in organisations was also found to be associated with a higher average beliefs consistency score. The district size only influenced positively the average beliefs consistency scores for the non-initiators.

Perceived degree of complexity was associated with difficulty in understanding and using the technology. At the organisational level, it was found in this study that on average, responding employees in organisations that had more responding female employees perceived the technology to be more complex. In addition, responding employees in the organisations that had older responding higher-level staff members perceived the technology to be more difficult. These results demonstrate the influences of peers and leaders in shaping individuals' perceptions. In this study, it was found that female employees as well as older employees perceived the technology to be more difficult[26]. Therefore, on average, responding employees in organisations that had high proportions of responding female employees as well as high proportions of responding older higher-level staff members were likely to perceive the technology to be more difficult.

Interesting results were recorded for the effects of socio-economic level on the level of exposure to the technology. In the initiators model the relationship was negative. This result suggests that for initiators, responding employees in organisations located in less developed districts reported a greater extent of exposure. In contrast for non-initiators, the relationship was the other way around. These results suggest that in less developed districts exposures to the technology were mainly for the initiators, who were the mid- to upper-level staff members. The levels of exposure of the non-initiators, who were the low-level staff members, might be relatively limited.

By contrast, in highly developed districts, the levels of exposure of the low-level staff members would be high. This result may also be related to the previously stated findings that are: (a) socio-economic level was also found to have positive effects on organisational complexity in the non-initiators model, which indicated that employees in organisations that were located in highly developed districts reported higher levels of IT skills; and (b) organisations in districts with a higher socio-economic level experienced a lower degree of centralisation. Therefore, the level of exposure to the technology of low-level staff members in highly developed districts, which were usually accompanied by higher proportions of low-level employees with IT skills and less centralised systems, were high.

Extent of past experiences with computers was expected to contribute significantly to the adoption processes. Average educational level had direct effects on average compatibility for initiators, whereas supporting facilities available and average observability were found to have direct effects on average compatibility for non-initiators. Interestingly, people in an organisation with higher average educational levels for the initiators group members reported that they feel less compatible with the technology. One possible reason for this relationship is that the higher the educational levels of the employees, the more they have been exposed to the

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[26] For further details see Chapters Nine and Ten.

technology. Consequently the more they are aware of the vast change in the technology. The later technology can be very different from the previous ones. Another possible explanation is that the higher the educational levels of the employees, the more complex the tasks that they have to carry out. The limited technology resources that are available make them feel less compatible with the technology.

The average perceived relative advantages of the technology in the organisations studied seem to be affected by the proportion of females and average observability for initiators on the one hand. Non-initiators, on the other hand, were affected by the level of centralisation, organisational complexity, proportion of females, and average observability in positive ways. However, it was found that there was a negative association between the average perceived relative advantages of the technology and organisational complexity. These coefficients can be interpreted in the terms that organisations with a higher proportion of female employees had higher average perceptions of the relative advantages of the technology in both initiators and non-initiators groups. Where there were more female employees in a particular organisation, employees in the organisation believed that the technology delivers greater benefits over the previous practices. It is also interesting to observe that the results suggest the more IT expertise was available in sample organisation, the less the average perception of relative advantages of the technology. This result suggest that those employees who had IT expertise were the ones who realised not only the potential of the technology, but also the difficulties and limitations they faced in trying to deliver the benefits of the technology, which, in turn, had an effect on other employees' perceptions.

Proposition 7

District characteristics are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

IT adoption in an organisation is greatly dependent on contextual and environmental characteristics of the organisation like the size and the socio-economic level of a district as well as IT infrastructures and other supporting facilities in the surrounding areas (Bingham, 1976; Dasgupta, Agarwal, Ioannidis, & Gopalakrishnan, 1999).

The functional need for IT in local government might relate particularly to the size of the information processing environment that is reflected by the total population served and by the size of the associated land area. In addition to the total population and the land area, the amount of financial support from the upper level government was also used to reflect the size of the district. The intergovernmental influence of one level of government on another has been reported to play an important role in adoption behaviour. For example, central government support is one of the major factors in adopting new technology in local government (Bingham, 1976; Danziger & Dutton, 1977; Ventura, 1995). Therefore, it was expected that district size was positively associated with each phase of IT adoption processes.

The socio-economic level of the district may also facilitate the adoption of IT. With respect to the community support, past research showed that greater levels of IT usage in organisations were positively associated with the higher levels of socio-economic status of the communities where they were located (Bingham, 1976; Danziger & Dutton, 1977). This relationship may relate to the affordability of the technology. The technology was more affordable for districts that had higher socio-economic levels. Thus, the positive relationships were expected between the socio-economic level of the district and each phase of IT adoption processes.

Furthermore, various previous studies suggest that the availability of supporting facilities in the area where government agencies were located also played a major role. These supporting facilities consisted of two fields, namely, the telecommunication infrastructure (Bingham, 1976; Danziger & Dutton, 1977) and the IT related services (Bingham, 1976; Danziger & Dutton, 1977). Thus, it was expected that the availability of supporting facilities was positively related to each phase of IT adoption processes.

In this study, some parts of these propositions were supported while others were not. For the initiation and adoption phases, which only apply for the initiators, district characteristics did not have direct effects in these first two phases. District size was only found to be positively associated with the average level of active usage for both initiators and non-initiators. These results suggest that higher average levels of active usage were found in larger districts. It was also found in this study that there was no significant effect of socio-economic level and availability of supporting facilities on all the four phases of IT adoption and implementation processes. In the case of Bali, as has been explained in Chapter Nine, Denpasar and Badung were the two districts that had relatively high socio-economic levels. The other seven districts had relatively the same low levels of socio-economic status. In addition, most of the IT related services (around 80%) were located in Denpasar. Between five and ten per cent were located in Badung, and only a small number of IT related services were located in the remaining districts. The distributions of socio-economic status and supporting facilities which were highly concentrated in the two areas, Badung and Denpasar, have make it difficult to find the significant effect of socio-economic level and availability of supporting facilities on all the four phases of IT adoption and implementation processes in this study.

Proposition 8

Organisational characteristics are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

It has been argued in the literature that organisational attributes (size and structural characteristics) play an important role in the adoption of IT in an organisation. Four widely studied dimensions in this category have been organisational size, centralisation, formalisation, and complexity (Dasgupta et al., 1999; DeLone, 1981; Lai & Guynes, 1997; Moch & Morse, 1977; Raymond, 1985).

Organisational size has been reported to be one of the organisational factors that affects IT adoption and implementation in an organisation. It is argued that size may have a positive effect on IT adoption (DeLone, 1981; Lai & Guynes, 1997). This proposition was not supported in this study. It was found that organisational size only influenced the level of IT usage negatively for non-initiators. This may be related to the observation in this study that for large organisations it could be expected that the average active usage in the organisation was lower. Many low-level staff members had limited opportunities to use the technology actively due to the limited amount of technology available for them to use.

Centralisation refers to the locus of decision making and dispersal of power (Lai & Guynes, 1997). Greater degrees of centralisation have been observed to result in a negative association with initiation (Hage & Aiken, 1967; Zaltman, Duncan, & Holbek, 1973) and a negative association with adoption (Kimberley & Evanisko, 1981). These propositions, however, were not supported in this study. It was found that there was no significant effect of centralisation on IT adoption processes. This result is consistent with the findings reported by Lay and Guynes (1997). It may be conjectured that some contribution to the readiness to adopt IT may be made by Balinese acceptance of authority/leadership (manut). From the interview findings, it was revealed that most of the decisions regarding IT adoption and implementation were made by the higher level management, either the central or provincial government. They also did not have the authority to recruit new skilled employees that were needed. This highly centralised decision system, either at the provincial or central government, had prevented the district level agencies from being innovative in this area. Moreover, the availability of financial resources was also very limited for acquiring the technology[27].

The variable organisational complexity involves the employees' range of knowledge, expertise, experience, and professionalism. Rogers (1983) and Dasgupta et al. (1999) have argued for the significance of employee complexity on innovation adoption because complexity encourages organisational members to conceive and propose innovations. This suggests that the greater the complexity of the organisation the greater the possibility for it to adopt IT. It was found in this study that organisational complexity was positively associated with IT adoption. This finding is consistent with the previous finding by Rogers (1983). In addition, organisational complexity was also found to have significant effects on IT utilisation directly, and user satisfaction and perceived user performance indirectly for initiators. The same indirect effects were also observed for the non-initiators.

The legal basis for the systems of regional and local government in Indonesia at the time this study was undertaken was set out in Law no 5 of 1974. Building on earlier legislation, this law separates governmental agencies at the local level into two categories (Devas, 1997):

a) decentralised agencies (decentralisation of responsibilities to autonomous provincial and local governments), and

b) deconcentrated agencies (deconcentration of activities to regional offices of central ministries at local level).

In addition to these two types of governmental agencies, government owned enterprises also operate at the local level. These three types of government agencies have distinctly different functions and strategies. It is believed that these differences affect agencies' attitude toward the adoption of innovation (Lai & Guynes, 1997). It was found in this study that employees in enterprise type organisations had a higher level of active usage, followed by employees in deconcentrated agencies, and finally employees in decentralised agencies had the lowest level of active usage. These findings are also consistent with interview results which suggest that technical type agencies were more likely to adopt the technology rather than administrative type agencies. One of the interviewees argued that:

It will take a long time to change the systems. If I were given a chance to go to a technical agency, for example LLAJ [transportation agency], to implement a new system, it will take a lot shorter period when it is compared to the time needed to implement a new system in an administrative agency[28].

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[27] From interviews conducted between August and November 1999, as part of the field study.

[28] From interviews conducted between August and November 1999, as part of the field study.

Proposition 9

Average individual characteristics are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

It was found in this study that for non-initiators, employees in organisations where the proportions of female employees were larger tended to have a higher level of passive usage. A higher level of passive usage was also found in organisations that had larger proportions of older employees. In addition, communication channels, formal and informal channels as well as written materials, had positive direct effects on user performance. This relationship can be interpreted in terms that in the organisations where employees in the non-initiators group communicated the ideas regarding IT widely they tended to report they felt a greater impact of the technology on their performance.

For initiators, communication channels had a major role in IT adoption processes. The more employees in this group communicated, formally and informally, the ideas regarding IT in an organisation, the higher the level of IT adoption in that particular organisation. In addition, this high level of communication channels was also associated with a higher level of active usage. This effect was mediated by the levels of user satisfaction and user performance. Even though the direct effect of communication channels on perceived user performance was negative, its total effect was positive since the indirect effect was greater than the direct effect. This result also suggests that the more the employees communicated their ideas regarding IT, the more they felt the impact of IT on their performance.

Proposition 10

Average employees' perceptions of IT attributes are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

For initiators, the findings in this study suggest that the perceived relative advantage of the technology had negative effects on initiation. This finding was surprising. The opposite relationship was expected. This could be associated with views about the possibility of successful change in their organisations. IT may offer large potential but require greater procedural change which may be difficult to be realised. Another possible reason is that past attempts to incorporate IT into their activities may have failed. In the adoption phase, employees' perceptions of the relative advantages of the technology had positive effects as expected. The higher the average perceptions of employees regarding the benefits of IT in an organisation, the higher the level of adoption in that particular organisation. Even though compatibility did not have significant direct effect on the level of initiation, adoption, and IT utilisation in this group its indirect effects were found to be relatively large. Observability, which can be interpreted as the level of exposure to the technology, was found to have positive effects on initiation. The effects of observability were as expected. In addition, observability also had significant indirect effects on the levels of adoption, user satisfaction and perceived impact of IT on user performance. Nevertheless, for initiators, perceived IT complexity acted on passive usage in a positive way. This result suggests that employees in organisations where most of the employees perceived the technology to be complex had a higher level of passive usage. However, complexity had a negative effect on satisfaction. This negative coefficient indicated that employees were less satisfied when they perceived the technology to be more complex.

For non-initiators, the only effect that was found to be significant was between complexity and user satisfaction. This result suggests that low-level employees in organisations where most of them perceived the technology to be more difficult felt less satisfied with the technology.

Proposition 11

Average employees' attitudes toward IT are associated with pressures at the initiation phase, level of IT adoption, utilisation, user satisfaction and user performance.

For initiators, organisations where most initiators had positive attitudes toward change had higher levels of initiation, adoption, passive usage, user satisfaction, and perceived impact of IT on user performance. The effect on initiation and passive usage were direct effects, while the remainder were indirect effects.

For non-initiators, positive effects were found for attitudes toward change on the level of user satisfaction. This coefficient suggests that the more, on average, the employees in an organisation were willing to change the more they felt satisfied with the technology. In addition, attitude toward change also had a positive effect on perceived impact of IT on user performance. Anxiety, on the other hand, was found to have a negative effect on perceived impact of IT on user performance. This result suggests that for non-initiators, responding employees in organisations with higher levels of average anxiety perceived less impact of IT on their performance.

Proposition 12

Each phase of IT adoption and implementation processes has positive effects on the subsequent phases.

For initiators in the adoption phase, initiation had positive effects as expected. These effects were carried indirectly to the level of user satisfaction and the level of perceived impact of IT on user performance. Moreover, initiators in organisations that had higher levels of adoption tended to be more satisfied with the technology, and indirectly felt a greater impact of IT on their performance. In addition, the level of user satisfaction, in turn, had a positive effect on perceived impact of IT on user performance.

For non-initiators, the level of adoption and the level of passive usage in organisations had positive effects on the levels of active usage and user satisfaction in those organisations.

Three Level Models for Adoption and User Performance

In order to take into account the differences between districts, three-level hierarchical linear models were tested in this study. By using three-level HLM models, the disaggregation effects accompanying the two-level path models could be avoided. As a result, better estimates of district effects and district variance were expected along with more appropriate error terms in addition to the individual level effects and organisational level effects. Moreover, this approach not only provided the direct effects from various levels, but also the interaction effects between variables at three different levels, namely the individual level, organisational level, and district level.

However, this type of analysis can not examine the indirect effects and it only allows one outcome variable to be examined at a time. Thus, ideally, there should be a three-level HLM model for each phase. However, for the HLM analyses in this study, only three models were tested. They were three level models of: (a) adoption for the initiators, (b) user performance for initiators, and (c) user performance for non-initiators. Consequently, the results presented on the following pages were used to supplement the results of the two-level path analyses that have been previously discussed to obtain a better and more complete picture of the nature of the relationships involved in the models.

It should be noted that in this section, the terms level-1 and individual level are employed interchangeably. The terms level-2 and organisational level are used synonymously. Likewise, level-3 and district level terms are used interchangeably.

Proposition 13

There are environmental, organisational, and individual factors that influence the level of IT adoption in the three-level hierarchical model for initiators. Moreover, there are cross-level interaction effects among variables influencing the level of IT adoption in the three-level hierarchical model for initiators.

For the initiators, as shown in Figure 13.5, it was found in this study that the IT adoption was influenced by four factors. The four main effects were the direct effects from average organisational complexity at the district level (level-3), average compatibility and average initiation at the organisational level (level-2), as well as perceived IT complexity at the individual level (level-1). In addition, there was an interaction between average initiation at level-2 and perceived complexity at level-1 in influencing the level of adoption.

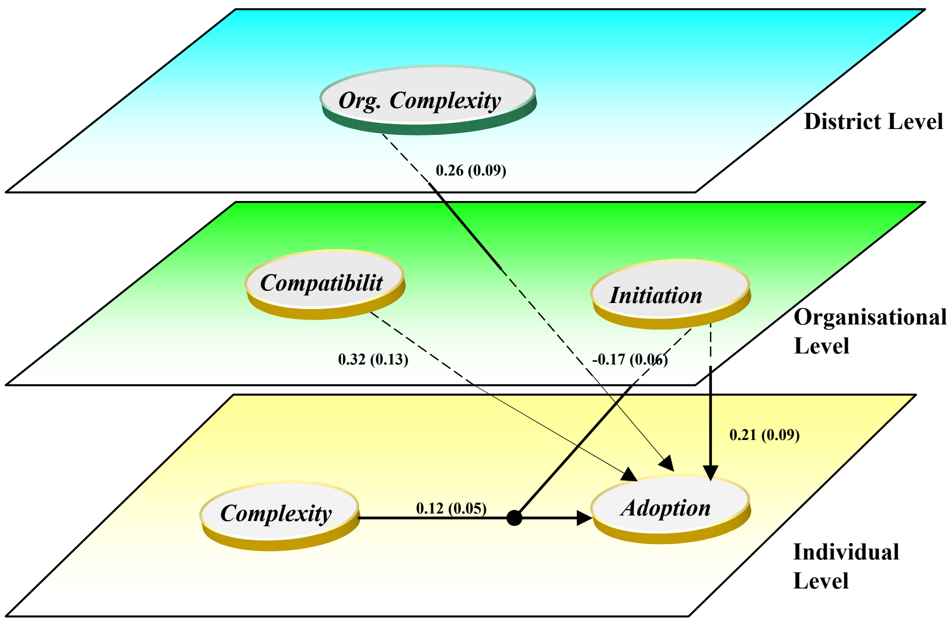

Figure 13.5 Three-Level Model for Adoption

When the differences between districts were considered, the findings of this study indicate that the impact of organisational complexity on IT adoption was significant at district level. The finding that there were significant differences between districts in relation to the level of organisational complexity may suggest that more affluent districts were found to be organisationally more complex, which meant that the organisations had a higher level of IT expertise, and consequently had higher levels of adoption.

On the contrary, when the pressure was low, these people tended to consider the level of IT complexity as a challenge that motivated them to experiment with it and hence there was a positive impact of perceived IT complexity on adoption. In addition, the level of initiation also had a direct effect on adoption. Organisations that had a high level of pressure at the initiation stage had higher levels of adoption. As might be expected, there was a significant and positive relationship between adoption and perception by respondents of the compatibility of the technology.

Proposition 14

There are environmental, organisational, and individual factors that influence the level of employees' perceptions of the impact of IT on their performance in the three-level hierarchical model for both initiators and non-initiators. Moreover, there are cross-level interaction effects among variables influencing the level of employees' perceptions of the impact of IT on their performance in the three-level hierarchical model for both initiators and non-initiators.

Initiators

For the initiators, as presented in Figure 13.6, five level-1 variables had an effect on performance, namely gender of employee, age of employee, the level of initiation, active usage, and user satisfaction. In addition, one level-2 variable also influenced performance, namely the average communication channel at the organisational level, which was aggregated from the individual level. Furthermore, the average satisfaction at level-2 interacted with initiation in influencing performance, whereas the average perceived complexity of the technology and the average perceived adoption level at level-2, and the average age of employees at level-3 interacted with satisfaction slope.

