DRIVERS OF INFORMATION SYSTEMS IMPLEMENTATION SUCCESS IN SMALL PROFESSIONAL FIRMS

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Abstract

Two main objectives are addressed in this thesis; (1) the development of a model of which identifies drivers of information technology (IT) and information systems (IS) implementation success in small professional firms; and (2) the contextualisation of existing small firm research in the IS domain. The hypothesised model is based upon existing research approached through the development of a three-level hierarchical taxonomy. Level one classifies research which evaluates the relationship between IT/IS implementation success and organisational performance. Level two identifies direct drivers of IT/IS implementation success; while level three identifies indirect drivers of IT/IS success.

Within the positivist approach appropriated to test the model, structural equation modelling is employed. A two-stage approach consisting of; (1) exploratory model development and refinement; and (2) confirmatory model testing; facilitates the development of a theoretically and empirically strong model.

A revised taxonomy presented on the basis of model findings found no evidence of a significant relationship between measures of perceived IT/IS implementation success and measures of organisational performance which form level one of the hierarchy. Four direct drivers of IT/IS implementation success are identified in level two; (1) organisational IT/IS knowledge; (2) IT/IS sophistication; (1) consultant effectiveness; and (2) vendor effectiveness. Five indirect drivers of IT/IS success are identified in level three; (1) investment in IT/IS; (2) management support for IT/IS; (3) management IT/IS experience; (4) IT/IS training; and (5) IT/IS learning. Such findings expose the weaknesses of existing research. In particular, the reliability of research that fails to recognise the importance of intermediate and contextual variables in the implementation process is questioned. In exposing the
weaknesses of the traditional user information satisfaction (UIS) measure, doubt is also cast upon findings based upon its use.

This study is the first to contextualise and evaluate variables shown to play a part in small firm IT/IS implementation process in a single holistic model. The findings act as a point of departure from which further research can develop understanding of the factors and interactions which drive IT/IS implementation success in small firms. These are approached in the context of developments which may destabilise the business environment for small firms.
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Chapter One – Introduction to the IS literature

1.1. Introduction

The use of information systems (IS) to achieve competitive advantage is expected to be particularly important in information-intensive firms (Porter and Millar, 1985; Capaldo et al., 1995). A category of firms that clearly falls within this definition is professional practices. These firms, such as architecture practices and law firms, are staffed by a high proportion of professionally qualified staff and rely upon their knowledge and information to attract clients and perform their tasks. The majority of such firms are small in size. As such, they represent a sector of great importance. As Mulhern (1995) asserts, small firms represent the backbone of the European economy. In the UK, organisations with 50 or fewer employees represent 99.1% of businesses (DTI, 1998).

While a vast and ever-growing body of literature exists covering all aspects of information technology in large, well established organisations, there is a lack of empirical research focusing upon information technology (IT) or information systems (IS) and the small business (Doukidis et al., 1996). Even where such research has taken place, its purpose has, until recently, remained limited to identifying the levels of information technology and general computer use within small enterprises (e.g. Farhoomand and Hrycyk, 1985; Kagan et al., 1990; Hepworth, 1994). Little research appears to have been undertaken into the factors which lead to the successful implementation of IT/IS within small businesses.
Over the last fifteen years, the cost of computer hardware and software has decreased dramatically while, at the same time, software has become increasingly user-friendly (Naylor and Williams, 1994). As a result, information systems have become more accessible for the small business. However, according to Fuller and Jenkins (1994) "only a few small firms seem able to convert this potential into practice." As Fuller asserts, small firms "appear to suffer from numerous problems at all stages of the process of adopting IT systems." Of course large organisations too can suffer problems in the adoption and implementation of IT. However, as Welsh and White (1981) argue, small businesses are not little big businesses. The characteristics and conditions that typify many small organisations are very different and result in paradigms and prescriptions appropriate for large organisations becoming inappropriate or redundant for their smaller scale counterparts.

Small firms tend to suffer from resource poverty (Welsh and White, 1981). This includes not just financial limitations, but constraints on managerial time as well as deficiencies in less tangible assets such as knowledge and experience (d'Amboise and Muldowney, 1986; Kapp and Voora, 1992; Cragg and King, 1993; Thong et al., 1994; Thong et al., 1996; Proudlock et al., 1998). The combined impact of such factors can result in small firms shouldering a significantly greater risk in the occurrence of mistakes or misjudgments than their larger, resource-rich counterparts (Welsh and White, 1981; Thong et al., 1994). The cost of failure in terms of implementing inappropriate technology may prove fatal for an organisation lacking adequate financial cushioning (Doukidis et al., 1996).

Resources permitting, knowledge gaps can sometimes be overcome with external expertise. The employment of such professional support can also prove effective in mitigating against risk (Senn and Gibson, 1981). However, research suggests that small-business managers are more likely to obtain advice from informal
sources including immediate family, friends and acquaintances, who essentially have little or no knowledge of the business (Monsted, 1993; Naylor and Williams, 1994).

External factors also impact more heavily on small firms. According to Welsh and White (1981), changes in governmental regulations, tax laws and interest rates usually affect a greater percentage of expenses for small businesses than for large organisations. The small firm environment is generally considered to be less stable than that of the large organisation (Matthews and Scott, 1995). As Fuller (1996, p.28) asserts, “the strategic future of many small businesses is unpredictable and therefore largely unplannable.” According to Fuller, small firm managers have an aversion to planning as a result. Doukidis et al. (1996) describe the main characteristics of the small firm environment as impulsive, involving a lack of delegation and a lack of conscious planning. Furthermore, they suggest that the small firm infrastructure fails to effectively define or use its control and information systems, lacks standard procedures, rules and formalised systems, and suffers from poor job descriptions and poor responsibilities.

Perhaps most significant is the increased importance and influence of the owner-manager. Not only does their personal influence as decision-maker have a much wider impact upon the operations of the organisation, but their attitudes and perceptions can also permeate throughout the entire organisation (Delone, 1988; Yap et al., 1992; Cragg and King, 1993; Doukidis et al., 1994). As such, the owner/manager can represent a significant inhibitor or motivator of change and innovation.

It is in this context that the current study attempts to examine how small firms assess and adopt information technology. Several factors that are hypothesised to play an important role as part of the acquisition process are examined. A model is developed which illustrates how these factors interrelate and affect the success with
which IT/IS is implemented in an organisation. IT/IS implementation success is the
generic term used by existing research (e.g. Delone, 1983; Cragg, 1990) and
throughout the current study for subjective measures of the positive effect of IT/IS on
an organisation, such as IT/IS impact or user information satisfaction (UIS). It
remains open to debate as to whether what is regarded by management as perceived
IT/IS-driven benefit can and should be regarded as IT/IS implementation success in
objective terms. Ultimately, the model attempts to test this proposition by examining
the relationship between IT/IS implementation success indicators and measures of
organisational performance.

1.2. Introduction to the information systems literature

Research into information systems and, in particular, IS in the small firm context,
remains a comparatively new strain of management research. "An information
system [IS] in its simplest form can be described as a technological system that
manipulates, stores, and disseminates symbols (representations) that have, or are
expected to have, relevance and an impact on socially organised human behaviour"
(Hirschheim et al., 1996, p.2). Information technology (IT) is the terminology used to
depict the individual components that create an IS. With its roots in technology,
organisational behaviour, management and linguistic theory, the body of IS literature
is broad in its research remit, encompassing many themes and areas (Hirschheim et
al., 1996). The abbreviation IT/IS (information technology/information systems) is
employed throughout the course of this study. This prevents any assumptions being
made regarding the level of computerisation within the small firm.

In spite of its wide and ambiguous nature, one strain of research stands out
within the large body of IS literature. It is that which is devoted to the study of
information systems development.¹ This area of research focuses upon the analysis, design, construction and implementation of information systems with the intent of finding those approaches that prove most successful in creating an IS which meets the needs of the organisation. Yet this field of research alone is diverse and eclectic in nature. It has been approached from a vast and varied selection of perspectives resulting in a conglomeration of findings and recommendations.

A problem central to the whole IT/IS debate is the measurement of the value (or success, or performance, or effectiveness, or impact) of IT/IS in an organisation, as it is this measure that is most frequently used as a reference point in the study of IS development. As Esther and Brooke (1995, p.278) assert, there exists an “absence of appropriate measures for assessing the total effects of IT.” This has resulted in the employment of a variety of measures by different researchers trying to measure the impact of IT/IS on the organisation (see Delone and Mclean, 1992). However, as Wong and Phelps assert (1997, p.4), “the lack of conceptual foundations to guide the development of measures and the lack of rigorous measure validation has meant that measures of systems success displayed by research studies are generally weak.” The end result is a non-cumulative body of research from which it is difficult to draw conclusions due to the use of different effectiveness measures by different researchers. As Hirschheim et al. (1996, p.3) reflect, “the diversity in the field has led to piece-meal research tactics and fragmentation... This has raised the concern that IS research does not contribute to an accumulative research tradition thereby throwing into question its value.”

The literature also contains counter-arguments disputing the need for such a common conceptual platform. Banville and Landry (1989) and Hirschheim et al. (1996) argue that such an approach would not improve the value of IS research. They

¹ See Hirschheim et al., 1996, p.3, for a detailed discussion of why information systems development is
contend that IS research is highly contextual, and that a unifying IS research paradigm would not only "lead to weaken theory development and associated research practices but also to harmful practical consequences such as the lack of practical relevance or too narrow a conception of research stakeholders" (p.4). Different project leaders have different agendas when adopting IT/IS: a standardised approach to IS research is unlikely to provide the precision and subtlety required to increase our knowledge of the impact of IT/IS. While Hirschheim et al. repel the notion of a fixed paradigm to guide IS research, they do propose that a relaxed framework would prove valuable in providing categories for "interpreting and relating the research literature and for understanding the co-evolution and de-evolution of research concerns" (p.5).

1.2.1. A framework for approaching existing research on the impact of IT. Grover et al. (1996, p.181-182) provide such a framework and, in so doing, a useful point of departure when reviewing the literature on IT/IS implementation success. The authors divide IS research into two primary categories; (1) macro level research (i.e. where evaluation is undertaken at the organisational level); and (2) micro level research (i.e. where IS effectiveness is measured at the individual level).

"From the macro perspective, the well-being of an organisation is indicated by its overall competitiveness in a changing environment. Thus IS effectiveness is related to how much the IS helps organisations in gaining competitiveness. From a micro perspective the organisation may be viewed as a socio-technical system whose members require appropriate information. Hence, IS effectiveness is related to the extent to which IS satisfies the requirements of the organisation’s members."

(Grover et al., 1996, pp.181)
The same authors develop their framework of previous IS effectiveness research by subdividing macro and micro level evaluation into three additional subsections. These are (1) process; (2) response; and (3) impact. Process evaluation “is based upon user dependence on the IS, user perception of system ownership, and the extent to which IS permeates the organisational administrative and operating procedure.” At the macro level, it is termed “infusion measures,” and represents the means by which research captures “the extent to which IS permeates the organisation in terms of completeness, efficiency, and accuracy in analysis and distribution of information.” At the micro level, the authors call such evaluation “usage measures”. Here, it is defined as the frequency of IS use, ease of access, and motivational aspects associated with IS use – as the authors state, the “if, when, how much, and why users depend on IS for accomplishing their business activities.”

The second type of evaluation – response – assesses the reaction of the individual or the organisation (and other stakeholders) to the IS of the organisation being researched. At the macro level, the authors call such criteria “market measures”. Such measures “reflect the dynamics of market mechanisms as a consequence of system introduction.” At the micro level, perceptual measures capture “user attitudes, beliefs, and perceptions toward IS.” As Grover et al. state, such complex variables “are important response-based criteria in assessing the various post-implementation effects of IS.”

The final evaluation type is impact. Impact is defined as the “direct effects of IS implementation on individual or organisational performance.” At the macro level, economic measures, such as financial and productivity criteria, are used to measure the effect of IS on the organisation. These reflect “quantitative changes in financial or competitive positioning resulting from investing in IS.” At the micro level, productivity measures “reflect how IT influences or enhances the performance of
organisational members. These outcome-based measures reflect the success of system implementation in terms of managerial performance and productivity.” Grover et al. (1996) describe impact as the most comprehensive, yet difficult means of IT/IS evaluation.

1.2.2. Existing views on the impact of IT/IS

While the framework proposed by Grover et al. (1996) focuses upon large organisational research into IS, it still proves a useful tool for approaching the entire body of IS literature, including research into small businesses. In terms of comparative output, the body of research looking at IT/IS in the small firm context remains small. Until recently, its purpose was for the most part limited to identifying the levels of information technology and general computer use within SMEs (e.g. Farhoomand and Hrycyk, 1985; Kagan et al., 1990; Hepworth, 1994) – what Grover et al. might term infusion and usage measures. However, a strain of research has developed which focuses upon more weighty matters such as the processes driving technology adoption and the decision-making processes occurring within SMEs and their influence on the success with which IT/IS is implemented (e.g. Cragg and King, 1993; Fuller and Jenkins, 1994; Capaldo et al., 1995; Proudlock et al., 1998).

Where an absence of relevant research about small firms is encountered, reference is made to the findings of large organisation research. While this provides a reference point from which to begin our investigation, it must be remembered that the findings of research in large organisations cannot necessarily be generalised to encompass small firms due to the different conditions which exist in each (Raymond, 1985).
1.2.2.1. Research into the economic impact of IT/IS at the organisational level

The quantitative based research approach to the measurement of IT/IS success (classified as *economic measures* by Grover *et al.*) generally employs a more rigorous statistical approach than other research in this area. It centres on the examination of relationships between measures of IT/IS investment and traditional indicators of business performance, such as return on investment (ROI), return on sales (ROS) and turnover. Due to its roots in financial measures, this body of research represents one of the more cumulative areas of IS research. It is still, according to Byrd and Marshall (1997, p.45), "plagued with ambiguities and inconsistencies." A major problem is the inconclusive nature of an overall firm performance measure. As Hanes and Ramage (1977) point out, it is extremely difficult to isolate the effect of IT/IS from the "many other uncontrollable and unmeasurable factors [which] influence organisational performance" (p.84). As a result, it is difficult to draw direct relationships between the use of IT/IS and business performance.

This argument is borne out in the literature. Research into the impact of IT/IS on financial measures of business performance is contradictory. A number of studies (e.g. Cron and Sobol, 1983; Loveman, 1994; Kivijärvi and Saarinen, 1995; Hitt and Brynjolfsson, 1996; Coopers and Lybrand, 1996; Byrd and Marshall, 1997) have consistently failed to show IT/IS to afford significant financial benefits to organisations. Others show IT/IS to improve specific measures of an organisation's financial performance (e.g. Bender, 1986; Alpar and Kim, 1990; Harris and Katz, 1991; Weill, 1992; Mahmood and Mann, 1993). According to Hitt and Brynjolfsson (1996), one reason for the variation in findings is confusion about the questions being asked.
1.2.2.2. Case study-based research

A number of researchers, perhaps uncertain of the likelihood of IT/IS ownership being reflected in quantitative economic impact measures at the organisational level, have instead attempted to measure the impact of IT/IS through means which embrace all facets of organisational performance. Such approaches, including case studies and longitudinal research, cannot be easily defined in terms of the parameters established by Grover et al. (1996). This is due to their agglomeration of a variety of qualitative and quantitative measures: it is possible to find elements of all six classes of IT/IS evaluation as defined by Grover et al. in any one research study. While frequently restricted to small sample sizes, case studies and longitudinal research have proven to be illuminating approaches to the measurement of the impact of IT/IS due to their in-depth investigation of individual organisations.

Evidence from case studies investigating large organisations suggests that IT/IS can enable an increase in productivity and performance (Hammer, 1990; Caron et al., 1994; Venkatraman, 1994). This reflects the overriding impression given by literature focusing upon IT/IS in small organisations. Naylor and Williams (1994) followed a case study based approach in their investigation of IT/IS use in 30 SMEs on Merseyside. The authors found time saving and improved business image to be the most frequently reported benefits. One third of organisations reported improvements in sales analysis, forecasting and services or turnover while less than a fifth of firms reported achieving administrative cost savings. Research undertaken by Proudlock et al. (1998) reported similar findings regarding the impact of IT/IS in their study of 9 professional SMEs.

Malone (1985) undertook in-depth interviews with ten small supply firms in the building industry. Half of the respondents reported that IT/IS had increased their

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2 These studies focus on medium and large sized firms.
ability to make quick and accurate decisions; four perceived IT/IS to have afforded some benefits in this area, while one believed that IT/IS had actually slowed the decision-making process. Eight of the ten owner managers also reported significant time saving benefits to result from IT/IS use. All of the participating managers felt that their information systems had significantly improved the quality of decision making within their organisations. None of the firms interviewed were dissatisfied with their IT/IS. Malone’s findings are, however, dated and the sample size small (n = 10). The generality of the findings should be approached accordingly.

Yetton et al. (1994) followed a longitudinal case study-based approach in their article recording the success of a small Australian architecture practice. The practice is reported to have increased its business by 400 percent between 1987 and 1992 as a result of IT/IS adoption. This occurred during a period when local firms were experiencing a severe recession and a significant number went out of work. Improvements were noted in a number of areas, such as the design task, customer responsiveness, internal task and management processes, and relations with consultants and suppliers. The outcome was a reshaped strategic position that was perceived by management to give the firm a competitive advantage. Other similar cases have been reported in a number of professions (e.g. Curriden, 1995; Sanctosus, 1995; France, 1996).

1.2.2.3. Research into the impact of IT/IS on productivity at individual and organisational levels

While case studies and longitudinal research are valid methodologies, small sample sizes restrict the generality of findings. Fortunately, a growing body of research exists which approaches IT/IS impact measurement via empirical means, yet avoids
employing straightforward *economic measures*. For the most part, this body of literature is formed by research which measures IT/IS impact via quantitative methodologies at the *individual level*. These are termed *productivity measures* by Grover *et al.* (1996). While such research helps in increasing the reliability of findings through large sample sizes, it contributes significantly to the non-cumulative side of IS research.

The one exception to this rule is user information satisfaction (UIS) measures, developed by Bailey and Pearson (1983). As Wong and Phelps (1997, p5) assert, “the stream of research on UIS has evolved a consistent set of measures which makes it an attractive candidate for inclusion in an IS effectiveness instrument.” This supports the findings of Ives *et al.* (1983) who argued that UIS is ‘a meaningful “surrogate” for the critical but unmeasurable result of an information system, namely changes in organisational effectiveness’. Ives *et al.* imply that user information satisfaction is a measure of IT/IS implementation success which is in turn positively related to organisational effectiveness.

According to Delone and McLean (1992), UIS represents the single most widely used measure for three reasons. First of all, UIS has a high degree of face validity. In other words, if a system’s users say they like it, then it is difficult to argue against the usefulness of that system. Secondly, the UIS measure and its derivatives have proved a reliable tool for measuring satisfaction and for making comparative analyses (as proved more recently by Gatian, 1994; Iivari and Ervasti, 1994). Raymond (1987) validated and applied UIS as a measure of IS success in small businesses, finding it to possess temporal stability, internal consistency, content validity and construct validity. Finally, Delone and McLean (1992) argue that other methodologies are conceptually weak in comparison and are generally more difficult to measure by empirical means.
In spite of such recommendations, IS academia is not entirely satisfied with the UIS measure and, in particular, the assumptions that surround its employment. Melone (1990), for example, is suspicious of inferences drawn from UIS research, arguing that it is possible to have an “effective IS” without satisfaction on the part of users. Melone calls for the employment of multiple measures of IT/IS implementation success suggesting that such an approach will expose “the subjectivity inherent in the selection of single effectiveness criterion” and “point out the limitations in using criterion generated from a single model” (p.78). The author concludes that “separate models of the various components of IS effectiveness are likely to be a far more useful managerial tool than is any scalar summary measure of effectiveness.”

The current study follows such an approach in its employment of both UIS measures and measures of the organisational impact of IT/IS as implementation success measures. This also enables evaluation of the degree of linkage between UIS and the organisational impact of IT/IS as well as the value of UIS as a measure of IT/IS implementation success in its own right. In doing so, the study intends to add to the continuing debate over the appropriateness of UIS as a surrogate measure of the organisational impact of IT/IS. Further insight into this area is given during the literature review and hypothesis construction undertaken in chapter two.

The remaining body of literature in this area is considerably more fragmented in its use of IT/IS impact measures (Delone and McLean, 1992). Many measures do, however, rely to an extent on aspects of the UIS scale. The findings are, again, frequently conflicting. In its latest report on the use of technology in small firms, the Institute of Management found that IT was not perceived by small business managers as providing value for money (Howard, 1997). Sixty six per cent of “average” or
"ahead of competitors" users reported under-using their existing IT/IS asset because the costs associated with its development outweighed the benefits. Forty-four per cent believed that the benefits of IT/IS were overplayed. Owners and managers found it difficult to identify the benefits of IT/IS investment without devoting considerable time and effort, and even then they were sceptical that those benefits could really be achieved. Anticipated benefits were rarely achieved following IT/IS implementation.

The British Dental Association (BDA) undertook a similar survey obtaining data from 915 UK dentists (Morris, 1994). Contradicting the Institute of Management's findings, the BDA reported IT/IS to have made effective inroads into the dentistry profession with the benefits resulting from IT/IS generally outweighing the problems. Sixty-four per cent of dentists were highly satisfied with their IT/IS and the majority claimed to have improved practice efficiency (88%) and job satisfaction for all staff (70%) as a result of its use. Thirty-nine percent of practices claimed that the quality of care had improved, while sixty percent had recorded no change. Other benefits reported include; an increase in general administrative efficiency, improvements in the processing of forms and paperwork, and improved cash flow. Thirty-two per cent of practices perceived there to be no drawbacks to IT/IS use, while fourteen per cent claimed costs to be the biggest disadvantage. A small minority (9%) reported that IT/IS had increased their workload and was a significant drain on their time.

The results of a Hewlett-Packard/Mori survey (Reid and Hutchins, 1997) on IT/IS use in three hundred UK SMEs showed how small firms value the contribution to quality, or time and cost savings, and/or efficiency made by IT/IS. Firms reported that IT/IS had afforded the most significant benefits in the areas of finance/accounts/payroll and management information. Notable improvements were

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3 Delone and Mclean (1992) provide a useful taxonomy of studies of information systems success.
also recorded in customer service, correspondence, communications, and sales databasing. Eighty-nine percent of firms claimed that they had got value for money from their IT/IS investment and seventy-seven percent reported that IT/IS had successfully met the objectives of the organisation.

1.2.2.4. IT/IS and competitive advantage in the small firm

Research into the impact of IT/IS as perceived by small firms generally differs in perspective to the approach taken by large organisation research. The latter is often geared towards the strategic application of technology and the search for some form of sustainable competitive advantage (e.g. Kettinger et al., 1994; Loveman, 1994; Brown, Gatian, & Hicks, 1995; Powell & Dent-Micallef, 1997). Whether IT/IS can, in fact, afford a sustainable competitive advantage for firms investing in proprietary technology remains open for debate. Unsurprisingly, reports are conflicting. And as Wong and Phelps (1997) suggest, the competitive advantage issue may not be the most important question decision-makers within firms should be asking. As the authors assert, "a more salient question for individual firms is what IS to invest in and how to measure the benefits which result."

This statement is particularly true in small firm research. Small firms generally lack the resources to develop proprietary systems and gaining a sustainable competitive advantage is less likely to be on their agenda (Howard, 1997). This is generally acknowledged in the small firm literature and, as shown, most studies focus upon measures of performance that are more appropriate in the context of small firm operations. However, this brings into question the definition of competitive advantage. According to Bott et al. (1986) to gain a competitive advantage IT/IS must improve the position of the firm or create new opportunities. Bakos and Treacy (1986) argue that a competitive advantage is created when a firm increases its
comparative efficiency or its bargaining power. While it is difficult to quantify competitive advantage resulting from IT/IS at a purely economic level due to the number of intermediate variables which influence standard measures of business performance, the body of literature which yields positive results in terms of the impact of IT/IS over a number of varying measures might be considered evidence of competitive advantage gains. Of course, for such research to show true competitive advantage to have been gained, some form of intra-industry comparison must be made.

Due to their employment of a number of measures, case study approaches tend to be the most illuminating in showing small firms to have gained competitive advantage from IT/IS. As the case study undertaken by Yetton et al. (1994) illustrates, small firms can gain a competitive advantage as a result of implementing IT/IS, even if they had not planned to do so. Bergeron and Raymond (1992) refer to earlier work by Raymond et al. (1988) which described three small firms that had gained competitive advantage over their competitors through IT/IS. Resulting benefits included increased market share at the expense of competitors and reduced organisational costs.

1.2.3. The validity of drawing a direct relationship between IT/IS ownership and IT/IS implementation success

While fragmented and non-cumulative measures are suggested as one reason for the conflicting findings regarding the impact of IT/IS in small firms, a second strain of literature proposes that it is not simply the measures that are leading to inconclusive results. Other factors, which are part and parcel of IT/IS acquisition and use, play a critical role in the success with which technology is implemented and used. Floyd
and Zahra (1991) seem to encapsulate the thinking behind this body of work. They assert that overall, using IT/IS does not guarantee improvements in organisational performance. They argue that this is due to improper adoption and implementation procedures, poor administration or abuse. Kivijäri and Saarinen (1995, p.144) support this view, stating that “information and technology are, in general, poorly managed in the companies and they do not contribute to better performance.” As such, it seems improbable that business performance is likely to be influenced by a simple binary variable such as IT/IS ownership.

Other studies employ this idea as a point of departure and study intermediate and moderating variables that are inherent in the IT/IS-performance relationship. In terms of measurement, there are benefits to following such an approach. As Sethi et al. (1993, p.196) argue, “IT measures can include not only quantitative variables but also qualitative variables. There is therefore a great flexibility and versatility in IT definition and operationalisation. The use of a context-specific IT definition and operationalisation enhances the likelihood of reliably ascertaining the existence and the strength of the IT-Performance relationship.” They add as a note of caution that, “this method’s primary limitation is that there are potentially numerous IT factors associated with business performance. The problem is compounded by the fact that while some of the factors directly impact performance, others may have only an indirect impact” (pp.196-197).

There is a growing body of literature that investigates patterns of IT/IS adoption within small firms and how certain factors and moderating variables influence the overall success with which IT/IS is implemented. This body of literature is reviewed in the following chapter.
1.3. Summary and Conclusions

Given the importance of small firms in the economy, small firm IS research remains in its formative stages. The current chapter presents an introduction to the research undertaken in the small firm IS arena. A framework developed by Grover et al. (1996) is presented in order to facilitate the contextualisation of the different types of research. These include; (1) research into the economic impact of IT/IS at the organisational level; (2) case-study based research; (3) research into the impact of IT/IS on productivity at the individual level; and finally (4) research into the ability of IT/IS to afford competitive advantage to the small firm.

Following an overview of the different research types, the validity of drawing direct relationships between IT/IS ownership and IT/IS impact is questioned. Much of the research cited in chapter one attempts to identify such a relationship without considering the possibility of intermediate or contextual variables. Chapter two focuses upon the growing body of research that investigates patterns of IT/IS acquisition and how certain factors and intermediate variables influence the overall success with which IT/IS is implemented.
2.1. Introduction

As chapter one implied, IT/IS research is broad and fragmented in its remit. Chapter one also alluded to the growing body of literature investigating the moderating variables between IT/IS ownership and measures of performance. This chapter aims to narrow the field of inquiry in its review of literature focusing upon the factors inherent in the assessment and acquisition of IT/IS by small firms and how they impact upon measures of IT/IS implementation success. The relationship between IT/IS implementation success and measures of business performance is also re-evaluated. Variables that perform an influential role in the assessment and acquisition process are identified via a thorough review of the literature. As will become evident, many of the findings of existing literature prove conflicting, suggesting a need for further research. Finally, the variables identified are approached holistically in the development of a model of IT/IS assessment and acquisition in small firms.

Chapter two opens with a review of existing models of IT/IS assessment and acquisition in small firms.

2.1.1. Existing models of IT/IS assessment and acquisition in small firms

Few models exist that present a holistic picture of IT/IS assessment and acquisition in small firms. Most research evaluates simple relationships with little regard for intermediate or contextual variables (Yap et al., 1992; Thong et al., 1996). As Miller
(1978, p.514) asserts, "there appears to be too much faith in simple didactic relationships, while seldom is any reference made to the different contexts which might influence the strength and even the direction of the relationships." Byrd and Marshall (1997, p.55) reiterate the views of Miller two decades later, stating that "future quantitative studies should incorporate the contextual features of qualitative studies so that we can discover what organisational factors are important in facilitating a positive relationship between IT investment and performance."

Of those studies which are more comprehensive, a number still focus on a specific area of IT/IS assessment and acquisition. Fuller (1996), for example, focuses upon organisation learning and knowledge in presenting his recursive learning model. Fuller's theoretical model (underpinned by the findings of recent research in the small firm domain) hypothesises that the process of IT/IS assessment and acquisition in small firms is a recursive one in which learning is a key to success. As figure 2.1 illustrates, following the clients expression of needs, solutions are put forward. This results in the acquisition of a technology that is then absorbed into the work environment. The key to Fuller's model is its recursive nature. Each time an organisation proceeds through this cycle of assessment and acquisition, it learns how to improve upon the process and so becomes better at identifying and expressing needs, and implementing technology to meet those needs.

While Fuller's model remains untested empirically, its bringing to together of thinking (and empirical findings) in the small business IT/IS adoption research field is of significant value. Perhaps most importantly, Fuller presents IT/IS adoption in small firms as an ongoing process as opposed to an instantaneous event. The model developed in the current study draws on Fuller's model, and in doing so, aspects of it are subjected to tested empirically. The manner in which Fuller's work forms a
Igbaria et al. (1997b) evaluated a model of personal computing acceptance and system usage using data collected from 358 IT/IS users in 203 small businesses. The sample was formed from engineering and manufacturing organisations employing 20-100 personnel. The authors tested a structural model which focused upon the impact of; (1) computer training (in-house and external); (2) management support for IT/IS; and (3) external computer support on two measures of computer acceptance; (1) perceived ease of use; and (2) perceived usefulness. Igbaria et al. also evaluated the relationship between the two computer acceptance measures and the level of system usage.

Using structural equation modelling, the authors found perceived ease of use to be positively and significantly related to management support, external computer support and external computer training. Perceived useful of computers was positively and significantly related to both internal and external computer training, management support and external computing support. A strong positive association was also recorded between perceived ease of use and perceived usefulness, while both
computer acceptance measures were shown to strongly and positively impact upon the level of system usage.

While the methodological approach taken by Igbaria et al. is rigorous, the findings of their model are limited in terms of their scope and the level of generality in the context of the current study. The current study models drivers of IT/IS implementation success in small professional firms. Igbaria et al.'s study is limited to a sample of engineering and manufacturing organisations. Furthermore, their findings exclude data from firms with fewer than 20 employees. Such organisations will form an important sub-category of the sample examined in the current study. Perhaps most importantly, the success variables employed by Igbaria et al. also differ to those to be employed in the current study. Igbaria et al. test factors which impact upon the personal acceptance of computers in small businesses, and not factors which influence the impact that computers have within the organisation. As such, Igbaria et al.'s study asks a fundamentally different question to that which the current study aims to answer.

Delone's (1983; 1988) model, evaluating the impact of a number of factors on computer based information systems (CBIS) success is more far-ranging in scope (see figure 2.2). Delone's findings are drawn from data collected from 98 small manufacturing firms (defined by Delone as employing fewer than 300 personnel). On average, the respondent organisations forming the sample employed 62 personnel. Given Delone's sample, the generality of his findings are limited in the context of the current study. Delone measured CBIS success as a composite of the level of use by the chief executive and the impact of computer applications in the view of top management. While management IT/IS knowledge was measured using a composite of IT/IS experience and formal training, all other variables were evaluated using one-
item measures. The validity and reliability of Delone’s measurement models is thus questioned.

In spite of its limitations, Delone’s model goes some way in illustrating the possible interrelations that coexist in the process of IT/IS adoption and use in small firms. For example, management involvement in IT and management knowledge and experience represent central nodes in Delone’s model, with both directly and indirectly influencing IT/IS success measures. Delone’s model is, however, dated, as is evident from the inclusion of “computer location” as an independent variable. In spite of its age, a number of associations identified by Delone have been re-affirmed by more recent research (Yap et al., 1992; Thomas et al., 1994; Cragg and Zinatelli, 1995) and, as such, form an important part of this study. In particular, management involvement (redefined later in the current study as management support) and management IT/IS knowledge, both represent cornerstone variables.

Figure 2.2. Delone’s model of small firm IS success

Source: Delone (1983)
Cragg's (1990) model of IT success (see figure 2.3) provides some support for Delone's model in showing planning and IT experience to affect IT/IS use. Cragg collected data from 289 small firms (defined as employing fewer than 50 personnel). Seventy-six per cent of respondents forming Cragg’s sample employed fewer than 20 employees. As such, Cragg’s sample has a high degree of similarity with that intended for the current study in terms of the size of respondents. However, respondents are once again drawn from the manufacturing sector as opposed to the professional service sector. As such Cragg's findings cannot be generalised in the context of the current study with confidence.

Cragg also showed the use of modern technology to increase the level of IT/IS usage in small businesses. In turn, the level of use is positively associated with IT/IS success. Owner involvement also plays an important role. Overall, Cragg's model explains 20% of the variance of IT/IS success, measured using a construct formed from 10 success objectives (e.g. increased accuracy; time saving; improved planning) developed by Cragg. Cragg's model is approached in greater detail throughout the chapter.

Figure 2.3. Cragg’s model of small firm IS success

Source: Cragg (1990)
2.1.2. Development of a new model of IT/IS assessment and acquisition in small firms

While such models represent a valuable point of departure, since the completion of these studies, technology has advanced considerably as well as become far more accessible for the small firm. While the current study builds on previous research where appropriate, it is evident that certain variables are dated while others have taken on a greater importance. The hypothetical model presented in this study addresses those variables that have been shown to consistently play some role in the IT/IS assessment and acquisition process of small firms. This synthesis of research findings results in the development of a model which includes more variables than has been the case in previous small firm information systems development research.

The literature review that follows is used to underpin the model building process. Hypotheses are proposed on the basis of key associations drawn from existing research. Variables shown by existing research to play a role in the process of IT/IS assessment and acquisition are reviewed and appropriated where evidence suggests their contribution to IT/IS success, or other assessment and acquisition variables, is significant. As such, each hypothesis proposed is underpinned by existing IS research.