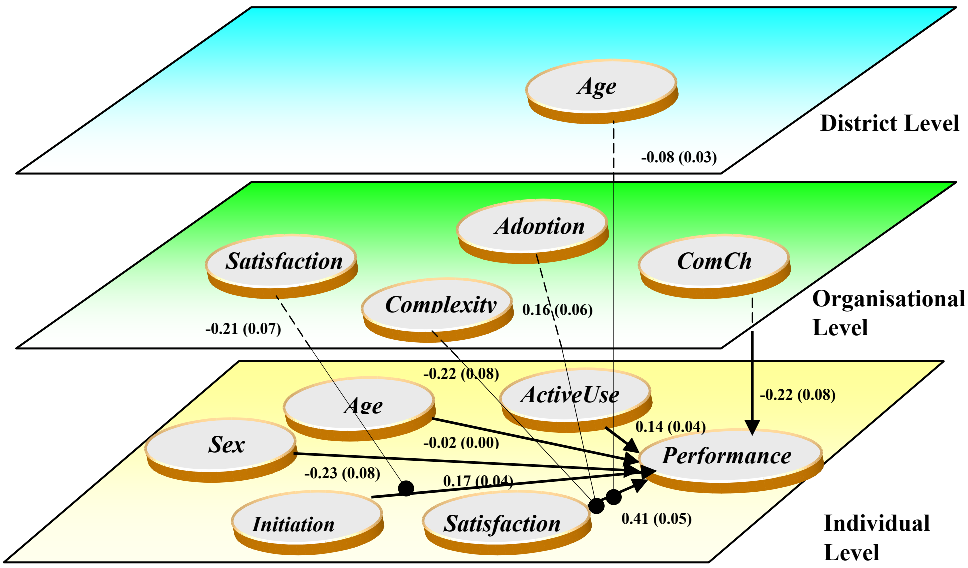

Figure 13.6 Three Level Model of Perceived Performance for Initiators

For the impact of technology on user performance, the findings of this study indicate that as far as the middle to upper level staff members (initiators) were concerned, the level of need for the technology as an indicator of the initiation stage had a positive impact on performance. This result was expected since such group members were in a position to estimate the usefulness of the technology and thus their levels of motivation were matched with their levels of performance. In addition, the level of satisfaction with IT and the level of active usage were positively correlated with performance. Gender had a negative effect on performance, which indicated that female employees felt less impact of IT on their performance. Moreover, younger employees reported that they felt a higher impact of IT on their performance. However, the magnitude of the effect appeared small since the performance scores were standardised while the age scores were not.

Some other interesting results involved the interaction effects between variables at level-2 and level-3 with variables at level-1 in influencing the perceived impact of IT on user performance. It has been mentioned earlier that on average, initiation had a positive effect on user performance. However, the magnitude of the effect varied across organisations. It depended on the extent to which the initiators, on average in an organisation, were satisfied with the technology. The lower the extent to which the initiators were satisfied with the technology in organisations, the higher the magnitude of the effect of initiation on performance. When the initiators were highly satisfied with the technology, the more they perceived the need for the technology in the initiation stage, and the less they reported they felt the impact of IT on their performance.

For the effect of satisfaction on performance, it was found that the magnitude increased in accordance with the level of adoption. In organisations that had a high level of adoption, the effect of satisfaction on performance was stronger.

Furthermore, it was also interesting to observe the interaction effects that influenced the effect of satisfaction on perceived user performance. Average perception of IT complexity in organisations had a negative effect on the magnitude of the effect of satisfaction on performance. In organisations where on average the initiators perceived the technology to be more complex, the effect of satisfaction on performance was weaker. In addition, a level-3 variable that represented the average age of initiators at the district level was also found to influence the magnitude of satisfaction effect on performance. In districts where the proportion of younger initiators was high, the effect of satisfaction on performance was found to be stronger.

Non-Initiators

For the non-initiators, as shown in Figure 13.7, four level-1 variables had an effect on performance, namely the perceived relative advantages of the technology, employees' attitude toward change, the level of active usage and the level of user satisfaction. In addition, two level-2 variables involved with the slopes of predictors in influencing performance at level-1, all variables were aggregated from the individual level, namely, the average performance in an organisation and the average perceived compatibility of the technology at level-2; and there were also two other level-3 variables involved in the model, all of them were variables aggregated from the individual level, namely, the average observability and the average perceived relative advantage at level-3.

The positive coefficients indicate that employees with positive attitudes, more active usage, and higher satisfaction reported they felt a greater impact of IT on their performance. The positive coefficient for attitude suggests that employees with positive attitude toward change perceived the technology to have a greater impact on their performance. A similar pattern was also found for the level of active usage. The more the employees used the technology, the more they found the technology to have an impact on their performance. This was also true for employees' satisfaction regarding the technology. The more they were satisfied with the technology, the more they perceived the impact of technology on their performance. In contrast, the negative coefficients show that employees who perceived a lower relative advantage of the technology perceived a greater impact of IT on their performance. In other words, the lower their level of expectation, the greater they perceived the impact of IT on their performance.

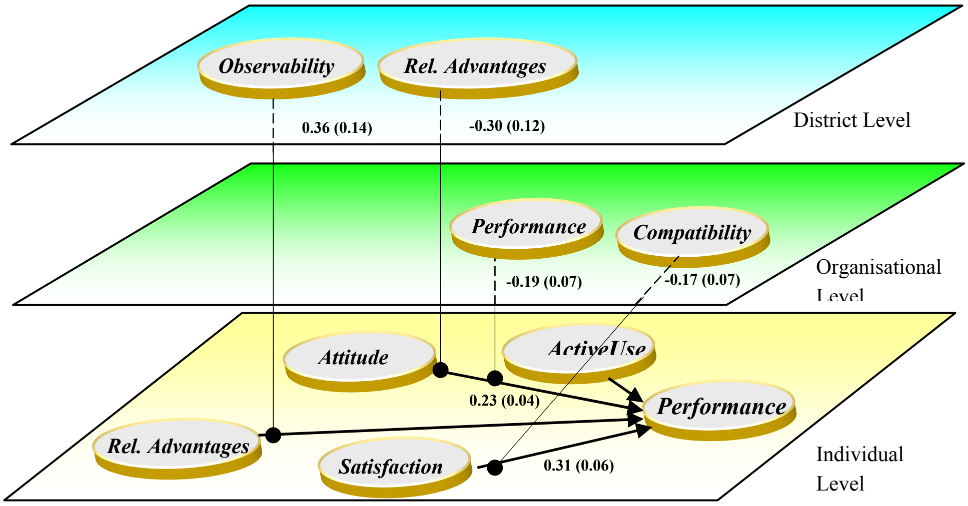

Figure 13.7 Three Level Model of Perceived Performance for Non-Initiators

However, the magnitude of these effects across organisations and across districts was influenced by the average condition in a particular organisation or district. This study found that employees in the districts that had high average observability seemed to feel the positive effects of relative advantage on their performance, while those in a district that had low average observability seemed to feel negative effects of relative advantage on their performance. The average perceptions of the relative advantages of the technology at the district level were also found to interact with employees' attitude toward change in influencing their performance. Employees in a district that had high average perceptions of relative advantage seemed to feel negative effects of attitude on their performance while those in the districts that had low average perceptions of relative advantage seemed to feel positive effects of attitude on their performance.

Two organisational environment variables, the aggregate of individual responses at the organisational level, also interacted with the level-1 variables. In organisations where the average performance levels were low, the effects of attitude toward change were stronger; while in organisations where the average performance levels were high, the effects of attitude toward change on performance were weaker. These relationships suggest that in organisations where most employees had a high level of performance, attitude toward change only had a small effect in explaining their differences in performance. However, in organisations where most employees had a low level of performance, attitude toward change did have a substantial effect in explaining their differences in performance. In addition, the average compatibility at the organisational level also influenced the magnitude of the effect of satisfaction on performance. In organisations where, on average, employees perceived the technology to be less compatible with their work styles, the effect of user satisfaction on user performance was stronger and vice versa.

Changes after IT Adoption and Implementation Processes

Proposition 15

There are some changes in structural dimensions, employees' perceptions of IT attributes, employees' attitudes toward IT after the IT adoption and implementation processes for both initiators and non-initiators.

The results from this analysis provided three sub models (structural, attitudinal, and perceptual models), a combined model, a higher level model for predicting the change in structural dimensions, IT perception dimensions, and attitudinal perception both directly and indirectly though usage, satisfaction, and performance as mediating variables for each group, initiators' group and non-initiators' group. The three sub models, structural dimensions, IT perceptions dimensions, and attitudinal dimensions models, and the combined model fitted the data very well. Although the higher level model gave simpler explanations and fitted the data reasonably well, the combined model fitted the data slightly better.

The combined models show that formalisation, beliefs consistency, attitude toward IT before implementation had large path coefficients on the corresponding after implementation latent variables indicating that these paired constructs were highly correlated. It can be assumed that after-implementation constructs were strongly influenced by the corresponding before-implementation constructs. Therefore it may be inferred that a small change occurred between those paired constructs. The path coefficients of centralisation, observability, compatibility, relative advantage and anxiety indicate that they experienced changes of medium size. The path coefficients of complexity were small. These indicate that large changes occurred. Although the values were slightly different, all models provided largely consistent results. Most of the relationships recorded involved the direct effects of the initial measures while the indirect effects through usage, satisfaction, and performance showed only small influences.

The results for the higher level models are presented in Figure 13.8 and Figure 13.9 for initiators and non-initiators respectively. These models show that in this study centralisation and formalisation appeared to make no contribution to the IT implementation processes for both groups.

These phenomena were partly due to the fact that most of the governmental agencies in Bali were experiencing a highly similar level of centralisation and formalisation. Employees' perception of IT, however, was found to have a significant effect on the level of IT usage for both groups. It was found that responding employees with positive attitudes toward IT reported to have higher level of active usage. In addition, employees' perceptions of IT also affected the level of centralisation and the attitudinal dimensions after IT implementation processes for both groups. Moreover, IT usage had a positive effect on user satisfaction and user performance. The more the responding employees used the technology, the more they reported to feel satisfied with the technology and the greater they perceived the impact of IT on their performance. User satisfaction and user performance, in turn, had positive effects on perception after the implementation process.

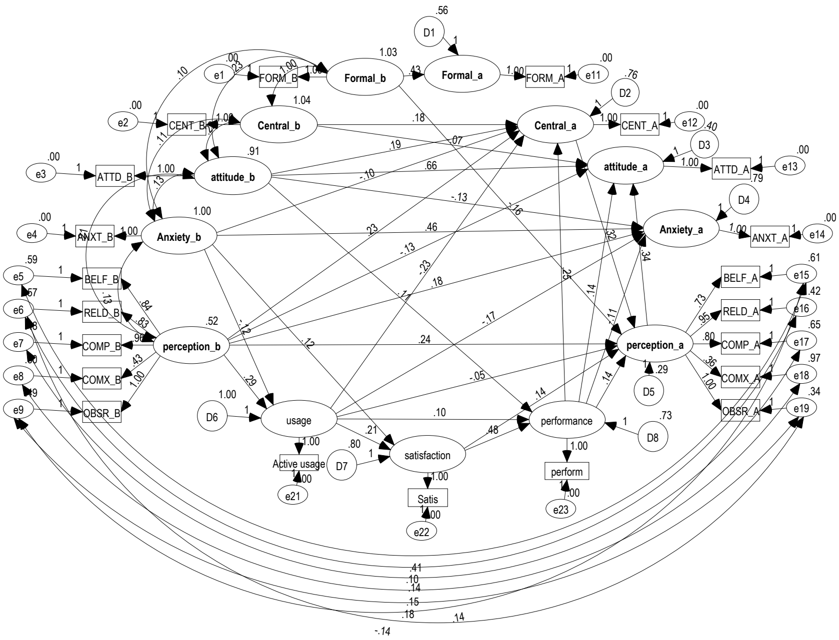

Figure 13.8 Higher Level Model of Changes for Initiators

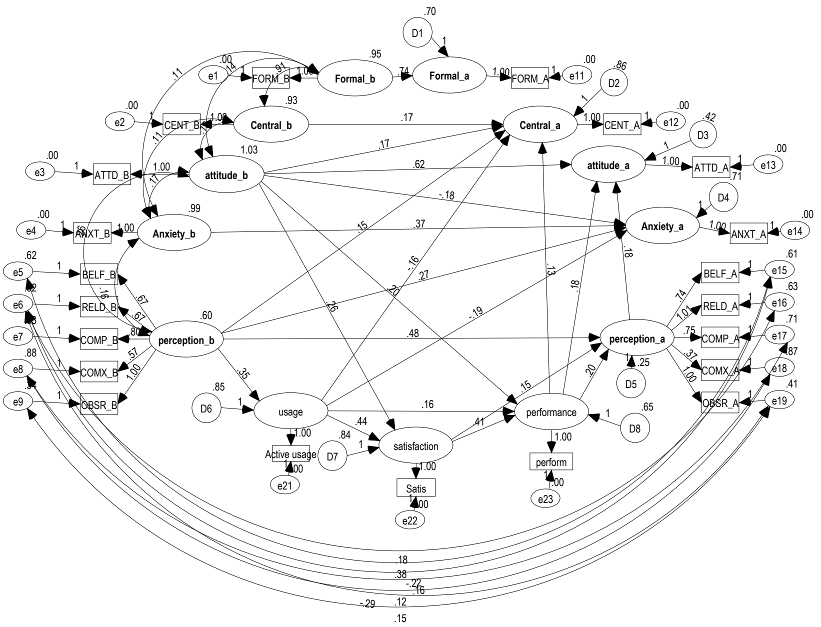

Figure 13.9 Higher Level Model of Changes for Non-Initiators

It is interesting to note that IT usage had a negatives effect on the level of centralisation after the implementation process for both groups. This result indicates that the use of IT reduced the level of centralisation in the responding organisations. Although attitudes toward change had no effect on IT usage, it is shown that attitudes had a positive relationship with user satisfaction and user performance. These relationships indicate that responding employees with more positive attitudes toward IT were more satisfied with the technology and they also perceived greater impact of IT on their performance. Furthermore, anxiety had negative effects on IT usage for both groups. The more the responding employees fell anxious, the less they used the technology. However, once the users used the technology and fell satisfied with the technology, they became less anxious.

Block Models

These results, both at the individual level and the organisational level, for the sake of simplicity were represented in more simplified forms, in block models, as presented in Figure 13.10 and Figure 13.11 for initiators and non-initiators respectively. Variables in the same domain were combined to form a single block. In order to show the links between blocks, any link between these variables with any other variable in other domains was considered to be a sufficient indicator for establishing partial links between blocks. Therefore, any arrow in these models represents a partial link between blocks, which can be interpreted that at least one variable in a particular domain has a direct link to one variable in the corresponding domain.

For initiators at the individual level, as shown Figure 13.10, in general, individuals' perceptions on IT or their IT behavioural beliefs were partly due to differences between individual characteristics. Furthermore, initiators' attitude toward IT was associated with their characteristics and perceptions. At the initiation stage, these three factors were found to have significant effects on the level of initiation, which, in turn, influenced the level of adoption. At the implementation stage, the recognition of various pressures at the initiation stage as indicators of the level of initiation along with the level of IT adoption as well as individual characteristics affected IT utilisation level in terms of passive and active usage of the technology. It has been shown in previous studies that high levels of initiation stage combined with high levels of IT utilisation are associated with user-satisfaction (Gelderman, 1998). However in this study, at the final stage, employees' perceptions of IT impact on their performance were influenced by user-satisfaction and individual characteristics. There was no direct link between IT utilisation and the perceived impact of IT on user performance.

At the organisational level, two other groups of factors were added to the model, the environmental characteristics and the organisational characteristics. Environmental factors affected the organisational characteristics and average employees' perceptions as well as the average level of IT utilisation in organisations.

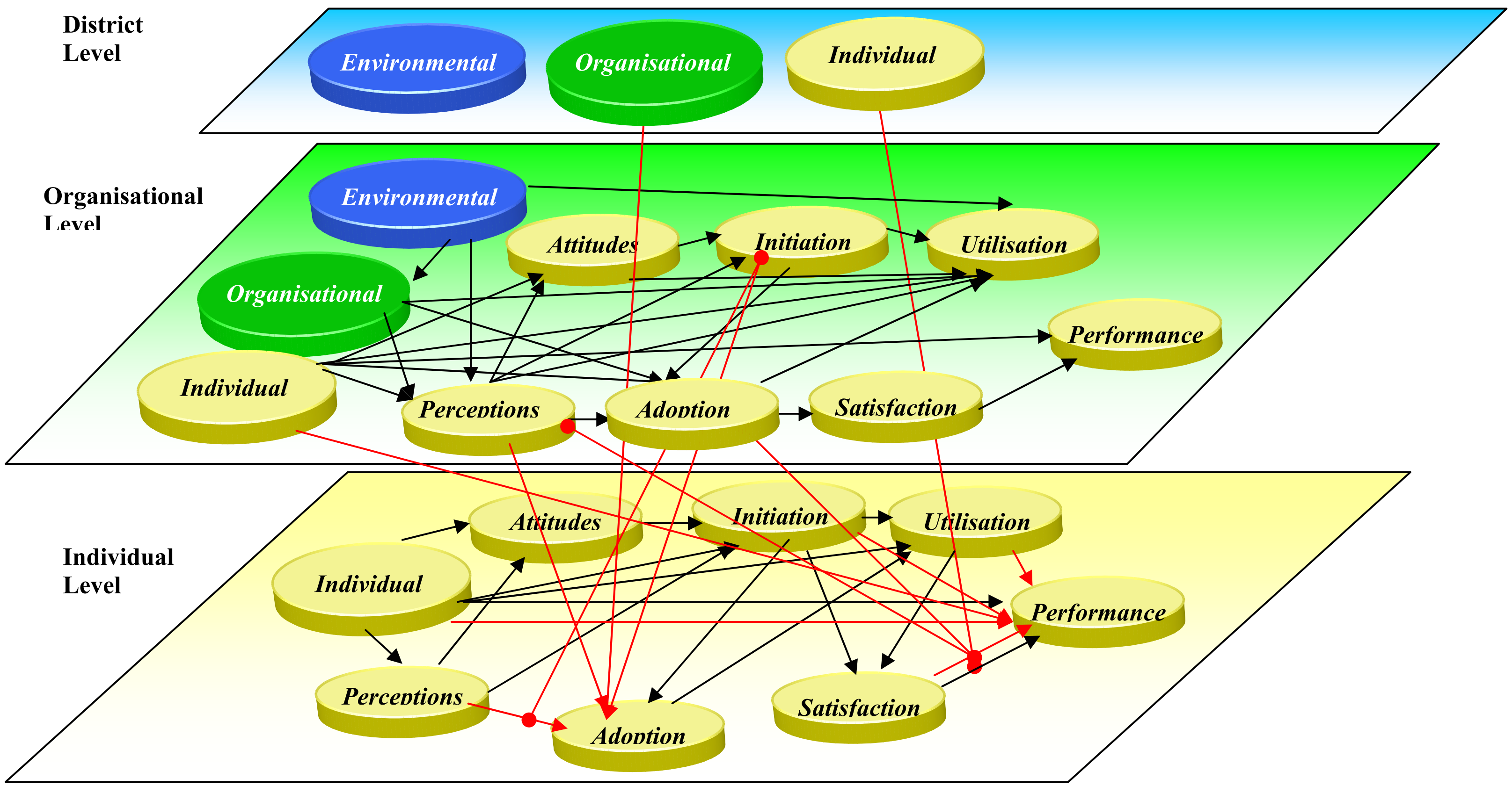

Figure 13.10 Three-Level Block Model for Initiators

Organisational characteristics influenced the average employees' perceptions of IT, the level of adoption, and the level of IT utilisation in organisations. However, there was no connection between environmental factors or organisational characteristics and the average individual characteristics in organisations. The average individual characteristics were associated with average individual perceptions and attitudes, the average level of adoption, the average level of IT utilisation, and the average perceived impact of IT on user performance.

Employees' perceptions and beliefs of IT (behavioural beliefs) affected employees' attitudes toward IT. In addition, these behavioural beliefs were also associated with the realisation of various pressures at the initiation stage, which was followed by the IT adoption process. Furthermore, a high perception of IT was also associated with a high level of utilisation. Attitude toward IT, however, was only found to have significant contributions to the levels of initiation and utilisation. The level of initiation was expected to be associated with the level of adoption, and in turn, both factors were expected to be associated with the average level of utilisation. However, the links between the average level of utilisation and the average levels of user satisfaction and user performance were found to be non-significant. Finally, the average level of user satisfaction in organisations appeared to lead to the average perceived impact of IT on user performance.

The two-level block model for non-initiators is presented in Figure 13.11. For non-initiators at the individual level, in general, individuals' perceptions of IT or their IT behavioural beliefs were partly due to differences in individual characteristics. Employees' individual characteristics along with their perceptions of IT affected their attitude toward IT.

At the implementation stage, employees' individual characteristics, perceptions, attitudes, and the level of IT adoption affected IT utilisation level in terms of passive and active usage of the technology. Previous studies have shown that the level of IT utilisation is associated with the level of user-satisfaction and the level of perceived impact of IT on user performance (Gelderman, 1998). Furthermore, the level of user satisfaction was associated with the level of perceived impact of IT on user performance.

At the organisational level, two other groups of factors were also added to the model, the environmental characteristics and the organisational characteristics. For the non-initiators, environmental factors affected the organisational characteristics and average employees' perceptions but not the average level of IT utilisation in organisations. In addition, the average individual characteristics were also influenced by environmental factors. Organisational characteristics influenced the average employees' perceptions of IT as well as their attitudes toward IT and the average IT utilisation in each organisation. The average individual characteristics were associated with average individual perceptions, the average level of IT utilisation, and the average perceived impact of IT on user performance. However, there was no relationship between employees' perceptions and beliefs of IT (behavioural beliefs) and employees' attitudes toward IT, as was found in the initiators model.

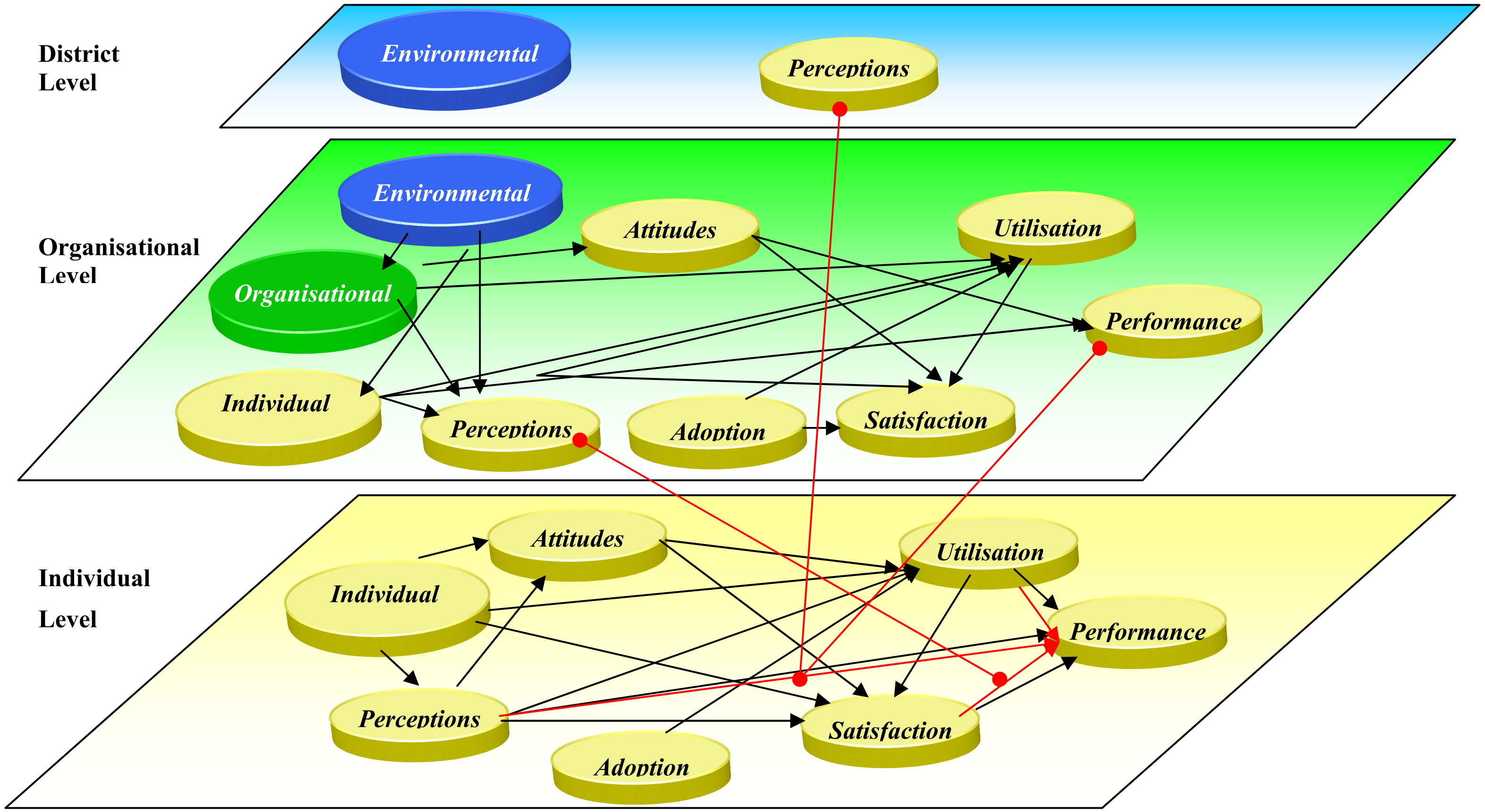

Figure 13.11 Three Level Block Model for Non-Initiators

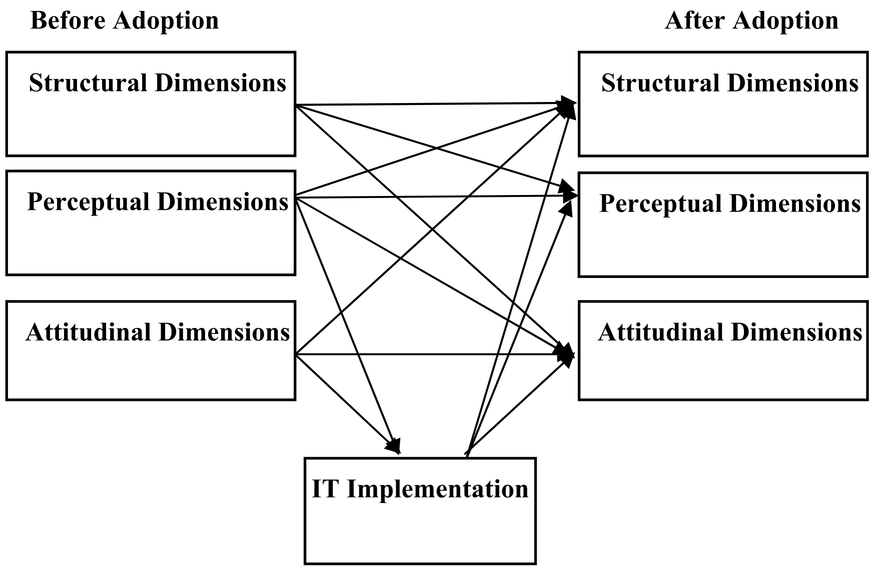

Figure 13.12 Change Model for Initiators

Furthermore, these behavioural beliefs were associated with the average levels of utilisation and user performance. Attitude toward IT, however, was found to have significant contributions to the levels of satisfaction and perceived IT impact on user performance.

In addition, the level of adoption in an organisation also affected the level of IT usage in that organisation. This average level of IT usage, in turn, affected the average level of user satisfaction.

However, the link between the average level of utilisation and user performance as well as the link between user satisfaction and user performance were found to be non-significant. Finally, the average level of user satisfaction in organisations seemed to lead to the average perceived impact of IT on user performance. In addition to the paths that represent the MPLUS results at both individual and organisational levels, the direct effects as well as cross level interaction effects found to be significant in HLM analyses were also added to the models and presented in red paths.

In addition, from the results of two-level path models discussed in Chapter Ten, it was also found that user performance are strongly reflected by the perceived impact of IT on respondents' efficiency and effectiveness as well as the perceived appropriateness of the technology in performing their daily tasks for both initiators and non-initiators groups at the individual level. However, at the organisational level, it was also revealed that initiators, who were usually middle- to high-level management staff members, on average, perceived the technology to have a low impact on their effectiveness.

The block models for change mechanism are presented in Figures 13.12 and 13.13 for initiators and non-initiators respectively. It was shown that the structural dimension made no contribution to the IT implementation processes for both groups. Perceptual and attitudinal dimensions, on the contrary, were found to have a significant effect on IT implementation process for both groups.

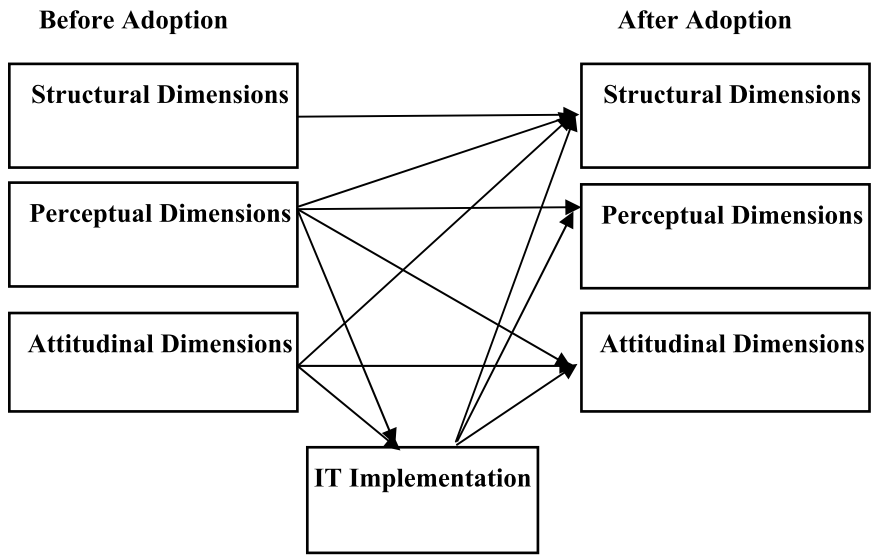

Figure 13.13 Change Model for Non-Initiators

The IT implementation process, in turn, had effects on structural, perceptual and attitudinal dimensions after the adoption. In addition, some relationships were also found between various dimensions before and after adoption.

SUMMARY

Major issues to be addressed in this study were the investigation of factors influencing IT adoption and implementation processes in the local government of Bali. This study is highly descriptive and exploratory in nature. However, as mentioned in Chapter Five, a series of propositions based on the literature were tested. The first set of propositions dealt with factors influencing IT adoption and implementation processes at the individual level. The second set of propositions dealt with various factors affecting IT adoption and implementation processes at the organisational level. Both the first and the second sets of propositions required the use of a two-level path modelling technique. The third set of prepositions required the use of hierarchical linear modelling (HLM) technique to investigate three-level hierarchical models of factors influencing IT adoption and perceived user performance. Finally, the fourth set of prepositions dealt with the change in structural, perceptual and attitudinal dimensions before and after IT implementation process.

Most of the findings are consistent with the previous research. Some surprising results involved the negative effect of perceived relative advantage at the initiation stage. In addition, a positive effect of perceived IT complexity was also recorded at this stage. The opposite associations were expected. Moreover, the negative effect of perceived IT complexity on the level of IT adoption was not as expected. However, the three-level HLM analyses show that perceived IT complexity had a negative effect on adoption when the pressure to adopt the technology at initiation stage was high. It was possible that people get anxious and became more aware of the level of complexity of the technology and therefore the latter acted as a deterrent rather than as a motivator. On the contrary, when the pressure was low, people seemed to consider the level of complexity as a challenge that motivated them to experiment with it and hence there could be a positive impact of complexity on adoption.

14

Conclusions

Public administration is playing a central role in today's information age. Governments provide a range of services to citizens and industry, and engage in functions as diverse as economic development, environmental monitoring, and the provision of public information. The adoption and implementation of information technology in the public sector has been a source of interest among policy makers, the media and the academic world. Research in this field has mainly focused on organisations in developed countries, in particular the United States and the United Kingdom, without considering how or whether these frameworks and models can be applied and extended to developing countries. Very few empirical studies have been done regarding the factors affecting the diffusion and the use of information technologies in developing countries, particularly in local and regional governments.

The overall purpose of this study has been to investigate the IT adoption and utilisation in the local government organisations of Bali from an innovation adoption-diffusion perspective. Furthermore, this study also provided an empirical assessment of the impact of the IT implementation processes on end users. In particular, this study examined the changes in end users' perceptions of structural dimensions of organisations (the level of centralisation and formalisation), the changes in end users' perceptions of IT attributes (belief consistency, compatibility, relative advantage, complexity, and observability), and the changes in end users' attitudes toward IT (attitude toward change, and computer related anxiety). This study examined both direct changes produced by these constructs and their indirect changes through IT usage, user satisfaction, and user performance as mediating variables. In addition, it addressed the more technical issues involved in specifying appropriate units of analysis and choosing the proper analytical methods since the structure of the available data was hierarchical in nature.

Summary of findings

From the discussion in Chapters Two to Four of theories of IT adoption and diffusion in organisations, a series of propositions was advanced in Chapter Five to guide the design and execution of the investigation. Data collection procedures, methods of data analysis and the results of preliminary data analysis were presented in Chapters

Six, Seven and Eight respectively. Chapter Nine was concerned with the descriptive statistics of the data and the triangulation of data from the interview and survey responses. The results obtained from the testing and estimation of the two two-level path models of IT adoption and implementation for both the initiators and non-initiators were presented in Chapter Ten. Research findings were also presented in Chapter Eleven, in which three three-level HLM models predicting the level of IT adoption for initiators and the impact of IT on user performance for both initiators and non-initiators were examined and their parameters were estimated. Chapter Twelve was concerned with the changes in structural, perceptual, and attitudinal dimensions before and after IT adoption and implementation processes. In Chapter Thirteen, the propositions advanced in Chapter Five were examined against the evidence obtained in the inquiry. Hence, the summary of research findings presented in the paragraphs that follow is limited only to those with a direct bearing on the aims of the study.

Relationships between Human Factors and Each Phase of IT Adoption and Implementation in Bali's Governmental Agencies

In this study, it was found that there were differences between male and female employees. For initiators, on the one hand, female respondents reported less pressure to adopt the technology. They perceived less need to adopt the technology to increase organisational performance. In addition, they also perceived less impact of IT on their performance. For non-initiators, on the other hand, female employees tended to report higher levels of passive usage and felt less satisfied with the technology.

With respect to age of employees, it was found that younger employees in both initiators and non-initiators groups tended to have higher levels of active usage. It was also found that younger employees were more satisfied with the technology and perceived higher impact of IT on their performance.

In terms of educational levels, it was found that the average education levels of employees in the sampled organisations might influence the IT adoption and implementation processes. A similar pattern was also applied for communication channels. It was the average level of communication in the organisation rather than the individual's level of communication that made the differences. Communication channels, formal and informal channels as well as written materials, had positive direct effects on user performance for both groups. This relationship can be interpreted in terms that in the organisations where responding employees communicated ideas regarding IT widely they tended to feel a greater impact of the technology on their performance. In addition, for initiators, communication channels had a major role in IT adoption processes. The more employees in this group communicated, formally and informally, ideas regarding IT in an organisation, the higher the level of IT adoption in that particular organisation. In addition, this higher level of communication channels was also associated with a higher level of active usage.

It was also found in this study that for initiators, employees' attitudes toward change had positive effects on initiation as expected. In addition, organisations in which most initiators had positive attitudes toward change had higher levels of adoption. Positive attitude toward change was also associated with higher levels of user satisfaction and perceived user performance.

However, the effect of anxiety for initiators, on the one hand, was surprising. It was found that the more the initiators felt anxious about the technology the more they felt satisfied with it after they used it. For non-initiators, on the other hand, anxiety was found to have a negative effect on perceived impact of IT on user performance. This result suggests that for non-initiators, responding employees in organisations with higher levels of average anxiety perceived less impact of IT on their performance.

Relationships between Technological Factors and Each Phase of IT Adoption and Implementation in Bali's Governmental Agencies

Five factors within the technological domain were examined in this study, namely, belief compatibility, work style compatibility, complexity, observability, and relative advantage of the technology.

A greater degree of beliefs consistency, which was considered to be the degree to which an innovation was perceived as being consistent with existing values and beliefs, has generally been observed to generate more favourable adoption attitude and behaviour (Ettlie & Vellenga, 1979; Moore & Benbasat, 1991, 1996; Rogers, 1983; Rogers & Shoemaker, 1971). However in this study, there was no significant direct effect found between compatibility of beliefs and IT adoption processes for both groups. Even though there was no direct effect of compatibility of beliefs on IT adoption processes, there were medium level indirect effects for initiators at the individual level.

Compatibility referred to the degree to which an innovation was perceived as being consistent with past experience and the need of the receivers (Rogers & Shoemaker, 1971). In this study, however, there was no significant role of perceived compatibility of the technology on IT adoption processes for the initiators. The only positive effect of compatibility found in this study was with perceived IT impact on user performance for the non-initiators. Employees in this group who perceived the technology to be more compatible with their work style expressed greater impact of IT on their performance.