As stated in chapter one, this field of research is a comparatively new one. As such, there is limited research focusing specifically on the successful implementation of IT/IS in small firms. As a result, the scope of research drawn upon is wider than would be preferred. While hypothesis formation is based wherever possible on empirical research published in peer reviewed management and IT/IS journals, due to the small canon of work in this area, case study research and practitioner-orientated material is occasionally employed in support of specific hypotheses. Where this is the
case, this is acknowledged. Precedence is also given, in the event of conflict between two research articles, to that deemed to have the stronger theoretical and empirical underpinning. Because the first stage of this study focuses upon the building and exploratory testing of hypotheses, propositions that are not supported due to less strong theoretical underpinning are omitted at the modelling stage. Thus, while the scope of previous research employed is broader than preferred during the hypothesis building stage, the research method employed is such that unsupported hypotheses (whether unsupported due to weak theoretical underpinnings or for other reasons) are omitted prior to confirmatory modelling.

The cumulative effect of the drawing together of hypotheses is a model of causality and interaction illustrating associations between the many variables highlighted in the literature. It is intended that in evaluating the model of causality and interaction proposed, the current study will further understanding of the IT/IS assessment and acquisition process in small firms.

2.1.3. Some definitions

As has been shown, there is a vast array of measures employed to quantify the impact of IT/IS in organisations. Not surprisingly, the terminology used is diverse and fragmented. Thus, it is believed prudent to define the terminology that will be used prior to reviewing the literature in greater detail. Standardising the terminology will facilitate a more cohesive picture of current findings.

2.1.3.1. Organisational Performance

Chapter one alluded to several economic and market measures of organisational performance. While individual measures will be referred to where appropriate, the
generic term *organisational performance* will be used hereafter to refer to measures of business performance.

2.1.3.2. IT/IS implementation success

IT/IS implementation success is the generic term used by existing research (e.g. Delone, 1983; and Cragg, 1990) and throughout this study for subjective measures of the positive effect of an information technology or technology-based information system on an organisation. As alluded to in chapter one, it remains open to debate as to whether what is regarded by management as perceived IT/IS-driven benefit can and should be regarded as IT/IS implementation success in objective terms. However, it is implied within the measures used in the majority of research, and indeed the measures employed in this study, that higher levels of perceived IT/IS-driven benefit should be synonymous with the more successful implementation, application and use of IT/IS.

As described in chapter one, two main types of IT/IS implementation success measures exist; (1) measures of the impact of IT/IS at the organisational level; and (2) UIS measures. These are defined as follows.

2.1.3.2.1. Impact of IT/IS on the organisation

*Impact* proves to be the most commonly used generic terminology for the non-economic measure of the affect that IT/IS has on an organisation (Saarinen, 1989; Chen, 1993; Mahmood and Mann, 1993; Saarinen and Vepsalainen, 1994). Grover *et al.* (1996, p.182) defines non-economic impact measures as those that "reflect how IS influences or enhances the performance of organisational members. These outcome-based measures reflect the success of system implementation in terms of managerial performance and productivity." Other commonly used terms include effectiveness
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(Computerworld, 1988-1991; Kim and Umaneth, 1993; Post, 1993; Iivari and Ervasti, 1994; Pitt et al., 1995), value (Hitt and Brynjolfsson, 1996), and success (Boynton and Zmud, 1984). While individual items will be described in the literature review, *impact* will be used, where appropriate, as the generic term for non-economic implementation outcome-based measures of the IT/IS implementation success. *Impact*, as defined above, will exclude user information satisfaction (UIS) measures.

2.1.3.2.2. User Information Satisfaction (UIS)

Chapter one also focused upon user information satisfaction (UIS) measures as one component of IT/IS success measures regarding productivity at the individual level. Defined by Grover (1996, p.182) as a "perceptual measure", UIS measures "capture user attitudes, beliefs and perceptions toward IS." In reviewing literature on IT/IS impact, the current study will differentiate between UIS measures and impact measures as defined above. While Ives et al. (1983) imply that UIS is 'a meaningful "surrogate"' for the impact that IT/IS has upon the organisation, (referred to by the authors as changes in organisational effectiveness), there is little to support such an assertion in the small business literature. (This assertion is evaluated in the current study). Hence, UIS measures and impact measures are here approached as separate measures of IT/IS implementation success.

2.2. A taxonomy of IT/IS assessment and acquisition in small firms

In order to simplify what proves to be a complex and interconnected web of variables and performance measures, the literature review that follows is structured hierarchically. A taxonomy consisting of three principal hierarchies is developed and introduced in order to present the fragmented findings in this area in a more
approachable manner (see figure 2.4). This also facilitates the development of the model. The taxonomy is explained as follows.

**Figure 2.4. Hierarchy of variables**

While small businesses may not implement IT/IS with the intention of increasing business performance directly, intuition would suggest that technology, if implemented successfully, should improve performance through increased efficiency, improvement of work processes, and so forth. Hierarchy level one reviews studies that focus upon the association between IT/IS implementation success measures and measures of business performance in order to add theoretical support to such intuitive assertions.

Hierarchy level two reviews literature that evaluates associations between IT/IS implementation success measures and variables that are part and parcel of the IT/IS assessment and acquisition process. Here, variables that are shown to directly influence the success with which IT/IS is implemented are introduced and reviewed. The final hierarchical level reviews factors that have been shown to influence those
variables that affect the IT/IS assessment and acquisition process. Such factors may have an indirect impact on the success with which technology is implemented as opposed to, or as well as, having a direct affect. One such example is an organisation's investment capability. While this may not directly affect the success with which technology is implemented, it may have an impact through an IT/IS assessment and acquisition variable such as the level of investment in technology or whether a technology consultant is employed. The three hierarchical levels are illustrated diagrammatically in figure 2.4.

At the broadest level, this study has its roots in the work of Woodward (1965) and Perrow (1967) and their research into drivers of organisational performance. Woodward in particular focused upon the way in which firms employed technology, its impact upon organisational structure, and ultimately, how the technology-structure relationship affected organisational performance. In the same way, the current study intends to identify and examine variables that influence the success with which IT/IS is implemented in small firms and whether IT/IS perceived subjectively by management as beneficial to the organisation ultimately impacts upon measures of organisational performance.

2.3. Hierarchy level one: the relationship between IT/IS implementation success and organisational performance

Chapter one presented an overview of the types of research undertaken in the IS field. In particular, it focused upon the body of research that attempts to measure a direct relationship between IT/IS ownership and measures of IT/IS and organisational performance. The current chapter adds to this approach by reviewing the body of literature that considers the influence of intermediate variables in the IT/IS
investment-performance relationship to be of significance. In doing so, it will stress how certain approaches and factors that form part of the IT/IS assessment and acquisition process influence the success with which technology is appropriated by small firms. Before reviewing literature focusing upon hierarchy level two, we turn our attention to hierarchy one; the association between measures of IT/IS implementation success and measures of overall firm performance.

As illustrated in chapter one, research has consistently failed to identify a relationship between investment in IT/IS and business performance (Cron and Sobol, 1983; Loveman, 1994; Kivijärvi and Saarinen, 1995; Coopers and Lybrand, 1996; Hitt and Brynjolfsson, 1996; Byrd and Marshall, 1997). It is evident, however, that measuring a direct association between IT/IS ownership and business performance is problematic. Studies evaluating the impact of IT/IS ownership (or investment) on business performance may prove inconclusive as the range of success with which organisations implement IT/IS varies substantially. There are a large number of factors that affect the success with which technology is implemented in an organisation and, as such, there exists a large spectrum in terms of the degree to which individual organisations benefit from IT/IS. In order to evaluate the impact of IT/IS on organisational performance, research should compare like with like. Thus, research should employ IT/IS implementation success as an intermediate variable, and thus control those factors that cloud the IT/IS-business performance relationship.

Cragg (1990) followed this method in his study of small engineering firms. The author collected data from 289 small firms (<50 employees), 76% of which employed fewer than 20 employees. His results show a weak association between IT/IS success (measured using a ten-item construct designed to measure a broad range of impacts resulting from IT/IS implementation and use) and three measures of performance; (1) one year sales growth; (2) one year net return; and (3) five year sales
growth. Cragg's findings suggest that, even when perceived as beneficial by management in terms of successful implementation, IT/IS failed to impact strongly upon measures of business performance.

While Cragg employed an adequate sample size in his employment of path analysis, little information is afforded regarding the examination of the data or the construction and testing of measurement models necessary for the satisfactory use of this technique (see Chapter 5). This casts uncertainty on Cragg's findings and the results of his research should be approached accordingly. In the context of the current study (i.e. professional firms), Cragg's study also differs. While definite differences in the impact of office-based IT/IS between manufacturing organisations (as studied by Cragg) and professional service firms (as undertaken in the current study) is unknown, it is probable that the impact will be greater in the latter due to the knowledge-based nature of the professional service firm. Reiterating the words of Porter and Millar (1985), the use of IT/IS to achieve competitive advantage is expected to be particularly important in information-intensive firms. As such, the generality of Cragg's findings to the current study is questionable.

Limitations aside, it is not surprising, given the argument put forward by Hanes and Ramage, that Cragg's findings fail to identify a significant relationship between IT/IS implementation success and organisational performance. Hanes and Ramage (1977, p.84) point out that it is extremely difficult to isolate the effect of IT/IS from the "many other uncontrollable and unmeasurable factors [which] influence organisational performance," and this may be one reason why findings prove inconclusive. While IT/IS may contribute in some way to overall firm performance, the contribution of other factors clouds any association that might exist.

In spite of Hanes and Ramage's assertions, research does exist (particularly in case study form) that suggests that where technology has been shown to impact
positively on small firms, business performance rewards have followed (Yetton, 1994; Curriden, 1995; Sanctosus, 1995). Yetton et al.'s (1994) case study of a small architecture practice whose implementation of IT was so effective that it increased its business by 400 percent between 1987 and 1992 during a period when local firms were experiencing a severe recession, is one such example. According to Yetton et al., not only did IT help the practice win contracts but it also enabled a significantly more efficient design operation. Whether such a competitive advantage is sustainable is questionable. Curriden (1995) and Sanctosus (1995) reported similar success stories in the law profession.

As is apparent, little research (particularly empirically based) exists which draws direct associations between measures of IT/IS success and measures of organisational performance, especially in small firms. Delone and McLean (1992) suggest that this is because of the difficulty researchers have in isolating the contribution of the information systems function from other contributors to organisational performance. Perhaps for this reason, the majority of literature in this area follows a case-study approach. This, of course, has its advantages and disadvantages. On the positive side, the findings of case study research can be rich in the information they offer. On the downside, they have limited generality: they frequently observe and record events which are out of the ordinary rather than the norm. This, for example, is likely to be true of the study undertaken by Yetton et al. (1992). It is improbable that all architecture practices implementing IT at the same time as the firm studied by Yetton et al. experienced analogous improvements in business performance. Like much case study research, Yetton et al. (1992) record an extreme case to illustrate a point and the findings of their research should be approached as such.
The outcome of a review of the limited research in this area is inconclusive. It is not surprising, then, that Delone and McLean call for further research in this area. According to the authors, "this connection is of great interest to information systems practitioners and to top corporate management. MIS organisational performance measurement deserves further development and testing."

Due to the large amount of case study based research that suggests a strong relationship between IT/IS implementation success and organisational performance, and the shortcomings of empirical research that has failed to identify a significant relationship, the current study hypothesises that a positive relation will exist between IT/IS implementation success and organisational performance. This is further supported by theorists who believe that any benefits afforded by IT/IS should, ultimately be reflected as improvements in business performance (Alpar and Kim, 1990). Thus, it is hypothesised that;

*Level I Hypothesis 1: Measures of IT/IS implementation success will be positively and significantly associated with measures of organisation performance.*

The current study also re-evaluates the association between the two most frequently used measures of IT/IS implementation success; (1) IT/IS impact; and (2) user information satisfaction (UIS). Seddon (1997, p.246) defines UIS measures as "the subjective evaluation of the various Consequences evaluated on a pleasant-unpleasant continuum. Of all the measures...User Satisfaction is probably the closest in meaning to the ideal Net Benefits measure. UIS measures such as that of the Ives et al. (1983) instrument fall a long way short of the measuring of this idealized construct."

User information satisfaction measures remain one of the most widely used single measures of IT/IS success (Delone and McLean, 1992). And yet, according to Gatian (1994, p.120), justification for the use of UIS measures is "based solely on
extrapolations of theoretical arguments from other disciplines.” Irrespective of this fact, a significant proportion of researchers have deemed UIS measures to be a reliable means of evaluating IT/IS impact (e.g. Ives et al., 1983; Montazemi, 1988a; Palvia, 1996). According to Delone and McLean (1992, p.69), the reasons for the widespread use of UIS are threefold: ‘First, “satisfaction” has a high degree of face validity. It is hard to deny the success of a system which its users say they like. Second, the development of the Bailey and Pearson instrument and its derivatives has provided a reliable tool for measuring satisfaction and for making comparisons among studies. The third reason for the appeal of satisfaction as a success measure is that most of the other measures are so poor; they are either conceptually weak or empirically difficult to obtain.’

The underpinning argument for the validity of UIS as a measure of IT/IS impact is that, if a user is satisfied with the information product and IS staff and services, then they will use the system more frequently (as shown by Baroudi et al., 1986; Grover et al., 1996), perform better than dissatisfied user, resulting in a more effective system. But as Wong and Phelps (1997) assert, while the UIS measure does capture the main dimensions of individual effectiveness, the measure alone cannot capture the whole meaning of IT/IS impact due to its focus on individual rather than organisational efficiency. Nancy Melone (1990) is in agreement, adding that it is possible to have an effective IS without satisfaction on the part of the users.

Following an evaluation of different measures of IT/IS success, Delone and McLean (1992) argued that the many specific IT/IS measures that they identify within their six IT/IS success categories indicate that MIS success is a multidimensional construct and should be measured as such.

“Vanlommel and DeBrabander (1975) early pointed out that success of a computer-based information system is not a homogeneous concept and therefore
the attempt should not be made to capture it by a single measure. Ein-Dor and Segev (1978) admitted that their selection of MIS use as their dependent variable may not be ideal. They stated that "a better measure of MIS success would probably be some weighted average for the criteria mentioned above" (i.e. use, profitability, application to major problems, performance, resulting quality decision, and user satisfaction). In reviewing the studies cited... it is clear that most of them have attempted to measure I/S success in only one or possibly two success categories... These attempts to combine measures, or at least use multiple measures are a promising beginning. It is unlikely that any single, overarching measure of I/S success will emerge; and so multiple measures will be necessary." (Delone and McLean, 1992, pp.86-88).

Perhaps unsurprisingly, the findings of the limited number of empirical investigations into the strength of the UIS measure as a measure of IT/IS success have been mixed. Hufnagel (1990) asserts that user satisfaction measures may be a less than adequate surrogate for the organisational impact of IT/IS. Strong empirical studies undertaken by Miller and Doyle (1987), Gatian (1994), and Livari and Ervasti (1994), on the other hand, found evidence of positive associations between UIS measures and organisational-level measures of IT/IS impact. In the latter two studies, Gatian reported high correlations between user satisfaction and impact of IT/IS, measured as decision performance (.64) and efficiency (.97) while Livari and Ervasti reported a moderately high correlation between UIS measures and IT/IS impact.

Theoretical assertions as well as the empirical findings of Miller and Doyle (1987), Gatian (1994), and Livari and Ervasti (1994) point towards the existence of a positive association between UIS measures and IT/IS impact measures. As such, it is hypothesised that;

\[ H_1 \quad H_2: A \text{ positive and significant association will exist between UIS and the organisational impact of IT/IS.} \]

The relationships hypothesised in level one are represented diagrammatically in figure 2.5.
2.4. Hierarchy level two: direct drivers of IT/IS implementation success

Level two of the model focuses upon factors that form part of the acquisition process, and have been shown by existing research to directly influence the success with which IT/IS is implemented. Factors identified in the literature as having a direct affect can be broadly classified into three categories. The first reviews IT/IS assessment and acquisition decision issues. Factors include; (1) the level of investment in IT/IS; (2) IT/IS sophistication and coverage; (3) levels of planning and formalisation in the acquisition process; (4) levels of employee involvement; (5) the amount of IT/IS training undertaken; and (6) the employment of external support. A thorough review of the literature focusing upon these variables follows in section 2.4.1.

The second category evaluates management IT/IS characteristics. The characteristics of the small firm are such that management takes on a greater importance than their counterparts in large organisations (Doukidis et al., 1994). The owner-manager is the locus of decision-making and, as a result, his or her attitudes, knowledge, beliefs and ways of working permeate the entire organisation. As such, "management difference" can produce a critical distinct advantage (Powell and Dent-
The IT/IS management characteristics reviewed in section 2.4.2 are; (1) management IT/IS experience; and (2) the level of management support for technology use within the organisation.

The third category reviews the affect of organisational characteristics and resources. It is evident that certain conditions evident in both the internal and external small business environment affect the IT/IS assessment and acquisition process (e.g. Scholhammer and Kuriloff, 1979; Farhoomand and Hrycyk, 1985; Cragg and King, 1993, Naylor and Williams, 1994). Here, we review the affect of; (1) organisation size; (2) levels of internal IT/IS knowledge; and (3) the employment of dedicated IS personnel. Section 2.4.3 shows such factors to stand out as directly influencing IT/IS assessment and acquisition success.

2.4.1. IT/IS assessment and acquisition decision issues

2.4.1.1. IT/IS investment

"Learning the relationship between IT investment and organisational performance is critical to improving operational effectiveness. Yet the link between IT initiatives and business value is rarely clear, direct or immediate." (Henderson and Lentz, 1996, p.245)

It is under such difficult circumstances that organisations and researchers strive to evaluate the relationship between IT/IS investment and measures of impact and performance. While large organisations show indications of assessing their IT/IS investments as capital investments (Kobler, 1987), small organisations often fail to employ any post-implementation evaluation techniques in order to measure the benefits (or lack of) generated by IT/IS (Howard, 1997; Reid and Hutchings; 1997). As Howard (1997, p.6) reports following a survey of UK SMEs, "owners and
managers find it difficult to identify benefits without devoting considerable time and effort, and even then they are sceptical that those benefits can really be achieved."

For small businesses (and indeed large firms), purchasing IT/IS is often seen as "a necessary but not sufficient condition for improved business performance" (Hepworth and Blizzard, 1996). The need to obtain tangible benefits from technology acquisition is further leveraged for the small firm. Should IT/IS investment fail to produce any benefit, the cost may prove fatal for small resource-poor firms (Doukidis, 1996). Alpar and Kim (1990) suggest that, if IT helps firms to improve, then such improvements should be reflected financially, irrespective of their form. In spite of this assertion, organisations and researchers alike are having difficulties in consistently showing IT/IS investments to be related to overall firm performance. This has led to what some economists call the "productivity paradox" - the paucity of evidence to show that IT/IS investment results in benefits that justify the expenditure involved. This is encapsulated in Solow's much quoted observation, "We see computers everywhere but in the productivity statistics" (David, 1990).

While such a statement may suggest more about the economist perspective than about computers, finding evidence of an association between the level of capital invested in IT/IS and the success with which IT/IS is implemented in small firms remains difficult. Research investigating the impact of IT/IS investment tends to use business performance as a "surrogate" for IT/IS implementation success. However, as has already been shown, it is difficult to distinguish the impact of IT/IS on business performance from the many other variables that play a role. As will become evident, the end product is a collection of inconclusive and inconsistent findings that should be approached with caution.

Floyd and Zahra's (1991), and a Coopers and Lybrand's (1996) surveys of SMEs, concluded that there was no correlation between IT/IS spend and business
performance. It should be noted, however, that approximately two-thirds of the Coopers and Lybrand Survey data was obtained from firms with between 50 and 500 employees. Only 5% of data were from firms with less than 50 employees. As a result, the survey is weighted more towards larger SMEs. Furthermore, while Floyd and Zara's research focused upon small banks, these were in fact branches of larger organisations and cannot, therefore, be categorised as independent small businesses in their own right.

In spite of the inconclusive nature of the above research in the context of the small business, Hepworth and Blizzard (1996) support the findings, stating that "small firms tend to rank new technologies below other critical factors in explaining their performance." They back their statement with data from the 'Europe's 500' project which found that small firm managers and owners viewed soft competencies, such as marketing and human resources, as more critical to business performance than investment in IT/IS (EFER, 1995).

Small business research undertaken by the Institute of Management (Howard, 1997) found similar results. One manager's point of view, recorded during focus group discussions, is particularly telling. 'IT is a very expensive business facility and I do not believe that it in any way repays the investment in either money or IT specialist time. It is effectively a "stress-purchase" - we have to keep on buying new IT equipment just to keep up' (p.3). While this is the view of but one owner manager, such opinion proves to be supported by the institute's empirical research, which found that the majority of IT/IS owners under-use technology because they perceive the costs of development to outweigh the benefits. Furthermore, a significant proportion of managers reported that benefits were frequently not achieved following IT/IS implementation. Howard does not, however, offer a breakdown of the sample \( n = 500 \) according to organisation size. Firms included in the study employed up to 250
employees and thus the findings include organisations that are relatively large in the context of the professional SME. The generality of Howard’s findings should be approached accordingly. The findings do, however, suggest that increased investment in IT fails to result in the benefits anticipated.

Quantitative research studies examining statistical relationships between measures of IT/IS investment and traditional indicators of business performance, such as return on investment (ROI) and return on sales (ROS), also tend to fail to show any positive relationship between IT/IS investment and performance. Mahmood and Mann (1993), employing data from the Computerworld “Premier 100”, found IT/IS budget as a percentage of total revenue to be negatively and significantly correlated with return on investment, sales by total assets, and market to book value. Byrd and Marshall (1997), replicated Mahmood and Mann’s model and, using structural equation modelling, arrived at the same conclusion. Kivijarvi and Saarinen (1995) also found no evidence of a direct relationship between IT/IS investment and the overall performance of the firm. The authors found no statistically significant difference in the financial performance of firms that invest heavily in IT/IS and those whose IT/IS investments are minimal. These findings are not, however, clear-cut. A Kobler Unit (1987) survey employed the economic performance measure return on capital employed (ROCE) for IT/IS investments in order to evaluate the relationship between IT/IS investment and resulting benefits. The results indicate a significant association between the two variables.

While the literature reviewed above affords an insight into the findings of studies focusing upon the impact of IT/IS investment on measures of organisational performance, the findings do not relate directly to the research question at hand, namely the relationship between IT/IS investment and the successful implementation
of IT/IS. Once again, this is a result of the small canon of research that focuses upon such a relationship.

Several studies have been undertaken that go some way in measuring an intermediate IT/IS success variable between IT/IS investment and organisational performance. Large scale empirical studies undertaken by Alpar and Kim (1990), Harris and Katz (1991) and Mitra and Chaya (1996) all found that IT/IS investment resulted in lower organisational costs, thereby contributing to improved performance. Brynjolfsson and Hitt (1993) and Hitt and Brynjolfsson (1996) also found the level of IT/IS investment to have a significant and positive impact on firm output. Building on the work of Brynjolfsson and Hitt, Rai et al. (1997) looked at the affect of IT/IS investment on three dimensions; (1) firm output (measured using value added by the organisation and total sales; (2) business results (assessed using return on assets and return on equity measures of financial performance); and (3) intermediate performance (assessed using labour productivity and administrative productivity measures). Using data obtained from Compustat (a database of financial and market information on public companies), Rai et al. found IT/IS investment to be positively associated with firm output, while its relationship with business performance proved to be less clear. The level of expenditure on IT/IS also proved to be positively associated with labour productivity, but not administrative productivity. Again, these findings are in the large organisation domain with data frequently obtained from secondary sources (as in studies undertaken by Brynjolfsson and Hitt, 1993; and Hitt and Brynjolfsson, 1996; and Rai et al., 1997). In the examples given, the data drawn from secondary sources focused upon the top 500 companies according to Fortune 500 manufacturing and service listings. The end result is findings which lack generality and are not easily transferable in the context of the current study.
The body of literature evaluating the relationship between the level of IT/IS investment and IT/IS implementation success in the small business domain is again weak. No empirical research focuses upon the relationship: Cragg (1990) did not include the level of IT/IS investment as a variable in his model of IT/IS success. Several case studies exist which paint an optimistic picture of the relationship between the amount invested in IT/IS and the success with which IT/IS is implemented in small businesses. As alluded to earlier, Yetton et al. (1994) describe the acquisition and increased investment in IT/IS by a small Australian architecture practice which led to increasing market share and revenue. Malone (1985) and Naylor and Williams (1994) also describe small firms whose IT/IS has impacted upon performance through reduced costs, improved marketing and production, and better managerial decision making, enabled by increased investment. The shortcomings of case study research based on small sample sizes has already been noted.

While it is evident that there is a significant body of literature focusing upon the IT/IS investment-performance relationship, little research has been undertaken that evaluates the association between investment and more immediate measures of return on investment such as IT/IS implementation success. In particular, no empirical research exists which focuses upon the identification of such an association in the small business domain. The empirical studies cited above focus upon the IT/IS investment-performance relationship in large organisations and, as such, cannot be assimilated into the domain of small business research without caution.

While the findings of existing research remain inconclusive in the context of the current study, recent empirical studies (albeit undertaken in large organisations) and small firm case studies focusing upon the relationship between IT/IS investment and IT/IS implementation success indicate that such an association exists. Thus, it is hypothesised that;
There is a positive and significant association between IT/IS investment and measures of IT/IS implementation success.

Grover et al. (1996) point out that, while impact evaluation remains a top priority amongst practitioners and academics seeking to justify increasing reliance on IT/IS investment as a source of competitive advantage, many factors cloud the relationship between IT/IS investments and IT/IS acquisition success. This point is supported by Esther and Brooke (1995), who suggest that better management of IT/IS as opposed to pure reliance on technology purchases is a main factor regarding the impact of IT/IS upon an organisation and any effect on measures of business performance that IT/IS may have. As a result, it is inappropriate to look solely at IT/IS investment as an independent variable in the IT/IS acquisition-impact relationship. A whole host of factors or moderating variables exist which influence the success with which IT/IS is implemented in small firms. It is to such variables that we now turn our attention.

2.4.1.2. IT/IS sophistication and coverage

While the Kobler unit (1987) failed to find a direct association between IT/IS investment and business success, they did conclude that there was a strong relationship between the range and number of tasks that could be performed using IT/IS and business success. Cragg (1990) employed several measures of IT/IS sophistication and coverage, including; (1) the number of sophisticated applications; (2) the number of functional areas covered by IT/IS; and (3) number of managerial applications. Using these measures, Cragg found statistically significant correlations between IT/IS sophistication and IT/IS impact. This supported and built upon the findings of Raymond (1985), who reported the number of administrative applications
used by a small firm to be positively correlated with IT implementation success measured as a aggregate of user information satisfaction and system utilisation.

While Raymond's findings are based upon a large sample of computerised firms (n = 464), there are a number of limitations regarding the generality of findings in the context of the current study. First of all, the size of organisations surveyed by Raymond ranged from 20 to 250 employees (median size = 80). Thus, while the study focuses upon 'small businesses' according to the American Small Business Administration's definition, it is evident in reality that the firms analysed are large when approached in the context of small professional practices (organisation size and the professional firm context is approached in more detail in chapter 5). Secondly, businesses with fewer than 20 employees were excluded from the survey process as it was regarded that they were less likely to employ technology. This significantly impacts upon the generality of Raymond's findings to the current study: firms with fewer than 20 employees are expected to form a fundamental element of the current study's sample.

Raymond's decision to omit firms with fewer than 20 employees from the survey process is also a reflection upon the age of the study. Fifteen years ago, the implementation of technology represented a far greater drain on the small organisation's resources than is the case today; hence the rationale behind Raymond's survey methodology. It is also possible that the interrelations between factors integral to the implementation of technology within the small firm may have also changed since the publication of Raymond's findings. Thus, the relevance of Raymond's findings are questioned. Finally, Raymond's sample evaluated manufacturing organisations as opposed to professional organisations. Thus the findings cannot be generalised to the professional sector domain without caution.
Lefebvre et al. (1995) researched technological penetration and organisational learning amongst Canadian Manufacturing SMEs. They found that IT/IS had the most marked impact in those firms with the most sophisticated and innovative information systems. Such firms also proved to perform best in international markets, suggesting a relationship between technological penetration and export performance. Greater technological sophistication appeared to facilitate the export process. This did not, however, apply to financial performance. The authors cite a possible reason for this to be that SMEs that invest more in computer-based applications must often do so at the expense of short-term profitability. This is supported by Mahmood (1997) as illustrated earlier. Once again, problems arise with regard to the generality of findings to the current study. The sample surveyed \((n = 84)\) consisted solely of manufacturing organisations. While the organisations are described as small, the upper limit of ‘small’ employed by Lefebvre et al. is 200 employees. No further analysis of the size of organisations forming the sample is given.

Reid and Hutchings (1997) report that most small firms involved in their survey perceived sophisticated applications including communications/e-mail/intranets, database marketing or mining, data storage and collection of management information, to be the most beneficial in terms of impact on their organisations. Such opinion is supported by the findings of Howard (1997).

Kagan et al. (1990) focused upon the relationship between user information satisfaction (UIS) and software sophistication in small firms, but found no significant relationship. Their research evaluated a cross-industry sample of 252 organisations. Once again, the generality of the findings should be approached with caution: the organisations surveyed employed up to 250 employees conforming to the US Small Business Administration’s definition of ‘small’. The findings of Kagan et al. are supported by subsequent large organisation (mean number of employees in excess of
500) research undertaken by Law and Gorla (1996). Their study of 16 organisations (divided equally between professional and non-professional) found that organisations that were considered high software users reported no significant differences in productivity, success or satisfaction than firms regarded as low software users. This is perhaps unsurprising given the sample size.

These findings again prove inconclusive. Two studies of large organisations, undertaken by Choe (1996) and Lu and Wang (1997) found that the more mature the IS growth stage (and thus the more sophisticated the use of technology) the greater the user information satisfaction and impact of IT/IS. Choe surveyed 78 Korean organisations in varying industries while Lu and Wang's study evaluated 172 Taiwanese organisations (consisting of 59.3% manufacturers and 40.7% service businesses). Lu and Wang employed an abridged version of Bailey and Pearson's user satisfaction measure while Choe used user satisfaction and systems usage as surrogates for IT/IS success. Both recorded significant relationships between the IT/IS growth stage and the respective IT/IS implementation success measures.

Finally, Kivijarvi and Saarinen (1995) undertook a comprehensive study evaluating the relationships between measures of IT/IS applications coverage, maturity of IS and measures of IT/IS impact in terms of profitability and work processes, as well as measures of user information satisfaction (such as information quality and information content). Results from a study of 36 Finnish manufacturing and sales companies (average size = 3,700 employees) show a significant relationship between maturity of IS and the impact of IT/IS on profitability and work processes. Applications coverage is most strongly associated with profitability. Their research also found that if IS applications cover a wide range of functional areas, the users are generally more satisfied.
The appropriateness of generalising the findings of existing research focusing upon the relationship between IT/IS sophistication and IT/IS implementation success (as reviewed above) in the construction of hypotheses for the current study is questionable. As is evident, findings are drawn from a variety of populations, many of which focus on larger organisations than is intended in the current study. Most have a more manufacturing industry bias. This makes hypothesis construction difficult. In spite of this fact, it is evident from the findings of existing research that reliable empirical studies evaluating this relationship have repeatedly identified a significant positive association between IT/IS sophistication and IT/IS implementation success. This appears to be irrespective of the size or type of organisation studied. It is thus hypothesised that;

\[ H_2: \text{The level of IT/IS sophistication and coverage is positively and significantly associated with measures of IT/IS implementation success.} \]

2.4.1.3. IS planning and formalisation in the assessment and acquisition process

The nature of the supply environment is such that organisations are faced with a bewildering array of sources, confusing jargon, and technology which is evolving at a rapid and unnerving rate of change (Geisler, 1992). How, then, do small firms select IT/IS products? While in some firms the motivation is based upon rational grounds such as an evaluation of the costs and benefits, competitive pressures, or client expectations (Coopers and Lybrand, 1985), other firms purchase systems for ill-founded reasons such as their popularity, or their perception as a management
prerequisite (Farhoomand and Hrycyk, 1985; Malone, 1985). As a result, benefits are frequently anticipated which fail to materialise (Capaldo, 1995).

While there is a significant body of literature focusing upon the adoption of IT/IS, there has been little empirical evidence focusing upon the decision-making process and in particular, focusing upon the association between decision-making approaches and IT/IS implementation success. Huff and Munro (1985) undertook a field study of large Canadian organisations in order to examine their strategies and mechanisms for identifying, assessing and adopting new information technology. From their findings they derived four models of acquisition; (1) the issue driven model; (2) the technology driven model; (3) the opportunistic model; and (4) the normative ideal model. While these models arise from large organisational research, it is evident that they can, to a degree, be applied in the context of small organisations.

The technology driven model is perhaps the least comprehensive approach to IT/IS assessment and acquisition in that it is entirely removed from the business planning process (if indeed such planning exists) and organisational issues. Instead, the sequence progresses from “identification of an interesting technology, often by individuals relatively low in the organisation, to the location of a problem to which it can be applied” (p.332).

The opportunistic model represents the next level in terms of the degree of formalisation of the assessment and acquisition process. Technology is essentially purchased as and when required. Any identification of business needs and scanning of technology is informal. Huff and Munro (p.332) describe this approach as involving a “learn-as-we-go” ethic – “rather than investigating either issues or technology in depth before proceeding further these firms tend to take the ITAA [information technology assessment and adoption] process a step at a time, feeling their way in a somewhat cautious, relatively unstructured mode.”
The issue driven model involves an approach by which the process starts with the “delineation and prioritisation of issues at the senior management level, then proceeds to more and more detailed levels of analysis” (p.331). Technology assessment and adoption is closely integrated with business planning and as a result, issues of organisational importance are discussed, prioritised and funded. An individual or small team performs an information search for appropriate technology via literature, vendor contacts, internal staff with IT/IS knowledge, counterparts in other organisations, and so on. Internal systems analysis, cost benefit analysis, hands on product evaluation and trial use within the organisation are other activities which might be carried out. As such, this approach involves a high degree of planning and formalisation.

The final, and most formalised, approach to IT/IS assessment and adoption identified by Huff and Munro is the normative ideal model. Huff and Munro (1985) identify six main phases. These are; (1) awareness - the technology is brought to the attention of the organisation, but an information gap exists; (2) interest - missing information is obtained; (3) evaluation - the use of the technology is considered and a decision is made whether or not to try it; (4) trial - the technology is tested in order to assess its appropriateness in terms of current and future needs; (5) implementation - the trial is extended to full use of the technology within limited areas of the organisation; (6) diffusion - the innovation is extended to other areas within the organisation.