The complexity of an innovation reflected the degree of relative difficulty experienced by users in understanding and using the innovation (Rogers & Shoemaker, 1971). Normally it would be expected that negative effects of greater complexity would be observed as being caused by lack of adequate knowledge and skill in the adopting unit (Moore & Benbasat, 1991, 1996; Rogers & Shoemaker, 1971; Tornatzky & Klein, 1982). In this study, the opposite effect was found for initiators. There was a positive association between perceived complexity of the innovation and initiation level. This positive effect of initiators' perceptions on IT complexity at the initiation stage was surprising. However, there was no significant effect observed for non-initiators at the individual level.

In addition, as a group at the organisational level, initiators in organisations where the average perceived IT complexity was high were more likely to have higher levels of passive usage as well as lower levels of user satisfaction. For non-initiators, the only effect that was found to be significant was between average perceived complexity and average user satisfaction. This result suggests that low-level employees in organisations where most of them perceived the technology to be more difficult before the adoption processes took place felt less satisfied with the technology.

Observability has usually been taken to refer to the degree to which the results of an innovation were visible to others (Rogers & Shoemaker, 1971). In this study, observability also referred to the degree to which an innovation might be experimented with on a limited basis as well as the degree to which an innovation can be viewed before any decisions to adopt the technology was made. In this study it was found that observability had positive effects on the level of IT utilisation both passively and actively. Through these effects, observability influenced indirectly the level of user satisfaction and perceived impact of IT on user performance for non-initiators.

At the organisational level, observability was found to have positive effects on initiation. The effects of observability were as expected. In addition, observability also had significant indirect effects on the levels of adoption, user satisfaction and perceived impact of IT on user performance.

Relative advantage has been considered to reflect the degree to which an innovation was perceived to be better than the idea it superseded or in comparison with other competing alternatives (Rogers & Shoemaker, 1971). Positive associations have usually been expected or observed (Al-Gahtani & King, 1999; Budic & Godschalk, 1996; Ettlie & Vellenga, 1979; Iacovou, Benbasat, & Dexter, 1995; Panizzolo, 1998; Rogers, 1983; Tornatzky & Klein, 1982). However in this study, it was found that in the context of Bali's local government the opposite associations were true for non-initiators except for the association between relative advantage and passive usage. Employees in the non-initiators group who perceived lower relative advantages of the technology tended to have a higher level of passive usage. These results suggest that the less they perceived the relative advantages of the technology the more they tended to be passive users. This relationship was expected. However, the expected positive relationship between perceived relative advantages of the technology and the level of active usage was not supported. There was no direct effect of perceived relative advantage on the active usage level. In addition, a higher level of perceived relative advantage of the technology was also associated with a lower level of satisfaction and a lower level of perceived impact of IT on user performance. These results suggest that a higher level of employees' expectation of the technology was associated with a lower level of employees' satisfaction regarding the technology and a lower level of perceived IT impact on user performance. These findings may also be interpreted that the use of technology was not fully delivering its promised benefits. There was no significant effect of perceived relative advantage on IT adoption processes for initiators.

Relationships between Organisational Factors and Each Phase of the IT Adoption and Implementation in Bali's Governmental Agencies

It has been argued in the literature that organisational attributes (size and structural characteristics) play an important role in the adoption of IT in an organisation. Four dimensions under this category have been examined in this study, namely, organisational size, centralisation, organisational complexity, and organisational type.

In terms of organisational size, it was found in Bali that organisational size only influenced the level of average IT usage in the organisation negatively for non-initiators. This result suggests that for large organisations it could be expected that the average active usage of non-initiators, who were usually the low-level staff members, would be lower. One possible reason for this result is that many low-level staff members had limited opportunities to use the technology actively due to the limited amount of technology available for them to use. Even though large organisations were also found to be commonly located in districts with high socio-economic levels, the increase in number of computers available would not seem to be in proportion with the increase in number of employees in those organisations.

Regarding centralisation, this study reveals that there was no significant effect of centralisation on IT adoption processes in the sample of Bali's local government agencies. The absence of such effects may have reflected the fact that most government organisations in Bali experienced almost the same degree of centralisation. On the contrary, the implementation, especially the level of active usage, was found to affect negatively the level of centralisation after the implementation processes took place.

It was also found in this study that organisation complexity was positively associated with IT adoption. This finding was consistent with the previous finding by Rogers (1983). In addition, organisation complexity was also found to have significant effects on the levels of passive usage directly, and user satisfaction and perceived impact of IT on user performance indirectly for initiators. The same indirect effects were also observed for the non-initiators.

There were three types of governmental agencies in Bali, namely decentralised, deconcentrated and enterprise type agencies. These three types of government agencies had distinctly different functions and strategies. It was argued by Lai and Guynes (1997) that the differences in functions and strategies affected their attitudes toward the adoption of innovation. It was found in this study that employees in enterprise type organisations had a higher level of active usage, followed by employees in deconcentrated agencies, and finally employees in decentralised agencies, who had the lowest level of active usage.

Relationships between Environmental Factors and Each Phase of IT Adoption and Implementation in Bali's Governmental Agencies

Among the three environmental factors considered in this study, namely district size, the socio-economic level of the district, and supporting facilities available in the district, only district size had significant effects on IT adoption and implementation processes. It would seem that organisations located in larger districts tended to have a higher level of IT adoption. In addition, the size of these organisations would also seem to be larger.

It is also found in this study that there was no significant effect of socio-economic level and availability of supporting facilities on all the four phases of IT adoption and implementation processes. In the case of Bali, the distributions of socio-economic status and supporting facilities which were highly concentrated in the two areas, Badung and Denpasar, have made it difficult to find the significant effect of socio-economic level and availability of supporting facilities on all the four phases of IT adoption and implementation processes.

Interactions among Human, Technological, Organisational, and Environmental Factors in Affecting Each Phase of IT Adoption and Implementation in Bali's Governmental Agencies

For non-initiators at the individual level, in general, individuals' perceptions of IT or their IT behavioural beliefs were partly due to differences in individual characteristics. Employees' individual characteristics along with their perceptions of IT, in turn, affected their attitude toward IT.

At the organisational level, two other groups of factors were also added to the model, the environmental characteristics and the organisational characteristics. For the non-initiators, environmental factors affected the organisational characteristics and average employees' perceptions but not the average level of IT utilisation in organisations. In addition, the average individual characteristics were also influenced by environmental factors. Organisational characteristics influenced the average employees' perceptions of IT as well as their attitudes toward IT and the average IT utilisation in each organisation. The average individual characteristics were associated with average individual perceptions, the average level of IT utilisation, and the average perceived impact of IT on user performance. However, no relationship was found between employees' perceptions and beliefs of IT (behavioural beliefs) and employees' attitudes toward IT, as was found in the initiators model.

Changes in Structural, Perceptual, and Attitudinal dimensions after Implementation of IT in Bali's Governmental Agencies

From the results of change analyses, it was found in this study that in Bali's government agencies centralisation and formalisation were not in themselves significant factors in IT implementation processes for both groups. Employees' perceptions of IT, however, were found to have a significant effect on the level of IT usage for both groups. In addition, employees' perceptions of IT also affected the level of centralisation and the attitudinal dimensions after IT implementation processes took place for both groups. Perception also had a positive effect on IT usage. IT usage had a negative effect on centralisation and positive effects on user satisfaction and user performance. User satisfaction and user performance, in turn, had positive effects on perception after the implementation process. Although attitudes toward change had no effect on IT usage, it was shown that attitudes had a positive relationship with user satisfaction and user performance. Anxiety had negative effects on IT usage for both groups. However, once the users had used the technology and felt satisfied with the technology, they seemed to become less anxious. Perception had a positive effect on IT usage, and IT usage had a positive effect on user satisfaction and user performance. User satisfaction and user performance, in turn, had positive effects on perception after the implementation process.

Implications of the Study

The findings of this study contribute to the theoretical and methodological knowledge as well as providing additional materials for management and policy formulation on the adoption and implementation of IT innovations by governmental agencies in developing countries, and in particular in the province of Bali, in the country of Indonesia. In addition, this study is also expected to contribute to the identification of the facilitators and inhibitors of IT adoption and implementation in local government agencies of Bali. From the identification of these factors, government agencies in Bali and other parts of Indonesia may be able to formulate better strategies for adopting and implementing IT in order to increase their service quality and productivity. This could help Bali tourism to compete with other tourist destinations in a highly competitive world-wide tourism industry and other aspects of Bali's development to proceed positively. It is also expected that the Indonesian government can have a better understanding of the ways in which the local conditions impact on the adoption and implementation of IT in a particular region.

Theoretical implications

Information technology is now the centre of a technological revolution in the current information era. The adoption and implementation of information technology in the public sector has aroused much interest mainly in developed countries without considering how these frameworks and models can be applied and extended to developing countries. Information systems are often developed on the basis of a set of assumptions that are pertinent to a certain situation of a particular country. This can cause problems in the transfer of such systems from one country to another. This issue becomes even more difficult when the transfer is from a developed country to a developing country. Developed and developing countries stereotypically differ in many ways. Therefore, the assumptions underlying the adoption and implementation of IT in developed countries may not match the realities in developing countries. However, very little is known about the obstacles to accessing information technology, the diffusion, and the use of information technologies in developing countries, particularly in local and regional governments. Consequently, the theoretical contributions of this study are fourfold. First, this is the first study in this field, which has been undertaken in Bali, Indonesia. Although there are some differences between districts and provinces in Indonesia which may affect the application of the findings to other local government or areas in the country, some useful perspectives may be drawn from these findings. In addition, it contributes a focused case study pertinent to developing countries more generally.

Second, this study also provides empirically based analytical procedures for testing and extending existing frameworks and models. Although there are many differences like the characteristics of the environment, the characteristics of the organisations, the characteristics of the individuals, between developing and developed countries, it was found that factors that influence information technology adoption are similar, with the exception of age and gender which are found to be insignificant in developed countries. In Bali, as in some other developing countries, there are still gaps between female and male employees and between younger and older employees. These results may indicate that there are still unequal opportunities between males and females that need to be addressed. Age effects may suggest that there are knowledge gaps between the older and younger generations.

In addition, the readiness to adopt IT may be partly influenced by Balinese characteristics. Balinese hierarchical orientation, conformism, and acceptance of authority would seem to contribute partly to the absence of an expected positive effect of compatibility on attitudes to adopt IT. It is expected that the more compatible the technology with the employees' work style, the greater their tendency to adopt the technology. However, the Balinese people respect their leaders, and voluntarily follow the rule and policy set by higher authority. Therefore, compatibility might not be an issue in this context. The Balinese concepts of co-operation, devotion and self-initiated industrious creativity would seem to explain partly the positive effect of complexity on the level of IT adoption. Balinese are conscientious and hard working. They also have a high sense of devotion to their job. Therefore, it is possible that complexity was perceived as a challenge rather than a deterrent.

For other factors, generally, the results of this study support the previous findings. However, the effects of employees' perceptions of complexity and relative advantages of the technology are surprising. The positive effects of complexity on adoption can be explained with the results of the HLM analysis by looking at the interaction effects. Even though the average effect of complexity on adoption was positive, the results of the three-level analysis also revealed that complexity had a negative effect on adoption when the pressure to adopt the technology at the initiation stage was high. It is possible that people get anxious and become more aware of the level of complexity of the technology and therefore the latter acts as a deterrent rather than as a motivator. On the contrary, when the pressure was low, respondents tended to consider the level of complexity as a challenge that they said motivated them to experiment with it and hence there was a positive impact of complexity on adoption.

The negative effects of perceived relative advantage on user satisfaction and user performance suggest that there is an IT paradox phenomenon. IT is not fully delivering its promised benefits at least if Bali's local government can be a guide. The higher the employees set their expectations the less they seem to feel satisfied with the technology. The same pattern also applies for the perceived impact of IT on user performance.

Third, in addition to testing and examining the significance of various potential factors, this study also assembled all identified potential factors into a single model. Therefore this study provides interrelationships between these various potential factors as well as their role in the IT adoption and implementation processes. It is expected that these complex models provide a more complete picture of the processes, including the general relationships among groups of factors as well as the detailed relationships among variables. Furthermore, by undertaking the HLM analysis, this study also makes it possible to examine the cross-level interaction effects between the three different levels, namely individual, the organisational and the district levels.

Fourth, previous empirical studies in this field have not articulated or tested for differences in structural, perceptual, and attitudinal dimensions before and after adoption. It is an important distinction since IT adoption is actually an ongoing process, even though this study simplifies the models into recursive models that have no feedback loops. The change analyses in this study provide grounds for considering IT adoption as an ongoing process. The post implementation data suggest that feedback loops can be identified and should be subject to further research.

Methodological implications

The research questions that are addressed in this study cover a wide variety of issues. They range from various factors that may influence each step of IT adoption processes to more technical issues involved in the measurement of attitude and perception changes before and after IT adoption. Furthermore, the structure of the available data also reflects a hierarchical nature that must be taken into consideration in analysis.

Thus, the methodological implications of this study are threefold. First, a recently developed procedure, the Multiple Imputation (MI) method, has been used for handling missing values. Missing observations occur in many areas of research. The methods widely available for analysing incomplete data have focused on removing the data with missing values. Little and Rubin (1987) contend that, with standard statistical techniques, there are basically three methods of handling multivariate data with missing values: (a) complete case analysis (listwise deletion), (b) available case methods (pairwise deletion), and (c) filling in the missing values with estimated scores (imputation methods).

Some advantages of the complete case approach to missing data are: (a) simplicity and (b) comparability of univariate statistics. However, there are disadvantages. Some problems may stem from the potential loss of information in discarding incomplete cases that introduce bias. In addition, case-deletion procedures may bias the results if the subjects who provide complete data are unrepresentative of the entire sample. The second approach uses all cases where the variable of interest is present. This technique has the advantage of being simple and increases the sample size. However, its disadvantage is that the sample base changes from variable to variable according to the pattern of missing data. This can lead to distortion in the estimates of the parameters of a model. Other methods of imputation are also no less problematic. The mean substitution, the imputated average on a variable-by-variable basis, preserves the observed sample means, but it distorts the covariance structure, biasing estimated variance and covariance toward zero. Regression substitution, imputing predicted values from regression models, on the other hand, tends to inflate observed correlations, biasing them away from zero (Schafer, 1997).

During the last two decades, substantial progress has been made in developing software to handle statistical procedures for missing data. Rubin (1987) has developed a procedure for multiple imputations (Schafer & Olsen, 1998). Multiple Imputation (MI) methods allow valid estimates of the variance to be calculated using standard complete data procedures.

Second, Tuijnman and Keeves (1994) have emphasised the widespread but inappropriate reliance of researchers and computer programs on significance tests, which assume a simple random sample when most of the studies in social research do not follow such a design. This statement is also supported by Brick et al (1997). They argued that when data are collected as part of a complex sample survey, there is often no easy way to produce approximately unbiased and design-consistent estimates of variance analytically. Some procedures attempt to take into consideration such sample characteristics. For example, design effects are employed to adjust for complex cluster design and multilevel techniques seek to take into account the nested structure of samples. In this study, the WesVarPC program, which employs a class of techniques called replication methods for estimating variances for complex sample design, was used to calculate the significance of differences.

Third, it has already been pointed out that the data collected in this study include information not only on variables gathered at the employee level but also on questions regarding the characteristics of each organisation involved in the study. In addition, there are also data on some district characteristics collected through various secondary data sources. Hence the data files contain information obtained at three different levels, namely individual level, organisational level, and district level. Models of IT adoption might be developed from theory that incorporate certain individual, organisational and district variables, which might influence each phase of the IT adoption processes. The examination of such models is undoubtedly of particular interest, yet severe problems arise from the combination of data that are obtained at different levels into one model.

Two methods that are commonly employed when data are combined from two or more levels into a single-level analysis are: (a) the aggregation of data collected at the lower level (e.g. individual) to the higher level (e.g. organisation); or (b) the disaggregation of higher level data to the lower level, for example by assigning organisation-level data to each individual employee . Both techniques, aggregation and disaggregation, quite typically introduce bias, leading to an over- or under-estimation of the magnitude of effects associated with variables that are aggregated or disaggregated.

This problem is the same for all types of multivariate analysis that are confined to a single level of analysis such as ordinary least square (OLS), partial least squares path analysis (PLS) or linear structural equation modelling (SEM). Therefore a multilevel path modelling technique is employed in this study. Separate earlier analyses of the IT adoption study data using the single-level analytical tools of PLSPATH and AMOS are limited to information collected at the individual level and organisational level and only form a basis for the analyses of two-level path models using MPLUS in seeking the direct and indirect effects of various potential determinants of IT adoption processes.

At the individual level, the first two analyses (PLSPATH and AMOS) are done under the assumption that each unit is independent of each other. This type of analysis is commonly referred in terms of 'between individual overall' analysis. While the MPLUS analysis, using a two level model analysis, employs a 'between individuals within groups' type of analysis. In this analysis, the measures for each individual are subtracted from the group mean and thus the deviation values from the group mean are employed. Moreover, the data for all groups are pooled for a combined analysis. Even though this technique has taken into account the hierarchical nature of the data, it still fails to provide for the estimations of the cross level interaction effects. The examination of cross-level interaction effects is the third methodological procedure introduced into this study. A multilevel modelling technique using HLM is employed in order to examine such effects.

Management and Policy implication

In addition to theoretical and methodological implications, this study also provides important, although somewhat speculative, management and policy implications for managers of governmental agencies. Bearing in mind the limitations of the study, it can be argued that in order to speed up the adoption and diffusion of IT in local government agencies it is necessary to reduce the level of inhibiting factors and further increase the facilitating factors. There are some issues that need to be addressed in supporting this effort.

Issues of Awareness

In so far as the local government of Bali can be a guide, it appears that the spread of IT expertise in organisations plays an important role both at the district and organisational levels. The levels of IT adoption and implementation are more likely to be higher in districts or organisations where the spread of IT expertise is higher. In addition, in organisations that have higher average educational levels, initiators seem to realise that they adopt technology that is not based on their needs. However, they are seemed to be less satisfied with the current IT arrangement and report the needs to adopt more. Moreover, other interesting results are also found that the average communication channels used in an organisation rather than individual communication channels make a difference as well as the effects of age. Older employees tend to be more passive and less active in using IT, less satisfied and perceived less impacts of IT on their performance.

Therefore harnessing IT for organisational development seems to require awareness-raising. Key decision-makers need to make informed decisions about which technology is most appropriate for their contexts and needs. Understanding how IT can serve specific goals of government agencies requires both knowledge and appropriate technologies and a grounded appreciation of how these technologies can be deployed to address their problems.