While Huff and Munro do not empirically test the models they define in order to see whether any one approach is better than the others, the implication is that the normative ideal model is, as the name suggests, the rational and most complete approach to IT/IS assessment and acquisition. Evidence suggests that this is not the IT/IS acquisition route most frequently followed by small firms. While Montazemi
(1988b) found a lack of appropriate policies for the selection and use of information resources, Cragg and King (1993, p.53) report finding "few formal planning and control activities associated with the computer, or for that matter, with the business as a whole." Fidler et al. (1993) and Doukidis et al. (1994) add further support in their assertion that small firms remain in the dark ages in terms of their approach to planning and modern management practice. In his study of seventy-nine small firms, for example, Montazemi (1988b) reported that only nine percent of firms employed a full information requirements evaluation. On the basis of these findings, he concludes that the opportunistic model most accurately describes the small firm IT/IS selection process.

On the basis of their case study research undertaken in small firms, Doukidis et al. (1996) found that where planning does take place it is generally; (1) undertaken on an ad hoc, problem basis; (2) only an activity of the owner/manager; (3) informal, sporadic and closed; and (4) influenced heavily by advice from outside sources with less skills and experience than the owner/manager. They conclude that, while "I.T. is usually associated with a systematic approach to management and decision-making and its introduction requires careful planning...much SB [small business] management practice is based on short-term, informal, ad hoc lines" (p.192). This is further supported by Osborne (1992) who, following a study of 31 small entrepreneurial firms, reported that decision processes were based on surprisingly modest, often anecdotal information from both within and outside the firm. Johannisson (1986), summarised by Birley et al. (1991), argues that;

"entrepreneurs and small firm managers are rarely rational decision makers, rather they are action oriented persons who seek situations which enable things to get done...up-to-date information and the opinions and know-how of peers is more relevant than written data...their action orientation produces an aversion to
information overload and the planned collections of data.” (Birley et al., 1991, p.57)

While we can conclude from this that most small firms approach IT/IS assessment and acquisition in an unformalised, ad hoc, and unplanned manner, there is a paucity of empirical evidence focusing upon the association between IT/IS planning and the success with which technology is implemented in small firms. There is, as one might expect, a plethora of prescriptive articles lauding the benefits of IS planning and prescribing normative approaches to IT/IS investment decisions to large and small businesses alike (e.g. Boynton and Zmud, 1984; Bergeron and Raymond, 1992; Geisler, 1992; Hogbin and Thomas, 1994; Prince, 1994; and Lederer and Sethi, 1996). Deitz (1995) argues that the existence of such literature is a by-product of the importance of IS planning and the importance of a thorough analysis of IT/IS investments. In essence, Deitz is implying that a normative approach to IT/IS investment decisions will bring about higher quality decisions which should result in IT/IS impacting more effectively upon the organisation.

Deitz’s assertion is also supported by the small body of research that has analysed the association between the planning and formalisation of IT/IS assessment and acquisition and successful implementation of IT/IS (e.g. Lees, 1987; Lee and Kim, 1992; Choe, 1996). Lees (1987) focused upon the affect of formal systems analysis, design and implementation procedures on IT/IS success (measured as user satisfaction and usage) in 110 small businesses. In general, he found that in firms which followed a formalised approach, benefits were reported in terms of both satisfaction and usage. While Lees states a clear conclusion in terms of findings, there is little information afforded with regard to methodology, or profile information on respondents. This makes the contextualisation of the research difficult, and raises questions about its reliability. These may or may not be justified.
On the basis of structured interviews undertaken over a decade ago with owner/managers in ten retail building material dealers, Malone (1985) reported that small organisations that had adopted more formal planning systems were encountering fewer IT/IS problems. Delone (1983) evaluated the value of IS planning in his study of the determinants of computer usage and impact in small businesses. He reported a positive association between computer planning and IT/IS success (measured as a composite of owner/manager use of computer generated reports and the impact of computer applications on the organisation). A replication of the study undertaken by the same author (1988) again reported a positive association between IS planning and success, but this time only in the presence of computer controls. The latter study surveyed 93 US manufacturers. Firms surveyed employed fewer than 300 employees with an average size within the sample of 62. The generality of these findings with regard to the current study should once again be noted.

The value of planning in small businesses is also illustrated by Cragg (1990), who found IS planning to drive IT/IS success indirectly via IT use. Thus, where IT systems were increasingly planned prior to implementation, they were used more following implementation. This impacted upon Cragg's measure of IT/IS success. Montazemi (1988a) also reported end-user satisfaction to be positively associated with the degree of intensity of information requirements analysis performed in small firms. As a result, the author hypothesises that a lack of IS planning will have the same negative impact on small firms as reported for large organisations. Montazemi's findings are based on research undertaken for the Society of Management Accountants of Canada (1988b). Research involved the surveying of 77 organisations (45 service firms and 35 manufacturing organisations). The number of employees in these firms ranged from one to 250, with an average of 73 employees.
While the methodology employed is rigorous, due to the sample studied, the same problems of generality again arise.

There is a significant body of literature that focuses upon the need to integrate business and IS planning in large organisations (e.g. Powell, 1993; Teo and King, 1996; Powell and Dent-Micallef, 1997). There is, however, a paucity of small business research in this area. This may be because it is felt that owners and managers of small businesses do not distinguish between business and IS strategies, and due to the nature of small businesses and the centrality of decision making, plans are more highly integrated.

Once again, the body of literature which focuses on the area of interest and, more specifically, surveys a population directly comparable with that intended in the current study, is small. While this emphasises the need for the current study, it makes the proposing of sound hypotheses difficult. While the quality of the literature reviewed in this area, and the population sampled, varies, few studies failed to find evidence of a significant positive relationship between the level of IT/IS planning undertaken and IT/IS implementation success. Thus, it is hypothesised that;

$L_{II} H_{3}$: The level of planning and formalisation in the IT/IS assessment and acquisition process is positively and significantly associated with measures of IT/IS implementation success.

2.4.1.4. Level of employee involvement in the acquisition process

Lees (1987) found that the way in which users are involved in the systems development process in small firms was vital in determining whether their involvement was beneficial or detrimental. Where employees had proposed an IT/IS purchase, investigated alternative solutions and/or had a high level of input into the final purchase decision, IT/IS implementation proved more successful. Benefits
which proved to be positively related to high degrees of employee involvement included; (1) increased revenues; (2) better record keeping; (3) improved customer/client service; (4) increased productivity; and (5) more accurate costing. Firms where employees had a high degree of employee involvement also used their computers more hours per week: 41 hours as opposed to 28 hours per week. Where employees had restricted involvement in IT/IS decision-making, Lees reported their chances of successful implementation to decrease. Understanding of the system and employee morale was lower in such organisations.

The limitations of Lees' work was discussed earlier in the current chapter. In summary, Lees fails to afford any detailed quantitative information on either his final sample or the statistical findings of his research. While the author's discussion of findings appears insightful, it is difficult to evaluate its validity in the absence of the underpinning methodology and data. It is thus difficult to generalise Lees' findings in the context of the current study with full confidence.

Lees' findings are, however, supported by subsequent research in this area. Montazemi (1988a) reported a positive relationship between end-user involvement and UIS. This he suggested could be the by-product of a multitude of factors such as better IS fit with requirements, ease of operating the systems due to learning experience during the selection phase and feelings of ownership. Organisations in Montazemi's study (n = 77) employed on average 73 personnel.

More recently, Yap et al. (1992) further confirmed Montazemi's findings. The authors' study analyses data from 96 small businesses (defined as businesses with 100 or fewer employees). The majority of firms responding were from the service industry, with large response rates also from manufacturing and commerce. Over half of the firms responding employed 30 or fewer employees. Only 21% employed between 50-100. Yap et al. found that where users had participated in the design and
implementation of a system, the level of computer-based information systems success (measured using a UIS measure) was significantly greater \((r = .16; \text{sig. level} = 0.024)\). This is perhaps unsurprising given that if users have influenced the design of a system to better meet their needs, they are more likely to be more satisfied if this objective is met. These findings are important, however, given that the sample focuses on organisations similar in size profile to those examined by the current study. While Yap et al.'s sample differs to that intended in the current study in terms of industry profile, a large proportion (34%) are from the service industry.

The findings of large organisation research also generally show employee involvement in the development process to be beneficial (e.g. Choe, 1996; and Doll and Torkzadeh; 1989). Lu and Wang (1997), for example, reported user participation in IT/IS implementation decisions to be positively associated with IT/IS success, measured using a derivative of Bailey and Pearson's (1983) UIS questionnaire. However, it is worth reiterating that the findings of large organisation research cannot necessarily be deemed consistent with what one might expect for small businesses. In particular, differences in size impact upon both the physical and structural gap between employee and manager. As such, the need to facilitate employee involvement in the small firm may be less necessary as employees may already be well informed and have been able to forward their point of view due to the nature of the small firm environment.

On the basis of the literature review, and in particularly the small business findings of Yap et al. (1992), it appears that employee involvement in the IT/IS acquisition process is of benefit to an organisation. Thus, it is hypothesised that;

\[ L_{III} H_{II}: \text{Employee involvement in the IT/IS acquisition process is positively and significantly associated with IT/IS implementation success.} \]
2.4.1.5. Level of IT/IS training

Choe (1996) found that in large organisations undertaking user training and education, system usage was greater. Thus, he concluded that the impact of IT/IS can be increased with user training and education. Similarly, Guimaraes et al. (1996) argue on the basis of a survey of 114 information system end-users in E.I. Dupont de Nemours & Company that there is a clear need for end user training. Their research evaluated training in a single organisation and the use of an organisation-specific system. As such, the generality of the findings are limited. In spite of this, other similar large organisation research arrives at similar conclusions (e.g. Cronan and Douglas, 1990).

In their study of the impact of IT/IS investment in organisations listed in the Computerworld "Premier 100", Mahmood and Mann (1993) evaluated the affect of IT/IS budget spent on training as an intermediate variable. Their findings indicated that budget spent on employee training is positively and significantly related to sales to total assets, market value to book value, and return on investment. According to the authors, such a relationship is to be expected:

"As more is spent on the training of employees, assuming that the funds are effectively used, the better the employees are expected to be at what they do, thereby pushing the organisation to a higher level of performance. This should in turn result in an increase in net worth of the organisation and return on investment to shareholders... Training of employees should, therefore, be one of the more important components of IT investment." (Mahmood and Mann, 1993, p.113)

The limitations of Mahmood and Mann's (1993) study with regard to the problems of using secondary data as well as the generality findings in the context of the current study have been noted.
Recent empirical research undertaken by Igbaria et al. (1997) also finds training to be beneficial in terms of IT/IS implementation success in large organisations. Their study shows training to be positively associated with the perceived usefulness of IT/IS and ease of use. On the basis of their findings, Igbaria et al. (p.295) assert that "individuals without adequate training are likely to experience problems using the system. Since they are struggling, they may actually believe that the system is too hard to use and that the performance benefits of usage are outweighed by the efforts of using it and eventually become reluctant to use the technology, thus defeating the purpose of introducing the new technology."

Research findings in this area prove inconsistent. Using Mahmood and Mann’s (1993) study as a point of departure, Byrd and Marshall (1997) in their study of 350 companies drawn from ComputerWorld over three years found that the percentage of IT/IS budget spent on training for staff was not related to any other variables. As such, they deleted it from their final model. Yaverbaum and Nosek (1992) undertook an empirical evaluation of the effects of information system training on user satisfaction using a group of 73 MBA students (all employed in organisations) undertaking IT training in a college setting. They conclude that, while IT/IS training leads to changes in user satisfaction and changes in user perceptions of IS staff and services, the end product and knowledge and involvement with the systems, the changes were not all positive. In particular, Yaverbaum and Nosek found that improved knowledge resulting from training leads to a better understanding of the computer and, consequently, less tolerance for the user’s information product and IS staff and services.

The minimal body of research focusing upon the effect of training in 'small' businesses is equally conflicting. Delone (1988), looking at critical process factors, reported that the level of computer training was not associated with IS success.
(measured as the impact of IT/IS on the organisation and computer use). Delone’s sample consisted of Canadian manufacturing organisations employing up to 300 personnel. Montazemi (1988b), on the other hand, reported a positive relationship between levels of training and measures of the impact of IT/IS. Where employees were dissatisfied with the levels of training available, he found their computer literacy, end-user satisfaction and appreciation of IT/IS was lower than their better trained counterparts. Again, the firms sampled by Montazemi are larger than those intended in the current study.

Confident construction of a hypothesis is difficult in this area. Very few studies focus upon training in small business, and none focus on organisations as small as those expected to form the main sample in the current study. Approaching the literature objectively, the findings of Montazemi (1988b) are closest in terms of generality with regard to the current context. Montazemi’s identification of a positive relationship between training and IT/IS implementation success are also supported by a number of rigorous empirical research studies undertaken in large organisations over the last decade (e.g. Cronan and Douglas, 1990; Mahmood and Mann, 1993; Choe, 1996; Guimaraes et al., 1996; Igbaria et al., 1997). It is thus proposed that:

\[ H_5: \text{IT/IS training is positively and significantly associated with IT/IS implementation success.} \]

2.4.1.6. External support for IT/IS assessment and acquisition

According to Thong et al. (1994, p.210), “small businesses have more problems in IS implementation and are more dependent on external expertise, in the forms of consultants and vendors, compared with large businesses.” Employing consultant expertise can help a small business avoid the need to hire and maintain expensive
internal IS staff. This becomes particularly cost effective following implementation when maintenance needs are less (Thong et al., 1996). Consultants tend to provide support at a managerial level, performing information requirements analysis, recommending suitable hardware and software, and managing implementation of IT/IS. "With little internal computer expertise, small firms", according to Cragg and King (1993, p.56), are also "very reliant on the advice and support they obtain from vendors." Thong et al. describe the role of a vendor:

"The duties of a vendor generally include providing the computer hardware, software packages, technical support, and training of users. In some cases, a vendor also plays the role of a consultant. For small businesses that want to implement basic operational systems, a vendor can provide the same level of consultancy service as a specialised consultant." (Thong et al., 1996, p.252)

Despite frequent reliance on external expertise for support, Fields (1995) asserts that, small business owner/managers have difficulty identifying a link between such support and improved business performance. In spite of this, it is argued that good external consultants can reduce small firm failures due to their greater expertise and objectivity. Gable (1992) argues that, engaging external expertise can raise IT/IS knowledge within an organisation or compensate for a deficiency in IT/IS knowledge and experience, thereby improving the chances of successful IT/IS implementation within the small business.

In his study of 96 small businesses (<100 employees), Yap et al. (1992) reported that where consultants were employed, user information satisfaction (UIS) was positively associated with consultant effectiveness. This proves to be an important distinction. Consultant employment, in itself, was not reported to improve chances of user information satisfaction. As Yap et al. report (p.605), "some small businesses with consultants commented that their consultant lacked specific experience, did not consider future CBIS [computer-based information systems]
expansion, seemed to be unaware of actual user requirements, and could provide help at the macro level whilst specifics or micro aspects of the business were often ignored." Yap et al. (1992) also reported UIS to be positively associated with the level of vendor support. Individual benefits reported include the quick rectification of IS problems and good after-sales service and training. Yap et al.'s focus upon smaller businesses - the majority of respondents in the sample employed fewer than 50 employees - is of particular value in the context of the current study.

Soh et al. (1992) looked at the effect of consultant support on measures of UIS, computer usage, economic success (impact on operating costs and staff productivity after computerisation) and overall success in small businesses (<100 employees) in Singapore. They found that, while computer usage was greater in firms where consultant advice had been employed, there were no significant relationships between consultant support and UIS or economic measures and overall success. Cragg (1990), however, found that the association between consultant support and success was moderated by intermediate variables. While external assistance had a very low correlation with IT/IS success, such assistance had strongly influenced planning, which in turn influenced use of IT/IS. The level of IT/IS use had a significant influence on IT/IS implementation success.

Some of the most thorough research in the area of small business employment of external support is that undertaken by Thong et al., 1994; 1996. Thong et al. (1994) undertook a study comparing the IS effectiveness of a group of small businesses that engaged separate consultants and vendors (consultant-vendor approach) with that of another group of small businesses that engaged vendors who also provide consultancy service (vendor only approach). Data was obtained from 57 small business (defined as employing 100 or fewer employees) across several sectors. In terms of organisational size profile, the final sample was heavily skewed towards
businesses with fewer than 50 employees. On the basis of their research, Thong et al. found that small businesses employing the vendor only approach had significantly more satisfied users; greater organisational impact of IS; and greater overall IS success. They also found that the ability of vendors to provide consultancy was on a par with that provided by consultants.

In a more recent study, Thong et al. (1996) measured the association between consultant effectiveness [the consultant’s ability to; (1) perform an information requirements analysis; (2) recommend a suitable IT/IS solution; (3) manage implementation; and (4) relate to other parties in the project]; vendor effectiveness [the adequacy and quality of; (1) technical support during IS implementation; (2) technical support after IS implementation; (3) training provided; and (4) the vendor’s relationships with other parties]; and three measures of performance; (1) UIS; (2) organisational impact (employing pre-tax profit; sales revenue; staff productivity; competitive advantage; operating cost; and quality of decision making as measures); and (3) overall IS effectiveness. Structural equation modelling carried out on data collected from 114 small Singapore businesses (the majority again with fewer than 50 employees) showed both consultant and vendor effectiveness to be significantly positively associated with UIS, organisational impact and overall IS effectiveness. Once again, the vendor approach proved to be more strongly associated with performance than consultant support.

Such findings counter those of Raymond (1985), presented over a decade earlier, in which small businesses reported higher levels of satisfaction where IS had been assessed and adopted by internal employees. Lees (1987) also reported small firms to associate consultant employment with negative success ratings. User satisfaction was shown to be lower and owner/managers were less satisfied with the IT/IS purchased. Lees reports (p.36) that, “when consultants were involved,
businesses tended to underestimate costs to be incurred, the work requirements for day-to-day operations, and the disruptive impact the computer would have on the organisation. Fifty percent of the companies using consultants blamed consultant advice for these discrepancies.” The limitations of the research undertaken by Raymond (1985) and Lees (1987) has already been discussed. Limitations arise with regard to the relevance of the research, undertaken some time ago, to the contemporary IT/IS environment. The size of organisations forming the samples in the research undertaken by the two authors is also larger than that intended for the current study. Lees (1987) excluded firms with 20 or fewer employees from his sample believing that they would be unlikely to employ IT/IS. This sub-population within the small business profile is central to the current study.

The most relevant research in the area of external IT/IS support to small businesses is comparatively consistent in its finding of positive associations between IT/IS support and success. This is particularly true of the research undertaken by Thong et al. in the mid 1990s. This research is particularly relevant to the current study given the size profile of respondent organisations forming the sample. On the basis of recent findings with strong generality in the context of the current study, it is hypothesised that;

$L_{II} H_6$: A positive and significant association exists between vendor effectiveness and measures of IT/IS implementation success.

$L_{II} H_7$: A positive and significant association exists between consultant effectiveness and measures of IT/IS implementation success.
2.4.2. Management characteristics

2.4.2.1. Level of management support for IT/IS

The nature of small firms in terms of who has responsibility and involvement in key IT/IS decisions varies from that of the large organisation. This is, perhaps, best summed up by Doukidis et al. (1994).

"Senior managers/owners in small firms play a uniquely important part in the running of the small business, and their personal influence has a much wider impact than their counterparts in larger firms. In the absence of other managers or armies of administrators, the chief executive of an SB [small business] may well be the main information user and decision maker and he/she needs to be directly involved in any computerisation." (Doukidis et al., 1994, p.22)

Approaching the implementation of IT/IS within an organisation as a management-led function represents the adoption of a strategic choice perspective (Huczynski and Buchanan, 1991). While Child's (1972) summary of the strategic choice perspective is put forward in the context of its impact upon organisational structure, it is also relevant in the context of technological development within an organisation. Child essentially views change within an organisation as being "a process in which constraints and opportunities are functions of the power exercised by decision makers in the light of ideological values" (p.72). Given the considerable influence of management in the small firm, it is likely that strategic choice plays an important role, and that management values and actions are likely to be closely linked to the affect of IT/IS upon the organisation.

Small firm owner/managers are in a position to allocate resources as they see fit and are, therefore, the driving force behind computerisation in small firms (Markus, 1983; Thong et al., 1996). As such, it would seem that owner-management support for IT/IS acquisition is fundamental if IT/IS implementation is to be successful. In their study of high and middle-level decision makers in 30 small and
medium-sized organisations, Abdul-Gader and Kozar (1995) found that where the
owner/manager of an organisation feels alienated by technology, and does not
perceive its benefits to outweigh its costs, then investment in IT/IS will be lower.
This finding is supported in the small business arena by the research of Thong and
Yap (1995). Thong and Yap collected data from 166 Singaporean service firms
(defined as having 100 or fewer employees). While a precise profile regarding
respondent size is not given, in other studies of Singaporean firms involving the same
authors, the majority of respondents employed fewer than 50 employees (e.g. Yap et
al., 1992; Thong et al., 1994; 1996). The main finding to emanate from Thong and
Yap’s research is that small businesses with CEOs who have a positive attitude
towards IT/IS acquisition are significantly more likely to adopt IT/IS.

In a study of 96 small firms discussed earlier, Yap et al. (1992) found a
positive relationship between owner/management support for technology and IT/IS
success. Thomas et al. (1994) also illustrate how managerial perceptions of the value
of IT play a fundamental role in their level of involvement and the success with which
technology is implemented. In their study of larger organisations, Law and Gorla
(1996) report that where top management support for IT/IS implementation exists,
firms reported higher levels of productivity, success and satisfaction emanating from
IT/IS. Law and Gorla’s sample is small (n = 16). As such the generality of findings is
questionable. According to Cragg and Zinatelli (1995), where there is insufficient
management support for IT/IS, by-products can include; (1) reduced levels of formal
IT/IS training for employees; (2) lower levels of management involvement in the
process; and (3) lower levels of planning and formalisation in IT/IS assessment and
acquisition. Cragg and Zinatelli’s findings stem from longitudinal research
undertaken with 18 small manufacturing firms over three years. Eleven of the 18
firms employed fewer than 30 employees: only 3 employed between 50-100. While
the research gives a rich insight into IT/IS evolution in the firms researched, the approach is not conducive to the generalisation of findings.

A number of authors have cited the forms that management support for IT/IS implementation can take. These manifestations can be summarised as; (1) allocation of resources; (2) managerial guidance in planning, design, development, and implementation activities; (3) development priorities; and (4) project development policies (Thong et al., 1996). Delone (1988) and Cragg (1990) found that the level of top management support and involvement in small firm computerisation was positively associated with success (measured in terms of use of IT/IS and its impact upon the organisation). Delone (1988) summarises much research in this area in his assertion that there is no substitute for management support for IT/IS during the acquisition and implementation process. According to Delone, it is the owner/manager within a small organisation that understands the factors that are critical to its success and the areas where IT/IS will add greatest value. On the basis of his case-study research of five small (50 or fewer employees) service firms, Gable (1991) also stresses the importance of management support in small firm IT/IS acquisition.

The findings of Thong et al. (1996) are less clear-cut. They measured the relationship between top management support, consultant and vendor effectiveness and three measures of performance; (1) user information satisfaction; (2) organisational impact; and (3) overall IS effectiveness. Their findings showed that top management support was less closely related to the three measures of performance than was external IS expertise, suggesting that it is not the most important factor for successful small business IT/IS implementation. This confirmed the findings of their earlier study (1994) in which they conclude that the importance of management support in small business IT/IS implementation may need to be qualified. “Although
CEO support plays an important role in influencing IS effectiveness, its importance may be overshadowed by the quality of external expertise. The CEO may provide the resources needed for the project but ultimately, it is the external experts in the forms of consultants and vendors who will implement the systems" (p.424). The research of Thong et al. (1994; 1996) supports the earlier findings of Senn (1978) who asserted that top management support is a necessary but not sufficient factor for successful IT/IS implementation.

A more recent study of computing in small firms, undertaken by Igbaria et al. (1997) contradicts the findings of Thong et al. (1994; 1996). On the basis of research undertaken in 358 small (employing between 20 and 100 personnel) manufacturing and engineering organisations in New Zealand, the authors conclude that management support is of greater importance than external support. These findings could, however, be a result of different dependent variables; Igbaria et al. studied personal computing acceptance (focusing upon perceived ease of use and perceived usefulness) while Thong et al. evaluated user satisfaction, organisational impact and IS effectiveness.

Large organisation research proves to be consistent in its findings regarding the importance of top management support during IS development. According to Henderson and Venkatraman (1993), a CEO who acts as a “business visionary” and “prioritiser” who supports and is involved in IS is fundamental to IS success. Powell and Dent-Micallef (1997, p.395) reported that “management difference” produced the critical, distinct advantage. They conclude managerial support to be a fundamental component of the successful implementation of IT/IS. Similarly, in their study of large organisations, Sabherwal and King (1995) found that a high level of top management involvement improved the decision-making process and removed barriers to IT/IS implementation.
Ginzberg (1981) and Neo's (1988) findings, while dated, also show the importance of top management support. Both reported the level of management support during IT/IS implementation to be a factor that differentiated between successful and unsuccessful IT/IS implementation. Weill (1992) reported that strong management commitment and involvement lead to superior "conversion effectiveness" (the way IS is converted to productive outputs) and thus better IT/IS performance for the same level of IT/IS investment. The weight of evidence points towards owner/management support playing an important role in the successful development of IT/IS.

It is evident from a review of the literature that management support plays an important role in the successful implementation of IT/IS, irrespective of the size or nature of the organisation. As such, it is hypothesised that;

$L II H8$: Management support for IT/IS be positively and significantly associated with IT/IS implementation success.

2.4.2.2. Management IT/IS experience

In reviewing contingent variables which represent level three of the hierarchy, we will see how management IT/IS experience is associated with intermediate variables including; (1) levels of IT/IS investment (Senn and Gibson, 1981; Doukidis, 1994; Thong and Yap, 1995) and (2) planning (Farhoomand and Hrycyck, 1985; Cragg and King, 1993); (3) evidence of learning (Henderson and Lentz, 1996; Fuller, 1996); and (4) whether or not dedicated internal IS personnel or external support is employed (Montazemi, 1988b; Cragg and King, 1993; Crabtree et al., 1995). Associations also exist between management IT/IS experience and measures of IT/IS implementation success.
Mata et al. (1995) define managerial IT/IS experience and knowledge in their study of IS resources in large organisations:

"In the case of IT, managerial skills include management’s ability to conceive of, develop, and exploit IT applications to support and enhance other business functions. Examples of important IT management skills include: (1) the ability of IT managers to understand and appreciate the business needs of other functional managers, suppliers, and customers; (2) the ability to work with these functional managers, suppliers, and customers to develop appropriate IT applications; (3) the ability to coordinate IT activities in ways that support other functional managers, suppliers, and customers; and (4) the ability to anticipate the future needs of functional managers, suppliers and customers..." (Mata et al., 1995, p.499)

While tailored to the larger organisation, this definition proves useful in its description of the management IT/IS knowledge and skills necessary for successful IT/IS assessment and acquisition. Unlike technical skills, managerial IT/IS skills are, according to Mata et al., often developed over longer periods of time through "learning by doing". In other words, knowledge of IT/IS is developed through experience.

This idea is also put forward by Fuller (1996) in his recursive learning model of IT/IS adoption in small firms. Here Fuller hypothesises that each time management and the organisation proceed through a cycle of technology assessment and acquisition, learning takes place and experience is gained. This in turn leads to the more effective implementation of IT during the following technology acquisition cycle.

Delone (1988) reported management experience of IT/IS to be fundamental to IT/IS success (measured as actual use of IT/IS and impact of IT/IS on the business). Where managers were more experienced, actual use of IT/IS was higher and the impact of IT/IS on the business was greater. Martin (1989) and Heikkila et al. (1991)
support Delone’s findings, asserting on the basis of their study of small Finnish businesses, that there is little substitute for management IT/IS experience. Thong and Yap (1995) following their finding that CEOs with greater levels of IT/IS knowledge were more likely to adopt IT/IS, state that “with greater knowledge, the degree of uncertainty involved in IT acquisition will diminish, resulting in a less risky adoption of IT” (p.438). Thong and Yap support their argument with findings from the technical innovation literature which suggest that extensive experience is important for the adoption of technical process innovations.

Lees (1987) reported satisfaction with IT/IS and IT/IS usage to be higher in small firms where the decision-maker had prior experience of leasing or purchasing computers. The impact of IT/IS on the organisation was also more marked with businesses with greater management IT/IS experience reporting increased revenue, better cash control, reduced payroll costs, better record keeping and improved customer/client service. Cragg (1990) reported years of IT/IS experience to be positively associated with the level of IT use which, in turn, is related to IT success. Prior experience with IT was treated separately as a variable and was shown to influence levels of planning as discussed earlier.

Congruent with the findings of research focusing on impact of management support for IT/IS and IT/IS implementation success, the findings of research evaluating the impact of management IT experience indicate that it, too, has a significant positive impact on the success with which IT/IS is implemented. This, again, appears to be irrespective of the size or nature of the organisation or the research conditions and methodology. As such, it is hypothesised that;

\[ H_9: \text{The level of management IT/IS experience within a small business is positively and significantly associated with measures of IT/IS implementation success.} \]
2.4.3. Organisational characteristics and resources

2.4.3.1. Organisation size

While organisation size has been shown to influence intermediate variables such as planning (Mcfarlane et al., 1983; Lyles et al., 1993) and the employment of dedicated IS personnel (Montazemi, 1988b), the size of an organisation has also been reported to directly influence measures of IT/IS implementation success.

In a somewhat dated study, Ein-dor and Segev (1978) indicate a positive relationship between organisation size and measures of IT/IS performance. It would appear, however, that Ein-dor and Segev’s findings maintain some currency. In a more recent study, Choe (1996) supports the findings of Ein-dor and Segev, also finding a significant positive relationship between organisation size (measured as number of employees) and IT/IS implementation success (measured as system usage and user satisfaction). Choe evaluated the relationship between organisation size and IT/IS implementation at two stages of IS evolution; (1) the prior stage (where IT/IS is adopted and expanded in an organisation; and (2) the posterior stage (where IT/IS is formalised and separate IT/IS committees and departments evolve). While Choe’s findings indicate that a significant positive relationship exists between size and IT/IS implementation success irrespective of the stage of IT/IS evolution, the relationship is stronger in the posterior stage (0.434 as opposed to 0.164).

Lees (1987) reports that even in ‘small businesses’ (a term which the author fails to define) size remains influential. Respondents in larger firms reported using IT/IS more and found its benefits in terms of enhanced management control and decision-making to be greater. Intuitively this makes sense. The larger the organisation, the more information it collects and the more data needs processing.
The more data, the greater the role for IT/IS in its collection, analysis and dissemination.

While the findings presented above focus upon a direct association between organisational size and measures of IT/IS success, a number of researchers suggest that any findings are in actual affect the by-products of intermediate variables. For example, Raymond (1990) showed organisational size to have an indirect influence on IT/IS success through its association with system sophistication, while Choe (1996) suggests that the positive association between IT/IS success and organisational size (presented above) is a result of the positive association between size and availability of resources for investment in IT/IS.

The findings noted above are not, however, conclusive in their implication that size is positively associated with measures of IT/IS success. Law and Gorla (1996) found that smaller firms in their sample (in which the mean number of employees exceeded 500) reported significantly greater productivity and success (as perceived by management) using IT/IS than larger firms. This they claim may be the result of greater levels of top management support as well as greater satisfaction with IT/IS training, both of which were reported by smaller organisations.

A review of the literature indicates that there is a paucity of research focusing on the relationship between organisational size and the success with which IT/IS is implemented. This is particularly true in the small firm domain. The empirical conclusions of Ein-Dor and Segev (1978) and Choe (1996) in the large organisation arena, and Lees (1987) in the small business arena, indicate that a positive relationship exists. Law and Gorla's (1996) findings suggest the contrary. However, their sample is minimal at 16. As a result, the generality of their findings is questioned. On the basis of the evidence available, it is hypothesised that;
$H_{10}$: Organisational size is positively and significantly associated with measures of IT/IS implementation success.

2.4.3.2. Organisation IT/IS Knowledge

While the majority of studies focus upon management knowledge and experience as opposed to the collective knowledge of the organisation, two recent studies (Chen, 1993; Palvia, 1996) provide support for an association between organisational knowledge and measures of IT/IS implementation success. Chen asserts that in organisations involved in his study, most interviewees implied that the satisfactory implementation and use of computers was related to the knowledge and experience of in-house users, suggesting a positive association between knowledge and UIS.

Chen’s findings are empirically supported by Palvia et al. (1996), who evaluated the association between the self-perceived IT/IS knowledge of employees and a measure of small business user satisfaction with IT (SBUSIT). Palvia found that where self-reported computer skills were higher, so too were reports of user information satisfaction. Palvia’s measure also includes items evaluating the impact of IT/IS on the organisation as opposed to solely investigating user information satisfaction. IT/IS knowledge is, for example, identified by Palvia as increasing productivity resulting from IT/IS. Thus, where firms are more knowledgeable regarding information technology and information systems, the impact resulting from IT/IS will be greater than in their knowledge deficient counterparts.

The findings of Palvia’s study are of particular relevance to the current study. The final sample consisted of 100 firms all with fewer than 100 employees. In reality, the sample firms were much small than this description suggests; the median number of employees across the sample being 4. Furthermore, Palvia followed a rigorous measurement model construction and testing exercise resulting in reliable measures of
small business user satisfaction with IT. Perhaps the greatest weakness of Palvia's study is the use of self-reporting measures for the evaluation of IT/IS knowledge. However, studies of the accuracy of self-reporting variables (such as those undertaken by Dess and Robinson, 1984; and Govindarajan and Fisher, 1990) suggest that data obtained through self-report measures afford an accurate assessment of the phenomenon they purport to measure.

Given the findings of Palvia (1996) and the paucity of additional evidence (either supporting or contrary) in this area, it is hypothesised that;

\[ H_1: \text{There is a positive and significant association between perceived in-house IT/IS knowledge and measures of IT/IS implementation success.} \]

2.4.3.3 Dedicated IS personnel

Little research has been undertaken into the affect of dedicated IS personnel on the assessment and acquisition process. This is particularly true of small business research. Indeed, the very nature of the small business environment is a contributing factor. In small firms, the owner/manager tends to represent the locus of IS decision-making, and input regarding IT/IS generally comes from employees with IT/IS knowledge (but who are not dedicated IS personnel), employed external expertise, or from the owner/manager's own research into IT (Doukidis et al., 1994; Proudlock et al, 1998). Few small firms deem it necessary to employ dedicated IS personnel and, as a result, there has proven to be little necessity for research in this area.

Choe (1996) evaluated the influence of IS personnel upon IT/IS success in large organisations and concluded that the technical capability of IS staff had a major influence on system design and, as a result, the overall performance and impact of the
system. Montazemi (1988b), in his small firm research, reported that user information satisfaction is positively associated with the presence of systems analysts. As such, Montazemi identifies an environment facilitating ease of access to a specialised systems analyst as conducive to the effective implementation of IT/IS. Raymond (1985) and Lees (1987) also found that IT/IS implementation was more successful in small businesses where internal IS personnel developed and monitored the information systems.

Yap et al. (1992), on the other hand, found no evidence to show that IT/IS success is positively associated with the presence of an internal IS specialist. The authors fail to offer any information on what proportion of their sample of 96 small businesses employed dedicated IT specialists. They also argue that their failure to identify a positive and significant association between the employment of dedicated IS personnel and IT/IS implementation success congruent with that identified by previous research (e.g. Raymond, 1985; Montazemi, 1988b) may be due to the use of a simple dichotomous measure of the employment of IS personnel as opposed to a measure of the number of IS personnel employed. Igbaria et al. (1997b) looked at the association between internal IS personnel and the perceived usefulness and ease of use of IT/IS. No significant relationship was found between the employment of dedicated staff and either of the dependent variables.

The current study intends to add to this small body of literature by re-evaluating the relationship between the employment of dedicated IS personnel and performance measures of IT/IS. The empirical findings of Choe (in the large organisation field) and Raymond, Lees and Montazemi (in the small organisation

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4 The Proudlock et al. (1998) reference refers to a paper published following case study research undertaken to inform early stages of the current study. This research was independent and a precursor to the collection of empirical data employed for hypothesis testing.

5 Montazemi's defined small as 250 and fewer employees. The average number of personnel employed by organisations within his sample is 73.
field) identify a positive relationship between the employment of dedicated IS personnel and IT/IS implementation success. Only Yap et al. (1992) failed to identify a significant relationship between the two variables. The authors' uncertainty of the measure has been noted.

On the basis of the review of the literature, it is hypothesised that;

\[ H_{12} \]: The employment of dedicated IS personnel is positively and significantly associated with measures of IT/IS implementation success.

2.4.4. Level two: a holistic view

Figure 2.6 shows a holistic representation of the associations hypothesised as forming level two of the model of IT/IS assessment and acquisition. As is evident, the variables hypothesised as playing a significant role in level two, are proposed as directly influencing measures of IT/IS implementation success.
2.5. Hierarchy level three: indirect drivers of IT/IS implementation success

Level two focused upon IT/IS assessment and acquisition variables that have been shown by existing research to directly influence measures of IT/IS implementation success. In many ways, this represents a simplified view of the process of IT/IS implementation in small firms, but nonetheless one which is frequently put forward by existing research. Associations are drawn directly between independent variables and measures of implementation success. In reality, the process of IT/IS assessment and implementation within small firms is more complex. There is interaction between independent variables within the model that influences the success with which IT/IS is implemented. Additional factors interact with IT/IS implementation success measures indirectly.

Level three focuses upon the indirect variables and associations between variables that are inherent in a model of IT/IS assessment and acquisition within small
firms. Several factors are independent and only influence measures of IT/IS success indirectly. Others have been shown by previous research to influence IT/IS implementation success measures both directly and indirectly. In the final section of the literature review we add this final layer of variables and associations which form an integral part of the model of IT/IS assessment and acquisition.

2.5.1. Drivers of investment in IT/IS

Investment in IT/IS is shown by existing research to be influenced by several factors. Howard (1997) and Reid and Hutchins (1997) reported that in a large proportion of small firms participating in their respective surveys, financial constraints were the overriding barrier to company spending on IT/IS. In their study of 96 small businesses (<100 employees), Yap et al. (1992) report that the availability of financial resources is positively associated with the successful acquisition of IT/IS. This is informative in the context of the current research. As discussed earlier, over half of respondents in Yap et al.'s sample employed fewer than 30 employees. As such, the findings have a high degree of generality with regard to the size of organisations to be sampled in the current study. The findings of Yap et al. indicate that capability of small organisations to allocate sufficient funds for IT/IS investment is critical factor for the successful implementation of IT/IS.

While financial barriers are difficult to overcome, Howard's (1997) research highlights other obstacles to investment. Management support for IT/IS was found to play an important role regarding levels of IT/IS investment. A number of owner-managers reported the costs of IT/IS to outweigh the benefits, while others perceived IT/IS to be of little use to their organisation. Abdul-Gader and Kozar (1995) undertook a study of the impact of computer alienation on IT/IS investment in 30 small and medium-sized organisations. They define computer alienation as "the
socially and psychologically induced subjective state of separation from computers. It refers to a spectrum of mental states that include, among other things, a feeling of lack of power when interacting (or considering interacting) with computers, a sense of lack of comprehensibility of computer concepts, distrust in computer suppliers, and a sense of isolation from computer professionals and suppliers" (p.541). The authors found that where alienation occurred, and support was lacking for IT, managers were less likely to invest in IT/IS.

Along similar lines, Gable and Raman (1992) reported a belief among some CEOs in small businesses that IT was unnecessary for them. Such opinion, based on a misunderstanding of the potential benefits of IT/IS, not surprisingly resulted in a reluctance to invest in computer technology. According to Thong and Yap (1995), small businesses (defined as employing fewer than 100 personnel) in which owner/managers or CEOs are more experienced regarding IT/IS are more likely to invest higher levels of resources in technology implementation. Their findings are consistent with those of earlier studies that suggest lack of knowledge and experience of the acquisition process and insufficient awareness of the potential benefits represents a barrier to small firm IT/IS investment (Senn and Gibson, 1981; Doukidis, 1994).

On the basis of the literature it is hypothesised that;

$L_{III} \text{ H}_{1-3}: \text{Investment in IT/IS is positively and significantly associated with; (a) management support for IT/IS; (b) management IT/IS experience; and (c) the investment capability of the organisation.}$
2.5.2. Drivers of IT/IS sophistication and coverage

Cragg and King (1993) focused their research on factors that influenced the level of software sophistication within small organisations. Findings are drawn from in-depth longitudinal research undertaken with six small companies (all employing fewer than 50 personnel). Four main factors were identified. First of all, Cragg and King found that a lack of organisational IT/IS knowledge, resulting from low levels of IT/IS training, had discouraged the consideration of other applications or even of improvements to the existing environment. This was found to play an important role particularly at the owner-manager level, where IS ignorance was found to discourage others from exploring possibilities and inhibit the progression from anything but standard applications. This factor is related, to a degree, to the third factor, attitude towards IT/IS. Cragg and King report that, in those firms where managers and staff perceived IT/IS to be of little benefit to the organisations, IT/IS remained at a comparatively basic level. Finally, the financial strength of the organisation, proved to have a significant influence on the level of software sophistication. Firms that were financially weak proved more reluctant to expand their applications portfolio via investment in IT/IS. This finding is supported by Proudlock et al. (1998).
While the generality of Cragg and King's findings is limited, their case study approach affords a rich insight into the factors which motivate IT/IS growth in the small firm. Their approach also views the IT/IS implementation as a process rather driven by "individual, organisational, and environmental factors" as opposed to an independent autonomous event. The current study intends to test Cragg and King's findings empirically. Thus, it is hypothesised that;

\[ L_3 \ H_{4.7}: \text{The level of IT/IS sophistication and coverage is positively and significantly associated with: (a) the level of organisation IT/IS knowledge; (b) management support for IT/IS; (c) management IT/IS experience; and (d) investment in IT/IS.} \]

Figure 2.8. Hypothesised drivers of IT/IS sophistication

2.5.3. Drivers of IS planning and formalisation

While little research has been undertaken focusing upon factors that influence levels of IS planning and formalisation, Matthews and Scott (1995) present some interesting findings regarding antecedent conditions of business planning. They report that in entrepreneurial firms and small business ventures the level of sophistication of planning declines with increasing environmental uncertainty. According to the authors, this pattern proves consistent, regardless of the source of the uncertainty –
financial, competitive or governmental. Fuller (1996) too asserts that the strategic future of many small businesses is unpredictable and is therefore largely unplannable. As a result, a considerable aversion to planning exists within such firms.

Mcfarlane et al. (1993, p.156) suggest that the size of an organisation influences the level of planning. "Greater size and complexity [of an organisation] often lead to more formal practices in general. Where the business units are small and simple, formal planning approaches become less important, irrespective of other factors. The same holds for the systems environment." This is further supported by Lyles et al. (1993). The authors draw on data collected from 188 small US businesses (defined as employing fewer than 500 personnel). In reality, the significant majority of respondents were towards the lower end of the size range. The mean size of firms responding was 35: less than a third employed more than 50 employees. Firms that had no written plan were coded as non-planners \( n = 117 \) while those with written plans were coded as planners \( n = 71 \). Lyles et al. found that on the whole, the planners were significantly large than the non-planners.

Scholhammer and Kuriloff (1979) cite the lack of in-house IT/IS knowledge as affecting IS planning, while low levels of management IT/IS knowledge and experience have also been reported to impede the effective selection and evolution of information systems (Farhoomand and Hrycyck, 1985; Cragg and King, 1993). Cragg (1990), however, reported that in small firms that had employed consultant support, more planning took place. While external assistance had a very low direct correlation with IT/IS success, such assistance was shown to strongly influence planning. Finally, in their longitudinal study of 18 small firms, Cragg and Zinatelli (1995) reported finding lower levels of IS planning and formalisation to take place in firms with insufficient managerial support for IT/IS.

On the basis of the literature, it is hypothesised that;
LIII H8.13: The level of IS planning and formalisation is positively and significantly associated with; (a) perceived environmental stability; (b) organisational size; (c) management IT/IS experience; (d) organisation IT/IS knowledge; (e) management support for IT/IS; and (f) consultant support.

Figure 2.9. Hypothesised drivers of IS planning

2.5.4. Drivers of investment in IT/IS training

There is a paucity of research into drivers of investment in IT/IS training in small businesses. On the basis of their in-depth research into the evolution of IS in 18 small businesses, Cragg and Zinatelli (1995) report finding reduced levels of formal IT/IS training for employees in firms where management support for technology is weak. It is also proposed that the investment capability of the organisation will again play a role. Yap et al. (1992) allude to this possibility following their empirical research of 96 small businesses. The authors found that the capability of an organisation to invest in IT/IS is critical to its level of IT/IS implementation success. They argue that trained personnel are an integral component of the allocation of funds in order to drive
such success. Following two rounds of surveys of small businesses and in-depth interviews with 12 firms from the second round, Pollard (1998) arrived at the same conclusion. Thus it is hypothesised that;

\[ L_{III} H_{14-15}: \text{The level of investment in IT/IS training is positively and significantly associated with; (a) the investment capability of the organisation; and (b) management support for IT/IS.} \]

Figure 2.10. Hypothesised drivers of IT/IS training

2.5.5. Drivers of employment of external support and external support effectiveness

This study hypothesises that the effectiveness of external support will be positively associated with measures of IT/IS implementation success. While a small number of studies probe what represents good or bad external support in detail (e.g. Fields, 1995; Thong et al., 1994), the independent research of external support processes and methodologies is outside the remit of the current study. While Yap et al. (1992) found that external support, in itself, was not reported to improve measures of IT/IS implementation success, it is evident that in the absence of such support, satisfaction with external support is an impossibility. Thus, the association between the employment of external support and the effectiveness of external support is here re-evaluated. It is hypothesised that;
LIII H16: There is a positive and significant association between the employment of external support and the effectiveness of external support.

Because external support effectiveness is contingent upon a firm employing external support in some form, the current study here focuses on those factors that influence an organisation's decision to employ external support.

Employing consultants can be costly, and given the poverty of many small firms, such expense, unsurprisingly proves to be a major barrier to consultant support (Mingay and Peattie, 1992; Pollard, 1998). This has not, however, been empirically tested and, as such, the current study intends to add to research in this area. Empirical small business research undertaken by Cragg (1990) and Crabtree et al. (1995), and longitudinal research undertaken by Cragg and King (1993) suggest that the employment of external support is a by-product of low levels of perceived in-house knowledge, both in terms of management experience and the employee knowledge pool. On this basis, it is also hypothesised that where dedicated IS personnel are employed, the need for external consultant support will be less. Thus;

LIII H17: The employment of consultant support is positively and significantly associated with an organisation's investment capability.

LIII H18-20: The employment of external support is negatively and significantly associated with: (a) levels of organisation IT/IS knowledge; and (b) levels of management IT/IS experience; and (c) the employment of dedicated IS personnel.
2.5.6. Drivers of management experience and organisation IT/IS knowledge

While organisational IT/IS knowledge is identified as having a direct influence upon IT/IS success measures, such knowledge is only accrued through learning. Beach (1980) defines learning as the human process by which skills, knowledge, habit and attitudes are acquired and altered in such a way that behaviour is modified. Thus, one might expect individuals within a small firm to improve their decision-making processes as incremental increases in IT/IS knowledge and experience accrues through interaction with IT. Such a hypothesis only proves valid, however, if that firm learns from its interactions with IT and applies what it has learnt.

Henderson and Lentz (1996) expand upon this thesis in a case study of the Sun Life organisation, in which the application of knowledge gained from prior interaction with IT is seen as fundamental to future IT/IS developments. The authors describe the value of organisational learning as follows:

"Organisational learning in the traditional sense, that is, learning from past experience, is difficult because no two events are exactly alike. Similarly, the IT
initiatives deployed in an organisation are always unique to some degree. Yet, having deployed strategic IT initiatives, the organisation may acquire some knowledge and insights which are useful for deploying other IT initiatives.” (Henderson and Lentz, 1996, p.245)

Viewing the process from a similar perspective, Fuller (1996, p.25) views the “process of software development and adoption” as “a process of knowledge acquisition by small business.” He goes on to assert that “learning – in the sense of a growing understanding of how to use technology, how to employ it and how to avoid mistakes – characterises the successful cases of implementation” (p.31).

Naylor and Williams (1994) and Yetton et al. (1994) both present case study examples showing small firms in which management has recognised emerging opportunities for creative use of IT and has consequently implemented system changes and developments over time. Such changes are evidence of organisational learning, and in both cases, resulted in an increased impact of IT on the organisation involved. However, Naylor and Williams (1994) and Proudlock et al. (1998) reported such evolution within small firms to be contingent upon the level of management competence to derive and apply learning from previous development stages.

Management and staff can also learn about IT/IS, both at the management application level, and the hands-on use level via IT/IS training. Yaverbaum and Nosek (1992) found that training can indirectly impact upon IT/IS success measures via IT/IS knowledge. In other words, IT/IS training can raise knowledge levels within an organisation and, in turn, result in the more effective use of IT/IS. Cragg and King (1993) also found a positive association between IT/IS training and organisational knowledge.

Fuller (1996) concludes, “the nature of the role of IT in enterprise learning and development has not been well explored and yet it would seem important to the
adoption and absorption of IT, particularly by smaller firms". Hence, it is hypothesised that;

LIII H21-22: Management and organisation IT/IS knowledge is positively and significantly associated with; (a) IT/IS learning; and (b) IT/IS training.

Figure 2.12. Hypothesised drivers of management and organisation IT/IS knowledge

2.5.7. Drivers of management support for IT/IS

With foundations in the work of Ajzen and Fishbein (1980), Karahanna et al. (1999, p.187) argue that "attitude toward adopting (or continuing to use) an IT is generated by the individual’s salient beliefs about the consequences of adopting (continuing to use) the IT (behavioral beliefs) and evaluation of these consequences. Thus, attitude is derived by the strength of the person’s beliefs that adopting (or continuing to use) the IT will lead to certain consequences, each weighted by the evaluation of each belief’s behavioral consequences.” Empirical research undertaken in a large US financial institution by Karahanna et al. discovered that underlying drivers of attitude towards the use of IT by those already using computers differed from those of individuals who had not yet adopted IT. The authors found that potential adopter attitude was composed of several behavioural beliefs (trialability, perceived usefulness, result demonstrability, visibility, and ease of use) while for users only perceived usefulness and image were shown to influence attitude. The implication is
that as a result of experiencing IT/IS use, attitude towards IT/IS changes, with a different set of behavioural beliefs underlying that attitude.

The Technology Acceptance Model (TAM) originating in the work of Davis (1989) and Davis et al. (1989) and later developed by Igbaria (1993a) and Igbaria et al. (1997a; b) also provides a valuable insight into factors that influence management attitude towards IT/IS adoption and use. In particular, the level of IT/IS experience gained by an individual is shown by Igbaria et al. (1997b) to increase the usefulness of IT/IS as perceived by that individual.6 As such, experience influences the individual's attitude towards technology, and ultimately, their behaviour. This reflects the ideas put forward by Karahanna et al. (1999). Earlier work undertaken by Nickel and Seado (1986) also supports such findings. Their research found that higher levels of IT/IS knowledge and experience resulted in a more positive attitude to computers.

Finally, Law and Gorla (1996) reported that top management support for IT/IS was greater in smaller firms than in larger organisations. No empirical research focusing on the role of organisational size in small firms was identified.

On the basis of the literature review, the following hypotheses are made;

$L_{III} H_{23-24}$: Management support for IT/IS is; (a) positively and significantly associated with management IT/IS experience; and (b) negatively and significantly associated with organisational size.

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6 Igbaria et al. (1997b) used data collected from 358 IT/IS users in 203 small businesses (defined as employing between 20-100 personnel) to test their structural equation model.
2.5.8. Drivers of the employment of dedicated IS personnel

As Montazemi (1988b, p.54-55) argues, “it may be thought that small business firms, due to their size of activities, “know” their requirements and that user friendly software generators can easily be selected through simplistic media... The owner/manager’s basic knowledge of computer systems may also be an incentive to ignore the need for service or specialised information systems personnel.” Expanding on Montazemi’s findings, it is proposed that the employment of dedicated staff is dependent upon; (a) the level of management IT/IS experience; and (b) the size of the organisation. Proudlock et al. (1998) and Pollard (1998) reported the level of available resources to play an important role in whether a small firm employed dedicated IS personnel. Resource constraints meant that firms could not afford to employ an individual solely to perform IT tasks.

Little in-depth research has been undertaken that identifies and evaluates the factors that motivate the employment of dedicated IS personnel. The current study intends to add to this field of research through the empirical testing of the following hypotheses;

$L_{III} H_{25-26}$: The employment of dedicated IS personnel is; (a) negatively and significantly associated with management IT/IS experience; (b) positively and
significantly associated with organisational size; and (c) positively and significantly associated with organisational investment capability.

Figure 2.14. Hypothesised drivers of the employment of dedicated IS personnel

2.5.9. Drivers of organisational investment capability

While the success of an organisation is dependent on a host of disparate factors, organisation size represents a factor that has been shown repeatedly to affect performance (Law and Gorla, 1996; Choe et al., 1996). Choe (1996) asserts that the positive association between IT/IS success and organisational size is a result of the positive association between size and organisational investment capability. In other words, because larger organisations have more funds to invest in information systems, their IT/IS outperforms their smaller resource-constrained counterparts.

The studies cited above focus on large organisations and, as such, it is difficult to extend their findings to the small business sector with complete confidence. However, no empirical research focusing specifically upon the relationship between organisational size and organisational investment capability was identified. As such, the current study intends to empirically test the findings of large organisation research in small organisational domain. Thus, it is hypothesised that;

L_{III} H_{27}: Organisational investment capability is positively and significantly associated with organisational size.
2.5.10. Autonomous independent direct drivers

Two variables that were hypothesised as having a direct influence on measures of IT/IS implementation success have not been approached as part of category three. These are; (1) organisation size; and (2) the level of employee involvement in small firm IT/IS assessment and adoption. There are two reasons for this. First of all, organisation size is treated in the current study as an autonomous independent variable. While it is accepted that a number of factors affect the size of an organisation, such investigations are outside the remit of the current study. Secondly, on the basis of the literature in the IS field, there is no suggestion of variables that may influence the level of employee involvement in IT/IS assessment and adoption. As such, this variable is also treated as an autonomous independent variable.

2.5.11. Level three: a holistic view

The literature review has been purposefully simplistic in its attempt to evaluate each variable independently. However, in approaching level three variables and associations holistically, the complexity of interactions becomes evident. The result is a web of causality and interaction that becomes increasingly complex with the addition of each variable. Level three is shown in figure 2.16. Here, all interconnections present in the third level of the hierarchy are illustrated. Level one and two associations are excluded.
Level three represents the culmination of the literature review. It contains paths hypothesised on the basis of existing theory. Where paths are absent, no existing theory has been identified to support the hypothesising of an association. As such, it is inappropriate to expand the model further.
2.6. A model of IT/IS assessment and acquisition in small firms

Hypotheses have been proposed for each of the three levels of the hierarchy introduced at the beginning of the chapter. These are drawn together in table 2.1.

Table 2.1. Summary of hypotheses

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<td>With the exception of where a negative association is stated, it is hypothesised that positive and significant associations will exist between the following variables:</td>
</tr>
<tr>
<td>$L_3 H_{1-3}$</td>
</tr>
<tr>
<td>$L_3 H_{4-7}$</td>
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<tr>
<td>$L_3 H_{8-13}$</td>
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<td>$L_3 H_{14-15}$</td>
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<td>$L_3 H_{16}$</td>
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<td>$L_3 H_{17}$</td>
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<td>$L_3 H_{18-20}$</td>
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<td>$L_3 H_{21-22}$</td>
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<tr>
<td>$L_3 H_{23-24}$</td>
</tr>
<tr>
<td>$L_3 H_{25-26}$</td>
</tr>
<tr>
<td>$L_3 H_{27}$</td>
</tr>
</tbody>
</table>
Hypotheses forming each level of the hierarchy are presented diagrammatically in figures 2.5, 2.6 and 2.16. When each level is combined, the end result is a complete hypothesised model of causality and interaction of IT/IS assessment and acquisition variables showing their direct and indirect influence upon measures of IT/IS implementation success and organisational performance in small firms. This is illustrated in figure 2.17. This model and its evaluation are central to the study.

2.6.1. Contextualisation of existing models of IT/IS implementation success in small firms

At the beginning of the chapter a number of existing models of IT/IS adoption in small firms were presented. Here, we look at how they relate to the model proposed in the current study (see figure 2.17).

The current model is drawn from existing relationships identified in previous research. This includes relationships identified as components of existing models. As such, the existing models presented earlier represent sub-models of the model hypothesised in the current chapter. For example, Fuller's (1996) theoretical model argues that the process of IT/IS assessment and acquisition in small firms is a recursive one in which IT/IS implementation becomes more successful with each purchase decision. Each time an organisation proceeds through the cycle of technology assessment and acquisition, management (and the organisation) learn how to improve upon the process and so become better at planning and expressing needs. This results in the more successful implementation of IT/IS.
Variables linked via dark blue arrows in figure 2.17 illustrate Fuller's (1996) model. As in Fuller's model, the current model proposes that management experience and organisational knowledge will increase as a result of learning from past interaction with IT/IS as well as more formal IT/IS training. Such interaction is, in turn, hypothesised to improve planning and needs analysis techniques, resulting in technology-based systems that better meet the needs of the organisation. It is also proposed that in improving its ability to identify needs, organisations may also approach decisions regarding the level of technology to be implemented differently. In this way, theory expounded by Fuller represents an integral sub-model within the model as a whole. The current study adds to Fuller's research through the empirical testing of his model.

Thong et al. (1994; 1996) presented a model focusing upon the role of management support and external support effectiveness in the IT/IS implementation process in small firms. Their findings indicated that while consultant effectiveness, vendor effectiveness and management support for IT/IS all influenced the success with which IT/IS was implemented in the small firm, external support proved to be the primary drivers of success. Management support was regarded as a necessary but not sufficient factor for successful IT/IS implementation. Interactions identified by Thong et al. are represented in figure 2.17 by light blue arrows.

Cragg (1990) and Delone (1983) evaluated models that were more far-ranging in scope. In both models management knowledge, experience and IS planning were all shown to positively impact upon measures of IT/IS implementation success. Both researchers identified external support as an influencer of IS planning, although Cragg's more recent findings (which suggested a positive relationship) countered those of Delone. Once again, components of the models proposed by such existing
research are appropriated and hypothesised as part of the current model. Management experience (knowledge), for example, represents a cornerstone in the current model.

While the work of Cragg (1990) represents an influential point of departure for the current study, Cragg’s model plays a less integral role in the current model than those of other researchers. This is mainly the result of Cragg employing IS use as a dependent variable. Seddon (1997) exposes the problems inherent in employing IS use as a variable. Most significantly, IS use is interpretable in three ways, presenting problems in interpreting IS use across studies. First of all, IS use can be viewed as a variable that proxies for the benefits of use. The drawback here is that researchers who have used IS use as an indicator of IS success have implicitly assumed a positive relationship between time spent using a system and the benefit it provides.

The second interpretation approaches IS use as the dependent variable in a variance model of future IS use. According to Seddon, when viewed in this way, IS use is being used to describe behaviour and not IS success. Finally, Seddon suggests that IS use can be interpreted as an event in a process that leads to individual or organisational impact. Here, user satisfaction, individual impact, and organisational impact are regarded as outcomes of a process that begins with IS use. As with the second meaning of IS use, Seddon argues that it is important to note that when interpreted in this way, IS use cannot be regarded as a measure of IS success. It is measures such as user satisfaction, and organisational impact – what Seddon terms the consequences of use - that are observed to determine if the system is successful. As such, IS use has no place in any variance model of interrelationships between IS success measures. It is for these reasons, that the current model avoids incorporating IS use as a variable.
Components of Igbaria et al.'s (1997b) model are also present within the model hypothesised in the current study. Their model showed management support for IT/IS, external support and IT/IS training to positively influence measures of the impact of IT/IS and measures of UIS within the organisation. Finally, Cragg and King's (1993) model, showing motivators of software sophistication, is illustrated (highlighted in green) as a sub-component of the proposed model. The model shows how management support for IT/IS, organisational knowledge, and management IT/IS experience all influence the level of IT/IS sophistication directly, while investment capability influences sophistication indirectly via IT/IS investment.

2.7. Summary and Conclusions

It is evident that existing models of IT/IS implementation success are limited to specific areas of the implementation process. While this is valuable in providing a detailed insight into individual areas of the implementation process, it fails in affording a broader picture of the underlying processes that occur as small firms assess and acquire technology. In order to facilitate the presentation of the fragmented and diverse findings of existing research, a taxonomy of IT/IS assessment and acquisition in small firms was developed and presented. The taxonomy classifies variables according to a hierarchical structure. Hierarchy level one focuses upon the relationship between measures of IT/IS implementation success and measures of organisational performance. Hierarchy level two presents factors identified as direct drivers of IT/IS implementation success. Finally, hierarchy level three presents those variables identified as indirect drivers of IT/IS implementation success.

In combining the three levels, a synthesis of research findings can be attempted. This synthesis contextualises existing IS research, showing how different
areas of the implementation process, as examined by researchers in the field, interact with one another as part of the overall process. The model is also useful in highlighting those variables that play a significant role. For example, management characteristics were identified as an important area of research. It was shown how the increased influence of the owner/manager resulted in management characteristics such as; (1) support for IT/IS; and (2) IT/IS experience, playing a central role in the acquisition of IT/IS. Figure 2.17 illustrates this clearly, with a number of paths hypothesised on the basis of existing findings shown as arrows emanating from, and inputting into, both management support for IT/IS and management IT/IS experience. As such, the two management-based variables represent central nodes in the model. The same is true of other factors.

This synthesis identifies and evaluates previous work and seeks to draw it together. The result is a holistic proposition that encapsulates the main body of existing research in this area. All paths hypothesised in the model are based upon associations drawn from existing research. Some associations are more strongly supported by existing research than others. Some are drawn from key small firm research while others are derived from small firm research with support, where appropriate, from large organisational findings. The next step of the research involves the empirical testing of the model in order to identify those associations that are most relevant and most explanatory regarding the IT/IS assessment and acquisition process in small firms.

In order to begin the testing of hypotheses, a number of decisions regarding the research approach are undertaken. The research strategy is presented and justified in the following chapter.
Chapter Three – Research strategy

3.1. Introduction

In the previous chapter, a model of interaction and causality regarding the assessment and acquisition of IT/IS by small firms was proposed on the basis of a review of the literature. This involved the identification of a number of variables that play a role in the acquisition process. The next step of the research involves the empirical testing of the model.

In this chapter, the research strategy employed in order to enable the empirical testing of the model is presented and justified. In presenting the methodology to be used, the reader is given an overview of the steps involved in the process. It is proposed that this will assist in the contextualisation of each step of the research.

3.2. Selecting a research approach

According to Jenkins (1985), the key to selecting the best methodology consists of two factors; (1) an awareness of the research objectives; and (2) recognition of the available methodologies and understanding their relative strengths and weaknesses. The objective of the current research is to test a theory. Grover (1997, p.5) quotes Kerlinger (1986) as defining theory as, “a set of interrelated constructs (concepts), definitions and propositions that present a systematic view of phenomena by specifying relationships among variables, with the purpose of explaining and predicting phenomena.” In the current study, a theoretical model of IT/IS assessment
and acquisition in small firms is hypothesised. The intention is to test the relationships hypothesised in the theoretical model in order to see whether the model proposed does indeed present a systematic view of the IT/IS acquisition process and explain and predict outcomes in terms of measures of IT/IS implementation success and organisational performance.

At the broadest level, two primary research approaches are at hand; (1) a positivist approach; and (2) a phenomenological approach. According to Saunders et al. (1997), the positivist approach to research owes much to what we would think of as scientific research. Saunders (p.71) lists five sequential stages through which positivist research proceeds:

1. Deducing a hypothesis (a testable proposition about the relationship between two or more events or concepts) from the theory.
2. Expressing the hypothesis in operational terms (i.e. ones indicating exactly how the variables are to be measured) which propose a relationship between two specific variables.
3. Testing this operational hypothesis. This will involve an experiment or some other form of empirical inquiry.
4. Examining the specific outcome of the inquiry. It will either tend to confirm the theory or indicate the need for its modification.
5. If necessary, modifying the theory in the light of findings. An attempt is then made to verify the revised theory by going back to the first step.

As such, the positivist approach; (1) is hypothetico-deductive (theory tested by observation); (2) seeks to explain causal relationships between variables; (3) normally uses quantitative data; (4) is reductive; (5) enables the generalisation of findings; and (6) uses a highly structured methodology to facilitate replication (Saunders et al., 1997).

According to Easterby-Smith et al., 1991 (in Saunders et al.), the aim of the social sciences should be to identify causal explanations and fundamental laws that
explain regularities in human behaviour. A hypothetico-deductive approach is an effective one in meeting this aim. Science proceeds through a process of hypothesising fundamental laws and then deducing what kinds of observations will demonstrate the truth or falsity of such hypotheses. In order to do this, however, the concepts which form the hypothetical model of causal explanations must be operationalised in a way which enables facts to be measured quantitatively. The reductionist properties of the positivist approach stem from the objectives of the approach. Positivists believe that problems as a whole are better understood if they are reduced to their simplest possible elements. Finally, as the aim of the positivist approach is to identify causal explanations and fundamental laws that explain regularities in human behaviour, sample sizes must be sufficiently large in order to generalise about regularities in human social behaviour (Saunders et al., 1997).

The second research approach – the phenomenological approach – is based upon the way in which individuals experience social phenomena in the world in which they live.

"Phenomenology is characterised by a focus on the meanings that research subjects attach to social phenomena; an attempt by the researcher to understand what is happening and why it is happening. Such research would be particularly concerned with the context in which such events were taking place. Therefore, the study of a small sample of subjects may be more appropriate than a large number as with the positivist approach....Researchers in this tradition are more likely to work with qualitative data and use a variety of methods to collect these data in order to establish different views of phenomena." (Saunders et al., 1997, p.72)
Table 3.1 summarises the key characteristics of the two approaches.

**Table 3.1. Summary of research approaches**

<table>
<thead>
<tr>
<th></th>
<th>Positivist</th>
<th>Phenomenological</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Objectives</strong></td>
<td>• Seeks to identify causal relationships between variables in order to explain regularities in human behaviour</td>
<td>• Attempts to understand what is happening and why it is happening</td>
</tr>
<tr>
<td></td>
<td>• Aims to reduce processes to their simplest possible elements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Should be able to generalise findings</td>
<td></td>
</tr>
<tr>
<td><strong>Key characteristics</strong></td>
<td>• Hypothetico-deductive</td>
<td>• Specifically concerned with the context in which events are taking place</td>
</tr>
<tr>
<td><strong>Key requirements</strong></td>
<td>• Concepts need to be operationalised in a way which enables facts to be measured quantitatively</td>
<td>• Researchers are more likely to work with small sample sizes and use a variety of methods in order to establish different views of phenomena</td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td>• Economical collection of large amount of data</td>
<td>• Facilitates understanding of how and why</td>
</tr>
<tr>
<td></td>
<td>• Clear theoretical focus for the research at the outset</td>
<td>• Enables researcher to be alive to changes which occur</td>
</tr>
<tr>
<td></td>
<td>• Greater opportunity for researcher to retain control of the research process</td>
<td>• Good for understanding social processes</td>
</tr>
<tr>
<td></td>
<td>• Easily comparable data</td>
<td></td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>• Inflexible – direction often cannot be changed once data collection has started</td>
<td>• Data collection can be time consuming</td>
</tr>
<tr>
<td></td>
<td>• Weak at understanding social processes</td>
<td>• Data analysis is difficult</td>
</tr>
<tr>
<td></td>
<td>• Often doesn’t discover the meanings people attach to social phenomena</td>
<td>• Researcher has to live with the uncertainty that clear patterns may not emerge</td>
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<tr>
<td></td>
<td></td>
<td>• Generally perceived as less credible by ‘non-researcher’</td>
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<tr>
<td></td>
<td></td>
<td>• Rarely able to generalise findings</td>
</tr>
</tbody>
</table>

(Acknowledging contribution of Saunders et al., 1997)

Earlier it was noted that the objective of the current study is to identify and test relationships between variables in the model of IT/IS assessment and acquisition in small firms presented in chapter two. At a broader level our objective can be viewed as an attempt to explain in its simplest form the process and factors that occur during the process of IT/IS assessment and acquisition in small firms and how they impact upon measures of IT/IS implementation success and overall organisational performance: in other words, an attempt to present a systematic view of phenomena.
by specifying relationships among variables with the purpose of explaining and predicting phenomena. As is evident from table 3.1, the aims of the positivist approach are congruent with the objectives of the current research. As such, a positivist approach is appropriated.

3.2.1. Appropriation of a model evaluation technique and research strategy

Thus far, we have presented a model of IT/IS assessment and acquisition in small firms. The model incorporates a number of causal relationships that need to be tested in order to evaluate the theory implied by the model. In the preceding section, the positivist approach was shown to be the most appropriate in facilitating this task. In order to operationalise the research, we need to identify a research strategy and technique within the positivist approach which has proven effective in analysing complex models containing a number of causal relationships. One such technique is Structural equation modelling (SEM).