Some actions suggested by the literature and the current study that can be considered in order to increase employees' awareness about IT are:

(a) conduct workshops and training which can increase employees' awareness about the potential for IT as well as general awareness and usage of IT in the community, including the private sector;

(b) facilitate the acquisition of IT related knowledge through various communication channels including formal contacts, informal contacts, and written materials, which enable users to exploit the available technical capabilities;

(c) expand observability by visits to IT demonstrations, presentations, and operational systems in other organisations;

(d) consider carefully planned pilot projects that can help potential beneficiaries discover how IT can be useful for their own needs;

(e) share knowledge and experience between organisations and governments;

(f) use projects teams which include experienced people from other governments as well as learners from other organisations which are considering similar technology subsequently;

(g) open realistic assessments of project progress performance in order to understand the critical success factors as well as the critical failure factors; and

(h) when raising awareness, ensure that the end-users are aware of the limitations as well as the possibilities of IT, so as to not to create false expectations.

Issues of Access

In a context such as Bali's, higher-level staff members in enterprise type organisations tend to have higher levels of IT usage. Meanwhile lower level staff members in larger organisations tend to have lower levels of IT usage. These findings may suggest that the availability of IT resources may be limited. Consequently, access to the facilities is also limited which may create physical obstacles to access and participation. In addition, there are also economic obstacles to access. Most agencies involved in this study only have limited financial resources available for them to acquire new IT equipment.

Moreover, gender inequalities also need to be addressed. There are still gaps between male and female employees. Employees in organisations with higher proportions of females report higher levels of satisfaction and performance.

Therefore, it is advisable to consider the following:

(a) combine new technologies with old which can overcome barriers of physical access and affordability; and

(b) incorporate gender awareness in policies, planning, implementation and evaluation of IT projects, and actively to encourage female employees to participate in using and managing IT.

Issues of relevancy and meaningful use

Regarding employees' perceptions of IT, this study suggests that the more consistent IT is with employees' existing beliefs, and the more compatible IT is with employees' work style the more likely they are to adopt and to use IT. Observability also has positive effects. However, it is interesting to observe that the average level of exposure to the technology in an organisation plays an important role for initiators, while the individual level of exposure to the technology plays an important role for non-initiators. These results suggest that the initiators, who are usually the mid- to top-level management staff members, are more concerned about the average exposure to the technology in their organisation, while the non-initiators, who are usually the low-level staff members, have perceptions and attitudes that are influenced by their individual level of exposure to the technology. Complexity, however, has mixed effects. It seems to increase the level of passive usage of initiators. In addition, it also seems to increase initiation, adoption, satisfaction and performance, which are surprising. However, using HLM analysis, the interaction effects can explain these anomalies. Moreover, the effects of perceived relative advantages seem to show the IT paradox phenomenon where IT is not delivering the promised benefits. It also seems that IT implementation in Bali is still at the first stage (in Nolan's Four Stage Model) and is using an isolate or idolise approach (Heeks, 2000)

Some implications from these results to consider are:

(a) to increase employees' exposure to the technology, so they can develop their understanding regarding IT;

(b) to reduce computer related anxiety and to build confidence in working with computers in employees who lack computer experience;

(c) to diminish the fear of IT due to perceived complexity;

(d) to increase exposure to the technology, to show IT related benefits (organisational and personal);

(e) to provide conditions for gradual change and thus reduce resistance to change; and

(f) when assessing information and service needs of organisations, be demand driven, not supply driven.

In addition to the above issues, there are also some problems suggested in the literature and from the present study that need to be addressed to enable the technologies to deliver the promised benefits. Among the problems are sustainability issues. In some cases, sustainability is compromised by insufficient training and occasionally the technologies chosen do not suit the task. Sometimes the simplest technologies can produce the best results. Another problem is the coordination issue. Lack of coordination can lead to duplication of effort and incompatibility of technical solutions. Therefore, some additional recommendations might be:

(a) to allow for on-going support for training;

(b) to match IT to the context of what is needed; and

(c) to build partnerships with other agencies.

Limitations of the Study and Recommendations for Further Research

As with all research, the current study has certain limitations. Each causal path, with its arrow, in the model must be seen as a hypothesis. The causal links that are proposed in the model, and the model itself must be tested for adequacy. The findings may support the acceptance of the model, but do not establish the truth of the model, which must remain as adequate until a better explanatory model is proposed and tested.

Moreover, this study does not try to evaluate all operations that are affected by the adoption and implementation of information technology. There are impacts of IT on collectivities, such as the work group, the department, the organisation, or even the society, as well as the impact on individuals. This study focuses only in terms of the perceived impact of IT utilisation on user performance for individuals who work in governmental agencies.

A longitudinal study obtaining multiple responses over a sufficiently long period of time could have provided a study that would have yielded stronger findings. However, because of the limitations of time and other resources, only a cross-sectional study could be conducted.

Lack of statistical data and other information, difficulties of access to existing information due to the distance between the place of study and the place under study are some other problems that confront this investigation. In addition, this study was done in the time period where the Indonesian local governments experienced highly centralised IT adoption and implementation policy, under Soeharto's administration. During this period, the level of central government interference in the IT adoption and implementation processes was very high. These interferences included those from centrally appointed software and hardware providers and uniform information systems, which sometimes were not suitable for the local needs. These external factors may contaminate the findings of this study to an unknown extent. Furthermore, the study is in many respects an exploratory investigation, rather than a confirmatory one because little information is available about the adoption over time and implementation of IT in Indonesia, in general, and in Bali, in particular. Therefore, some suggestions for further research can be advanced:

(a) since software and hardware have their own adoption and diffusion stages in organisations as well as having their own developmental rates and directions in the IT industry, it is useful to control one or the other and investigate their effects in more detail;

(b) since the interference of central government on local IT policy was very high at the time this study was undertaken that might distort the results to an unknown extent, it is worthwhile re-testing the models developed and tested in this study under the new reformation era in Indonesia;

(c) since there are some limitations in using a cross-sectional study for drawing causal inferences and the analysis of change, it is desirable to employ a longitudinal study in order to obtain stronger and more meaningful findings both in Bali and in other contexts.

Moreover, the study poses many challenges in the collection and analysis of the data, which are multilevel in nature, operating at the individual, organisational level, and district level, where appropriate methods of analysis are not widely known and well established. The management of these challenges, together with the practical implications of the study and the new theoretical understandings of the effects of local conditions on the implementation of an innovation, make this investigation a substantial and significant contribution to understanding the forces that operate in this and similar situations.

15

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A

Exploratory Factor Analysis

In this study, three different rotations - varimax, quartimax, and oblimin were employed and compared as explained in Chapter 6. As discussed earlier in Chapter Five, there are nine relevant domains - environmental factors, organisational factors, technological factors, human factors, initiation, adoption, utilisation, user satisfaction, and user performance. The constructs derived from the principle component factor analysis using the above procedure are presented in the following tables, which indicate the extracted factors and also the labels that have been provided for them. The loadings obtained from varimax, quartimax, and oblimin rotations are presented in columns with headings 'V', 'Q', and 'O' respectively.

Table A.1 Environment Factors

		Regency Size			Socio-Economic Level			Supporting Facilities		
		RSIZE			SOCEC			SUFAC		
Name	**Description**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**
AREA	Land Area	0.98	0.98	0.98						
POPU	Population	1.00	1.00	1.00						
ULEV	Upper Level Gov. Support	0.99	0.99	0.99						
INCO	Per capita Income				0.94	0.94	0.96			
REVC	Revenue/Capita				0.99	0.99	0.99			
SCBC	SC Budget/capita				0.97	0.97	0.97			
BUDC	Total budget/capita				0.94	0.94	0.93			
ITSU	IT Supplier /area							0.99	0.99	0.99
ITSE	IT Service/area							0.99	0.99	0.99
ITTR	IT Training/area							0.99	0.99	0.99
TELC	Telecommunication/capita							0.88	0.88	0.90

Table A.2 Organisational Factors

		Organisation Size			Centralisation			Formalisation			Org. Complexity		
		OSIZE			CENTRAL			FORMAL			OCOMPLEX		
Name	**Description**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**
CEN1	Centralisation item1				0.82	0.82	0.82						
CEN2	Centralisation item2				0.81	0.81	0.81						
CEN3	Centralisation item3				0.75	0.75	0.77						
CEN4	Centralisation item4				0.78	0.78	0.78						
FOR1	Formalisation item1							0.87	0.87	-0.88			
FOR2	Formalisation item2							0.90	0.90	-0.90			
FOR3	Formalisation item3							0.82	0.82	-0.82			
NEMP	Total Employee	0.70	0.68	0.78									
VLEV	Vertical Level	0.81	0.81	0.85									
HLEV	Horizontal Level	0.82	0.82	0.81									
EMIT	Total Employee with IT skills										0.95	0.96	0.98
ITSK	IT Skill										0.97	0.97	0.98
ITEX	IT Expertise										0.98	0.98	0.99

Table A.3 Technological Factors

		Belief			Relative Advantage			Complexity			Compatibility			Observability		
		BELIEF			RELAD			COMPLEX			COMPA			OBSERV		
Name	**Description**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**
RDST	Reduce staff	0.72	0.71	0.74												
RDCO	Reduce cost	0.69	0.70	0.72												
INPR	Increase productivity				0.71	0.72	-0.74									
INEF	Increase effectiveness				0.85	0.86	-0.87									
INAV	Increase availability				0.86	0.87	-0.89									
INTI	Increase timeliness				0.88	0.89	-0.90									
EACC	Easy to access				0.89	0.89	-0.91									
SOBT	Speed to obtain				0.89	0.90	-0.91									
CMJO	Create more jobs	0.58	0.59	0.63												
ISPL	Isolate people	0.75	0.75	0.75												
COLI	Control our live	0.56	0.57	0.63												
WSCO	Work aspects compatibility										0.85	0.84	0.91			
ALCO	All aspects compatibility										0.87	0.85	0.92			
PRCO	Previous exp. compatibility										0.78	0.77	0.84			
DIUN	Difficult to understand							0.86	0.86	0.88						
DIUS	Difficult to use							0.84	0.83	0.86						
SMVE	Small version availability													0.76	0.76	0.83
MODU	Modular design													0.79	0.79	0.85
TRYO	Chance to try out													0.82	0.82	0.86
SEPR	See presentation & Demo													0.75	0.74	0.81

Table A.4 Human Factors

		Computer Anxiety			Originator			System Oriented			Rule Oriented			Fitter In			Conservatism		
		ANX			ORIGIN			SYSTEM			RULE			FITTIN			CONSERV		
Name	**Description**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**
ANX1	Anxiety item1	0.75	0.75	0.75															
ANX2	Anxiety item2	0.84	0.85	0.85															
ANX3	Anxiety item3	0.87	0.87	0.87															
ANX4	Anxiety item4	0.88	0.88	0.88															
ANX5	Anxiety item5	0.81	0.81	0.82															
ATT1	Attd. twd. Change1													0.79	0.77	0.88			
ATT2	Attd. twd Change2				0.64	0.63	0.64												
ATT3	Attd. twd Change3							0.68	0.65	0.78									
ATT4	Attd. twd Change4				0.70	0.70	0.71												
ATT5	Attd. twd Change5										0.78	0.77	-0.84						
ATT6	Attd. twd Change6										0.82	0.80	-0.85						
ATT7	Attd. twd Change7										0.80	0.79	-0.82						
ATT8	Attd. twd Change8																0.71	0.76	0.78
ATT9	Attd. twd Change9																0.60	0.50	0.57
ATT10	Attd. twd Change10				0.80	0.81	0.82												
ATT11	Attd. twd Change11				0.72	0.71	0.72												
ATT12	Attd. twd Change12																0.74	0.71	0.76
ATT13	Attd. twd Change13							0.71	0.70	0.77									
ATT14	Attd. twd Change14							0.62	0.60	0.65									

Continued

Table A.4 Human Factors (continued)

		Computer Anxiety			Originator			System Oriented			Rule Oriented			Fitter In			Conservatism		
		ANX			ORIGIN			SYSTEM			RULE			FITTIN			CONSERV		
Name	**Description**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**
ATT15	Attd. twd Change15				0.78	0.79	0.80												
ATT16	Attd. twd Change16																0.72	0.78	0.81
ATT17	Attd. twd Change17				0.73	0.76	0.76												
ATT18	Attd. twd Change18				0.73	0.77	0.77												
ATT19	Attd. twd Change19													0.78	0.75	0.89			
ATT20	Attd. twd Change20				0.77	0.82	0.83												
ATT21	Attd. twd Change21							0.75	0.71	0.86									
ATT22	Attd. twd Change22				0.77	0.81	0.82												
ATT23	Attd. twd Change23																0.76	0.76	0.82
ATT24	Attd. twd Change24							0.70	0.57	0.81									
ATT25	Attd. twd Change25				0.75	0.75	0.76												
ATT26	Attd. twd Change26										0.77	0.77	-0.84						
ATT27	Attd. twd Change27										0.72	0.71	-0.79						
ATT28	Attd. twd Change28										0.71	0.72	-0.78						
ATT29	Attd. twd Change29														0.72	0.84			
ATT30	Attd. twd Change30				0.60	0.64	0.64												
ATT31	Attd. twd Change31																0.71	0.75	0.77
ATT32	Attd. twd Change32																0.64	0.53	0.60

Table A.5 Initiation

		Need Pull			Technology Push			Social Pressures		
		NEEDPULL			TECHPUSH			SOCPRES		
Name	**Description**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**
AEFI	Actual Efficiency drop		0.80							
FEFI	Future Efficiency drop		0.87							
AEFE	Actual Effectiveness drop		0.86							
FEFE	Future Effectiveness drop		0.88							
ITDE	IT Development					0.85				
ITAD	Adopt IT earlier					0.83				
PPRE	Public Pressure								0.74	
VPRE	Vendor Pressure								0.80	
UPRE	Upper level Pressure								0.80	

Table A.6 Adoption

		Level of Commitment			Extensiveness		
		COMMIT			EXTEN		
Name	**Description**	**V**	**Q**	**O**	**V**	**Q**	**O**
YEAR	Speed of Adoption				0.69	0.69	0.70
HW_B	Hardware Budget	0.81	0.81	0.81			
SW_B	Software Budget	0.84	0.84	0.85			
TR_B	Training Budget	0.77	0.78	0.78			
IT_B	Overall IT Budget	0.83	0.83	0.83			
NAPP	Number of Applications				0.80	0.80	0.80

Table A.7 Usage

		Level of Passive Usage			Level of Active Usage		
		PASSIVE			ACTIVE		
Name	Description	V	Q	O	V	Q	O
INPAU	Intensity of Passive usage	0.75	0.76	0.76			
FRINU	Frequency of indirect usage	0.86	0.86	0.86			
FRPAU	Frequency of passive usage	0.76	0.75	0.76			
INACU	Intensity of active usage				0.82	0.82	0.83
FRDIU	Frequency of direct usage				0.68	0.68	0.69
APPUS	# Applications used				0.73	0.74	0.73
TKSSU	# Task supported				0.66	0.68	0.67

Table A.8 Satisfaction

		IT Adequacy			System Satisfaction			Vendor Sup. Satisfac.			Training Satisfaction		
		ITADEQ			SYSSAT			VENSAT			TRASAT		
Name	**Description**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**	**V**	**Q**	**O**
HWAD_1	Hardware item1	0.67	0.52	0.73									
HWAD_2	Hardware item2	0.76	0.58	0.82									
HWAD_3	Hardware item3	0.62	0.50	0.66									
SWAD_1	Software item1	0.77	0.56	0.81									
SWAD_2	Software item2	0.74	0.64	0.82									
SWAD_3	Software item3	0.54	0.57	0.65									
CONT_1	Content item1				0.63	0.77	0.74						
CONT_2	Content item2				0.57	0.76	0.72						
CONT_3	Content item3				0.63	0.79	0.75						
CONT_4	Content item4				0.62	0.75	0.72						
ACCU_1	Accuracy item1				0.73	0.80	0.80						
ACCU_2	Accuracy item2				0.76	0.80	0.81						
FORM_1	Format item1				0.77	0.80	0.81						
FORM_2	Format item2				0.80	0.80	0.82						
EUSE_1	Easy of Use item1				0.66	0.75	0.74						
EUSE_2	Easy of Use item2				0.66	0.75	0.74						
TIME_1	Timeliness item1				0.75	0.74	0.77						
TIME_2	Timeliness item2				0.75	0.75	0.78						
VSUP_1	Vendor S. item1							0.87	0.85	-0.92			
VSUP_2	Vendor S. item2							0.90	0.87	-0.94			
VSUP_3	Vendor S. item3							0.83	0.80	-0.90			
TRNS_1	Training S. item1										0.85	0.84	0.90
TRNS_2	Training S. item2										0.89	0.87	0.93
TRNS_3	Training S. item3										0.87	0.86	0.91

Table A.9 User Performance

		IT Adequacy
Name	**Description**	**V/Q/O**
QUICKR	Quicker	0.80
INPROD	Increase Productivity	0.80
INWVOL	Increase Work volume	0.80
IMPERF	Improve Performance	0.77
IMWOQL	Improve Work Quality	0.74
EASIER	Easier	0.72
INEFFE	Increase Effectiveness	0.78
INJOCT	Increase Job Control	0.80
GUTILY	Great Utility	0.81
BENFCL	Beneficial	0.77
ACCPBL	Acceptable	0.80
APPRPT	Appropriate	0.76