3.2.2. Structural equation modelling

Structural equation modelling (SEM) has become increasingly popular as a confirmatory tool for researchers in the social sciences field. According to Anderson and Gerbing (1988b) this is because it provides such researchers with a comprehensive means for assessing and modifying theoretical models and, as such, offers significant opportunities for theory development. Several authors in the IS arena have employed structural equation modelling in order to evaluate complex models in which interaction between variables is hypothesised to occur (e.g. Brock and Sulsky, 1994; Chan et al., 1997). As Hair et al. (1998, p.578) assert, structural
equation modelling examines a series of dependence relationships simultaneously. "It is particularly useful when one dependent variable becomes an independent variable in subsequent dependence relationships." It is evident that this occurs in the current model as one moves between the different hierarchies.

Hair et al. (1998) suggest two reasons for the attractiveness of structural equation modelling: "(1) it provides a straightforward method of dealing with multiple relationships simultaneously while providing statistical efficiency, and (2) its ability to assess the relationships comprehensively and provide a transition from exploratory to confirmatory analysis. This transition corresponds to greater efforts in all fields of study toward developing a more systematic and holistic view of problems. Such efforts require the ability to test a series of relationships constituting a large-scale model, a set of fundamental principles, or an entire theory. These are tasks for which structural equation modeling is well suited."

Due to its strength in meeting the requirements of the current research, structural equation modelling is selected as the optimum statistical tool for the exploratory and confirmatory testing of the model. As an emerging tool in the IS research field, structural equation modelling has also proven its worth (e.g. Brock and Sulsky, 1994; Chan et al., 1997; Igbaria and Tan, 1997; Karahanna et al., 1999).

The employment of structural equation modelling dictates the undertaking of a number of different stages in the modelling process and, as such, also dictates the research strategy. These stages are illustrated diagrammatically in figure 3.1. The methodology is drawn predominantly from the recommendations of Hair et al. (1998), with additional insight obtained from the work of other specialists in the SEM field (e.g. Anderson and Gerbing; 1988; Chou and Bentler, 1995; Hu and Bentler, 1995; Hoyle, 1995; Hoyle and Panter, 1995; MacCallum, 1995; West et al., 1995).
Explaination and justification for each stage is provided where appropriate during the study. Here, we give a brief introduction to the different stages in order to assist the reader in the contextualisation of each stage of the research and to facilitate justification of the research strategy chosen.

Figure 3.1. Research steps necessary in the employment of SEM

1. Review of existing literature
2. Development of hypotheses
3. Development of model based upon hypotheses
4. Operationlisation of concepts which form the model (i.e. construct development)
5/11. Collection of data that measures the variables (operationlised concepts)
6/12. Testing constructs for validity and reliability
7. Completion of measurement and structural models
8. Exploratory evaluation of model (empirical and theoretical justification)
9. Model refinement
10. Construct refinement (where appropriate)
13. Confirmatory evaluation of model (based solely on empirical findings)

Key
Stage one: Exploratory model evaluation
Stage two: Confirmatory model evaluation

(Acknowledging Arbuckle, 1997; Hair et al., 1998; Anderson and Gerbing, 1988b)

The first three steps of the research process; (1) the reviewing of the literature; (2) the development of the hypotheses; and (3) their incorporation in a theoretical model;
have already been completed and are presented in chapter two. Here we reach the operationlisation step of the process in which variables which form the model are transformed into measurable constructs. In order to test the theory, researchers must provide an operational definition of the variables (or concepts) that is observable. This operational definition must represent a symbol or a variable to which numeric values can be assigned (Grover, 1997). This process is undertaken in chapter four.

Step five involves the collection of numeric data in order to empirically test the proposed model. Argument regarding the sample size required in order to effectively undertake structural equation modelling varies. Arbuckle (1997, p.252) provides rules of thumb provided by authors in the field:

"...we suggest that the estimation of structural equation models by maximum likelihood methods be used only when sample sizes are at least 200. Studies based on samples smaller than 100 may well lead to false inferences, and the models then have a high probability of encountering problems of convergence and improper solutions." (Boomsma, 1987, p.184)

Hair et al. (1998), also provide a useful guideline:

'Maximum likelihood estimation (MLE), the most common estimation procedure, has been found to provide valid results with sample sizes as small as 50, but a sample size this small is not recommended. It is generally accepted that the minimum sample size to ensure appropriate use of MLE is 100 to 150. As we increase the sample size above this value, the MLE method increases in its sensitivity to detect differences among the data. As the sample size becomes too large (exceeding 400 to 500), the method becomes "too sensitive" and almost any difference is detected, making all goodness-of-fit measures indicate poor fit. Although there is no correct sample size, recommendations are for a size ranging between 100 to 200. One approach is to always test a model with a sample size of 200, no matter what the original sample size was, because 200 is proposed as being the "critical sample size"." (Hair et al., 1998, p.605)
In summary, Hair et al., recommend as a matter of course the use of a sample size of 200, with increases occurring if misspecification is suspected or the model is overly large or complex. It is evident that in order to collect such levels of quantitative data, data collection using surveys is necessary. As such a survey-based approach represents the core research strategy.

Following the collection of data hypothesised to measure the variables (concepts) which form the model, testing is required in order to check that the measures are valid (i.e. that the construct which operationalises the concept does in fact measure what it is deemed to measure) and reliable (the items that form the measure are asking questions about the same concept). A rigorous approach during this stage should reduce measurement error (Grover, 1997). A detailed explanation of this process is afforded later in the study.

In SEM, constructs developed to measure variables (or concepts) are called measurement models (Arbuckle, 1997). Once each measurement model is tested for reliability and validity, the hypothesised paths between variables (illustrated in figure 2.17) are added. These causal relationships represent what is referred to in SEM terminology as the structural model. Once this stage is complete, the outcome is a structural equation model analogous with the hypothesised theoretical model developed from the literature. In essence, the structural equation model represents the complete operationalisation of the theory. The next step involves its testing.

The approach that will be taken in the current study is a two-step one, involving; (1) exploratory model testing and refinement using an initial sample of data; followed by (2) confirmatory model testing using a second data sample. Such an approach is the most rigorous in the development and testing of a hypothesised model (Hair et al., 1998). The objective of the exploratory stage is to evaluate the
hypothesised model both empirically and theoretically in order to refine it in such a way as to produce a hypothetical model which best explains the processes at work. During this exploratory stage, theoretical justification for the refinement of the model is equally as important as empirical considerations (Hair et al.).

The end result of exploratory modelling should be a theoretically and empirically supported model that can be tested on a second data set. In order to refine the model to this stage, a competing models strategy is employed. This strategy is effective as a means of evaluating a proposed model with alternative models over a number of model comparisons (i.e. the weakest hypothesised paths are removed prior to the testing of the model against the original model as presented in chapter two). The measurement models remain the same, while the number of relationships hypothesised to form the structural model vary. As such, the competing model strategy is a test of different hypothetical structural relationships.

As stated, the aim of the modelling effort is to refine the model through modifications of the structural model. According to Hair et al. (1998, p.592), “in many applications, theory can provide only a starting point for development of a theoretically justified model that can be empirically supported. Thus, the researcher must employ SEM not just to test the model empirically but also to provide insights in to its respecification.” The authors however, offer a note of caution. They argue that it is paramount that the researcher does not refine a model to the extent that it has acceptable fit but cannot be generalised to other samples or populations. Moreover, the respecification of a model must always be made with theoretical support rather than just empirical justification. The importance of these recommendations are reiterated in chapter seven.
On completing this stage, the end result is an exploratory model which, on the basis of empirical and theoretical considerations, effectively explains the underlying processes that occur. The next step is to test the refined model using a second data sample in order to evaluate its ability to explain the underlying processes. This is undertaken by means of the second model testing strategy – the *confirmatory modelling strategy*. In employing the confirmatory modelling strategy, evaluation of the explanatory strength of the model is based purely on empirical grounds (Hair *et al.*, 1998).

According to Grover (1997), there is a growing body of researchers that espouse inductive (or theory building) research approaches. Such approaches can use exploratory techniques such as exploratory surveys to search for patterns among variables in order to build theory. Their ultimate aim is to identify patterns in the data and modify the theory based upon these patterns. The exploratory approach appropriated in stage one of modelling to be undertaken in the current study draws upon these ideas in its aim to refine the model prior to further testing. Pure deductive research, on the other hand, tests theory, and any failure to confirm hypotheses results in the reconsideration of the theory independent of the data. This approach is indicative of the second stage of SEM to be applied in our study. Here, a confirmatory test is applied to the model in order to confirm or refute the existence of the hypothesised relationships. Grover (p.6) concludes that the best scientific research cycle is “a middle ground involving symbiotic interaction between deductive and interactive approaches, theory building and testing, and exploratory and explanatory research.” This ideal is met in the current study’s aim to employ a two-stage approach to modelling, which involves a synthesis of inductive and deductive research approaches.
3.3. Summary and conclusions

In this chapter, a positivist research approach has been selected and its use justified. Within the positivist approach, structural equation modelling has been chosen as the most effective means by which to undertake model development, refinement and testing. SEM has been shown to be an effective tool for examining a series of dependence relationships simultaneously. In doing so, it provides researchers with a comprehensive means for assessing and modifying theoretical models and offers significant opportunities for theory development. Hence, the strengths of SEM are congruent with the needs and objectives of this study.

The requirements of SEM are such that a data sample of 200 respondents is the optimum. As such, it is evident that a survey approach collecting quantitative data is necessary. Because of the two-stage approach which is to be taken in the current study (i.e. a competing models strategy followed by a confirmatory modelling strategy) two independent data collection exercises are necessary. The first sample will be used in the refinement of the model, while the second sample will be used solely for confirmatory purposes. The data collection procedure is described in detail in chapters five and eight.

Finally, in figure 3.1. a flow chart of the research process to be undertaken is presented. This is based upon research methodologies advocated by leading academics in the SEM field (e.g. Anderson and Gerbing, 1988; Arbuckle, 1997; Hair et al., 1998). This chart is provided in order to assist in the contextualisation of each stage in the research. At any stage of the research, the reader can refer to the chart in order to ascertain those stages that are complete, and those yet to be undertaken. As is evident from the chart, stages 1-3 have been completed and are presented in chapter two. The next stage is the operationalisation of the concepts (variables).
Chapter Four – Operationalisation of Concepts

4.1. Introduction

In chapter three, the research approach and strategy were discussed. Central to the approach chosen is the use of surveys to collect quantitative data from a large sample. In this chapter, we show how the concepts (variables) which are hypothesised to play a role in the model of IT/IS assessment and acquisition in small firms presented in chapter two, are operationalised in such a way that they can be measured using a survey. An explanation of the movement from the theoretical domain to the operational domain is afforded and a paradigm for developing measures presented and explained. The main body of the chapter focuses upon the rationale and theory underpinning the selection and development of specific measurement items.

4.2. Moving from the theoretical domain to the operational domain

Reiterating Kerlinger's (1986) definition, theory is defined as “a set of interrelated constructs (concepts), definitions and propositions that present a systematic view of phenomena by specifying relationships among variables, with the purpose of explaining and predicting the phenomena.” Grover (1997) suggests that this definition spans two domains. One can be labelled the theoretical domain and the other, the operational domain. If you consider the model of IT/IS assessment and acquisition presented in chapter two, the causal relationships hypothesised are done so
on the basis of existing theory. As such, the model is developed in the theoretical domain. In order to test the model empirically, it must be moved into the operational domain. Grover provides a useful explanation:

'Constructs or concepts are abstractions in the theoretical domain that express similar characteristics (e.g., intelligence, organisational success, manufacturing effectiveness). These constructs are "latent" or are not directly observable or measurable. Therefore, theory attempts to explain observed phenomena by systematically setting out interrelationships between constructs. However, since these constructs are latent, researchers must provide an operational definition of it that is observable. This operational definition represents a symbol or a variable to which numeric values can be assigned.' (Grover, 1997, p.5)

Figure 4.1 illustrates the relationship between the theoretical domain and the operational domain. The theoretical domain expresses a relationship between latent concepts “X” and “Y” (think of this as a simplified version of the model presented in chapter two). These concepts and the relationship hypothesised between them are derived from existing theory. At this stage, the concepts remain purely theoretical.

The operational domain examines a corresponding relationship between the variables “x” and “y” in the operational domain. Here, specific measurable attributes are assigned to the concepts in order to operationalise them. As Grover (1997, p.6) asserts, "theory (or the construct relationships in the theoretical domain) is invaluable in classical confirmatory research (deductive research), since it prespecifies the makeup and structure of the constructs and can guide propositions or hypotheses to be tested in the operational domain. The results of these tests can confirm or modify theory." Thus, it is this transition from the theoretical domain to the operational domain that enables the testing of the theoretical model.
4.2.1. Potential sources of measurement error

In moving from the theoretical domain to the operational domain (i.e. translating latent constructs into measurable variables) several sources of error can be introduced. These are also illustrated in figure 4.1. While the types of error and how they can be addressed is elaborated upon later in the study, it is deemed appropriate to give a brief precis of the sources of error and how they occur prior to the presentation of measures.

Four principal error components are illustrated in figure 4.1. These are; (1) measurement error; (2) sampling error; (3) internal validity error; and (4) statistical conclusion error. Measurement error is the error that occurs in measuring latent constructs. This can be the result of a number of causes including poorly worded questions, length of instrument, and bias introduced by the method (Grover, 1997). Careful validation of the instrument can reduce measurement error. Sampling error is the error introduced in selecting the study population and the representativeness of the
sample with respect to the population. Internal validity reflects the error introduced if other explanations can explain observed relationships. In other words, does "x" lead to "y" or do other variables explain the change in "y"? The final source of error – statistical conclusion error – reflects the probability that the null hypothesis has been correctly rejected and that mathematical relationships between hypothesised variables do exist.

4.2.2. A paradigm for developing measures of latent concepts

Measurement error can be kept to a minimum by appropriating a rigorous paradigm for the development and testing of measures. Churchill's (1979) seminal work provides such a paradigm, and is presented in figure 4.2.

Figure 4.2. Suggested paradigm for the development of measures

1. Specify domain of construct
2. Generate sample of items
3. Collect data
4. Purify measure
5. Collect data
6. Assess reliability
7. Assess validity
8. Develop norms

(Source: Churchill, 1979, p.66)
In the context of figure 3.1 in the previous chapter, figure 4.2 represents a more detailed and measurement operational approach to research steps 1-6. As such, the paradigm proves useful in aiding the contextualisation of the operationalisation of measures.

4.2.3. Item generation

The current chapter is concerned with item generation (i.e. the selection and development of items that measure the latent constructs that form the model). The recommendations put forward by Churchill (1979) and observed in the current study, give a detailed insight of the course that the researcher should follow in the development of items:

"The emphasis at early stages of item generation would be to develop a set of items which tap each of the dimensions of the construct at issue. Further, the researcher probably would want to include items with slightly different shades of meaning because the original list will be refined to produce the final measure. Experienced researchers can attest that seemingly identical statements produce widely different answers. By incorporating slightly different nuances of meaning in statements in the item pool, the researcher provides a better foundation for the eventual measure.....After the item pool is carefully edited, further refinement would await actual data." (Churchill, 1979, p.68)

The paradigm developed by Churchill relates to multi-item measures. The use of multi-item measures is the primary way in which the researcher can reduce measurement error prior to data collection. As Churchill asserts (p.66), "multi-item measures have much to recommend them. First, individual items usually have considerable uniqueness or specificity in that each item has a low correlation with the attribute (latent construct) being measured and tends to relate to other attributes as
well. Second, single items tend to categorize people into a relatively small number of 
groups.”

Grover (1997) argues that multi-item measures can:

“...better specify the construct domain, average out uniqueness of individual items, 
make fine distinctions between people, and have higher reliability. In developing 
these measures however, it is very important that the domain of the construct be 
well specified and that the items be generated based on this domain. This 
assessment of the appropriateness of the items to the domain of the construct is 
referred to as content validation. It can be done through the theoretical basis for 
the items in the literature or a panel of experts well versed in the 
domain....Realistically however, existing (and preferably validated) scales should 
be adopted (or adapted) wherever possible in order to cultivate a cumulative 
tradition of research.” (Grover, 1997, p.7)

Grover’s last point relates directly to stage two of Churchill’s recommended 
procedure. In this stage, it is recommended that measurement items are generated via 
several suggested methods including; (1) literature search (as argued by Grover); (2) 
experience survey; (3) insight stimulating examples; (4) critical incidents; and (5) 
focus groups (Churchill, 1979). The current study draws its measures predominantly 
from existing literature (as recommended by Churchill and Grover). However, in 
accordance with the recommendations of Churchill, additional insight into item 
generation was also sought via semi-structured interviews undertaken in twelve small 
firms.7 Because the semi-structured interviews helped inform the item generation 
process, it is deemed appropriate to give a brief insight into the interviews undertaken 
prior to the presentation of the development of operationalised measures.

7 Semi-structured interviews in individual small firms replaced focus groups. Such an approach was 
undertaken for the convenience of individuals within the organisations.
4.2.3.1. Informing item generation: semi-structured interviews

Semi-structured interviews were employed in order to help inform the item generation process. Twelve firms were chosen in which to undertake semi-structured interviews. They were selected on the basis that they were local and were prepared to set aside time to be interviewed. Interview durations ranged from 45 to 105 minutes depending on the time constraints on the partner responding to questions, as well as their willingness to discuss their organisation's IT/IS processes. In particular, partners were asked about their willingness to provide both financial information as well as information about their internal processes and functions.

The interviews proved valuable in affording an indication of the type of data accessible within small firms and the extent to which it could be collected. A number of barriers to data collection were observed at this stage. Partners within the firms interviewed expressed a reluctance to provide any form of detailed financial information. Those that did not mind imparting such information on confidentiality grounds suggested that it would be time consuming and difficult to track down exact figures or accounts. Several partners also commented on the lack of standardised accounting techniques which, they believed, would make it difficult to compare different organisations. While firms were happy to provide data on non-organisational performance matters, it was evident that asking for exact measures (e.g. investment in IT/IS) caused problems. Such issues are addressed in the operationalisation of concepts described in the following section.

The remainder of the current chapter affords an explanation of the generation of measurement items, appropriated where possible from existing literature and informed by the interviews undertaken in small firms. These measures operationlise
the latent concepts (constructs) which form the model of IT/IS assessment and acquisition.

**4.3. Operationalisation of concepts**

It is at this point that we operationalise the concepts that form the model of IT/IS assessment and acquisition presented in chapter two. Following the recommendations of Churchill (1979) and Grover (1997), measures and items that have been validated in previous research have been adopted (and adapted). Where measures do not already exist, they have been developed for the purposes of the current study. The appropriateness of the proposed measures is also informed by insight obtained as a result of the interviews.

All measures are assessed (stages 6-7) following the collection and examination of data (described in the following chapter). The following section focuses upon the design of the questionnaire and the rationale and theory underpinning the selection and use of specific measurement items. Measures are approached in an order corresponding to their presentation in the literature review.

**4.3.1. Operationalising hierarchy level one**

**4.3.1.1. Organisational performance**

The assessment of organisational performance continues to receive attention in the literature, as illustrated in chapters one and two. As Jennings and Beaver (1997, p.67-68) assert, "the attribution of success/or failure to small firms is complex, dynamic and problematic... There is a need to think imaginatively about the construction and application of success or failure criteria recognising the pluralistic nature of business..."
by adopting a stakeholder perspective... Success is no longer regarded as synonymous with optimal performance since this represents an extremely elusive concept.” While debate continues around the use of “hard” measures (such as profit, turnover, and return on assets) versus “soft” measures (such as perceived productivity or job satisfaction), Robinson (1982) asserts that business performance is a multivariate phenomenon, and therefore, both types of measure have a role to fulfill.

The researcher measuring organisational performance in small privately owned firms faces a number of problems. These are summarised by Dess and Robinson (1984):

“Access to data on privately-held firms is severely restricted. Such information is not publicly available. Owners, very sensitive about releasing any performance-related data, are the sole gatekeepers to such information on individual firms. Trade associations and publications, such as Dun and Bradsheets Business Ratios...provide aggregate data on such firms. But it is of minimal use in exploring variation in performance between individual firms. Secondly, even if access to such information is obtained with a sample of privately-held firms, there is greater risk of error attributable to varying accounting procedures in these firms. Organisational form – sole proprietorship, partnership, corporation, etc. – can cause artificial differences. Procedures for handling owner compensation can present major sources of error across smaller, privately-held firms.” (Dess and Robinson, 1984, p.266-267)

Feedback from the interviews undertaken in small firms confirmed the findings described above, indicating that obtaining precise financial performance data would prove difficult. Three primary barriers to obtaining such data were observed. First of all, owner-managers were reluctant to make public their firm’s financial information. Secondly, time constraints prevented those who did not mind revealing financial data from tracking down their accounts and passing on information. Finally, a number of owner-managers suggested that obtaining such precise data would prove of little merit.
due to the unstandardised accounting procedures and tax avoidance common in small firms. On the basis of the interviews, and the work of Dess and Robinson, it was feared that if these issues were not addressed and overcome, the implications in terms of response rate and completed questionnaires would be severe.

To counter these problems, Likert type scales and ranges were devised to enable respondents to quickly choose the response that they felt best described their organisation and without asking them to pass on precise confidential information or undertaking time-consuming searches for information. There are of course advantages and disadvantages to such an approach. While essentially subjective in their measurement, Likert scales are generally accepted as reliable when compared with objective measures (Dess and Robinson, 1984; and Govindarajan and Fisher, 1990).

Dess and Robinson evaluated the correlations between two measures of organisational performance; (1) objective and subjective measures of return on assets; and (2) objective and subjective measures of sales growth in privately-owned firms. Their research reported a high correlation between objective and subjective measures of performance, leading the authors to conclude that, management “perception of how well their firm had performed – measured in a subjective and relative sense - was consistent with how the firm actually performed vis-à-vis return on assets and growth in sales” (p.271). On the basis of their findings they argue that, “although the objective measure(s) would be preferred... a researcher might consider using a subjective perceptual measure... under two specific conditions: (1) accurate objective measures are unavailable, and (2) the alternative is to remove the consideration of performance from the research design” (p.271).
While subjective measures and Likert scales may afford an accurate measure in the absence of an objective alternative, the level of precision with which variables can be measured is affected. Ranges and scales cannot provide the precise and detailed data obtained through exact measures. It is accepted that such a trade-off is difficult to avoid if one is to collect sufficient data.

The current study used the findings presented above as a point of departure in developing a measurement tool of small firm organisational performance. Several measures were employed, based on those developed by Robinson (1982), Cragg (1990) and Palvia et al. (1994). Robinson measured organisational effectiveness using; (1) growth (percentage increase/decrease in sales); (2) profitability (absolute increase in net profit before taxes/total sales); productivity (absolute increase in sales/employee); and (4) employment (percentage increase in the number of full-time employees). Cragg (1990) employed financial turnover and increase (decrease) in turnover from the previous year as measures of performance, while Palvia et al. (1994) measured profitability on a 4-point scale ranging from "very profitable" to "losing money". Measures used in the current study are based on those listed above. These are; (1) change in employee numbers; (2) turnover compared with last year; (3) current profitability; and (4) recent total market changes. All four were measured using Likert scales.

Table 4.1. shows several financial measures of organisational performance employed by existing studies. In the current study, turnover per employee was employed alongside the softer measures described above as a financial measure of organisational performance. It is proposed that such a measure represents an effective evaluation of performance in professions in which fees are earned for services rendered. Turnover per employee is particularly useful as it also accounts for 
organisational size. A number financial measures were discarded on the basis that they were inappropriate for use in the small private firm context (e.g. ROA, ROE), or because they were considered confidential or too time consuming to track down by the respondent.

Table 4.1. Measures of performance used in existing studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Measures of Financial Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cron and Sobol (1983)</td>
<td>Pretax Profits</td>
</tr>
<tr>
<td></td>
<td>Return on Assets (ROA)</td>
</tr>
<tr>
<td></td>
<td>Return on net worth</td>
</tr>
<tr>
<td></td>
<td>5-year growth rates.</td>
</tr>
<tr>
<td>Weill (1992)</td>
<td>Sales growth</td>
</tr>
<tr>
<td></td>
<td>ROA</td>
</tr>
<tr>
<td>Sethi, Hwang and Pegels (1993)</td>
<td>ROE</td>
</tr>
<tr>
<td></td>
<td>Return on Sales (ROS)</td>
</tr>
<tr>
<td></td>
<td>Sales Growth</td>
</tr>
<tr>
<td></td>
<td>Earnings Growth</td>
</tr>
<tr>
<td>Katz (1993)</td>
<td>Revenues</td>
</tr>
<tr>
<td></td>
<td>Reduced Material Costs</td>
</tr>
<tr>
<td></td>
<td>Overall Cost Reductions</td>
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<tr>
<td></td>
<td>ROI</td>
</tr>
<tr>
<td></td>
<td>ROA</td>
</tr>
<tr>
<td>Kivijarvi and Saarinen (1995)</td>
<td>Net sales growth rate</td>
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<tr>
<td></td>
<td>Personnel growth rate</td>
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<tr>
<td></td>
<td>Investment rate</td>
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<tr>
<td></td>
<td>Gross margin</td>
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<tr>
<td></td>
<td>Debts/net sales</td>
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<tr>
<td></td>
<td>Net income</td>
</tr>
<tr>
<td></td>
<td>Return on Investment (ROI)</td>
</tr>
<tr>
<td>Teo and King (1996)</td>
<td>ROI</td>
</tr>
<tr>
<td></td>
<td>Market share</td>
</tr>
<tr>
<td></td>
<td>Sales Revenue</td>
</tr>
<tr>
<td>Hilt and Brynolfsson (1996)</td>
<td>ROA</td>
</tr>
<tr>
<td></td>
<td>Return on Equity (ROE)</td>
</tr>
<tr>
<td></td>
<td>Value added</td>
</tr>
<tr>
<td></td>
<td>Sales Growth</td>
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<tr>
<td></td>
<td>Market Share</td>
</tr>
<tr>
<td></td>
<td>Debt</td>
</tr>
<tr>
<td>Rai, Patnayakuni and Patnayakuni (1997)</td>
<td>ROA</td>
</tr>
<tr>
<td></td>
<td>ROE</td>
</tr>
<tr>
<td>Byrd and Marshall (1997)</td>
<td>Sales per Employee</td>
</tr>
<tr>
<td></td>
<td>Sales by Total Assets</td>
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<tr>
<td></td>
<td>ROS</td>
</tr>
<tr>
<td></td>
<td>ROI</td>
</tr>
<tr>
<td></td>
<td>Market to Book Value</td>
</tr>
</tbody>
</table>

On the basis of pre-survey interviews, it was feared that requesting precise financial information that might be considered confidential by an organisation’s
owner/manager might result in the non-return of the questionnaire. Owner/managers were thus asked to record their turnover on a Likert scale that included a number of ranges (e.g. £1-£49,000; £50,000-£99,000, and so on.). They were also asked to record the number of partners and associates they employed. *Turnover per employee* was calculated at a later stage by dividing the midpoint of the turnover range by the number of employees.

This approach was tested in the pilot questionnaire (discussed later) and was found to be acceptable by respondents. As such, the same measure was employed in the first main mail shot (hereafter labelled the exploratory mailshot). This proved to be an effective approach in terms of the amount of data collected: only 11.4% of respondents chose not to respond to the question. The downside, however, is the precision of the data collected. While the ranges employed afford a fair indication of the financial performance of an organisation, they lack the precision and subtlety desired in such a study.

### 4.3.1.2. Measures of IT/IS implementation success

The measurement of IT/IS implementation success represents the cornerstone of the model presented in chapter two. It is useful at this point to return to Grover et al.’s (1996) construct space for IS effectiveness. Two of Grover’s six effectiveness measures; (1) *market measures*; and (2) *economic measures*; are already represented by the current study’s employment of organisational performance measures.

The other two effectiveness measures that are of relevance to this study are; (1) *perceptual measures*; and (2) *productivity measures*. These represent classic IT/IS implementation success measures and have been consistently employed by existing IS research. As described in chapter two, perceptual measures “capture user attitudes,
beliefs, and perceptions toward IS" (Grover et al., 1996, p.182). The most frequently used perceptual measures are measures of user information satisfaction (UIS). The current study appropriates the findings of previous UIS-based research in its development of a UIS measure for small organisations.

Productivity measures evaluate the organisational impact of IS. As will be shown, such measures are also popular in IS research. In building an instrument that measures IT/IS impact, the current study appropriates the most effective measures employed by previous research. As such, the measure employed has a strong theoretical underpinning.

4.3.1.2.1. User information satisfaction measures
Measures of User Information Satisfaction (UIS), originating in the work of Pearson (1977) and later developed by Bailey and Pearson and Ives et al. (1983), form the most cumulative body of research in the IS field. Generally, two main types of UIS measure exist (Ives et al., 1983). First of all, there are those that focus on the information system product, evaluating a system's output content, ease of use, accuracy, and so on (let us call these Type I measures). Secondly, there are measurement instruments that not only evaluate the information product, but also include measures of organisational support for the development and maintenance of the system (Type II measures).

The relationship between the two types of measurement instrument can be best clarified by looking more closely at the second type of measure, as initially developed by Bailey and Pearson (1983). Their UIS measure, and subsequent developments and modifications based around their work, tend to have three core dimensions (Doll and Torkzadeh, 1988; Palvia, 1996; Wong and Phelps, 1996). These are; (1) satisfaction
with the information product (essentially the same in conceptualisation as type I measures of UIS); (2) satisfaction with IS Staff and Services; and (3) knowledge/involvement (see table 4.2). Let us look at the three factors independently and in more detail.

Table 4.2. Existing UIS measures

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Derived From</th>
<th>Environment Tested</th>
<th>Factors in Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bailey and Pearson (1983)</td>
<td>Literature, interviews and empirical (n=29)</td>
<td>Traditional large organisation IS services environment</td>
<td>• IS Staff and services&lt;br&gt;• Information product satisfaction&lt;br&gt;• Knowledge/involvement</td>
</tr>
<tr>
<td>Ives et al. (1983)</td>
<td>Based on Pearson, empirical (n=280)</td>
<td>Traditional large organisation IS services environment</td>
<td>• IS Staff and services&lt;br&gt;• Information product satisfaction&lt;br&gt;• Knowledge/involvement</td>
</tr>
<tr>
<td>Doll and Torkzadeh (1988)</td>
<td>Literature, interviews, empirical (n=618)</td>
<td>Traditional large organisation IS services environment</td>
<td>• Information product</td>
</tr>
<tr>
<td>Montazemi (1988b)</td>
<td>Literature, interviews, empirical (n=78)</td>
<td>Small businesses (but with small defined as &lt;250)</td>
<td>• IS Staff and services&lt;br&gt;• Information product satisfaction&lt;br&gt;• Knowledge/involvement</td>
</tr>
<tr>
<td>Saarinen and Vepsalainen (1994)</td>
<td>Previous work by the same author, empirical (n=48)</td>
<td>Traditional large organisation IS projects</td>
<td>• Success of the development process&lt;br&gt;• Use&lt;br&gt;• Quality of IS&lt;br&gt;• Impact of IS</td>
</tr>
<tr>
<td>Kekre et al. (1995)</td>
<td>Literature, interviews, empirical (n=2,026)</td>
<td>IBM customers</td>
<td>• Information product satisfaction&lt;br&gt;• IS Staff and services</td>
</tr>
<tr>
<td>Palvia (1996)</td>
<td>Literature, empirical (n=100)</td>
<td>Small Businesses</td>
<td>• IT provider services&lt;br&gt;• Information product satisfaction&lt;br&gt;• Knowledge/involvement</td>
</tr>
<tr>
<td>Wong and Phelps (1997)</td>
<td>Literature, empirical (n=67)</td>
<td>Traditional large organisation IS services environment</td>
<td>• IS Staff and services&lt;br&gt;• Information product satisfaction&lt;br&gt;• Knowledge/involvement&lt;br&gt;• Operational efficiency&lt;br&gt;• Management effectiveness&lt;br&gt;• Support for external business linkages</td>
</tr>
</tbody>
</table>

4.3.1.2.1.1. Satisfaction with the information product

Ives et al. (1983) defined the dimension information product following a factor analysis of Bailey and Pearson’s measure of UIS. Items loading onto the factor include; confidence in the system; timeliness of output; currency of output; reliability of output; relevancy of output; volume of output; accuracy of output; precision of
output; and completeness of output. Doll and Torkzadeh (1988) developed a *Type I* measure of end-user satisfaction. A factor analysis of their data resulted in five subcategories interpreted as; (1) information content; (2) accuracy of information; (3) format of information; (4) ease of use; and (5) timeliness of information. The similarities between the five factors in Doll and Torkzadeh's *type I* measure of end-user satisfaction and Bailey and Pearson's information product dimension are apparent.

Items loading onto the information product factor in the measure designed by Wong and Phelps (1997) also have much in common with those studies described above. The six items loading onto the *information product* factor include; (1) reliability of output information; (2) relevance of output information; (3) accuracy of output information; (4) precision of output information; (5) completeness of output information; and (6) overall satisfaction with the information product.

Palvia's (1996) measure of small business user satisfaction with information technology draws heavily on the work of Doll and Torkzadeh (1988) and, not surprisingly, is similar to Wong and Phelps's (1997) *information product* measures. Palvia, like Doll and Torkzadeh, also employs an "ease of use" dimension identified as of importance by Davis (1989). The final measure comprises of 13 dimensions, 6 of which focus on information product satisfaction. These are; (1) software adequacy; (2) timeliness; (3) information content; (4) information accuracy; (5) information format; and (6) ease of use. Kekre *et al.* (1995) tested critical drivers of customer software satisfaction. Four of the seven drivers identified – (1) reliability; (2) usability; (3) capability (customer satisfaction with the functionality of the software); and (4) performance (storage capacity and response time) – represent measures of information product satisfaction.
Saarinen and Vepsalainen (1994) developed a measure of IT/IS quality as part of their research on IS procurement strategies. While they label their dependent variable *quality of the IS product* it is evident that it derives much of its content from UIS measures. As Lees (1987) asserts, UIS can be seen as a measure of both system quality and user acceptance. Saarinen and Vepsalainen's measure of IS quality is constructed as an average of; (1) *quality of the user interface* - comprising of measures of the system's performance, response times, user friendliness, and ease of use; (2) *flexibility of the system and quality* - focusing upon the precision, accuracy, and reliability of output information provided by the system; (3) *content* - evaluating the completeness, relevance, timeliness, and up-to-dateness of output information; and (4) *format of output information* - focusing upon the format and clarity of output information provided by the system.

4.3.1.2.1.2. Satisfaction with IS staff and services.

Measures of satisfaction with IS staff and services [frequently referred to as electronic data processing (EDP) staff and services in the earlier literature] are exclusive to *type II* measures. While there is a significant degree of consistency between items and dimensions used to measure satisfaction with the information product as described above, this is even more evident in measures of satisfaction with IS services and staff. This is essentially the result of most measurement instruments being based on the work of Bailey and Pearson (1983). This is clearly illustrated in the measurement instruments of researchers such as Ives et al. (1983), Montazemi (1988a), Baroudi and Orlikowski (1988), Yaverbaum and Nosek (1992) and Kekre et al. (1995). Staff and services measures appropriated from Bailey and Pearson include; relationship with IS
staff; processing of requests for changes to existing systems; attitude of IS staff; communication with IS staff; time required for new systems development.