B

Cluster Analysis

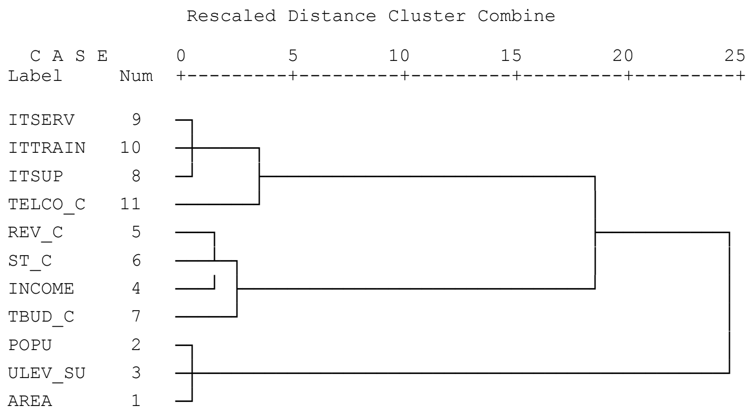

Figure B.1 Cluster Analysis for Environment Factors

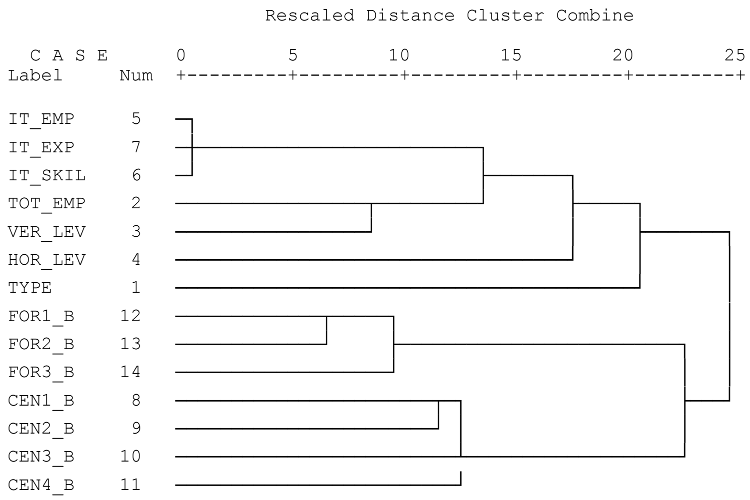

Figure B.2 Cluster Analysis for Organizational Factors

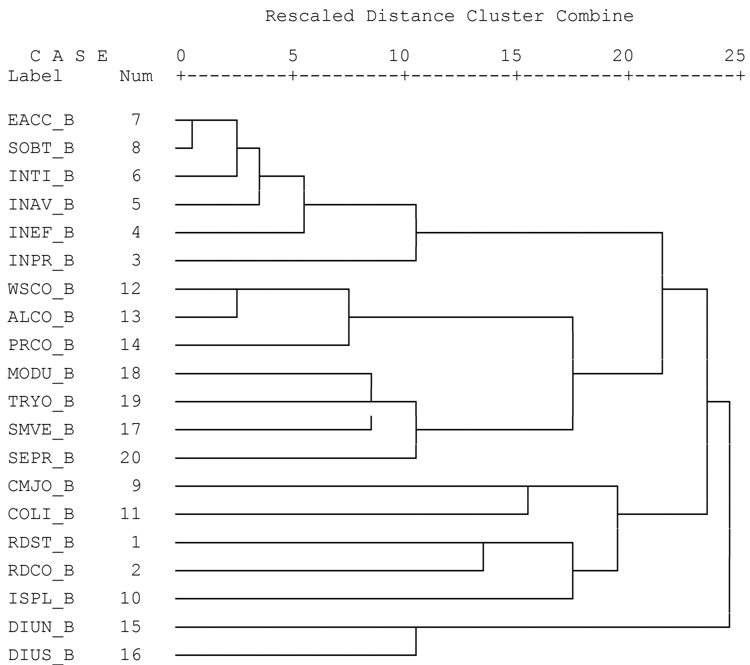

Figure B.3 Cluster Analysis for Technological Factors

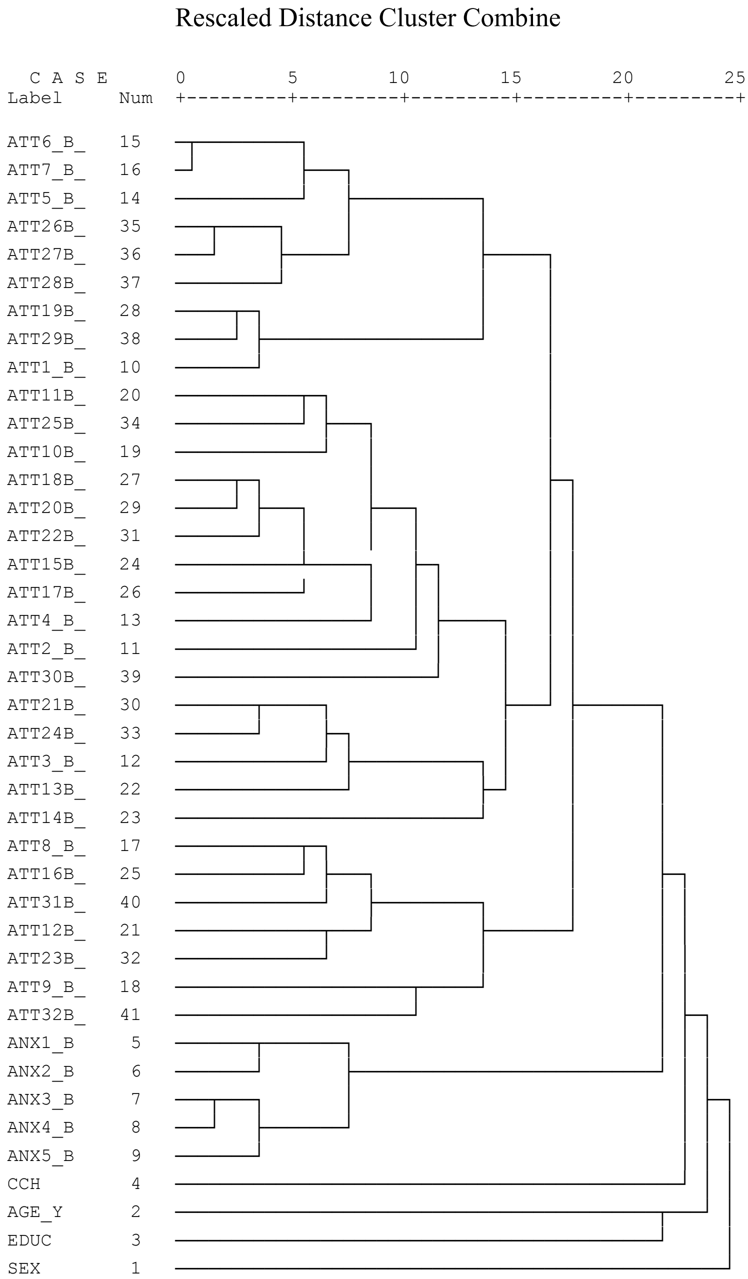

Figure B.4 Cluster Analysis for Human Factors

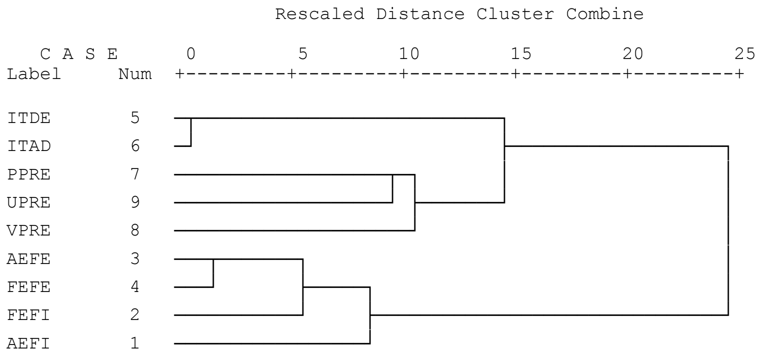

Figure B.5 Cluster Analysis for Initiation

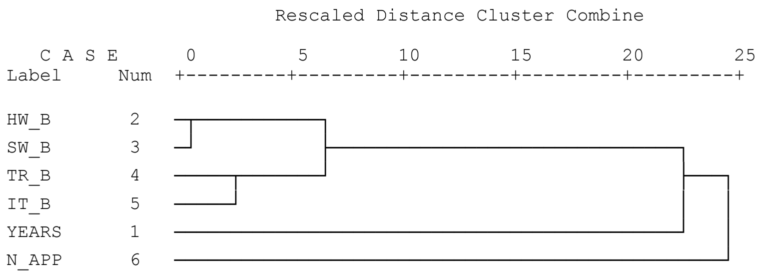

Figure B.6 Cluster Analysis for Adoption

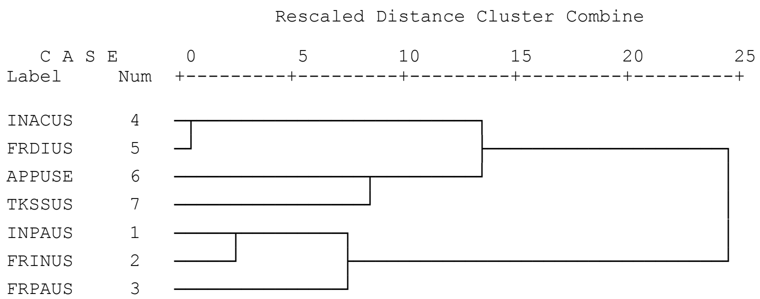

Figure B.7 Cluster Analysis for Utilization

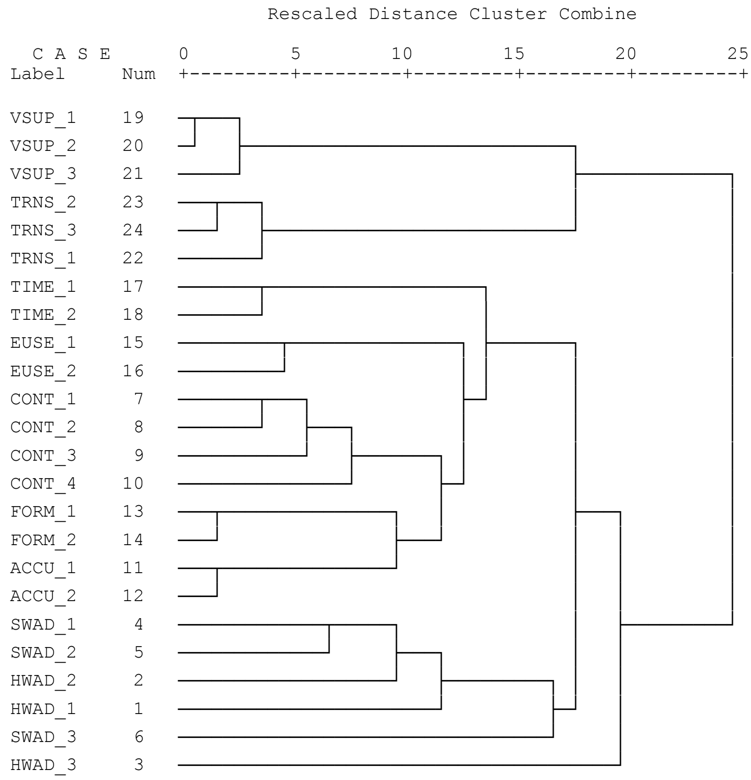

Figure B.8 Cluster Analysis for Satisfaction

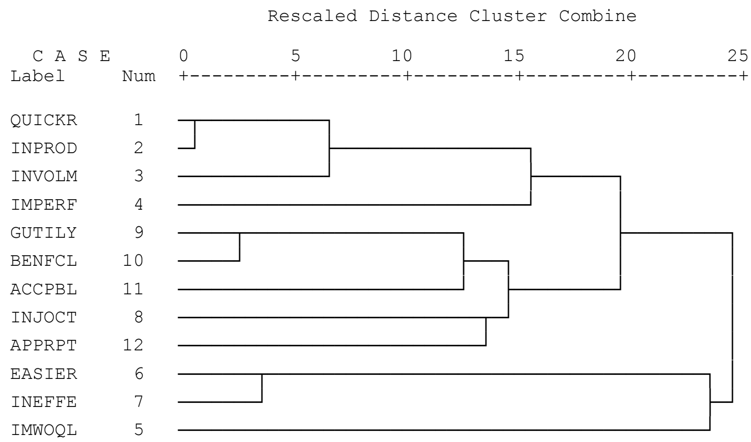

Figure B.9 Cluster Analysis for Performance

C

Confirmatory Factor Analysis

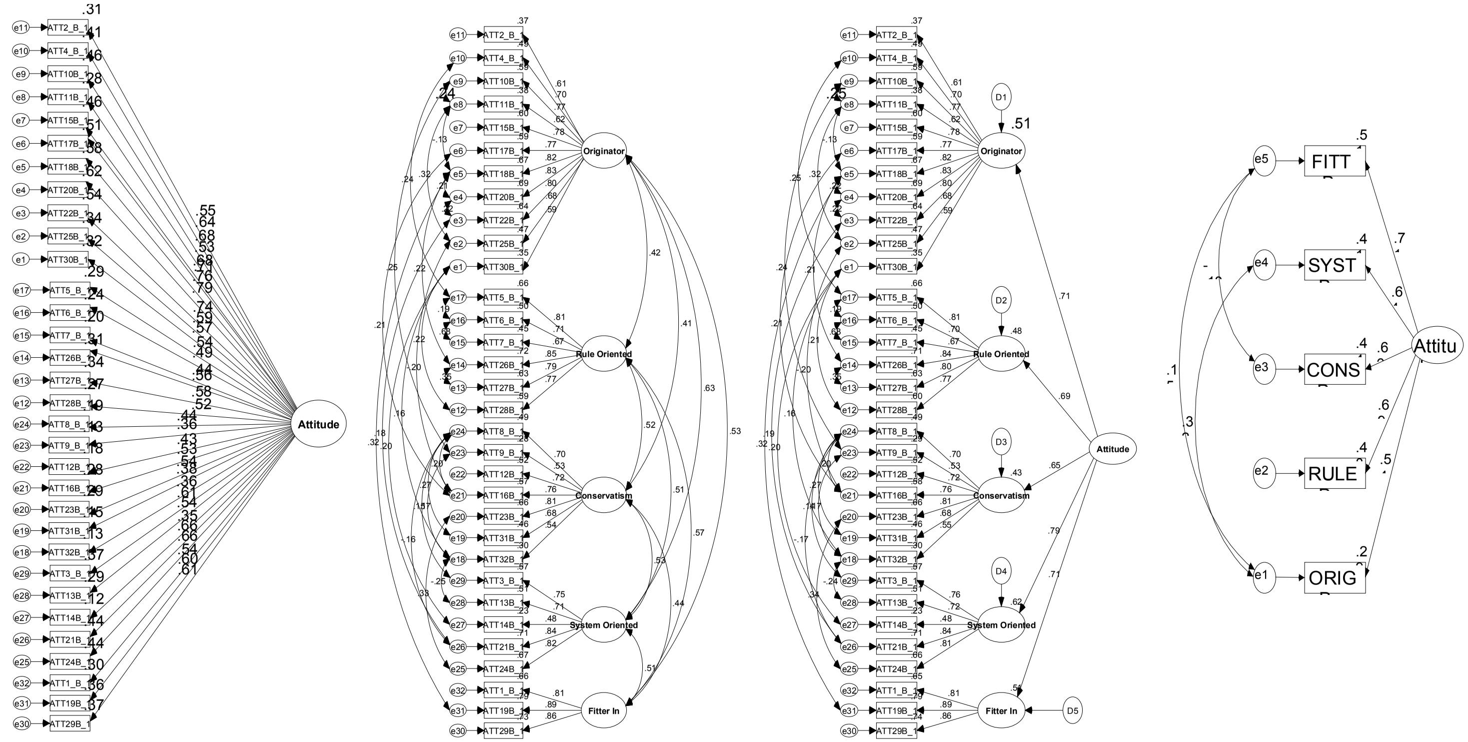

Figure. C.1 (a) One Factor (b) Five Factor, (c) Second Order Factor, (d) Higher Level Factor Models of Attitudes toward Change

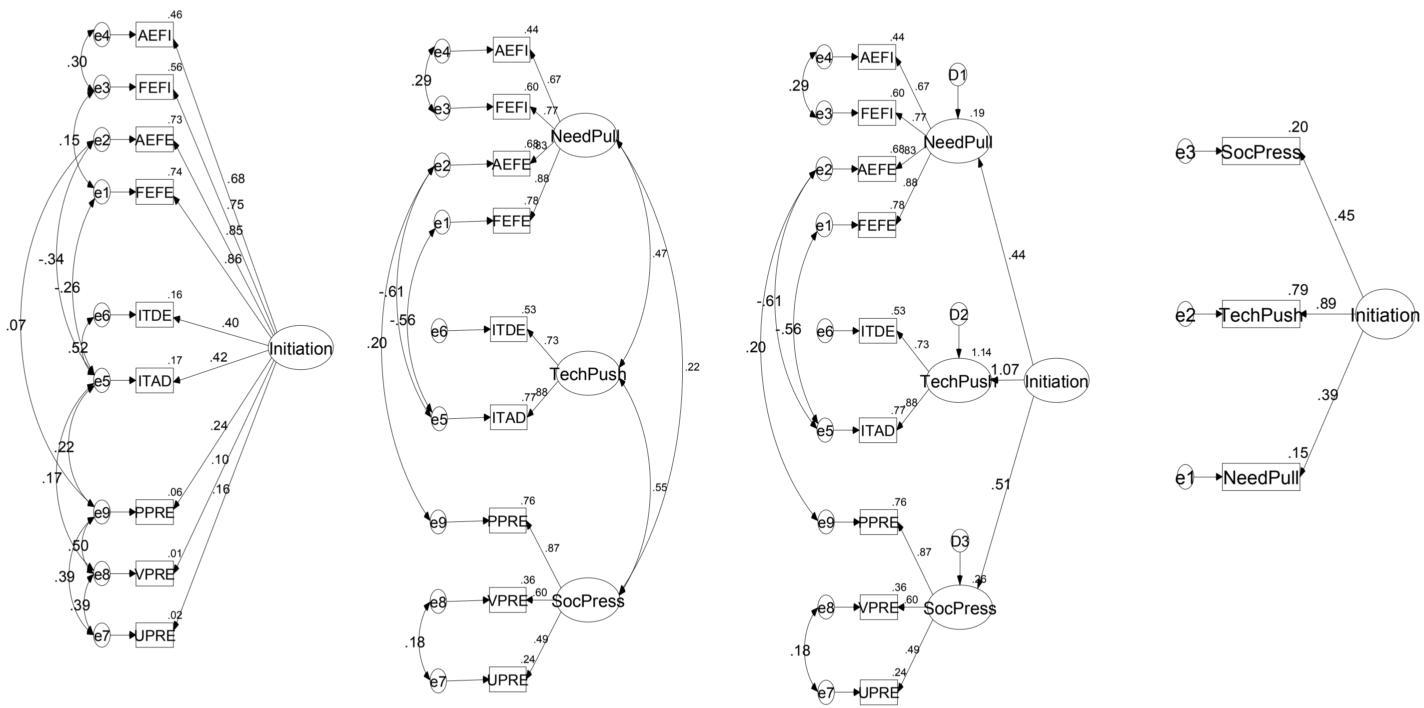

Figure C.2 (a) One Factor (b) Three Factor, (c) Second Order Factor, (d) Higher Level Factor Models of Initiation

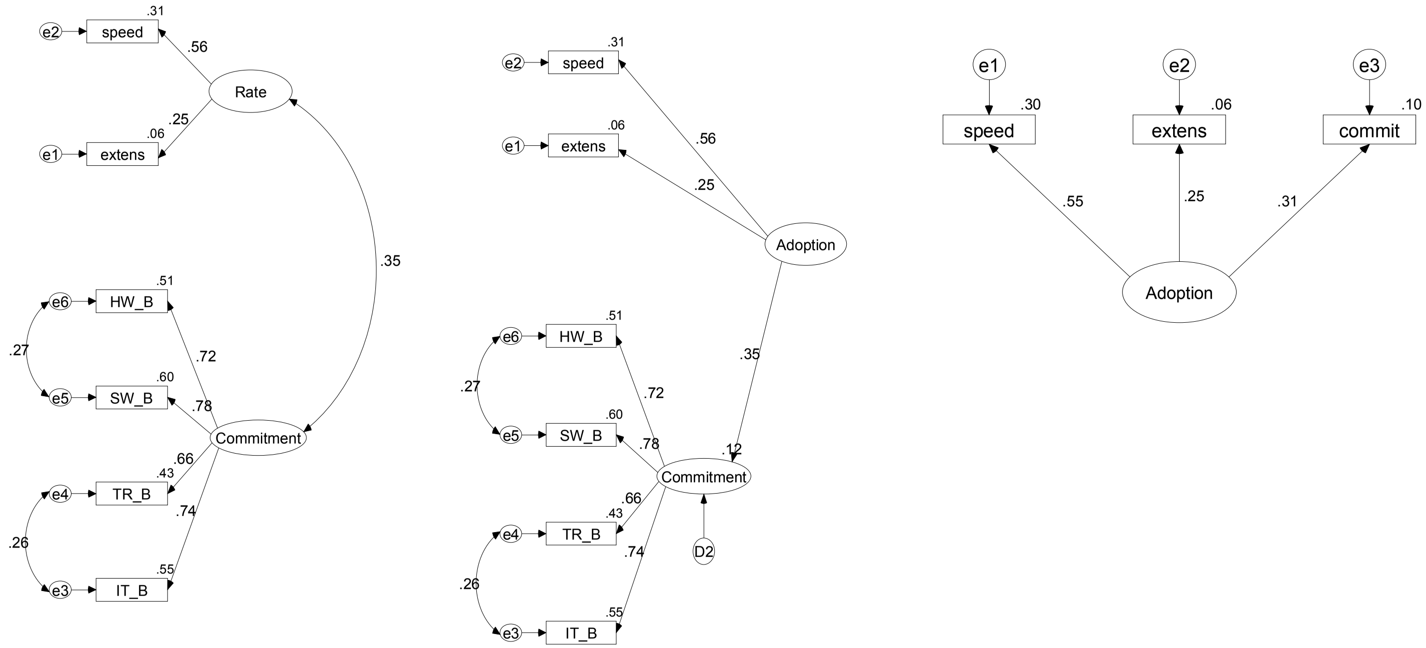

Figure C.3 (a) Two Factor (b) Second Order Factor, (c) Higher Level Factor Models of Adoption

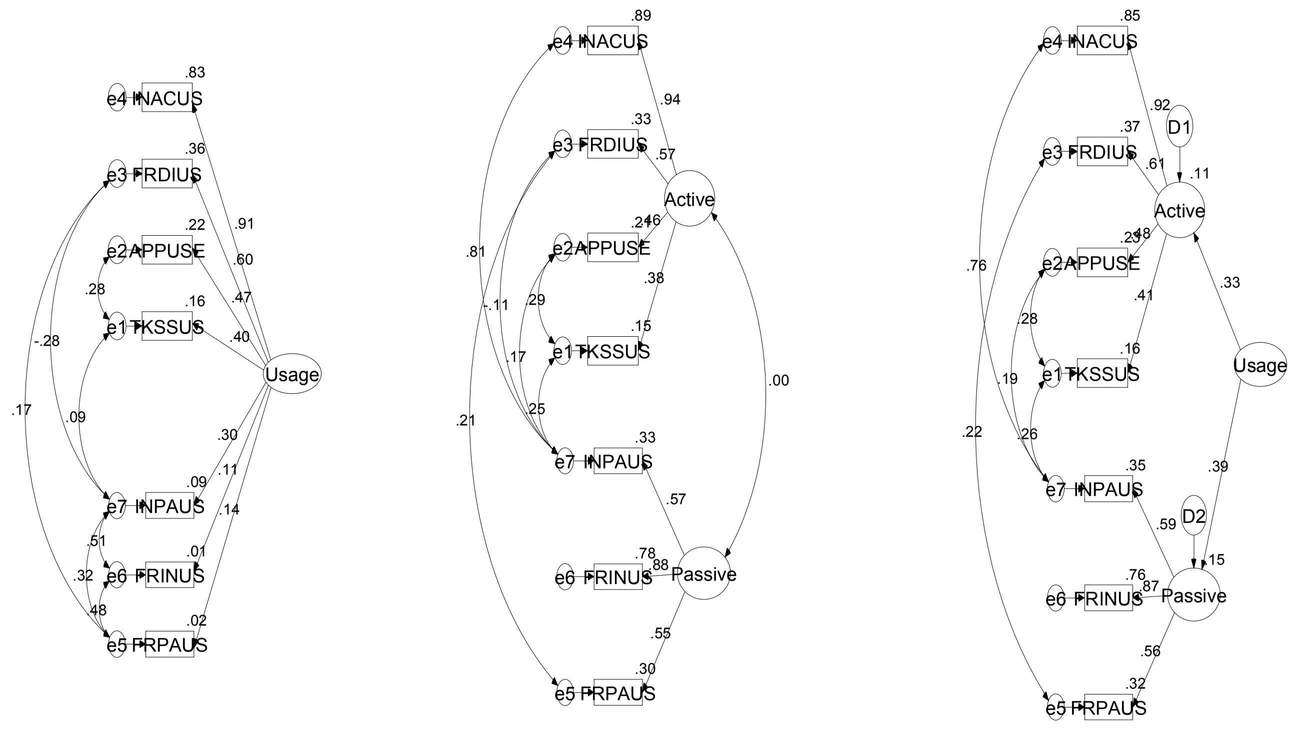

Figure C.4 (a) One Factor (b) Two Factors, (c) Second Order Factor of IT Usage

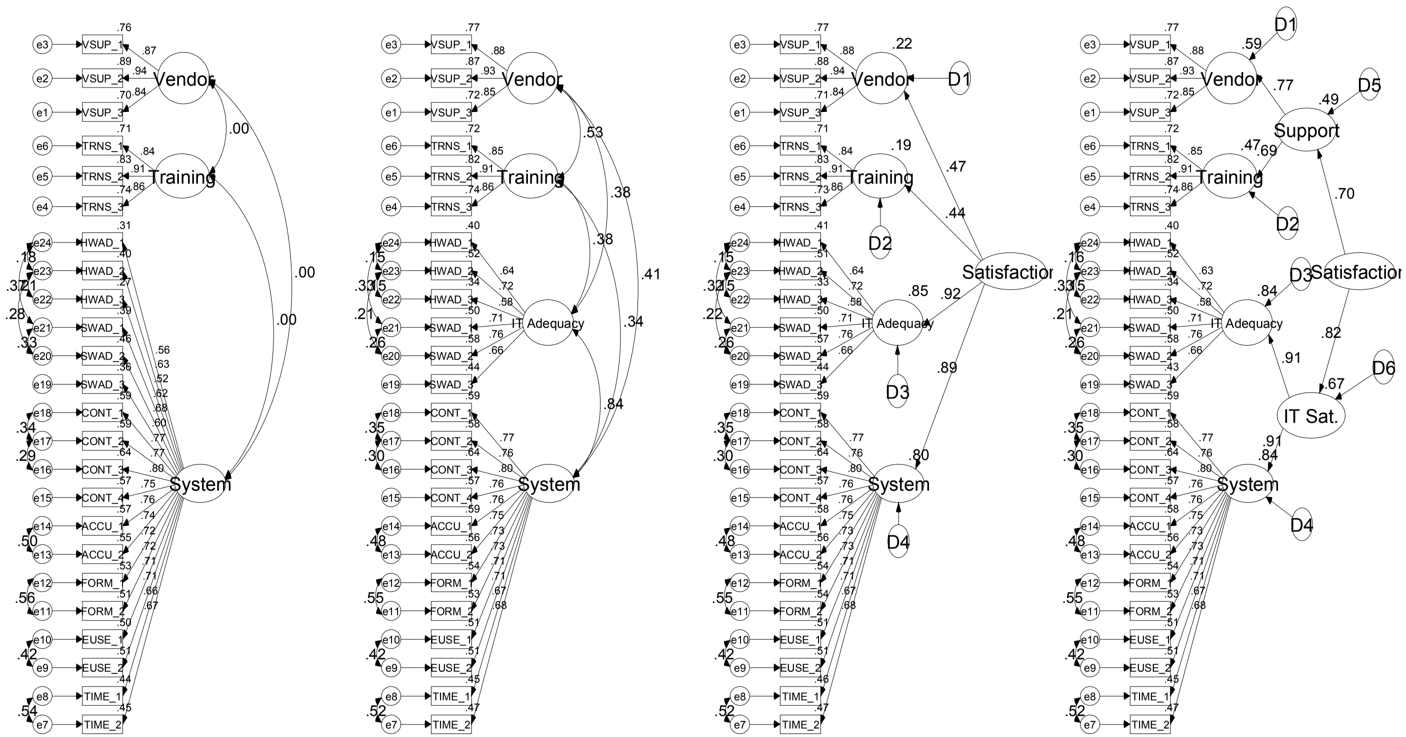

Figure C.5 (a) Three Factors (b) Four Factor, (c) Second Order Factor, (d) Third Order Factor Models of Satisfaction

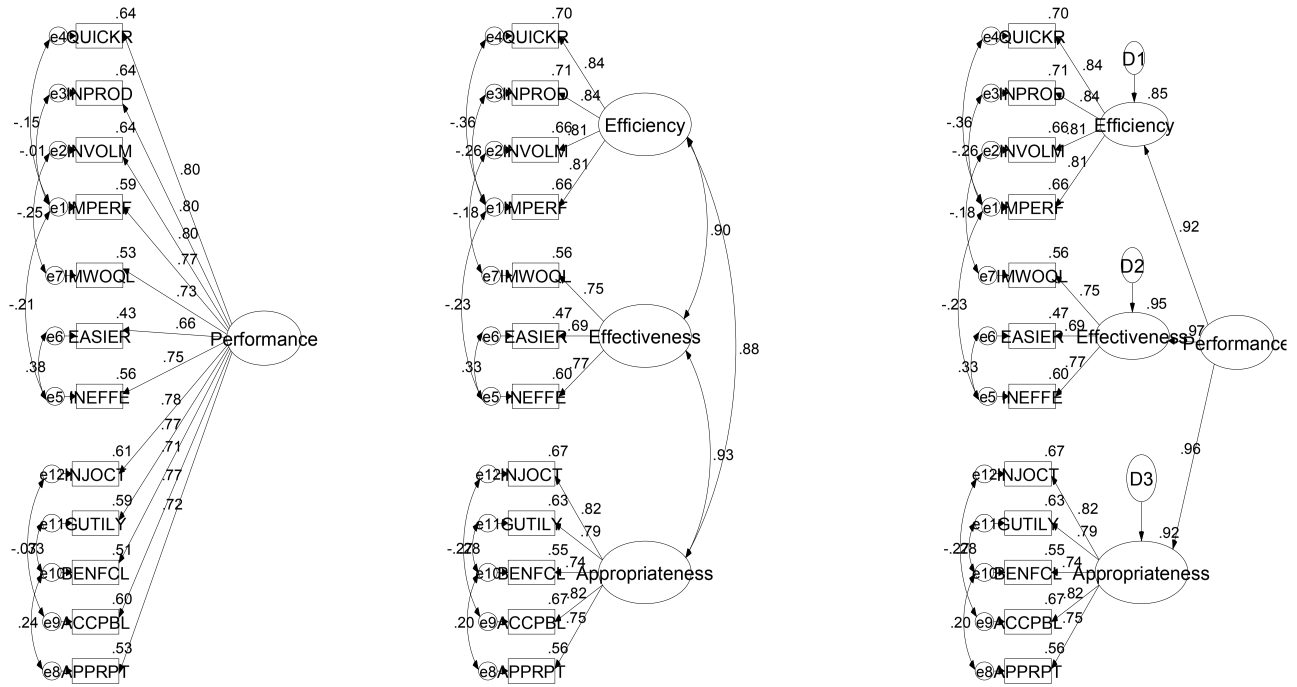

Figure C.6 (a) One Factor (b) Three Factors, (c) Second Order Factor, (d) Higher Level Factor Models of Performance

D

t-test results

Table D.1 Test of Differences for Initiators

Paired		Paired Sample t-test								WesVarPC				
Variables	**Description**	**Mean**	**SD**	**SE**	**t**	**df**	**Sig.**	**Effect Size**		**Mean**	**SE**	**CV(%)**	**N**	**DEFF**
Centralisation														
CEN1_B - CEN1_A	Decision for new service	-0.53	1.23	0.06	-9.19	447	0.000	0.43	Small	0.53	0.09	16.72	465	2.47
CEN2_B - CEN2_A	Decision for budgeting	-0.38	1.11	0.05	-7.19	446	0.000	0.34	Small	0.38	0.08	21.76	465	2.65
CEN3_B - CEN3_A	Decision for changes	-0.23	1.16	0.06	-4.19	446	0.000	0.20	Small	0.24	0.08	34.08	465	2.35
CEN4_B - CEN4_A	Decision for personnel	-0.11	1.17	0.06	-1.98	446	0.048	0.09	Small	0.10	0.08	83.76	465	1.99
Formalisation														
FOR1_B – FOR1_A	Formal procedure	-0.40	0.86	0.04	-9.87	447	0.000	0.47	Small	0.40	0.05	12.09	465	1.54
FOR2_B - FOR2_A	Adhere to procedure	-0.25	0.73	0.03	-7.39	450	0.000	0.35	Small	0.25	0.05	18.33	465	1.94
FOR3_B - FOR3_A	Tolerance for violation	-0.22	0.82	0.04	-5.74	447	0.000	0.27	Small	0.22	0.05	23.36	465	1.94
Belief														
RDST_B - RDST_A	Reduce Staff	-0.36	1.26	0.06	-6.07	453	0.000	0.28	Small	0.36	0.07	20.73	465	1.65
RDCO_B - RDCO_A	Reduce Cost	-0.31	1.37	0.06	-4.85	448	0.000	0.23	Small	0.31	0.10	30.87	465	2.41
CMJO_B - CMJO_A	Create more jobs	-0.36	1.28	0.06	-5.76	432	0.000	0.28	Small	0.36	0.09	26.47	465	2.70
ISPL_B - ISPL_A	Isolate people	-0.16	1.18	0.06	-2.81	432	0.005	0.14	Small	0.16	0.07	45.42	465	1.94
COLI_B - COLI_A	Control our live	-0.58	1.20	0.06	-10.14	430	0.000	0.49	Small	0.59	0.08	13.97	465	2.37

continued

Table D.1 Test of Differences for Initiators (continued)

Paired		Paired Sample t-test								WesVarPC				
Variables	**Description**	**Mean**	**SD**	**SE**	**t**	**df**	**Sig.**	**Effect Size**		**Mean**	**SE**	**CV(%)**	**N**	**DEFF**
Relative Advantages														
INPR_B - INPR_A	Increase Productivity	-0.87	1.46	0.07	-12.56	443	0.000	0.60	Medium	0.87	0.10	11.55	465	2.30
INEF_B - INEF_A	Increase Effectiveness	-0.73	1.33	0.06	-11.63	443	0.000	0.55	Medium	0.73	0.09	12.84	465	2.44
INAV_B – INAV_A	Information availability	-0.98	1.40	0.07	-14.72	444	0.000	0.70	Medium	0.98	0.10	10.70	465	2.71
INTI_B - INTI_A	Information Timeliness	-1.00	1.49	0.07	-14.03	436	0.000	0.67	Medium	0.99	0.10	10.17	465	2.26
EACC_B - EACC_A	Ease of Access	-1.00	1.60	0.08	-13.26	444	0.000	0.63	Medium	1.00	0.12	11.91	465	2.69
SOBT_B – SOBT_A	Speed to obtain	-1.00	1.54	0.07	-13.64	441	0.000	0.65	Medium	0.99	0.11	10.92	465	2.43
Compatibility														
WSCO_B - WSCO_A	Work style fit	-0.93	1.46	0.07	-13.23	432	0.000	0.64	Medium	0.94	0.09	9.66	465	1.93
ALCO_B - ALCO_A	Compatible with all aspects of jobs	-0.97	1.38	0.07	-14.55	430	0.000	0.70	Medium	0.98	0.09	9.14	465	2.10
PRCO_B - PRCO_A	Previous experience compatibility	-0.76	1.41	0.07	-11.28	431	0.000	0.54	Medium	0.77	0.08	10.79	465	1.76
Complexity														
DIUN_B – DIUN_A	Difficulty in understanding	-0.37	1.45	0.07	-5.27	431	0.000	0.25	Small	0.36	0.09	23.72	465	1.78
DIUS_B – DIUS_A	Difficulty in using	-0.01	1.41	0.07	-0.17	427	0.864	0.01	Small	0.02	0.08	493.61	465	1.51

continued

Table D.1 Test of Differences for Initiators (continued)

Paired		Paired Sample t-test								WesVarPC				
Variables	Description	Mean	SD	SE	t	df	Sig.	Effect Size		Mean	SE	CV(%)	N	DEFF
Observability														
SMVE_B - SMVE_A	Smaller version	-0.64	1.17	0.06	-11.26	424	0.000	0.55	Medium	0.63	0.08	12.49	465	2.34
MODU_B - MODU_A	Modular	-0.71	1.38	0.07	-10.61	424	0.000	0.51	Medium	0.71	0.09	12.31	465	2.03
TRYO_B - TRYO_A	Try out	-0.75	1.33	0.06	-11.59	420	0.000	0.56	Medium	0.75	0.09	12.38	465	2.51
SEPR_B - SEPR_A	See presentation & demo	-0.98	1.40	0.07	-14.41	423	0.000	0.70	Medium	0.98	0.10	9.98	465	2.47
Computer Related Anxiety														
ANX1_B - ANX1_A	Feel Apprehensive	0.29	1.54	0.07	3.99	441	0.000	0.19	Small	-0.29	0.09	29.71	465	1.58
ANX2_B - ANX2_A	Afraid damaging the computer	0.37	1.43	0.07	5.41	441	0.000	0.26	Small	-0.37	0.08	21.32	465	1.50
ANX3_B - ANX3_A	Fear of making mistake	0.20	1.35	0.06	3.17	442	0.002	0.15	Small	-0.21	0.08	38.65	465	1.77
ANX4_B - ANX4_A	Unfamiliar	0.49	1.45	0.07	7.11	442	0.000	0.34	Small	-0.49	0.08	16.11	465	1.47
ANX5_B - ANX5_A	Confusing	0.44	1.54	0.07	6.03	442	0.000	0.29	Small	-0.44	0.09	19.34	465	1.50
Attitude Toward Change														
ATT1_B - ATT1_A	Attitude 1	-0.36	0.81	0.04	-9.40	445	0.000	0.44	Small	0.36	0.05	13.22	465	1.67
ATT2_B - ATT2_A	Attitude 2	-0.26	0.90	0.04	-6.11	441	0.000	0.29	Small	0.26	0.05	19.38	465	1.54
ATT3_B - ATT3_A	Attitude 3	-0.36	0.80	0.04	-9.34	442	0.000	0.44	Small	0.36	0.04	12.28	465	1.45

continued

Table D.1 Test of Differences for Initiators (continued)