Ives et al. and Montazemi also use additional items devised by Bailey and Pearson, including, means of input/output with the IS centre; interdepartmental competition with the IS unit; organisational position of the IS function; personal control of the IS service received; documentation; and technical competence of the IS staff.

Kekre et al. (1995) employ dimensions that also measure satisfaction with IS services and staff (both internal and external). The dimensions used include (1) documentation (cf. Bailey and Pearson, 1983; Ives et al., 1983; Montazemi, 1988a; and Palvia, 1996); (2) maintainability (defined as the maintenance and back-up support provided by those responsible for the system); and (3) hardware/software reliability (respondents answered questions on the frequency of disruptions as well as the time taken to fix the disruptions).

4.3.1.2.1.3. Knowledge / involvement
Most type II UIS measures include items that load onto a knowledge/user involvement factor. Such items include the degree of training provided to users; user's understanding of systems; level of participation in systems development and top management involvement (Bailey and Pearson, 1983; Ives et al., 1983; Montazemi, 1988a; Palvia, 1996; Wong and Phelps, 1997;).

4.3.1.2.1.4. The application of UIS measures in small organisations
To understand the degree of fit between type II UIS measures and UIS issues within small firms, it proves useful to first of all evaluate the large organisation computing
environment for which most UIS measures were designed. Palvia (1996) describes such an environment:

“There are two [environments] in large organisations: traditional data processing and end-user computing... In the traditional DP mode, the user interacts with the computer indirectly, through the systems staff (i.e. analysts and programmers) or through the operations staff. In the end-user environment, the users (typically managers and staff analysts) interact directly with the computers through application software. They typically have access to a support group, or an information center. In both environments, there is usually a management information systems (MIS) department. It is normally the MIS department that deals with outside organisations, such as vendors, consultants, and education/training firms.” (Palvia, 1996, p.152) [see figures 4.3. & 4.4.]

Figure 4.3. Traditional MIS environment

![Figure 4.3](source)

(Source: Palvia, 1996, p.152)

Figure 4.4. End-users computing environment

![Figure 4.4](source)

(Source: Palvia, 1996, p.152)
4.3.1.2.1.5. The applicability of existing UIS measures in small organisations
On the whole, type II UIS measures represent a valid measure of UIS in large organisations. However, they are less suited as a measurement instrument in the small firm environment. Small firms have limited resources and rarely employ dedicated IS personnel (Palvia, 1996; Pollard and Hayne, 1998). As a result, employees within the firm, and ultimately its management, are responsible for making IT/IS decisions and for deciding the degree to which external expertise (i.e. vendors, consultants or trainers) is required (see figure 4.5). Looking at the three core dimensions of the UIS measure (information product; EDP staff and services; and involvement or knowledge), it is evident that they are not all suitable in the small firm context. They do, however, represent a valuable point of departure.

Figure 4.5. The small - firm IT/IS user environment

4.3.1.2.1.6. Development of a small business IS user satisfaction measure
Accounting for the small firm context and computing environment, the UIS measures described above were used as a basis for the construction of two measurement instruments evaluating small business user satisfaction with IT/IS. These are; (1) a
measure of satisfaction with the information product; and (2) satisfaction with IT/IS providers and services. The selection of measurement items involves two main stages; (1) identifying existing measures which proved reliable; (2) identifying those that could be used for measuring UIS in the small business context, or could be amended to do so.

The final factor which forms conventional type II measures of UIS (Knowledge/Involvement) focuses upon issues such as top management and employee involvement in IS development, and levels of training undertaken by employees. It is argued that items that might load onto this factor are more appropriately viewed as independent variables as opposed to dependent variables. This appropriates the methodological approach employed by Doll and Torkzadeh (1988).

4.3.1.2.1.7. Factor one: small business satisfaction with the information product
As is evident, Type I measures, and Type II items loading onto the information product factor, are essentially generic. Thus it is proposed that existing measures of user satisfaction can be used effectively in the small firm context. Six items with strong theoretical underpinning were chosen from existing measures (see table 4.3). Items include; (1) ease of use (2) reliability of output information; (3) relevance of output information; (4) up-to-dateness of output information; (5) format of output; and (6) frequency of disruption caused by IT/IS problems. Table 4.3 shows the basis for use of each measure.
4.3.1.2.1.8. Factor two: small business satisfaction with IT/IS providers and services

As shown in figure 4.5, the processes and groups involved in the procurement and maintenance of IT/IS differ significantly in the small firm context. Clearly, therefore, items loading onto the factor IS Staff and services are inappropriate as measurement instruments in the small firm environment. However, a factor adopting a redefinition of IS staff and service appropriate for small business research (here titled satisfaction with IT/IS Providers and Services) is believed to be important to the UIS measure. Such a dimension is integral to overall user information satisfaction as it accounts for factors that essentially enable the user to perform operations using their computer.

Instead of regarding IS staff and services in the traditional large organisation data processing environment, a redefined IT/IS staff and services factor should focus on those individuals and groups who perform the equivalent tasks and activities at the small business level. In most cases, vendors, trainers or consultants, or informal sources known by the owner-manager or an individual within the small firm, carry out such work (Doukidis et al., 1994; Pollard and Hayne, 1998). As a result, the services they offer can be evaluated in much the same way as conventional UIS
instruments measure satisfaction with IS staff and services in the large organisational context.

Using this approach, four user satisfaction items have been appropriated from existing research that can be used in their original form or adapted to meet the requirements of small business research (see table 4.4.). These are measures of; (1) maintenance and back-up support; (2) the security of data from misappropriation or unauthorised alteration or loss; (3) the turnaround time to fix IT/IS problems; and (4) the quality of documentation supplied with systems. In each item, no reference was made to whom might be responsible for providing IS services. This was done deliberately to enable respondents to evaluate their support regardless of whether it came from more formal sources of assistance, such as vendors or consultants, or less formal groups or individuals such as friends, family or acquaintances.

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<tbody>
<tr>
<td>1 Maintenance and back-up support</td>
<td>Vendor support</td>
<td>Vendor support</td>
<td>Vendor support</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>Vendor support</td>
</tr>
<tr>
<td>2 Security of data from misappropriation &amp; loss</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
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<tr>
<td>3 Turnaround time taken to fix IT/IS problems</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
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<tr>
<td>4 Documentation</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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</table>

4.3.1.2.2. Organisational impact of IT/IS
UIS measures provide an evaluation of user’s perceptions of the IS they use and are, therefore, a perceptual measure as defined by Grover et al. (1996). However, as Wong and Phelps (1997) assert, while the UIS measure is effective in capturing the main dimensions of IT/IS implementation success at the user level, it fails to capture
the whole meaning of implementation success due to its focus on the individual as opposed to the organisation. Now we turn our attention to Grover et al.'s (1996) impact measure labelled productivity in order to evaluate the affect of IT/IS at the organisational level.

Watad (1995) provides a useful model of organisational impact of IT. The author identifies four major organisational outcome themes from a review of the IS literature in the area. These he labels; (1) productivity; (2) quality of work life (QWL); (3) responsiveness; and (4) competitive advantage (see figure 4.6). Quality of work life (QWL) is concerned with the employee's well being and job satisfaction. Responsiveness involves providing a service faster and more effectively and informing the customer about the services offered. Competitive advantage, Watad defines as attempting to secure customer loyalty through linking related services, introducing new services, and improving the quality of services. Finally, increasing productivity can be interpreted as improvements in decision-making, efficiency, time saving, and organisational costs. As Watad states, these outcomes are not mutually exclusive and there is overlap between them.

Figure 4.6. Organisational outcomes model

(Source: Watad, 1995, p.75)
As the model suggests, changes in one outcome may cause changes in another. However, organisations are unlikely to achieve all outcomes simultaneously and furthermore, the achievement of one may occur at the detriment of another. Approached holistically, if IT is to be of benefit, the overall impact should be positive.

The impact measure developed here uses the model described above as a point of departure, with measurement items that focus upon each of the four organisational outcomes defined by Watad. Fifteen items were chosen following a review of the literature, with each item having its foundations in previous measures developed by researchers in the IS field (see table 4.5). These are as follows.

4.3.1.2.2.1. Item one: the impact of IT/IS on decision-making
Mukhopadhyay and Cooper (1992) state that one vital aspect of the impact of IT/IS is its enabling of better and more informed managerial decision-making. This proposition is supported by researchers in the IS field, many of whom have consistently evaluated organisational and management decision making as a measure of IT/IS impact (Malone, 1985; Cragg, 1990; Mukhopadhyay and Cooper, 1992; Saarinen and Vepsalainen, 1994; Kivijarvi and Saarinen, 1995; Molloy and Schwenk, 1995; and Law and Gorla, 1996).

Malone, for example, looked at changes in the speed and quality of decision-making resulting from IT/IS implementation, while Law and Gorla (1996) focused upon both decision effectiveness and decision efficiency brought about by IT/IS. Cragg (1990), Saarinen and Vepsalainen (1994) and Kivijarvi and Saarinen (1995) employ a more all-encompassing measure, simply evaluating the overall impact of IT/IS on decision-making.
<table>
<thead>
<tr>
<th>Item</th>
<th>Item 1</th>
<th>Item 2</th>
<th>Item 3</th>
<th>Item 4</th>
<th>Item 5</th>
<th>Item 6</th>
<th>Item 7</th>
<th>Item 8</th>
<th>Item 9</th>
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<tbody>
<tr>
<td>1</td>
<td>How IT has affected decision-making</td>
<td>How IT has affected decision-making</td>
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<tr>
<td>2</td>
<td>How IT has affected work processes</td>
<td>How IT has affected work processes</td>
<td>How IT has affected work processes</td>
<td>How IT has affected work processes</td>
<td>How IT has affected work processes</td>
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<tr>
<td>3</td>
<td>How IT has affected organizational costs</td>
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<td>How IT has affected organizational costs</td>
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<td>4</td>
<td>How IT has affected firm control</td>
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<tr>
<td>5</td>
<td>How IT has affected internal communication</td>
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<td>6</td>
<td>How IT has affected job satisfaction</td>
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<tr>
<td>7</td>
<td>How IT has affected the firm's ability to provide new services</td>
<td>How IT has affected the firm's ability to provide new services</td>
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<td>8</td>
<td>How IT has affected the firm's marketing ability</td>
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<td>9</td>
<td>How IT has affected general administrative efficiency</td>
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<td>14</td>
<td>How IT has affected accounts &amp; cash flow</td>
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Table 4.5: Impact measures employed in existing IS Research
4.3.1.2.2.2. Item two: the impact of IT/IS on work processes
While technology is recognised as an enabler of business process reengineering in large organisations (Caron et al., 1994), its implementation can also bring about improvements in small firms (Yetton et al., 1994). In their study of software use in small business, Heikkila et al. (1991) evaluated the degree to which IT/IS implementation had resulted in improvements in work processes. Saarinen and Vepsalainen (1994) and Kivijarvi and Saarinen (1995) also employed an item assessing the impact of IT/IS on work processes as part of their overall IT/IS impact measure, as did the BDA (Morris, 1994) in their evaluation of the impact of IT/IS in the orthodontist profession.

4.3.1.2.2.3. Item three: the impact of IT/IS on organisational costs
Watad (1995) reported reductions in operating costs to be a major productivity impact resulting from the implementation and use of IT/IS. A number of other prominent researchers have also evaluated the impact of IT/IS on organisational costs (Katz, 1993; Saarinen and Vepsalainen, 1994; Kivijarvi and Saarinen, 1995; Teo and King, 1996). Katz, for example, measured reductions in organisational costs resulting from IT/IS use including; (1) material costs; (2) cost avoidance; (3) and advertising costs; (4) reduction in staff; as well as an all-encompassing measure of overall cost reductions.

4.3.1.2.2.4. Item four: the impact of IT/IS on firm control
An effective information system should enable managers to monitor the performance of their staff and their organisation and hence, improve firm control (Saarinen and Vepsalainen, 1994). Saarinen and Vepsalainen (1994) and Kivijarvi and Saarinen
(1995) included an item evaluating the impact of IT/IS on organisational control as part of their measure of IT/IS impact.

4.3.1.2.2.5. Item five: the impact of IT/IS on internal communication
Saarinen and Vepsalainen (1994) and Kivijarvi and Saarinen (1995) also include an item evaluating the impact of IT/IS on internal communications in their impact measure. The use of such a measure is further supported by Bergeron et al. (1992) and Law and Gorla (1996), who measure the impact of IT/IS on an organisation's communication capacity.

4.3.1.2.2.6. Item six: the impact of IT/IS on job satisfaction
Watad (1995) identifies quality of work life (QWL) to be an important IT/IS impact factor in his organisational outcomes model (see figure 4.6). Watad's QWL factor comprises of three components; (1) work associated stress; (2) job satisfaction; and (3) morale and confidence. Igbaria and Tan (1997) and the BDA (Morris, 1993) also measured the impact of IT/IS on job satisfaction.

4.3.1.2.2.7. Item seven: the impact of IT/IS on ability to provide new services
Katz (1993) employed a measure that evaluated the impact of IT/IS on the ability of an organisation to introduce products and services to its market. Watad (1995) supports the inclusion of such a measure. His research incorporates two impact variables that relate to the provision of new services. These are; (1) the impact of IT/IS in terms of delivering products/services more quickly; and (2) the impact of IT/IS in terms of an organisation's ability to introduce new products/services. The latter variable was also measured in the same format by Cragg (1990).
4.3.1.2.2.8. Item eight: the impact of IT/IS on an organisation's marketing ability

IT can improve an organisation's marketing ability. Databases enable an organisation to know who its customers are and become more responsive to their needs (Hanage and Fuller, 1995). Combined with word processing and desktop publishing, databases can also enable cost effective mailing shots as well as the production of newsletters and other marketing material. Finally, the implementation of the necessary technology can enable an organisation to have a presence on the World Wide Web.

Watad (1995) includes two measures of an organisation's marketing ability as part of his organisational outcomes model. These are; (1) the impact of IT/IS on an organisation's ability to maintain updated knowledge about its customers; and (2) the impact of IT/IS on an organisation's ability to provide more information about its products/services to its customers. Katz (1993) and Law and Gorla (1996) also evaluate the impact of IT/IS on an organisation's marketing ability.

4.3.1.2.2.9. Items nine and ten: the impact of IVIS on an organisation's general administrative efficiency and productivity

Productivity and efficiency measures are amongst the most popular indicators of the impact of IT/IS on the organisations. They are consistently used by a significant proportion of researchers in this area (Cragg, 1990; Bergeron et al., 1992; Katz, 1993; BDA-Morris, 1994; Saarinen and Vepsalainen, 1994; Esther and Brooke, 1995; Kivijarvi and Saarinen, 1995; Watad, 1995; and Teo and King, 1996).

Esther and Brooke (1995), for example, evaluated the impact of IT/IS on productivity levels, while Katz (1993) employed direct measures of productivity and departmental performance. The BDA (Morris, 1994) evaluated the impact of IT/IS on
general administrative efficiency, while Teo and King (1996) measured the internal efficiency of operations. Saarinen and Vepsalainen (1994) and Kivijarvi and Saarinen (1995) also employed an efficiency measure.

4.3.1.2.2.10. Item eleven: the impact of IT/IS on access to information
If implemented effectively, IT/IS should provide easy access to information almost instantaneously. As such, it is in the area of information provision that IT can have its greatest impact. Kivijarvi and Saarinen (1995) and Law and Gorla (1996) measured the impact of IT/IS on direct access to information, while the BDA (Morris, 1994) surveyed the affect of IT/IS on dental practices’ ability to access information and data. Bergeron et al. (1992) employ two measures of the impact of IT/IS on information access. These are; (1) impact of IT/IS on ease of access to information; and (2) impact of IT/IS on the speed of access to information.

4.3.1.2.2.11. Item twelve: the impact of IT/IS on customer service
Existing research suggests that IT/IS should enable improvements in customer service (Cragg, 1990; Katz, 1993; BDA-Morris, 1994; Watad, 1995; Teo and King, 1996; and Law and Gorla, 1996). Cragg (1990) and Teo and king (1996) used one-item measures to evaluate the impact of IT/IS on customer service, while Law and Gorla (1996) measure improvements in customer interaction. Watad employs a number of items that can be interpreted as measures of customer service. These are; (1) the contribution of IT/IS to improving the quality of products and services; (2) the degree to which IT/IS enables the faster delivery of products/services; (3) how well IT/IS enables an organisation to retain up-to-date information on its customers; and (4) how effectively IT/IS provides customers with information. Finally, Katz (1993) measures
improvements in service levels as a result of IT/IS, while the BDA (Morris, 1994) measure the quality and efficiency of patient care.

4.3.1.2.2.12. Item thirteen: the impact of IT/IS on accounts / cash flow
IT can afford significant benefits in terms of improvements in accounts and cash flow (Hanage and Fuller, 1995). Katz (1993) employs a number of measures in this area, including; (1) the impact of IT/IS on cash flow; (2) the impact of IT/IS on billing; (3) the impact of IT/IS on receivables payment; and (4) changes in customer transaction response times as a result of IT/IS. The BDA (Morris, 1994) also measured the perceived impact of IT/IS on accounts and cash flow.

4.3.1.2.2.13. Item fourteen: the impact of IT/IS on practice image
The impact of IT/IS on the image of an organisation is an area that has been seemingly neglected by existing research. From a review of the literature, only the BDA (Morris, 1994) employed such a measure. While there is little in previous literature to support the inclusion of this measure, information obtained from initial interviews with small firms suggested that for many, IT/IS is seen as an important means of portraying an up-to-date image.

4.3.1.2.2.14. Item fifteen: the impact of IT/IS on workload
The final measure employed is an evaluation of the impact of IT/IS on workload. Watad (1995) alludes to such a measure in his employment of an item that evaluates job pressure/stress and forms part of his Quality of Work Life factor. Bergeron et al. (1992) also include a measure that evaluates changes in users’ work effort as a result of IT/IS use.
4.3.2. Operationalising hierarchy level two: direct drivers of IT/IS implementation success

In this section, variables hypothesised as direct drivers of IT/IS implementation success are operationalised. Once again, these are approached in the same order as in chapter two.

4.3.2.1. IT/IS assessment and acquisition decision issues

4.3.2.1.1. IT/IS Investment

While the difficulties involved in measuring the benefits of IT/IS investment have already been noted, quantifying IT/IS investment itself can prove a daunting task. Indeed, there is an entire research stream devoted to the refinement of such measures (see for example, Brown and Remenyi, 1995). Kaye et al. (1995) describe the costs associated with IT/IS as the "investment iceberg", an analogy which suggests there is more to IT/IS investment than tangible costs such as that of hardware and software. Other costs include maintenance, back-up time, data transfer, archiving and, perhaps most costly in professional practices, loss of fee-earning time.

While such costs are recognised, following interviews with several small firms, obtaining detailed measures was considered improbable. As a result, small firms were asked to report two measures of investment; (1) investment in computer technology (including hardware, software, communications technology and so on) in the last 12 months; and (2) investment in IT maintenance over the last 12 months. An interval scale was given for each measure. Each firms' response was then divided by the number of employees in order to calculate IT/IS investment per employee and IT/IS maintenance investment per employee. These were then combined to give an
overall score of IT/IS investment per employee. This provided a standardised IT/IS investment measure, independent of organisation size.

4.3.2.1.2. IT/IS sophistication & coverage
On the basis of the literature review, it was hypothesised that the level of IT/IS sophistication and coverage within an organisation would positively influence measures of IT/IS implementation success. As a result, the current research included items that measured the level of technology deployed within professional SMEs.

Respondents were asked to state the technology that they used within their organisation as well as the functions that were computerised. The development of a software coverage scale was appropriated and adapted from the work of Cragg (1990), Kagan et al. (1990) and Raymond (1987) using this information. The three observed measures developed include: (1) an organisation’s applications portfolio; (2) its sophisticated applications portfolio; and (3) the number of functional areas computerised within the organisation. The rationale behind the choice of these measures and their development is discussed as follows.

4.3.2.1.2.1. Applications portfolio
Applications portfolio represents a measure of the number of applications implemented within an organisation, and is appropriated from Raymond (1987). The measure formed a component in his empirical study of management information systems sophistication in small business. In the current research, firms were asked to report the number of different applications used. Positive responses were then totalled to give an overall applications portfolio score for each firm.
4.3.2.1.2.2. Sophisticated applications portfolio

This measure is derived from the work of Cragg (1990) and Kagan et al. (1990). Cragg’s study identified that, while the number of applications affords a measure of IT/IS coverage and, to a degree, sophistication, the number of sophisticated applications is a more precise measure. Cragg also asserts sophisticated applications are more likely to support decision making within an organisation and thus have a greater impact.

The codifying of applications into sophisticated and unsophisticated applications is based on the work of Cragg (1990) and Kagan et al. (1990). Cragg provides a table of codified software, while Kagan et al., using the results of survey data obtained from IS professionals, developed an IT/IS sophistication index in which various applications were given a level of sophistication score ranging from 0-10. On the basis of the codification employed by Kagan et al. and Cragg, applications used by respondents in the current study were codified as sophisticated and unsophisticated.

Table 4.6 presents those software applications identified as sophisticated for each profession included in the study. A sophisticated applications portfolio score was calculated for each firm by totalling the number of sophisticated applications that they reported using.
Table 4.6. Software applications codified as sophisticated by profession

<table>
<thead>
<tr>
<th>Architecture</th>
<th>Dentistry</th>
<th>Law</th>
<th>Veterinary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design (CAD)</td>
<td>Spreadsheet applications</td>
<td>Legal forms</td>
<td>Spreadsheet applications</td>
</tr>
<tr>
<td>Surveying</td>
<td>Client database</td>
<td>Computerised specialisms</td>
<td>Client database</td>
</tr>
<tr>
<td>Electronic diary</td>
<td>Fee calculation</td>
<td>Document management / text retrieval</td>
<td>Fee calculation</td>
</tr>
<tr>
<td>Fee calculation and costing</td>
<td>Completing FP17DCs</td>
<td>Text assembly</td>
<td>Computer linked</td>
</tr>
<tr>
<td>Desktop publishing</td>
<td>Intra oral photographs</td>
<td>Client reminder system</td>
<td>Imaging equipment</td>
</tr>
<tr>
<td>Spreadsheet applications</td>
<td>Patient reminder system</td>
<td>Electronic diary</td>
<td>Client reminder system</td>
</tr>
<tr>
<td>Client database</td>
<td>Electronic diary</td>
<td>Desktop publishing</td>
<td>Electronic diary</td>
</tr>
<tr>
<td>Computer design</td>
<td>CD ROM (library facilities)</td>
<td>Voice input systems</td>
<td>CD ROM (library facilities)</td>
</tr>
<tr>
<td>walkthroughs</td>
<td>Clinical charting</td>
<td>Spreadsheet applications</td>
<td>Clinical charting</td>
</tr>
<tr>
<td>Videoconferencing</td>
<td>Clinical records</td>
<td>Client database</td>
<td>Clinical records</td>
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<tr>
<td>CD ROM (library facilities)</td>
<td>Stock control</td>
<td>Document imaging</td>
<td>Stock control</td>
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<tr>
<td>Document imaging</td>
<td>Desktop publishing</td>
<td>Videoconferencing</td>
<td>Desktop publishing</td>
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<td>Plotting</td>
<td>Internal e-mail</td>
<td>CD ROM (library facilities)</td>
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<td>External e-mail</td>
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(Acknowledging Cragg, 1990 and Kagan et al., 1990)

4.3.2.1.2.3. Number of functional areas computerised

This third measure is also based on a measure devised by Cragg (1990) and looks at the number of functional areas within an organisation that employ information technology. In focusing upon the manufacturing sector, Cragg selects six functional areas including; (1) production; (2) design; (3) costing; (4) office administration; (5) marketing; and (6) financial management. A functional area score was then calculated by determining how many functional areas were aided by computer. This was determined by allocating each application to one or more functional areas.

The current study employs Cragg’s methodology as a point of departure, selecting different functional areas due to its focus on small service firms as opposed to manufacturing organisations. It also adds areas such as communications and reference facilities that have been enabled by product developments reaching the mainstream IT market since Cragg’s study. Eight functional areas are selected; (1)
profession-specific functions; (2) office administration; (3) marketing; (4) costing; (5) financial administration; (6) financial planning; (7) communications; and (8) professional reference functions.

**Table 4.7. Classification of software application into functional areas**

<table>
<thead>
<tr>
<th>Functional area</th>
<th>Architecture applications</th>
<th>Dental applications</th>
<th>Law applications</th>
<th>Veterinary applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Profession-specific function</strong></td>
<td>Design</td>
<td>Intra oral photographs</td>
<td>Legal forms</td>
<td>Computer linked imaging equipment</td>
</tr>
<tr>
<td></td>
<td>Surveying</td>
<td>Clinical charting</td>
<td>Document management / text retrieval</td>
<td>Clinical charting</td>
</tr>
<tr>
<td></td>
<td>Computer design</td>
<td>Clinical records</td>
<td>Computerised specialisms</td>
<td>Clinical records</td>
</tr>
<tr>
<td></td>
<td>walkthroughs</td>
<td></td>
<td>Text assembly</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plotting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Office Administration</strong></td>
<td>Word processing</td>
<td>Completing FP17DCs/ quotations</td>
<td>Word processing</td>
<td>Electronic diary</td>
</tr>
<tr>
<td></td>
<td>Electronic diary</td>
<td>Electronic diary</td>
<td>Electronic diary</td>
<td>Database</td>
</tr>
<tr>
<td></td>
<td>Database</td>
<td>Word processing</td>
<td>Database</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Document imaging</td>
<td>Database</td>
<td>Document imaging</td>
<td></td>
</tr>
<tr>
<td><strong>Marketing</strong></td>
<td>Desktop publishing</td>
<td>Patient reminder system</td>
<td>Client reminder system</td>
<td>Desktop publishing</td>
</tr>
<tr>
<td></td>
<td>Database applications</td>
<td>Desktop publishing</td>
<td>Desktop publishing</td>
<td></td>
</tr>
<tr>
<td><strong>Costing</strong></td>
<td>Fee calculation and costing</td>
<td>Fee calculation and costing</td>
<td>Fee calculation and costing</td>
<td>Fee calculation and costing</td>
</tr>
<tr>
<td><strong>Financial administration</strong></td>
<td>Maintaining client accounts and billing</td>
<td>Maintaining client accounts and billing</td>
<td>Maintaining client accounts and billing</td>
<td>Maintaining client accounts and billing</td>
</tr>
<tr>
<td></td>
<td>Recording and handling client payments</td>
<td>Recording and handling client payments</td>
<td>Recording and handling client payments</td>
<td>Recording and handling client payments</td>
</tr>
<tr>
<td></td>
<td>Accounts</td>
<td>Accounts</td>
<td>Accounts</td>
<td>Accounts</td>
</tr>
<tr>
<td></td>
<td>Wages</td>
<td>Wages</td>
<td>Wages</td>
<td>Wages</td>
</tr>
<tr>
<td><strong>Financial Planning</strong></td>
<td>Spreadsheet applications</td>
<td>Spreadsheet applications</td>
<td>Spreadsheet applications</td>
<td>Spreadsheet applications</td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td>Videoconferencing</td>
<td>Access to WWW</td>
<td>Videoconferencing</td>
<td>Access to WWW</td>
</tr>
<tr>
<td></td>
<td>Access to WWW</td>
<td>Internal e-mail</td>
<td>Access to WWW</td>
<td>Internal e-mail</td>
</tr>
<tr>
<td></td>
<td>Internal e-mail</td>
<td>External e-mail</td>
<td>Internal e-mail</td>
<td>External e-mail</td>
</tr>
<tr>
<td></td>
<td>External e-mail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Professional reference function</strong></td>
<td>CD ROM (library facilities)</td>
<td>CD ROM (library facilities)</td>
<td>CD ROM (library facilities)</td>
<td>CD ROM (library facilities)</td>
</tr>
</tbody>
</table>

*(Based upon Cragg, 1990)*

As in Cragg’s study, the functional area score was determined by analysing software use within each firm and identifying which areas were aided by computers. The
classification of software into functional areas is shown in table 4.7. Using the allocations shown in the table, a score was calculated for each organisation based upon the number of functional areas that were aided by computers.

4.3.2.1.3. Planning and formalisation in the IT/IS assessment and acquisition process

A review of the literature suggested that the higher the level of planning and formalisation in the assessment and acquisition process, the greater the chances of IT/IS implementation success. As a result, the level of organisational planning and formalisation is included as a variable in the current study.

Five main stages of the IT/IS assessment and acquisition process were identified from the literature. These are; (1) IS planning; (2) evaluation of existing IT/IS; (3) written statement of requirements; (4) cost-benefit analysis; and (5) post-purchase evaluation of benefits resulting from an IT/IS purchase (Huff and Munro, 1985; Lees, 1987; Montazemi, 1988b; Cragg, 1990; Chau, 1995; Doukidis et al., 1996; Proudlock et al., 1998). These were then reproduced as 5-point Likert-type scales measuring the degree to which each stage was formally undertaken.

4.3.2.1.4. Level of employee involvement

The level of employee involvement in IT/IS assessment and adoption is measured using a one-item instrument. Developed for the current study, the measure has its theoretical underpinnings in the work of Lees and Lees (1987). Respondents are required to record the level of employee involvement on a 3 point scale ranging from "not involved" to “closely involved".
4.3.2.1.5. IT/IS Training
While it was argued that interaction with IT/IS via the acquisition process is fundamental to the accruement of knowledge in terms of the assessment and adoption of IT/IS, the level of IT/IS training undertaken in an organisation has also been shown to influence performance measures ranging from user information satisfaction to financial performance measures. Measures used to evaluate investment in IT/IS training include; (1) percentage of IT budget invested in IT training (e.g. Mahmood and Mann, 1993; Byrd and Marshall, 1997); (2) number of hours spent undertaking IT training (Delone, 1988); and (3) employees perception of the level of training they have had (Montazemi, 1988b).

The current study employed three measures based on the research of Martin (1989). Martin’s measure evaluated the number of formal training days managers spent learning about IT. This measure is appropriated by the current study and represents the basis for two further measures; (1) average number of days spent on IT/IS training per partner and associate (over the last 12 months); and (2) average number of days spent on IT/IS training per member of administrative and support staff (over the last 12 months).

4.3.2.1.6. External Support for IT/IS assessment and acquisition
4.3.2.1.6.1. Consultant effectiveness
Thong et al. (1994) developed a four-item measure of consultant effectiveness. Items measured include; (1) effectiveness in performing an information requirements analysis; (2) effectiveness in recommending a suitable computerisation solution; (3) effectiveness in managing implementation; and (4) consultant relationship with other parties in the project. Two further items were added in the current study; (1) the
ability of the consultant to understand the firm’s business needs; and (2) overall consultant effectiveness. Both are based upon the work of Lees and Lees (1987).

4.3.2.1.6.2. Vendor effectiveness

The measure of vendor effectiveness employed in the current study is also based upon that developed by Thong et al. (1994). Their measure comprised of six items; (1) adequacy of technical support during IT/IS implementation; (2) adequacy of technical support after IT/IS implementation; (3) quality of technical support; (4) adequacy of training provided; (5) quality of training provided; and (6) relationship with other parties in the project. In the current study, the measure employed by Thong et al. was condensed and five further items added.

As Thong (1994) asserts, vendors can provide consultancy advice to small firms as effectively as consultants can. Hence, an item evaluating vendor ability to recommend a suitable IT/IS solution was added to the measure. As in the above measure, an item measuring vendor ability to understand the firm’s business needs was also added, as was an overall measure of vendor effectiveness. Two further items were also added; (1) an evaluation of the vendor’s response/turnaround time (Montazemi, 1988b); and (2) adequacy of documentation provided by the vendor (Farhoomand and Hrycyk, 1985).

4.3.2.2. Management IT/IS characteristics

4.3.2.2.1. Level of management support for IT/IS

A measure evaluating the owner/partner’s attitude towards IT/IS was developed for the questionnaire. Using Bird’s (1992) measure as a point of departure, the item was worded so as to obtain the owner/partner’s attitude towards the role that IT/IS can
play in an organisation (and not just their own practice). As such a four scale question was employed asking whether the respondent perceived IT/IS to be; (1) fundamental to the success of a firm; (2) important to the success of a firm; (3) supportive to a degree; or (4) largely peripheral to the running of an organisation.

4.3.2.2.2. Management IT/IS experience

According to Mata et al. (1995, p.499), 'managerial IT skills are often developed over long periods of time through the accumulation of experience by trial and error learning. Skills developed in this way are called "learning by doing" skills... Managerial skills in many cases are tacit and may involve hundreds and thousands of small decisions that cannot be precisely imitated.' Three important categorizations of IT/IS experience are here raised by Mata et al. First of all, management IT/IS experience is dependent upon the interaction of management with IT over time. Secondly, the number of interactions with IT (or the number of decisions made) are an important aspect of the experience gaining process. Thirdly, hands-on interaction is necessary in terms of "learning by doing". The gaining of experience and knowledge is contingent upon management learning from a previous interaction with IT/IS and moderating future behaviour as a result. In other words, learning from previous interaction must take place in order for useful knowledge and experience to accrue.

These concepts are taken into account in the development of a measure of management IT/IS experience. As a result, the measure employed in the current study has its basis in the research of Martin (1989), Fuller and Jenkins (1994) and Cragg (1990). Martin employed a three-item measure of top manager's previous computer and IS exposure. Items measured; (1) levels of formal IT/IS training; (2) previous
direct (hands-on) computer experience; and (3) level of previous managerial experience. These three measures were appropriated for the current study.

Two further measures were also used. Fuller (1996) and Proudlock et al. (1998) found that interaction with IT/IS (in terms of iterative IT developments) was critical in contributing to the accruing of IT/IS experience. As such, two measures indicating several developmental interactions with IT were developed. These include an item inquiring whether a firm had changed its approach to IT/IS acquisition, and a further item obtaining information on a firm's level of IS development (i.e. whether it is using its first computer or whether its IS had undergone developments or renewal since initial computerisation). These were deemed to be more effective as measures of experience than more straightforward measures such duration of IT/IS use (which do not afford any information on IS evolution) as proposed by Cragg (1990).

4.3.2.3. Organisational characteristics and resources

4.3.2.3.1. Organisation size
Organisation size was measured as the total number of full time personnel employed by an organisation.

4.3.2.3.2. Perceived organisation IT/IS knowledge
A one-item measure was developed in order to evaluate perceived in-house IT/IS knowledge within each firm. Firms were asked to rate themselves on a 5-point scale ranging from "highly knowledgeable" to "highly unknowledgeable".