Paired		Paired Sample t-test								WesVarPC				
Variables	**Description**	**Mean**	**SD**	**SE**	**t**	**df**	**Sig.**	**Effect Size**		**Mean**	**SE**	**CV(%)**	**N**	**DEFF**
ATT4_B - ATT4_A	Attitude 4	-0.26	1.09	0.05	-5.06	440	0.000	0.24	Small	0.27	0.07	25.82	465	1.93
ATT5_B - ATT5_A	Attitude 5	-0.16	0.85	0.04	-3.95	433	0.000	0.19	Small	0.16	0.05	31.27	465	1.67
ATT6_B - ATT6_A	Attitude 6	-0.19	0.99	0.05	-4.13	435	0.000	0.20	Small	0.19	0.05	24.45	465	1.15
ATT7_B - ATT7_A	Attitude 7	-0.19	0.93	0.04	-4.20	436	0.000	0.20	Small	0.19	0.05	26.72	465	1.42
ATT8_B - ATT8_A	Attitude 8	-0.12	0.72	0.03	-3.41	436	0.001	0.16	Small	0.12	0.04	35.21	465	1.64
ATT9_B - ATT9_A	Attitude 9	-0.14	0.80	0.04	-3.75	432	0.000	0.18	Small	0.14	0.04	30.31	465	1.44
ATT10B - ATT10A	Attitude 10	-0.29	0.90	0.04	-6.78	436	0.000	0.32	Small	0.29	0.05	16.79	465	1.46
ATT11B - ATT11A	Attitude 11	-0.22	0.89	0.04	-5.05	436	0.000	0.24	Small	0.22	0.05	22.76	465	1.51
ATT12B - ATT12A	Attitude 12	-0.22	0.81	0.04	-5.66	434	0.000	0.27	Small	0.22	0.04	20.21	465	1.46
ATT13B - ATT13A	Attitude 13	-0.26	0.81	0.04	-6.57	434	0.000	0.32	Small	0.26	0.04	14.48	465	1.05
ATT14B - ATT14A	Attitude 14	0.00	0.75	0.04	0.00	432	1.000	0.00	Small	0.00	0.03	1663.69	465	1.05
ATT15B - ATT15A	Attitude 15	-0.31	0.85	0.04	-7.52	436	0.000	0.36	Small	0.31	0.05	16.23	465	1.71
ATT16B - ATT16A	Attitude 16	-0.17	0.72	0.03	-5.02	443	0.000	0.24	Small	0.17	0.04	24.15	465	1.66
ATT17B - ATT17A	Attitude 17	-0.16	0.71	0.03	-4.85	438	0.000	0.23	Small	0.17	0.04	26.62	465	1.93
ATT18B - ATT18A	Attitude 18	-0.27	0.91	0.04	-6.11	436	0.000	0.29	Small	0.27	0.06	20.67	465	1.86
ATT19B - ATT19A	Attitude 19	-0.31	0.80	0.04	-8.18	437	0.000	0.39	Small	0.31	0.05	15.56	465	1.83

continued

Table D.1 Test of Differences for Initiators (continued)

Paired		Paired Sample t-test								WesVarPC				
Variables	**Description**	**Mean**	**SD**	**SE**	**t**	**df**	**Sig.**	**Effect Size**		**Mean**	**SE**	**CV(%)**	**N**	**DEFF**
ATT20B - ATT20A	Attitude 20	-0.25	0.74	0.04	-7.09	436	0.000	0.34	Small	0.25	0.04	16.82	465	1.63
ATT21B - ATT21A	Attitude 21	-0.27	0.65	0.03	-8.68	432	0.000	0.42	Small	0.27	0.03	11.91	465	1.25
ATT22B - ATT22A	Attitude 22	-0.26	0.89	0.04	-6.16	436	0.000	0.29	Small	0.26	0.05	18.77	465	1.55
ATT23B - ATT23A	Attitude 23	-0.16	0.73	0.04	-4.45	436	0.000	0.21	Small	0.16	0.04	22.66	465	1.22
ATT24B - ATT24A	Attitude 24	-0.29	0.75	0.04	-7.92	434	0.000	0.38	Small	0.29	0.04	14.22	465	1.48
ATT25B - ATT25A	Attitude 25	-0.23	0.87	0.04	-5.57	436	0.000	0.27	Small	0.23	0.05	21.75	465	1.65
ATT26B - ATT26A	Attitude 26	-0.18	0.80	0.04	-4.74	435	0.000	0.23	Small	0.19	0.04	21.73	465	1.27
ATT27B - ATT27A	Attitude 27	-0.25	0.82	0.04	-6.41	435	0.000	0.31	Small	0.25	0.05	19.59	465	1.82
ATT28B - ATT28A	Attitude 28	-0.19	0.85	0.04	-4.57	433	0.000	0.22	Small	0.19	0.05	27.29	465	1.82
ATT29B - ATT29A	Attitude 29	-0.35	0.83	0.04	-8.80	436	0.000	0.42	Small	0.35	0.06	15.64	465	2.15
ATT30B - ATT30A	Attitude 30	-0.21	0.78	0.04	-5.56	433	0.000	0.27	Small	0.21	0.04	19.93	465	1.43
ATT31B - ATT31A	Attitude 31	-0.14	0.67	0.03	-4.41	434	0.000	0.21	Small	0.14	0.03	23.26	465	1.21
ATT32B - ATT32A	Attitude 32	-0.25	0.76	0.04	-6.86	433	0.000	0.33	Small	0.25	0.04	16.82	465	1.51

Table D.2 Test of Differences for Non-Initiators

Paired		Paired Sample t-test								WesVarPC				
Variables	Description	Mean	SD	SE	t	df	Sig.	Effect Size		Mean	SE	CV(%)	N	DEFF
Centralisation														
CEN1_B - CEN1_A	Decision for new service	-0.09	1.14	0.05	-1.63	441	0.104	0.08	Small	0.11	0.07	65.08	492	2.19
CEN2_B - CEN2_A	Decision for budgeting	-0.36	1.16	0.06	-6.46	438	0.000	0.31	Small	0.36	0.08	21.70	492	2.50
CEN3_B - CEN3_A	Decision for changes	-0.61	1.38	0.07	-9.27	439	0.000	0.44	Small	0.59	0.10	16.83	492	2.85
CEN4_B - CEN4_A	Decision for personnel	0.10	1.07	0.05	1.92	439	0.056	0.09	Small	-0.08	0.09	107.81	492	2.62
Formalisation														
FOR1_B - FOR1_A	Formal procedure	-0.37	0.85	0.04	-9.25	444	0.000	0.44	Small	0.37	0.06	14.66	492	2.27
FOR2_B - FOR2_A	Adhere to procedure	-0.18	0.75	0.04	-4.98	444	0.000	0.24	Small	0.18	0.04	24.21	492	1.86
FOR3_B - FOR3_A	Tolerance for violation	-0.24	0.84	0.04	-5.96	439	0.000	0.28	Small	0.24	0.05	20.96	492	1.94
Belief														
RDST_B - RDST_A	Reduce Staff	-0.26	1.22	0.06	-4.52	460	0.000	0.21	Small	0.26	0.07	26.49	492	1.68
RDCO_B - RDCO_A	Reduce Cost	-0.35	1.20	0.06	-6.31	456	0.000	0.29	Small	0.35	0.08	21.21	492	2.06
CMJO_B - CMJO_A	Create more jobs	-0.38	1.14	0.05	-6.95	436	0.000	0.33	Small	0.38	0.06	16.79	492	1.72
ISPL_B - ISPL_A	Isolate people	-0.21	1.26	0.06	-3.57	438	0.000	0.17	Small	0.21	0.09	41.27	492	2.67
COLI_B - COLI_A	Control our live	-0.70	1.04	0.05	-13.98	432	0.000	0.67	Medium	0.69	0.05	7.64	492	1.45

continued

Table D.2 Test of Differences for Non-Initiators (continued)

Paired		Paired Sample t-test								WesVarPC				
Variables	Description	Mean	SD	SE	t	df	Sig.	Effect Size		Mean	SE	CV(%)	N	DEFF
Relative Advantages														
INPR_B - INPR_A	Increase Productivity	-0.76	1.44	0.07	-11.24	452	0.000	0.53	Medium	0.76	0.10	12.45	492	2.34
INEF_B - INEF_A	Increase Effectiveness	-0.69	1.27	0.06	-11.54	455	0.000	0.54	Medium	0.69	0.09	13.00	492	2.64
INAV_B - INAV_A	Information availability	-0.92	1.34	0.06	-14.55	449	0.000	0.69	Medium	0.92	0.09	9.39	492	2.25
INTI_B - INTI_A	Information Timeliness	-0.67	1.40	0.07	-10.16	450	0.000	0.48	Small	0.68	0.10	13.98	492	2.50
EACC_B - EACC_A	Ease of Access	-0.68	1.60	0.08	-9.12	452	0.000	0.43	Small	0.70	0.11	16.42	492	2.74
SOBT_B - SOBT_A	Speed to obtain	-0.72	1.67	0.08	-9.13	446	0.000	0.43	Small	0.73	0.12	16.23	492	2.76
Compatibility														
WSCO_B - WSCO_A	Work style fit	-1.23	1.51	0.07	-17.26	447	0.000	0.82	Large	1.21	0.09	7.43	492	1.95
ALCO_B - ALCO_A	Compatible with all aspects of jobs	-1.26	1.40	0.07	-18.85	440	0.000	0.90	Large	1.24	0.09	7.14	492	2.20
PRCO_B - PRCO_A	Previous experience compatibility	-1.01	1.42	0.07	-14.91	440	0.000	0.71	Medium	1.00	0.09	9.18	492	2.28
Complexity														
DIUN_B – DIUN_A	Difficulty in understanding	-0.26	1.45	0.07	-3.83	443	0.000	0.18	Small	0.27	0.08	30.65	492	1.77
DIUS_B – DIUS_A	Difficulty in using	-0.12	1.46	0.07	-1.66	437	0.097	0.08	Small	0.11	0.08	69.53	492	1.52

continued

Table D.2 Test of Differences for Non-Initiators (continued)

Paired		Paired Sample t-test								WesVarPC				
Variables	**Description**	**Mean**	**SD**	**SE**	**t**	**df**	**Sig.**	**Effect Size**		**Mean**	**SE**	**CV(%)**	**N**	**DEFF**
Observability														
SMVE_B - SMVE_A	Smaller version	-0.54	1.18	0.06	-9.48	432	0.000	0.46	Small	0.54	0.06	10.92	492	1.42
MODU_B - MODU_A	Modular	-0.63	1.29	0.06	-10.15	431	0.000	0.49	Small	0.63	0.08	13.12	492	2.34
TRYO_B - TRYO_A	Try out	-0.71	1.13	0.05	-12.94	428	0.000	0.62	Medium	0.71	0.07	10.26	492	2.34
SEPR_B - SEPR_A	See presentation & demo	-0.91	1.26	0.06	-14.94	428	0.000	0.72	Medium	0.91	0.08	8.86	492	2.33
Computer Related Anxiety														
ANX1_B - ANX1_A	Feel Apprehensive	0.36	1.52	0.07	4.97	433	0.000	0.24	Small	-0.36	0.08	22.00	492	1.51
ANX2_B - ANX2_A	Afraid damaging the computer	0.49	1.48	0.07	6.84	433	0.000	0.33	Small	-0.48	0.08	15.83	492	1.47
ANX3_B - ANX3_A	Fear of making mistake	0.49	1.33	0.06	7.68	435	0.000	0.37	Small	-0.47	0.07	14.93	492	1.56
ANX4_B - ANX4_A	Unfamiliar	0.69	1.45	0.07	9.95	433	0.000	0.48	Small	-0.68	0.07	10.82	492	1.44
ANX5_B - ANX5_A	Confusing	0.46	1.62	0.08	5.94	433	0.000	0.29	Small	-0.46	0.08	16.27	492	1.20
Attitude Toward Change														
ATT1_B - ATT1_A	Attitude 1	-0.30	0.77	0.04	-8.15	439	0.000	0.39	Small	0.30	0.04	14.36	492	1.76
ATT2_B - ATT2_A	Attitude 2	-0.23	0.88	0.04	-5.36	436	0.000	0.26	Small	0.23	0.05	19.51	492	1.41
ATT3_B - ATT3_A	Attitude 3	-0.33	0.75	0.04	-9.26	434	0.000	0.44	Small	0.34	0.05	13.52	492	2.03

continued

Table D.2 Test of Differences for Non-Initiators (continued)

Paired		Paired Sample t-test								WesVarPC				
Variables	Description	Mean	SD	SE	t	df	Sig.	Effect Size		Mean	SE	CV(%)	N	DEFF
ATT4_B - ATT4_A	Attitude 4	-0.36	1.04	0.05	-7.17	436	0.000	0.34	Small	0.35	0.05	15.31	492	1.49
ATT5_B - ATT5_A	Attitude 5	-0.05	0.82	0.04	-1.23	434	0.220	0.06	Small	0.05	0.04	78.70	492	1.51
ATT6_B - ATT6_A	Attitude 6	-0.16	0.89	0.04	-3.79	434	0.000	0.18	Small	0.16	0.05	27.54	492	1.43
ATT7_B - ATT7_A	Attitude 7	-0.18	0.93	0.04	-4.01	433	0.000	0.19	Small	0.18	0.05	29.80	492	1.84
ATT8_B - ATT8_A	Attitude 8	-0.13	0.70	0.03	-3.85	434	0.000	0.18	Small	0.13	0.04	29.89	492	1.67
ATT9_B - ATT9_A	Attitude 9	-0.07	0.66	0.03	-2.32	433	0.021	0.11	Small	0.08	0.03	43.20	492	1.45
ATT10B - ATT10A	Attitude 10	-0.28	0.87	0.04	-6.69	436	0.000	0.32	Small	0.28	0.05	17.84	492	1.81
ATT11B - ATT11A	Attitude 11	-0.25	0.82	0.04	-6.40	436	0.000	0.31	Small	0.25	0.05	18.40	492	1.73
ATT12B - ATT12A	Attitude 12	-0.12	0.80	0.04	-3.11	433	0.002	0.15	Small	0.13	0.05	40.70	492	2.27
ATT13B - ATT13A	Attitude 13	-0.29	0.71	0.03	-8.38	434	0.000	0.40	Small	0.28	0.05	15.89	492	2.25
ATT14B - ATT14A	Attitude 14	-0.05	0.81	0.04	-1.36	432	0.175	0.07	Small	0.05	0.05	94.32	492	1.91
ATT15B - ATT15A	Attitude 15	-0.37	0.88	0.04	-8.68	435	0.000	0.42	Small	0.36	0.05	13.48	492	1.72
ATT16B - ATT16A	Attitude 16	-0.28	0.76	0.04	-7.59	433	0.000	0.36	Small	0.27	0.05	16.62	492	1.95
ATT17B - ATT17A	Attitude 17	-0.26	0.75	0.04	-7.12	435	0.000	0.34	Small	0.25	0.05	19.30	492	2.31
ATT18B - ATT18A	Attitude 18	-0.38	0.87	0.04	-9.17	435	0.000	0.44	Small	0.37	0.05	12.94	492	1.73
ATT19B - ATT19A	Attitude 19	-0.33	0.81	0.04	-8.56	435	0.000	0.41	Small	0.33	0.04	13.31	492	1.65

continued

Table D.2 Test of Differences for Non-Initiators (continued)

Paired		Paired Sample t-test								WesVarPC				
Variables	**Description**	**Mean**	**SD**	**SE**	**t**	**df**	**Sig.**	**Effect Size**		**Mean**	**SE**	**CV(%)**	**N**	**DEFF**
ATT20B - ATT20A	Attitude 20	-0.30	0.80	0.04	-7.74	435	0.000	0.37	Small	0.29	0.05	15.82	492	1.87
ATT21B – ATT21A	Attitude 21	-0.31	0.70	0.03	-9.39	432	0.000	0.45	Small	0.31	0.04	13.88	492	2.16
ATT22B – ATT22A	Attitude 22	-0.36	0.84	0.04	-8.93	435	0.000	0.43	Small	0.35	0.05	14.24	492	2.00
ATT23B - ATT23A	Attitude 23	-0.30	0.76	0.04	-8.25	433	0.000	0.40	Small	0.29	0.05	17.66	492	2.58
ATT24B - ATT24A	Attitude 24	-0.35	0.77	0.04	-9.53	432	0.000	0.46	Small	0.35	0.04	12.01	492	1.66
ATT25B - ATT25A	Attitude 25	-0.20	0.83	0.04	-4.94	435	0.000	0.24	Small	0.20	0.04	21.11	492	1.41
ATT26B - ATT26A	Attitude 26	-0.32	0.79	0.04	-8.47	434	0.000	0.41	Small	0.31	0.05	15.01	492	1.97
ATT27B - ATT27A	Attitude 27	-0.31	0.80	0.04	-8.10	434	0.000	0.39	Small	0.31	0.05	15.24	492	1.91
ATT28B - ATT28A	Attitude 28	-0.24	0.89	0.04	-5.64	434	0.000	0.27	Small	0.24	0.06	23.30	492	2.15
ATT29B - ATT29A	Attitude 29	-0.34	0.84	0.04	-8.48	435	0.000	0.41	Small	0.34	0.05	13.60	492	1.71
ATT30B - ATT30A	Attitude 30	-0.26	0.83	0.04	-6.39	434	0.000	0.31	Small	0.25	0.05	19.52	492	1.95
ATT31B - ATT31A	Attitude 31	-0.16	0.69	0.03	-4.83	434	0.000	0.23	Small	0.16	0.03	21.18	492	1.32
ATT32B – ATT32A	Attitude 32	-0.19	0.75	0.04	-5.18	432	0.000	0.25	Small	0.19	0.03	17.73	492	1.14

Shannon Research Press
Adelaide, South Australia
ISBN: 1-920736-04-2