4.3.2.3.3. Dedicated IS personnel
A straightforward item measuring the employment of dedicated IS personnel was included in the questionnaire. The item asked whether any staff were employed
whose sole responsibility is for the acquisition and maintenance of IT/IS within the organisation.

4.3.3. Operationalising hierarchy level three: indirect drivers of IT/IS implementation success

In the previous section, variables hypothesised as direct drivers of IT/IS implementation success were operationalised. A number of variables which form part of level two also play a part in level three. As a result, a number of level three variables have already been operationalised. In the following section, the remaining variables (i.e. those that are identified solely as indirect drivers of IT/IS implementation success) are operationalised.

4.3.3.1. IT/IS learning

The literature review illustrated the importance of organisational learning in the IT/IS assessment and adoption process. Knowledge accrued from interaction with IT was seen as fundamental to improved future IT/IS developments. However, organisational learning can prove a difficult phenomenon to measure. Most research into learning involves case study based or qualitative research (e.g. Naylor and Williams, 1994; Henderson and Lentz, 1996; Fuller, 1996; Proudlock et al., 1998). Few quantitative measures of organisational learning regarding IT/IS assessment and adoption exist. As such, it is necessary to develop a measure for the current study.

In devising such a measure, Beach’s (1980) definition of learning as “the human process by which skills, knowledge, habit and attitudes are acquired and altered in such a way that behaviour is modified” proves a valuable theoretical basis. The important indicator that some form of learning has taken place, it is here
proposed, is the presence of modified behaviour resulting from previous interaction with IT/IS. On this basis, a three-item measure of learning was developed, evaluating whether interactions with IT/IS had resulted in organisations changing their approach to (1) IS planning; (2) IT/IS acquisition and management; and (3) responsibility for computer decisions.

4.3.3.2. Perceived stability of the business environment
It is hypothesised that the degree to which small firms undertake planning is influenced by management perception of the stability of the business environment. As such, a three-item measure was developed in order to test this hypothesis. The three items included questions on; (1) the stability of the firm's business environment; (2) whether the firm has sufficient customers/clients; and (3) how far ahead the firm feels it can plan with confidence.

4.3.3.3. Investment capability of the organisation
Chapter two showed the level of financial resources available to influence a number of variables, including; (1) the level of investment in IT/IS; (2) IT/IS sophistication and coverage; (3) the level of investment in IT/IS training; and (4) the employment of external support. Yap et al. (1992) measured the availability of financial resources as the amount of resources allocated for IT/IS investment. Using level of IT/IS investment as a surrogate measure of the availability of financial resources is deemed inappropriate, as, as previous research has shown, the level of IT/IS investment is also influenced by other factors, such as management support for IT/IS. Instead, a “soft” measure of the current profitability of the organisation has been chosen as an indication of its investment capability. It is proposed that in firms that are more profitable, increased resources will be available. Organisations were asked to record
their profitability on a four-point Likert scale ranging from "very profitable" to "losing money".

4.4. Summary and conclusions

The current chapter has given an account of the process of moving from the theoretical research domain to the operational domain. In making this transition, the theoretical model presented at the end of chapter two is operationalised in such a way that data can be collected in survey form in order to enable exploratory evaluation, refinement and, ultimately, confirmatory testing of the model. Churchill's (1979) paradigm for developing measures was presented and his guidelines followed. The presentation of the paradigm also enables the contextualisation of each stage of the operationalisation of measures.

In practical terms, the transition from the theoretical domain to the operational domain was made by selecting measurement items that have been employed in existing research, and have been deemed valid measures of the concepts that are to be measured. Where measures are either inappropriate or unavailable, the development of measures was undertaken. An insight into the appropriateness of measures was also obtained through interviews undertaken within twelve small firms.

The main body of the current chapter has focused upon the theory and rationale underpinning the measurement items used in the questionnaire. The next step in the research concerns the collection and examination of data that measures the concepts hypothesised to play a role in the theoretical model. The data collection process is described in the following chapter.
Chapter Five - Data Collection and Examination

5.1. Introduction

The previous chapter described the transition from the theoretical domain (where concepts are latent and unmeasurable) to the operational domain (where measurable constructs have been developed for each variable). This transition involved the selection of appropriate measurement items from existing literature with insight afforded by interviews undertaken in twelve small firms. The end-product is a survey instrument designed to evaluate the theoretical model presented at the end of chapter two.

The current chapter focuses upon stages 3-5 of Churchill’s (1979) paradigm; (3) data collection using a pilot survey; (4) improvement of the survey instrument in the light of the pilot survey; and (5) primary data collection. The pilot questionnaire was sent to two hundred small firms after which evaluation was undertaken in terms of both the response rate and reasons for non-completion. This chapter describes this process as well as how the findings were implemented in the improvement of the primary (exploratory) questionnaire. The final section of the chapter examines the sample in order to evaluate its generality to the intended population. The data are also examined in order to assess their congruence with the assumptions that must be met in order to apply structural equation modelling as the preferred model development and evaluation technique.

The chapter begins with the definition and description of the population and sample studied.
5.2. Subject profile

5.2.1. The population

As stated, the use of information systems to improve operations and achieve competitive advantage is expected to be particularly important in information-intensive firms (Porter and Millar, 1985). A category of firms that clearly falls within this definition is professional practices. These firms, such as consultancies and law firms, are staffed by a high proportion of professionally qualified staff and rely upon their knowledge and information to attract clients and perform their tasks. Furthermore, as a population, they remain under-researched, especially when compared with other industry sectors, such as manufacturing. The majority of such firms are also small in size (Electronic Yellow Pages Database, 1997; 1999), again an under-researched area. For these reasons, small professional service organisations were our chosen population.

5.2.2. The sample

The primary aim of the research is to develop a model that reflects processes and interactions which occur in small professional practices. Resource conditions exist, however, under which the research must operate. Specifically, funding was provided for the collection of data from four professions. The intention was thus to select four professions which it is intended, afford a comparatively balanced view of processes in small professional practices as a group.

The professions chosen were; (1) architecture; (2) dentistry; (3) law; and (4) veterinary. As stated, each profession is recognised as staffed by highly educated individuals. Within that, two of the professions; (1) dentists; and (2) veterinarians; are
tool users and would be expected to be aware of technical developments and the application of technology within their field. The second two professions; (1) architects; and (2) solicitors; can also benefit significantly from the application of IT/IS. Developments such as computer aided design (CAD) enables the architect to re-use standard components and designs without having to re-draw them, thus saving time (Yetton et al., 1994). The law profession is verbal-based and word-processor software, speech recognition packages, and case management software can save significant amounts of money in terms of time saved and reductions in employee costs (Sanctosus, 1995). Generic similarities are also apparent between the four professions with all four depending on their ability to capture clients, and provide an acceptable level of service thereafter. Because of the properties inherent within each profession, it was felt that collectively, they would afford a rounded picture of decision-making and processes within small professional practices as a whole.

It is accepted given the resource constraints which limit the number of professions from which information can be sought, that the generality of the findings may be limited. No claims are made regarding the precision of findings to specific professions. Such analysis is outside the remit of the current study. Nor are any bold claims made that the four professions selected provide an exact account of conditions and processes that can be directly generalised to small professional service firms as a population. The primary objective of the research is to identify those factors that appear strong and consistent in their influence over the way and success with which IT/IS is implemented across a cross-section of professions. It is hoped that in identifying generic conditions and factors which influence the IT/IS implementation process in the group of professions selected, the findings are as generalisable to the intended population as is possible given the conditions of the research.
Finding a balance between acceptable cost and the most suitable method is often difficult. Ideally, in order to generalise findings to the small professional service sector in its entirety, a sample including all professions within the small professional service sector in exact proportions relative to the profession profile statistics is the ideal. However, such an approach is impossible given the conditions of the current research study. While funding significantly facilitates data collection from the four professions selected, it also limits the scope of the research in terms of the number of professions that can be studied. The issue of generality is approached throughout the current chapter and reviewed in the final chapter.

5.2.3. Definition of small

The research focuses upon small organisations, again an under-researched area. There are, however, many definitions of small. The committee of inquiry on small firms (Bolton, 1971) based their definition upon three principal factors. They stated that to be defined as small; (1) an organisation must have a relatively small share of the market; (2) owner management must predominate, with no outside control; and (3) the organisation should not form part of a larger enterprise. This is supported by the Small Business Administration’s definition, which is, according to Peterson et al. (1986), the most widely used definition in small business research.

In terms of the number of employees permitted for an organisation to be defined as small, the inquiry on small firms committee imposed an upper limit of 200. However, this figure remains open to debate. The European Observatory for SMEs defines such enterprises as having less than 250 employees. Within this definition, the following main size-classes are distinguished:
1. very small enterprises (which employ less than 10 employees);
2. small enterprises (those employing between 10 and 49 employees);
3. medium sized enterprises (those which employ between 50 and 249).

While such definitions prove useful in a number of sectors, it is proposed that different size definitions are needed in the context of professional service sector research. This is supported by Keeble et al. (1992), who offer a definition of small for the professional service sector which differs significantly from the definitions described above.

‘...there is considerable consensus amongst executives and professional association representatives as to what constitutes a “small” rather than a “large” firm. Small firms are seen as employing no more than about 10 professional staff. This roughly equates to a maximum of 25 total staff, and a 1989 turnover of £1 million. The great majority of firms below this size are also independently owned and managed, in line with the functional criteria of “smallness” proposed by Bolton (1971).’ (Keeble et al., 1992, p.12)

Keeble’s definition is employed as the foundation for the selection of participants. Thus, in the current study a maximum organisational size of 25 employees was used to define participants. Demographic profile statistics for specific professions (Yellow pages database, 1997), indicate such a definition to include the majority of organisations within each profession (see table 5.1). While the size categorisations differ slightly thus making direct comparisons more difficult, it is evident from the chart that only a small minority of organisations employ more than 25 employees.
Table 5.1. Profession size profile statistics

<table>
<thead>
<tr>
<th>Profession</th>
<th>Practice size</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-5</td>
<td>6-10</td>
</tr>
<tr>
<td>Architects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>3,647</td>
<td>1,056</td>
</tr>
<tr>
<td>% within profession</td>
<td>69%</td>
<td>20%</td>
</tr>
<tr>
<td>Dentists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>5,356</td>
<td>3,044</td>
</tr>
<tr>
<td>% within profession</td>
<td>58%</td>
<td>33%</td>
</tr>
<tr>
<td>Solicitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>5,260</td>
<td>3,022</td>
</tr>
<tr>
<td>% within profession</td>
<td>46%</td>
<td>26%</td>
</tr>
<tr>
<td>Veterinarians</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>1,474</td>
<td>778</td>
</tr>
<tr>
<td>% within profession</td>
<td>53%</td>
<td>28%</td>
</tr>
</tbody>
</table>

(Source: Yellow Pages Database, 1997)

5.3. Data collection

The data collection process is divided into three stages as recommended by Churchill (1979). The first stage involves the collection of data using a pilot survey. This enables any problems with the instrument to be resolved (stage two) prior to the mailing of the primary (exploratory) survey (stage three). The three stages are described in this section.

5.3.1. Stage one: the pilot survey

The pilot questionnaire was mailed to 50 practices from each of the four selected professions. This was undertaken in June 1997. Firm addresses were downloaded from the Electronic Yellow Pages Internet site, reformatted and printed onto labels. Firms in Surrey were chosen as the initial test sample. Four independent searches were performed for each of the four professions within the Surrey county boundaries as defined by the search facility in-built into the electronic yellow pages. The first 50 addresses (arranged in alphabetical order) of each profession were then downloaded.
A separate file was stored in which each firm’s address was allocated a reference number. This number was also placed on the top of right hand corner of each questionnaire so that it would be possible to identify which firms had failed to return their questionnaire. Respondents did not, therefore, have to write the name of their firm on the questionnaire and they were also assured that all data would be treated anonymously. In some cases, the addresses that were downloaded included the name of a senior partner within the firm. However, for the majority of practices, no contact was given.

5.3.1.1. The pilot survey package

Each firm was mailed a questionnaire (see appendix 5.1) with a cover letter attached. This was mailed in an A4 envelope with the address printed on Avery labels.

5.3.1.2. The pilot survey response

The overall response to the pilot survey was poor. Precise figures are shown in table 5.2.

Table 5.2. Response rate for the pilot survey

<table>
<thead>
<tr>
<th>Profession</th>
<th>Questionnaires Mailed</th>
<th>Questionnaires Returned</th>
<th>Response Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>50</td>
<td>4</td>
<td>8%</td>
</tr>
<tr>
<td>Dentistry</td>
<td>50</td>
<td>3</td>
<td>6%</td>
</tr>
<tr>
<td>Law</td>
<td>50</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Veterinary</td>
<td>50</td>
<td>5</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>14</td>
<td>7%</td>
</tr>
</tbody>
</table>

The questionnaire was also employed in order to obtain additional data not used for the purposes of the doctoral research.
5.3.1.3. Feedback from the pilot survey

Two weeks following the pilot survey mailing shot, follow-up phone calls were made to all firms that had failed to respond. The primary objective of the phone calls was to identify barriers to the completion and return of the questionnaire. The underpinning aim was to remove those barriers by applying feedback information and hence increase the response rate of the primary survey. Chart 5.1. indicates the main reasons for firms failing to return their questionnaires.

**Chart 5.1. Reasons for not returning questionnaire**

- Not enough time
- Questionnaire fatigue
- Potential respondent on holiday
- In return post
- Inappropriate questions
- Language too technical
- Questionnaire length
- Not received
- No IT
- No SAE
- Will complete
- Other

Twenty per cent of firms did not give reasons for failing to return the questionnaire due to being out of the office or not returning our call. In several cases the phone contact was not the intended respondent and it was difficult to access the intended respondent, as they were fee earning. When the intended respondent was available,
significantly more information was gleamed as to why questionnaires were not returned. Further, it is assumed here that all contacts gave an honest response. However, it is plausible that in a number of cases, potential respondents created reasons for not returning the questionnaire (such as it had not yet arrived) when in actual fact they had discarded it.

5.3.1.4. Issues derived from feedback

Several main points arose from the follow-up phone calls. These were;

1. The partners within firms were too busy to complete the questionnaire. They earn fees on a time basis, and therefore anything that reduces the amount of fee-earning time is considered unproductive.

2. The language used in the questionnaire was too technical. One respondent did not understand what information technology or information systems were. It was plausible that others felt the same but were embarrassed to admit it.

3. Several partners thought that the questionnaire was targeted at larger firms due to the wording or content of some of the questions.

4. Less potential respondents than expected complained about the length of the questionnaire. However, this was obviously still a problem and no doubt accounts for people claiming to be too busy to complete it.

5. A significant proportion of target firms claimed that they had not received the questionnaire.

6. A number of firms had no, or very little, computerisation. These firms believed that they had little information to offer.

7. A small number of firms suggested that a SAE would have encouraged them to return the questionnaire.
5.3.2. Stage two: improving the survey instrument

On the basis of the feedback, a new strategy was devised for the main mailshot. This is described below.

5.3.2.1. Mailing process

It was proposed following the pilot survey that an increased response rate would be obtained if firms were contacted by phone prior to the mailing of the questionnaire. As a result this approach was adopted and phone calls were made to firms in order to obtain their consent prior to the mailing of the questionnaire. The phone contact was used to explain the purpose of the questionnaire, its content and how long it would take to complete. It was deemed vital that the person answering the questionnaire was knowledgeable regarding the running of the practice. As a result, phone calls were targeted at the practice or office manager. Some smaller practices did not have a practice or office manager and in such cases phone calls were targeted directly at senior partners within the practice.

5.3.2.2. Intended respondent within the organisation

While office or practice managers were targeted via phone calls (it was assumed that in most cases, partners would be engaged fee earning), questionnaires were targeted at partners as it was presumed that they would be most knowledgeable regarding the running of their practice (Doukidis et al., 1994). Thus, the phone contact was not only a means of gaining the consent of firms, it was also used to obtain the name of a partner within each organisation who would be willing to complete and return the questionnaire. The questionnaire was thus addressed to the contact name obtained.
5.3.2.3. Questionnaire and cover letter content

The language used in the questionnaire was simplified (see appendix 5.2). All references to 'information technology' or 'information systems' were changed to 'computer technology' or 'computer systems' in order to make the questions as approachable as possible. Questions that could be interpreted as being directed at larger firms were also reworded where possible.

The cover letter included an additional paragraph explaining that in order to obtain complete data it was necessary to ask questions that might not seem suited to certain firms. Respondents were further instructed that a number of tick-box options were available, one of which should be appropriate for their individual firm's situation. It was believed that this paragraph should prevent respondents from thinking that the questionnaire was inappropriate for their firm.

Finally, a freepost, addressed envelope was included in the package to facilitate the return of the questionnaire for the respondent.

5.3.3. Stage three: primary data collection (the exploratory survey)

Stage two focused upon improvements to the survey instrument. In stage three, the primary data collection procedure is presented and the response evaluated. In particular, this section focuses upon the development of a sample plan. According to Deming (1960, p.25), the aim of data collection is to "get useful information at the right time, and to hold the sampling error to an acceptable margin...These aims require the use of theory."

"Theory teaches us (a) what we need to know about a material in order to sample it properly; and (b) about what precision to expect from a proposed sampling plan. With the aid of theory, one can discover a number of sampling procedures, all valid
and all able to deliver the required precision, but with differing costs. A rational choice is then possible on the basis of cost and smoothness of operation under existing conditions.” (Deming, 1960, p.25)

The development of a sample plan is guided by the step-by-step approach recommended by Burns and Bush (1998). This is illustrated in figure 5.1.

**Figure 5.1. Steps in the sampling process**

1. Define the relevant population
2. Obtain a "listing of the population"
3. Design the sample plan
4. Draw the sample
5. Validate the sample
6. Resample, if necessary

(Source: Burns and Bush, 1998, p.380)

5.3.3.1. Step one: defining the population

The definition of the population has already been undertaken in section 5.2.1. The target population is small professional practices. Within the population, four professions; (1) architects; (2) dentists; (3) law firms; and (4) veterinarians are selected. Funding was available for the collection of data from four professions. As explained earlier, the four selected professions were chosen as it was proposed that within the constraints placed upon the research, they would afford a rounded (and less
profession-specific) view of IT/IS assessment and acquisition in small professional firms as a whole.

5.3.3.2. Step two: obtaining a “listing” of the population

Due to cost restrictions, the most efficient means of obtaining a population list was via the Electronic Yellow Pages. This enabled the downloading and printing of all addresses for the selected professions. In terms of sample frame error, two primary sources of error arise in selecting this method. Organisations listed which no longer operate are the first source of error, while organisations in operation that are either new or have not yet registered with the Yellow Pages is the second source. It is believed that such error should be kept to a minimum as the Electronic Yellow Pages is updated daily.

5.3.3.3. Step three: designing the sample plan

In chapter three, recommendations regarding the sample size required for the employment of the preferred statistical analysis technique were put forward. The consensus is towards the collection of 200 valid responses. Given the possibility of invalid responses as part of the data collection procedure, it was proposed that a sample size of approximately 300 should be obtained for the purposes of the current study. In order to achieve a final target sample of 300 responses, oversampling was deemed necessary. The consent of 600 organisations (accounting for a potential attrition rate of 50%) was sought (via pre-mailing phone calls). Oversampling also formed an integral part of the generation of a list employed to contact the firms. A list of 200 organisation names and addresses for each profession was produced.
Due to its “economic efficiency” (Burns and Bush, 1998, pp.368-369), systematic sampling was selected as the preferred sampling technique. According to Burns and Bush, “systematic sampling can be applied in a shorter time period than can simple random sampling. Furthermore, in many instances, systematic sampling has the potential to create a sample that is almost identical in quality to samples created from simple random sampling.” In spite of being simpler, less time consuming and less expensive than random sampling, systematic sampling is also less representative than random sampling because it arbitrarily places population members into groups before the sample is selected (Burns and Bush, 1998). Nonetheless, according to Burns and Bush (p.370), “the small loss in sample precision is more than counterbalanced by the economic savings.”

In practice, a skip interval (population list size/sample size) was calculated for each profession list. Furthermore, sufficient randomness is built into the system in terms of its starting point (alphabetically) for each list. Electronic Yellow Pages listings begin at random entry points within the alphabet so that there is no bias towards any particular business resulting from the letter of the alphabet with which their company name begins (yell.co.uk/yp/eypfaq.html). The end result is a systematic sample of organisations for each profession. Each organisation selected was tagged so as to avoid repetition in the selection of the second target sample (see chapter eight).

5.3.3.4. Step four: drawing the sample

Firms were contacted by phone until 150 from each profession had given their consent to posting the questionnaire and had given the name of the partner or practice manager within the organisation to whom the questionnaire should be mailed. The
names and addresses of firms agreeing to participate were formatted onto Avery labels and the questionnaires posted first class. Where firms did not give their consent to the mailing of the questionnaire, a drop-down substitution system was employed (see Burns and Bush, 1998).

An A4 envelope was mailed first class to each firm that had agreed to participate. The envelope contained a questionnaire, a cover letter, and a freepost addressed envelope for respondents to return their questionnaire.

5.3.3.5. Step five: validation of the sample

The response rate for the survey is shown in table 5.3. As is evident, the response rate is considerably better than that achieved for the pilot survey. This suggests that the improvements made to both the survey instrument and the data collection approach added significant value in terms of the data collection outcome.

<table>
<thead>
<tr>
<th>Profession</th>
<th>Questionnaires mailed</th>
<th>Questionnaires returned</th>
<th>Final response rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>150</td>
<td>71</td>
<td>47.3%</td>
</tr>
<tr>
<td>Dentistry</td>
<td>150</td>
<td>66</td>
<td>44.0%</td>
</tr>
<tr>
<td>Law</td>
<td>150</td>
<td>51</td>
<td>34.2%</td>
</tr>
<tr>
<td>Veterinary</td>
<td>150</td>
<td>82</td>
<td>54.3%</td>
</tr>
<tr>
<td>Total</td>
<td>600</td>
<td>270</td>
<td>45.0%</td>
</tr>
</tbody>
</table>

Table 5.4 compares the response profile of respondents with profession profile statistics in terms of practice size. Due to the differences in size categories from 11 employees upwards between the profession profile (Yellow pages database, 1997) and the sample profile, direct comparisons are difficult.
Table 5.4. A comparison of sample and profession profiles

<table>
<thead>
<tr>
<th>Profession</th>
<th>Practice size</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-5</td>
<td>6-10</td>
</tr>
<tr>
<td>Architects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile</td>
<td>3,647</td>
<td>69%</td>
</tr>
<tr>
<td>Sample profile</td>
<td>52</td>
<td>74%</td>
</tr>
<tr>
<td>Dentists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile</td>
<td>5,356</td>
<td>58%</td>
</tr>
<tr>
<td>Sample profile</td>
<td>37</td>
<td>56%</td>
</tr>
<tr>
<td>Solicitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile</td>
<td>5,260</td>
<td>46%</td>
</tr>
<tr>
<td>Sample profile</td>
<td>19</td>
<td>37%</td>
</tr>
<tr>
<td>Vets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile</td>
<td>1,474</td>
<td>53%</td>
</tr>
<tr>
<td>Sample profile</td>
<td>20</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>Small firm profile</td>
<td>15,737</td>
</tr>
<tr>
<td>Sample profile</td>
<td>128</td>
<td>48%</td>
</tr>
</tbody>
</table>

(Source for profession profile statistics: Yellow Pages database, 1997)

As indicated in table 5.4, there is a skew towards larger firms within the sample. A chi-square test undertaken on the overall profession and sample size profiles indicates this difference to be significant (p = .00). While error is inherent in this finding due to size codification differences, its magnitude suggests that the difference will remain significant even if exact comparisons were possible.

A possible explanation for the tendency towards more larger firms in the overall sample profile than one might expect may be the IT oriented nature of the questionnaire. Research has shown that in the small firm sector, the smallest firms are the last to computerise their functions (Gallup poll of small independent firms, findings reported in CPA Journal, 1997). According to research undertaken by Gallup, 67% of firms with 1-4 employees were computerised in 1997, 87% of firms with between 5 and 9 employees used computers, 94% in firms with 10-19 employees, while 97% of firms with between 20 and 49 employees had implemented
and were using IT. Thus, it is possible that the sample profile statistics are skewed towards larger firms because proportionately fewer firms in the smaller size categories employ IT and consequently, proportionately fewer firms in the smaller size categories are likely to respond.

This makes size profile comparisons even more difficult as like is not being compared with like. The profession profile (Yellow Pages, 1997) affords a profile of all firms in each of the four professions categorised by size, while the sample profile represents a profile of computer users within each profession categorised by size. Because the intended population is computerised small professional firms, and because the profession profiles given in table 5.5 do not include this information, the profession profiles can offer only a guide as opposed to a benchmark that must be met by the sample. It is noted that without specific profile statistics for computer users within each size category for each profession, precise comparisons are impossible. The generality of findings should be approached in this context. At this stage the sample profile in terms of size is regarded as representative of computer users within the small professional practices. This assumption is supported by the findings of research such as that described above (CPA, 1997).

In section 5.4, the data are examined and firms with more than 25 employees omitted. Cases with significant levels of missing data are also omitted. As a result, it is expected that the sample profile may alter further. Consequently, further comment regarding the generality of the data is deemed inappropriate at this point. The generality of the sample is discussed further during data examination.
5.3.3.5.1. Respondent within the organisation

Surveys were targeted specifically at managing partners within organisations as it was assumed that their knowledge of their organisation would be the greatest. If for some reason, they did not have time to complete the questionnaire, it was requested that it be passed onto a practice manager. Chart 5.2 shows the percentage of responses per job title (not including missing data). As is apparent from the chart, managing partners, associates, or partners with a specific interest in IT completed the majority of questionnaires. Thirty percent were delegated to practice managers for completion. As is evident, in the majority of cases where the respondent was identified, the intended respondents within the organisation completed the survey. As such, it is assumed that the information provided is accurate in the picture it affords of decision-making and processes undertaken in the small professional firms surveyed.

Chart 5.2. Percentage of responses by job title

![Chart showing percentage of responses by job title]

N = 152, Missing data, N = 118
5.3.3.6. Electronic data input

The questionnaire was designed in such a way that responses could be read electronically by a scanner and input into a data file. This involved codifying each question using Autodata computer software. Following the scanning of forms, the data file was exported into an SPSS (Statistical Package for Social Sciences) data file and each variable labelled and coded. In order to check the accuracy of the system, 20 completed questionnaires were drawn at random from the final batch and responses were checked against the data in electronic format in the SPSS data file. No discrepancies were identified.

5.4. Examining the data

The preceding section has presented and explained the data collection process. In the remainder of the chapter, the data set is examined in order to assess both its generality and its congruence with the assumptions which must be met in order to apply multivariate techniques. Several steps, based on the systematic approach recommended by Hair et al. (1998), and described by the authors as an “investment in multivariate insurance” (p.39) are undertaken. These involve; (1) missing data analysis; (2) outlier detection; (3) evaluation of normality; and (4) assessment of linearity. In the following sections the techniques employed are explained in turn, prior to their application to the data set.

5.4.1. Omission of firms with over 25 employees

The first stage in the data examination process involves checking that all firms satisfy the sample criteria. In the current study, the definition of a small professional firm put
forward by Keeble et al. (1992) was selected as an appropriate parameter in defining
the organisations that form the sample. Any organisations employing more than 25
staff were omitted. Only a minimal number (n=13) of practices that completed and
returned questionnaires reported employing more than 25 employees.

5.4.2. Missing Data

Hair et al. (1998) define a missing data process as "any systematic event external to
the respondent (such as data entry errors or data collection problems) or action on the
part of the respondent (such as refusal to answer) that leads to missing values." Some
missing data arise through research design and are acknowledged. For example, in
the current questionnaire, one would expect missing data where a firm was asked to
rate its IT/IS consultant, if that firm had not employed consultant services. In such
cases, a response is inapplicable. It is also expected that a number of respondents will
fail to answer questions towards the end of the questionnaire due to questionnaire
fatigue or lack of time. However, missing data also arise for other reasons. These can
range from procedural factors, such as errors in data entry or failure on the part of the
respondent to complete the questionnaire, to other inexplicable causes.

"Missing data are a fact of life in multivariate analysis; in fact, rarely does the
researcher avoid some form of missing data problem. For this reason, the
researcher's challenge is to address the issues raised by missing data that
affect the generizability of results. To do so, the researcher's primary concern
is to determine the reasons underlying the missing data, with the extent of
missing data being a secondary issue in most instances. This need to focus on
the reasons for missing data comes from the fact that the researcher must
understand the process leading to the missing data in order to select the
appropriate course of action." (Hair et al., p.46)
In evaluating whether a remedy for missing data can be applied, the researcher must first ascertain the degree of randomness present in the missing data. This is explained by Hair et al.:

"Assume for the purposes of illustration that two variables (X and Y) are collected. X has no missing data, but Y does have some missing data. If a missing data process is found between X and Y where there are significant differences in the values of X between cases for Y with valid and missing data, then the missing data are not at random. Any analysis must explicitly accommodate the missing data process between X and Y or else bias is introduced into the results... Missing data are termed missing at random (MAR) if the missing values of Y depend on X, but not on Y. By this we mean that the observed Y values represent a random sample of the actual Y values for each value of X, but the observed data for Y do not necessarily represent a truly random sample of all Y values. Even though the missing data process is random in the sample, its values are not generalizable to the population....A higher level of randomness is termed missing completely at random (MCAR). In these instances the observed values of X and Y are truly a random sample of all Y values, with no underlying process that lends bias to the observed data. If this is the form of the missing data process, any of the remedies can be applied without making allowances for the impact of any other variable or missing data process." (Hair et al., 1998, pp.49-50)

5.4.2.1. Missing data analysis

The current study draws heavily on the approach recommended by Hair et al. (1998) in order to diagnose the randomness of the missing data process. The method evaluates the missing data of a single variable Y by forming two groups - cases with missing data for Y and those with valid values of Y. An independent t-test is then performed in order to determine whether significant differences exist between the two groups and other model variables. Significant differences indicate the possibility of a
non-random missing data process. According to Hair et al., the researcher should examine a number of variables to see whether any consistent pattern emerges. It must be remembered that some differences will occur by chance, but any series of differences may indicate an underlying non-random pattern.

While undertaking missing data analysis of the collected data set proved to be an arduous task (given the number of variables used in the current study), such analysis proved useful in identifying evidence of underlying patterns. While for several variables analysis showed the results for the missing data group to be significantly different than those for the valid values group for a specific item, in all cases, there appeared to be no appreciable relationship between the items in terms of how one could influence the other. In such instances, it was concluded that the differences had occurred by chance.

Throughout most variables, however, a consistent pattern of missing data did emerge. For almost all variables, analysis indicated a significant difference between missing data and valid data groups for organisational turnover and organisational size. Means analysis indicates that where turnover and size was smaller, there were more missing data for most variables. This suggested that the smaller the organisation, the less likely it was to provide a fully completed survey. It is worth noting that this finding is relevant irrespective of the type or content of the question. This would appear to be a further indication that the smaller the organisation, the less time individuals within that organisation have to undertake non-fce-earning tasks.

5.4.2.2. Dealing with missing data

Hair et al. (1998) suggest that where a nonrandom pattern of missing data is present (as described above), the most efficient solution is for the researcher to determine the
extent of missing data on each case (or variable) and then delete the case(s) or variables(s) with excessive levels.

"The researcher may find that the missing data are concentrated in a small subset of cases and/or variables, with their exclusion substantially reducing the extent of missing data. Again, no firm guidelines exist on the necessary level for exclusion, but any decision should be based on both empirical and theoretical considerations. If missing values are found for what will be a dependent variable in the proposed analysis, the case is usually excluded. This avoids any artificial increases in the exploratory power of the analysis, which can occur when the researcher first estimates the missing data for the dependent variable by one of the imputation processes... and then uses the estimated values in the analysis of the dependence relationship." (Hair et al., 1998, p.52)

In the current study, the three measures of the IT/IS implementation success are dependent variables that are fundamental to the model. Data missing within these items represent a significant barrier to analysis. Hair et al., indicate the problems inherent in employing an imputation method to estimate values for a dependent variable and, on that basis, recommend a case deletion approach. As such, cases where data were missing for all three IT/IS implementation success variables were deleted. While this reduced the number of cases significantly (257 to 149), it also removed a significant proportion of missing data.

The main concern in deleting so many cases is any significant change in the overall profile of the data set and the impact that such a change might have on the generality of findings. Two primary concerns arise. First of all, it is intended through the data collection method employed that approximately equal proportions of data are collected from each profession in the hope of providing a broad picture of processes occurring in small professional practices as a whole. If through the necessary deletion of cases, the profile in terms of response rate for each profession becomes unbalanced,
this may influence the generality of the findings. The second concern centres on the earlier finding that more missing data were evident for organisations that were smaller and had a lower turnover. If in deleting the cases, the size profile of organisations responding alters significantly then this may also lead to false inferences. In order to evaluate the generality of the sample, the revised data set (with missing data cases omitted) is evaluated.

Table 5.5 presents the sample profile following the deletion of firms with more than 25 employees and cases with significant levels of missing data on dependent variables. The profile percentages are also recalculated to account for the focus on only three size categories. Once again, caution should be observed when comparing percentages between the sample and the profession profile statistics. Direct comparisons cannot easily be made due to the differences in the overall size range (1-25 for the sample, and 1-20 for the profession profiles) as well as the different size categories employed. Since the profession profile statistics give the percentages of firms in size categories within an overall range of 1-20 employees, the percentages should be marginally higher than for the sample percentages which are categorised within an overall range of 1-25 employees.

A chi-square test indicates that there is a significant difference between the numbers of responses from each profession \( (p = .00) \). This goes against the aims of the data collection process employed and has implications in terms of the generality of the data, but is an inherent risk of using a postal self-completion survey. The constraints on the data collection process in terms of time and resources are such, however, that the collection of further data is inappropriate. Furthermore, in targeting additional firms within specific professions, falsity is introduced into the data collection procedure. This is deemed to be inappropriate for the purposes of the study.
as the sampling would no longer be systematic. The other alternative is the omission of further cases from the entire sample. However, this is likely to lead to problems regarding the sample size in terms of the number of cases required to employ structural equation modelling.

Table 5.5. A comparison of sample profiles with profession profiles

<table>
<thead>
<tr>
<th>Profession</th>
<th>Practice size</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-5</td>
<td>6-10</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Architects</td>
<td>3,647</td>
<td>72%</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>78%</td>
</tr>
<tr>
<td>Dentists</td>
<td>5,356</td>
<td>58%</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>53%</td>
</tr>
<tr>
<td>Solicitors</td>
<td>5,260</td>
<td>51%</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>39%</td>
</tr>
<tr>
<td>Veterinarians</td>
<td>1,474</td>
<td>53%</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>23%</td>
</tr>
<tr>
<td>Total</td>
<td>15,737</td>
<td>57%</td>
</tr>
<tr>
<td></td>
<td>71</td>
<td>48%</td>
</tr>
</tbody>
</table>

While the intention of the research is to develop a model that reflects processes and interactions which occur in small professional practices, it is accepted given the resource constraints which limit the number of professions from which information can be sought, that the generality of the findings may be limited. For the purposes of the current study, it is argued that the four professions selected as a group represent the population intended. The exact accuracy with which findings are likely to reflect the population is unknown. Similarly, a moderate imbalance between professions within that group as occurs in the sample drawn is unlikely to be markedly detrimental to the findings given an understanding of the sample limitations already
noted and the model development methodology (which, as explained in chapter three, is based strongly on theoretical underpinnings during developmental stages).

Turning to the size profile, a chi-square test of the pre-case omission profile and post-case omission profile (as shown in tables 5.4 and 5.5 respectively) indicates that the deletion of cases does not significantly affect the overall profile of the sample regarding size ($p = .618$) in spite of the findings of missing data analysis. As a result, the sample to be used for modelling does not differ significantly in profile from that described in section 5.3.3.5. As indicated earlier, the size profile for the sample does differ from the profession profile as shown in tables 5.4 and 5.5. However, it is argued that this is a by-product of the slower absorption of technology that takes place in smaller firms in the small firm range defined.

A chi-square test comparing the respondent profile within the organisations where identified prior to the omission of missing data with that following the omission of missing data shows there to be no significant difference in the overall respondent profile ($p = .965$). This is perhaps to be expected, as cases where data were missing which were removed included the majority of those where the respondents failed to identify themselves.

It is accepted that the generality of the sample drawn to the population intended is not perfect. The sample profile statistics in terms of profession do not precisely reflect those in the population. As argued earlier, in order to draw a sample with perfect generality, a sample including all professions within the small professional service sector in exact proportions relative to the profession profile statistics in terms of both profession and size is required. The resources available for the current study make such a large scale data collection exercise impossible. Had resources enabled the collection of a larger sample of data, it would also have been
possible to use the collected data in such a way that they proportionality reflected the professional profile. However, as explained earlier, it is difficult to obtain exact information on the intended population as, as such, any attempts to meet such precise criteria are flawed. With an intended sample size of 200, and a collected data sample of 149 following the omission of cases with significant levels of missing data and firms with more than 25 employees, such an approach was not possible. The end-result is the need to employ all valid data collected in order to enable modelling. It is accepted that this creates limitations regarding the generality of the findings. However, these are unavoidable given the resource conditions.

5.4.3. Outliers

Hair et al. provide a useful definition of outliers:

"Outliers are observations with a unique combination of characteristics identifiable as distinctly different from other observations. Outliers cannot be categorically characterized as beneficial or problematic, but instead must be viewed within the context of the analysis and should be evaluated by the types of information they may provide. When beneficial, outliers - although different from the majority of the sample - may be indicative of characteristics of the population that would not be discovered in the normal course of analysis. In contrast, problematic outliers are not representative of the population, are counter to the objectives of the analysis, and can seriously distort statistical tests. Owing to the variability in the impact of outliers, it is imperative that the researcher examine the data for the presence of outliers to ascertain their type of influence." (Hair et al., 1998, p.64)

According to Hair et al. (1998), outliers can be divided into one of four categories. The first class arises from procedural errors such as errors in data entry or coding. Such errors warrant attention at the initial data cleaning stage. The second class of outlier is the observation that occurs as a result of an extraordinary event. This
extraordinary event explains uniqueness of the observation. It is, according to Hair et al., up to the researcher to decide whether the extraordinary event should be represented in the sample. The third category of outlier comprises observations for which the researcher has no explanation. While the omission of such outliers is the normal course of action, they may be retained if the researcher feels they represent a valid segment of the population. The final class of outlier contains observations that fall within the ordinary range of values for each variable but are unique in their combination of values across the variables. In such cases, the researcher should retain the observation unless "specific evidence is available that discounts the outlier as a valid member of the population" (Hair et al., p65).

5.4.3.1. Detecting potential outliers

According to West et al. (1995) and Hair et al. (1998), the research should employ a number of outlier identification techniques where possible, looking for a consistent pattern across methods. The current study employed two such techniques recommended by West et al. and Hair et al. These are; (1) univariate detection; and (2) multivariate detection.

Univariate detection focuses upon each variable independently and examines the distribution of observations, selecting as outliers those cases falling at the outer ranges of the distribution. For large sample sizes (80 or more observations, guidelines suggest identifying those scores that fall outside the ranges of 3 to 4 standard deviations from the mean (Hair et al., 1998). In smaller samples, the identification of scores that fall outside 2.5 standard deviations are recommended. Importantly, Hair et al. (p.65) add that "the researcher must recognize that a certain number of observations may occur normally in these outer ranges of the distribution. The
researcher should strive to identify only those truly distinctive observations and identify them as outliers."

Multivariate detection assesses each observation across a set of variables. It measures the multidimensional position of each observation relative to some common point. This is useful as multivariate analysis involves more than two variables. The specific method recommended is Mahalanobis' $D^2$ measure (West et al., 1995; Hair et al., 1998). According to Hair et al. (p.66), "Mahalanobis' $D^2$ is a measure of the distance in multidimensional space of each observation from the mean centre of observations. It provides a common measure of multidimensional centrality and also has statistical properties that allow for significance testing."

5.4.3.1.1. Univariate detection of potential outliers

Univariate analysis was undertaken on the variables as described above. 'Item parcels' were created for each variable (West et al., 1995). This is where items proposed as measures of each of the variables are aggregated in order give an overall score for that variable. This affords a more representative picture of outliers for each variable. For example, fifteen items were proposed as measures of the impact of IT/IS on the organisation. These fifteen items were thus aggregated in order to give an overall impact score for each respondent. Undertaking analysis on each individual item would not only be time consuming, but little information would be obtained in terms of outliers, as each item (where impact measures and most other items are concerned) is measured on a five-point likert scale. Not only does the aggregated score approach afford a more representative view of each variable, it also proves to be more informative in terms of the overall distribution for each respective variable.
Table 5.6. Identification of potential outliers

<table>
<thead>
<tr>
<th>Variable</th>
<th>Outlier case no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business performance (soft measures)</td>
<td>121, 21, 117, 91 (lower)</td>
</tr>
<tr>
<td>Turnover per employee</td>
<td>121, 75, 14, 16, 74 (upper)</td>
</tr>
<tr>
<td>IT/IS impact</td>
<td>6 (lower), 115, 15, 29, 31, 30, 79, 90, 9, 10, 222 (upper)</td>
</tr>
<tr>
<td>Information product satisfaction</td>
<td>35 (lower), 57, 105, 7, 91, 10, 5, 9, 79, 98 (upper)</td>
</tr>
<tr>
<td>Satisfaction with IT/IS providers and services</td>
<td>14, 16, 87 (lower)</td>
</tr>
<tr>
<td>IT/IS investment per employee</td>
<td>1, 42, 18, 19, 137, 79 (upper)</td>
</tr>
<tr>
<td>IT/IS sophistication and coverage</td>
<td>36 (upper)</td>
</tr>
<tr>
<td>IS planning and formalisation</td>
<td>112, 120 (upper)</td>
</tr>
<tr>
<td>Level of employee involvement in acquisition</td>
<td>None</td>
</tr>
<tr>
<td>Investment in IT/IS training</td>
<td>129, 139, 36, 152, 1, 17 (upper)</td>
</tr>
<tr>
<td>Vendor effectiveness</td>
<td>101 (upper)</td>
</tr>
<tr>
<td>Consultant effectiveness</td>
<td>43, 44, 6, 82 (upper)</td>
</tr>
<tr>
<td>Management support for IT/IS</td>
<td>None</td>
</tr>
<tr>
<td>Management IT/IS experience</td>
<td>None</td>
</tr>
<tr>
<td>Organisational IT/IS knowledge</td>
<td>47, 45, 50, 51 (upper)</td>
</tr>
<tr>
<td>IT/IS learning</td>
<td>None</td>
</tr>
<tr>
<td>Organisation size</td>
<td>None (size range pre-defined)</td>
</tr>
<tr>
<td>Investment capability</td>
<td>None</td>
</tr>
<tr>
<td>Perceived environmental stability</td>
<td>None</td>
</tr>
</tbody>
</table>

Table 5.6 presents the findings of the outlier analysis (with each outlier case presented in decreasing order of magnitude). As is evident, six of the variables; (1) level of employee involvement; (2) level of management support for IT/IS; (3) level of management IT/IS experience; (4) IT/IS learning; (5) investment capability; and (6) perceived environmental stability; contain no cases with outliers. Where potential outliers were identified within variables, a more detailed scrutiny of each was warranted. The ideal, as indicated by Hair et al. (1998) is to identify only those outliers that are truly distinct and are detrimental to the overall analysis. Outliers should be retained if the researcher feels that they represent a valid segmentation of the population.
5.4.3.1.1. Outlier identification: hierarchy level one variables

Focusing first of all on business performance, four potential outliers are identified. Further analysis of the outliers in terms of the overall distribution indicates that they are not truly distinct from the rest of the sample, nor are they detrimental to overall analysis. This is illustrated in the normal probability plot illustrated in figure 5.2. In the plot, observed values of a single numeric variable (in this case business performance) are plotted against the expected values if the sample were from a normal distribution. If the sample is from a normal distribution, points will cluster around a straight line. As is evident from figure 5.2, the points cluster around the line, and those on the lower boundary do not show a marked deviation. It is thus argued that all four outliers represent a valid segment of the population.

**Figure 5.2. Normal probability plot of business performance**

![Normal probability plot of business performance](image)

Two potential upper boundary outliers are identified for turnover per employee. Of particular concern is the identification of case 121 a second time. Both turnover per employee and business performance are overall performance measures. For business performance, case 121 is an outlier on the lower boundary, and for turnover per
employee the observation is an outlier on the upper boundary. Further examination of the case affords no further explanation of this observation. However, it is evident that such an observation seems improbable and likely to be detrimental to the overall analysis. As such, it is proposed that case 121 be deleted from the sample.

In terms of turnover per employee, the normal probability plot illustrated in figure 5.3 provides further evidence for the deletion of case 121. The case falls well away from the line and appears to be distinctly outside the general pattern of data.

**Figure 5.3. Normal probability plot of turnover per employee**

![Expected vs. Observed values](image)

Figure 5.4 illustrates the normal probability plot for turnover per employer after the deletion of case 121. As is evident, there is significant congruence between the expected values and the observed values. The remaining outlier identified is retained as it does not appear to be distinctly different from the overall pattern of data.
One potential lower boundary outlier and ten potential upper boundary outliers were identified for the variable impact of IT/IS on the organisation. Further analysis of the outlier cases shows them not to be detrimental to the analysis. In fact, they are deemed to be an important representation of the segment of the population that find IT/IS to add significant value. As the normal probability plot illustrates (see figure 5.5.), all cases cluster relatively closely to the expected values line. As such, it is argued that all cases provide important information and should be retained.

Figure 5.5. Normal probability plot for impact of IT/IS on the organisation
The findings are similar for information product satisfaction. Nine potential upper boundary outliers are identified while only one potential lower boundary outlier is identified (see figure 5.6). Again, the plot (illustrated in figure 5.6) shows that the outliers are not truly distinct in that they still cluster comparatively closely to the expected values line. Further examination of case 35 (on the lower boundary) indicated the observation to be sound in the context of other IT/IS satisfaction and impact data returned from that organisation. As such, case 35 represents an organisation that has not benefited from IT/IS implementation and, as such, is useful to the analysis. All cases are retained.

Only three potential outliers were identified for the last of the level one variables—satisfaction with IT/IS providers and services. All three were at the lower boundary. Again, the normal probability plot (see figure 5.7) shows the outliers to fall around the expected values line. All cases are retained.
5.4.3.1.1.2. Outlier identification: hierarchy levels two and three

In undertaking univariate analysis on variables that form hierarchy levels two and three, it is evident that half have no outliers with all cases cluster around the expected normal line in the normal probability plots (see table 5.6 and appendix 5.3). As such, all cases for these variables are deemed to be representative of the overall population. There are, however, several variables where outlier cases are identified. These are evaluated in this section.

The variable IT/IS investment per employee has six identified outliers, all at the upper boundary (see figure 5.8). While the five less extreme observations cluster together and follow a general pattern emerging from the overall sample, the most extreme observation - case 1 - is significantly removed from the remainder of the sample. However, in spite of the distance between case 1 and the rest of the sample, it is evident that it, too, forms part of the overall pattern. As such, all six outliers are informative in their representation of the higher investing segment of the population.
While outliers are identified on several more variables including; (1) the level of IT/IS sophistication; (2) level of IS planning; (3) level of investment in IT/IS training; (4) vendor effectiveness; (5) consultant effectiveness; and (6) level of organisational IT/IS knowledge; normal probability plots (see appendix 5.3) indicate that these outliers are not truly distinct from the remainder of the sample. None of the cases seem to demonstrate the characteristics of outliers that should be eliminated. Overall, a number of variables have some cases that are extreme. But none (with the exception of case 121 on business performance and turnover per employee) are extreme enough on a sufficient number of variables to be considered unrepresentative of the populations. In all instances, the observations identified as outliers seem similar enough to the remaining observations to be retained in the analysis. Removing them would result in the deletion of valuable information and be of detriment to the overall analysis.
5.4.3.1.2. Multivariate detection of outliers

Following the univariate identification of outliers, multivariate detection was undertaken. This involved employing the Mahalanobis $D^2$ measure. As stated earlier, Mahalanobis $D^2$ measure is a measure of how much a case’s values on all the independent variables differs from the average of all cases. Two analyses were undertaken. The first employed the hierarchy level one variables – business performance and turnover per employee – as the dependent variables while all variables hypothesised in the model to influence the performance measures were input as independent variables. The second analysis evaluated the level two and three variables in the context of the level two dependent variables, IT/IS impact, information product satisfaction and satisfaction with IT/IS providers and services.

Figure 5.9. Normal probability plot for Mahalanobis’ $D^2$ using performance variables as the dependent variable

In the first test, analysis identified two potential outlier cases. Figure 5.9 above presents a normal probability plot of the distribution of the sample in terms of the
Mahalanobis $D^2$ measure. The two outliers are clearly visible. While there is some distance between the two outlier cases and the rest of the sample, it is again evident that the outliers represent an extension of the emerging pattern. As such, they are deemed as a valid representation of the population and are retained in the study.

The same is also true of the outliers identified in the final multivariate outlier detection analysis. Hierarchy level two IT/IS success variables were entered as the dependent variables in the final Mahalanobis $D^2$ analysis. Six outlier cases were identified. However, it is evident that the outliers, although removed from the rest of the sample (especially true of the three most extreme cases), are again an extension of the overall pattern that emerges (see figure 5.10). Again, it is argued that such cases provide valuable information and should be considered representative of the population.

**Figure 5.10. Normal probability plot for Mahalanobis' $D^2$ using IT/IS success variables as the dependent variable**
5.4.3.1.3. Retention or deletion of outliers

While a number of potential outliers have been identified in both the univariate and multivariate outlier detection analyses, only case 121, whose extreme inconsistency over the two business performance measures, appears worthy of deletion. While it is often difficult to decide under what circumstances a case should be deleted, the current study follows the approach recommended by Hair et al. (1998). They argue that extreme cases should be retained “unless there is demonstrable proof that they are truly aberrant and do not represent any observations in the population” (p.66). As a result of the diagnostic tests, only case 121 demonstrates the characteristics of an outlier. Its inconsistent diametrically opposed identification over the two performance variables suggests that an error has occurred at some stage of the data collection process. As such case 121 is deleted from the sample.

While a number of the other variables have some extreme observations, none of the cases are extreme over a sufficient number of variables to be considered truly unrepresentative of the population. In all instances, the cases designated as outliers, even with the multivariate tests, seem similar enough to the remaining observations to be retained in the multivariate analyses. Because it is believed that the cases identified represent a segment of the population, it is argued that they should be retained to ensure generality. As outliers are deleted, the researcher runs the risk of improving the multivariate analysis but limiting its generality (Hair et al.).

5.4.4. Normality

The next step in examining the data involves testing the assumptions underlying multivariate analysis. An important assumption in multivariate analysis is normality (Hair et al., 1998). Analysis of normality evaluates the shape of the data distribution.
for an individual metric variable and its correspondence to the normal distribution. Graphical analysis of normality is most reliable when using the normal probability plot (Hair et al.). As stated earlier, normal probability plots compare the cumulative distribution of actual data values with the cumulative distribution of a normal distribution. The normal distribution forms a straight diagonal line, and the plotted data values are compared with the diagonal. If a distribution is normal, the line representing the actual data distribution closely follows the diagonal.

Plots for business performance; turnover per employee; impact of IT/IS on the organisation; information product satisfaction; satisfaction with IT/IS providers and services; and IT/IS investment per employee, have already been presented in the current chapter (see figures 5.2-5.8). Normal probability plots for the remaining variables also fail to show any evidence of a significant departure from normality.

The variables (1) IT/IS investment per employee; (2) investment in IT/IS training; and (3) consultant effectiveness show the greatest degree of non-normality. However, it is argued that where deviation from the expected distribution is small, the application of remedies for non-normality may prove more detrimental than beneficial to the analysis. In other words, applying remedies for non-normality may distort the actual findings more than any problems caused by the degree of non-normality evident.

West et al. (1995) give the results of a number of simulation studies designed to assess the performance of structural equation modelling techniques under diverse conditions of non-normality. They reported that where measures were highly non-normal (skewness = 3; kurtosis = 21) the chi-square (or function of log likelihood) statistic was artificially high. Other indexes of fit were also affected (see West et al., 1995 for a full account of the impact of non-normality on individual fit indexes). Hair
et al. (1998) report that a lack of multivariate normality also creates an upward bias in critical values for determining coefficient significance.

A number of methods can be applied to counter such problems. However, it is up to the individual researcher to decide whether such techniques will be beneficial to the analysis given the degree of non-normality. One such technique is the use of a different method of estimation. The asymptotically distribution free estimator (ADF) is an alternative technique which is less susceptible to the presence of non-normal distributions. However, the technique requires a sample size in the range of 1000 to 5000 to be effective (West et al., 1995). In a study comparing different estimation methods using two models, one with moderate nonnormality and one with extreme levels of nonnormality, Chou and Bentler (1995) found the ADF technique to perform consistently worse than the maximum likelihood estimate method (employed in the current study). This was especially true where sample sizes were smaller (i.e. <1000 cases) and in spite of the fact that the ADF method was developed specifically for use with models where nonnormal conditions exist.

Another remedy is the transformation of non-normal variables. This necessitates the use of item parcels in the actual structural equation analysis rather than the measurement models in their multi-item format. Using item parcels can, however, obscure underlying patterns within the data and lead to potential complication in the interpretation of relationships and structure in models (West et al., 1995). According to West et al., identification problems are also more likely to occur. Finally, transforming the data changes the original measure \( x \) to a new measure \( x^* \). The new correlations or covariances are computed between the \( x^* \) transformed variables, not between the original variables. Reflecting this change, fit statistics, parameter estimates, and standard errors will be based on the \( x^* \) variables and may
differ, perhaps substantially, from those based on the original variables. As such, artificiality is introduced into the analysis, which may distort results more than the non-normality in the data (West et al., 1995). Even more severe interpretational problems are likely to result when different transformations are applied to the same measure across studies.

Given the arguments for and against the transformation of variables and the application of different techniques such as ADF, the current study applies the methodology that variables should only be transformed if they differ substantially from the normal distribution and may be detrimental to analysis. Such a method was supported in personal communication with William Black, author of “Structural Equation Modeling” in Multivariate Data Analysis (Hair et al., 1998).

In the current study, it is argued that only one variable - IT/IS investment per employee - falls into this category. Figure 5.11 shows the normal probability plot for IT/IS investment per employee. As is evident, the observed values deviate from the expected values line.

![Figure 5.11. IT/IS investment per employee](image)

Figure 5.11 shows the normal probability graph for IT/IS investment per employee following a logarithm transformation, the recommended transformation method for a
positively skewed distribution (Hair et al., 1998). As is evident, there is a significantly greater congruence between the expected values and the observed values. More specifically, in transforming the variable, complications resulting from the skewed distribution illustrated in figure 5.11 should be avoided during the modelling stage. The transformation procedure is straightforward with the IT/IS investment per employee due it being a one-item numeric measure. As such, there is no need for the formation of an item parcel. Complications at the analysis stage should thus be avoided.

Figure 5.12. IT/IS investment per employee (logarithm)

While IT/IS investment per employee benefits from transformation, undertaking transformations on further variables is considered inappropriate. As is illustrated in the normal probability plots, there is little evidence of significant departures from normality, and certainly nowhere near the degree of non-normality tested by West et al., 1995. Thus, where non-normal patterns are evident, they are not sufficiently non-normal as to warrant transforming. Any further transformations would be detrimental to the analysis and serve only to create artificial findings that may prove difficult to interpret.
In conclusion, it is evident that the variables employed do not deviate significantly from the normality assumptions fundamental to multivariate analysis. With the exception of the variable IT/IS investment per employee, any divergence from normality is so marginal that it is not large enough to warrant the removal or the transformation of the offending variable. As is often the case, it is a trade off between the benefits of retaining the variable in its original format, transforming it, or removing it altogether. As Norusis (1998) asserts, for the majority of statistical tests it is sufficient that the data are approaching normality.

In the current sample, only IT/IS investment per employee proved problematic. However, due to the format of the measure, non-normality could be resolved through the logarithmic transformation of the variable. No extremes of non-normality are observed regarding the other variables that form the model. As such it is argued that the data should remain in their original format, thus avoiding any complications and interpretation difficulties that might arise as a result of data transformation.

5.4.5. Linearity

A final implicit assumption of all multivariate techniques, including structural equation modelling, is linearity (Hair et al., 1998). Correlations represent only the linear association between variables. As such, nonlinear effects will not be represented in the correlation value. This results in the underestimation of the actual strength of the relationship. It is for this reason that Hair et al. recommend that the researcher examines all relationships to identify any significant departures from linearity that may impact the correlation.
Linearity is assessed for each variable using scatterplots. A number of charts (e.g. investment in IT/IS per employee versus satisfaction with IT/IS providers and services) show no significant correlations and, as such, the corresponding scatterplots shows no signs of linearity. However, where significant correlations are shown, a visual inspection of the charts does not reveal any apparent significant non-linear relationships.

5.4.6. Final sample size

Following the removal of firms with more than 25 employees, cases with significant levels of missing data and the one outlier identified as likely to be detrimental to analysis, the final sample to be employed for model development purposes is \( n = 148 \). Hair et al. (1998) argue that while maximum likelihood estimation (the most common SEM estimation procedure) has been found to provide valid results with sample sizes as small as 50, it is generally accepted that the minimum sample size to ensure appropriate use of structural equation modelling is 100 to 150. Boosma (1987) agrees that as sample sizes approach 100 or fewer cases, false inferences become increasingly likely. While a larger sample (i.e. the recommended 200 cases) would have been preferable, the sample employed for model development is regarded as satisfactory.

It should also be recalled that during the model development stages of research, theoretical underpinnings remain equally important as empirical concerns. The importance of theory during model development is approached in detail during chapter seven. While the findings of empirical analysis at the model development stage remain important, paths are not rejected solely on the basis of their level of significance. Any path that falls below the specified significance level is re-evaluated.
theoretically. As a result, fewer demands are made on the empirical data during exploratory modelling than is the case during stage two – confirmatory model testing.

5.5. Summary and Conclusions

The current chapter has presented and explained the data collection process. More specifically it has aimed to compare the degree to which the data sample collected is representative of the population it intends to describe. The limitations of the sample in terms of its generality to the intended population are discussed. Given the resource constraints, it is argued that the approach taken is acceptable given the objectives of the research. However, the limitations of the findings should be noted.

The latter part of the chapter focused upon the data sample and how well it meets the underlying assumptions necessary for analysis using structural equation modelling. The data examination was based closely on a systematic approach recommended by Hair et al. (1998), referred to by the authors as an “investment in multivariate insurance” (p.39). This facilitated a step-by-step evaluation of the data, assessing it in terms of; (1) missing data; (2) outliers; and (3) the statistical assumptions specific to multivariate techniques. Missing data analysis resulted in the deletion of a number of cases. The recommendations of Hair et al. were followed in the deletion of those cases where data on necessary dependant variables were missing. In the identification of outliers, the recommendations of Hair et al. were again followed resulting in the deletion of only one case shown to be implausible and unlikely to represent any observations in the population. Finally, analyses undertaken in order to evaluate the congruence of the data sample with the assumptions necessary for the application of structural equation modelling, presented no significant evidence of deviation from the assumptions underlying the use of such a multivariate technique.
Following the examination of the data as described in the current chapter, the next step is the building of the model using the techniques of structural equation modelling. The following chapter opens with a description of structural equation modelling and the model building approach employed.
Chapter Six – Construct and hypothesis testing

6.1. Introduction

Chapter four gave an account of the process of moving from the theoretical domain to the operational domain (step four in figure 3.1). As such, it described the measurement items included in the questionnaire to collect data on variables shown in chapter two to play an important role in the assessment and acquisition of IT/IS by small firms. In the previous chapter, item parcels were formed using data collected from small firms in order to evaluate the data sample over each of the proposed measures. With data examination complete, the current chapter formalises the construction of measurement models as introduced in chapter three. It explains how measurement items, and the data obtained through their employment, are approached in order to create constructs that provide valid and reliable information on the variables they purport to measure. As such, the current chapter focuses upon steps six and seven of the recommended methodology presented in the flow chart in chapter three (figure 3.1).

The chapter is divided into three primary sections. The first is an introduction to structural equation modelling. Taking the theory underpinning the use of SEM presented in chapter three as a point of departure, the current chapter gives an insight into the practical application of SEM and, in particular, the construction and testing of the structural equation model. More specifically, it is explained how the process is a two-step one, involving; (1) the construction and testing of measurement models; followed by (2) the construction and testing of the structural model.
This division represents the two remaining sections of the chapter. In section two, the construction and testing of the measurement models employed to operationalise the model of IT/IS assessment and acquisition in small firms is explained. In the final section the construction and testing of the structural model is presented. Following the presentation of the output from the completed structural model, a brief evaluation of the model is afforded.

6.2. Structural equation modelling

The steps necessary in the employment of structural equation modelling were presented in the flow chart in figure 3.1 of chapter three. In the context of the flow chart, the current chapter focuses upon steps six and seven, the testing of constructs for validity and reliability, and the completion and testing of the measurement and structural models. In this section, we focus upon how this is done and illustrate that the delineations afforded in figure 3.1. are not so clear cut in practice.

As the flow chart indicates, following the collection and examination of data (as described in the previous chapter), constructs are tested for validity and reliability prior to the final completion of the measurement models and structural model. Anderson and Gerbing (1988b) argue, however, that the construction and testing of the measurement models (developed to measure unobserved variables) and the structural model (where paths are hypothesised between variables) should be undertaken independently. As such, the authors posit a two-step approach which has been appropriated by subsequent researchers and authors in the SEM arena (e.g. Brock and Sulksy, 1994; Igbaria et al., 1997).

"The model-building task can be thought of as the analysis of two conceptually distinct models... A confirmatory measurement, or factor analysis, model specifies
the relations of the observed measures to their underlying constructs, with the constructs allowed to intercorrelate freely. A confirmatory structural model then specifies the causal relations of the constructs to one another, as posited by some theory.” (Anderson and Gerbing, 1988b, p.411)

Anderson and Gerbing (p.411) contend that there is “much to gain in theory testing and the assessment of construct validity from separate estimation (and respecification) of the measurement model prior to the simultaneous estimation of the measurement and structural submodels. The measurement model in conjunction with the structural model enables a comprehensive, confirmatory assessment of construct validity. The measurement model provides a confirmatory assessment of convergent validity and discriminant validity. Given acceptable convergent and discriminant validities, the test of the structural model then constitutes a confirmatory assessment of nomological validity.”

Due to its methodological rigour, the two-step approach is appropriated as a means of developing the structural equation model used to validate the model of IT/IS assessment and acquisition in small firms hypothesised in the current study. The two stages of the recommended approach are described in the following sections.

6.2.1. Stage one: measurement model construction and testing

The first stage in the building of a structural equation model involves the construction of the submodels necessary to build a complete measurement model (referred to as a “confirmatory measurement, or factor analysis, model” by Anderson and Gerbing, 1988b). Anderson and Gerbing attempt to divide this primary stage of measurement model development into two independent sub-stages; (1) exploratory factor analyses; followed by (2) confirmatory factor analyses. However, it is evident that in practice
the distinction between the two is not clear-cut. The authors describe the relationship between exploratory and confirmatory factor analysis as follows;

"An exploratory factor analysis in which there is no prior specification of the number of factors is exclusively exploratory. Using a maximum likelihood (ML) or generalized least squares (GLS) exploratory program represents the next step in the progression, in that a hypothesized number of underlying factors can be specified and the goodness of fit of the resulting solution can be tested. At this point there is a demarcation where one moves from an exploratory program to a confirmatory program. Now a measurement model needs to be specified a priori, although the parameters themselves are freely estimated." (Anderson and Gerbing, 1988b, p.412)

The end product of stage one should be the realisation of valid constructs that can be linked via paths during the second stage to create a structural model. This is illustrated diagrammatically in the example shown in figure 6.1. Here, it is hypothesised that the measurement items; (1) $X_1$; and (2) $X_2$ represent underlying measures of $X$. Using SEM terminology, these underlying measures are known as observed variables, as they have been measured using some form of objective or subjective means. Observed variables are represented in rectangles. ‘$X$’ is termed an unobserved or latent variable, as it has not been independently measured. It is here proposed that the two observed variables represent a measure of the underlying variable, here entitled $X$. In carrying out a factor analysis and tests of validity on the hypothesised construct, its validity and unidimensionality will be evaluated.

**Figure 6.1. A measurement model of the latent variable, $X$**
When confirmatory analysis is undertaken on each measurement model, the loading coefficients provide estimates of the reliabilities of the indicators (i.e. in the example given for $e_1$ and $e_2$). This represents an empirical estimate of the degree to which the indicator fails to be a perfect predictor (i.e. its measurement error). The main aim of the construction and evaluation of measurement models is to develop constructs which are as valid and reliable as possible. Validity is the degree to which a measure accurately represents what it is supposed to. In our example we must be sure that $X_1$ and $X_2$ ask the 'correct' questions and afford accurate information on the state of $X$. Even if validity is assured, the reliability of the measure must still be considered. Reliability is the degree to which the observed variable measures the ‘true’ value and is ‘error free’ and, as such, is the opposite of measurement error.

6.2.2. Stage two: construction and testing of the structural model

Once the measurement models explaining each independent variable are complete, the structural model can be created. Here, hypothesised paths are drawn between variables based on existing theory (see figure 6.2). Hair et al. (1998) refer to the importance of theoretical justification for the specification of the dependence relationships. In this context they define theory as “a systematic set of relationships providing a consistent and comprehensive explanation of a phenomena.... From a practical perspective, a theory-based approach to SEM is a necessity because the technique must be completely specified by the researcher.” As is evident, such an approach has been employed throughout by the current study, with all paths specified on the basis of hypotheses drawn from the findings of existing research and presented in the model proposed at the end of chapter two.
As figure 6.3 illustrates, the combination of the measurement models and structural model results in the completed structural equation model.

Figure 6.4 presents a more detailed approach to steps six and seven of the flow chart presented in figure 3.1. of chapter three. In the revised chart, attention is given to the two-step nature of modelling recommended by Anderson and Gerbing (1988b), with the construction and testing of the measurement models preceding that of the structural model. Attention is also drawn to the two-step nature of the construction and testing of the measurement models. Exploratory testing proceeds the
confirmatory testing where models are specified *a priori* on the basis of the exploratory analysis.

Figure 6.4. Recommended SEM construction and testing methodology

1. Measurement model construction: exploratory testing
2. Measurement model construction: confirmatory testing
3. Structural model: construction and testing

In the following sections, the methodological approach presented above is applied in the construction and testing of a structural equation model of IT/IS assessment and acquisition in small firms. In constructing and testing the model, the last stage in the movement of the hypothesised model from the theoretical domain to the operational domain is undertaken.

Section 6.3 presents step one of modelling, focusing upon the exploratory analysis, construction and testing of each variable included in the model hypothesised in chapter two. Section 6.4 focuses upon step two, the construction of the structural model.

6.3. Step one: the construction and testing of measurement models

The first step, the exploratory analysis of measurement models, was undertaken using exploratory factor analysis. Analysis was carried out on measurement items hypothesised to measure variables included in the model using SPSS software. As
described in chapter four, most measurement items employed to operationalise concepts that formed the model were based on existing measures. As such, it was presumed that factor analysis would indicate acceptable levels of unidimensionality within proposed constructs.

Where items loaded onto factors, the meaning of identified unobserved variables was then inferred. Again, it was presumed that where items and measures had been used previously, little interpretation would be necessary, as analysis would repeat earlier findings. In spite of this, thorough analysis was undertaken on measurement items proposed to measure specific unobserved variables in order to ensure that items measured did in fact measure what they were intended to measure (i.e. measurement validity).

Following the identification of a unidimensional measure of an unobserved variable using exploratory factor analysis, its degree of unidimensionality (i.e. if all observed measures loading onto the underlying construct provide similar information) was tested using Cronbach’s alpha test of reliability. According to Anderson and Gerbing (1988b), obtaining a unidimensional measurement is a crucial undertaking. As Anderson and Gerbing (p.414) assert, “a necessary condition for assigning meaning to estimated constructs is that the measures that are posited as alternate indicators of each construct must be unidimensional. That is, each set of alternate indicators has only one underlying trait or construct in common.” Each unobserved variable constructed from two or more observed variable was thus tested for internal reliability.

The second stage was the confirmatory test of each measurement sub-model proposed as a result of stage one (stage two of step one in figure 6.4). It is at this stage that the researcher moves from an exploratory to a confirmatory program
(Anderson and Gerbing, 1988b) – in this case Amos structural equation modelling software. As Anderson and Gerbing assert, the measurement models are now specified \textit{a priori}, although the parameters are once again freely estimated. As such, confirmatory factor analysis is undertaken on each measurement model. The end result is several measurement models measuring variables hypothesised to play an important role in IT/IS assessment and acquisition in small firms.

In the following sections, the method described above is presented in turn for each variable hypothesised to play a part in the model of IT/IS assessment and acquisition in small firms.

6.3.1. Organisational performance measurement models

Five items were employed to measure organisational performance. These are; (1) change in the number of employees; (2) turnover compared with the previous year; (3) current profitability; (4) recent total market changes; and (5) turnover per employee. A factor analysis was undertaken on the five items in order to test their level of unidimensionality. The results are shown in table 6.1. Factor loadings of less than 0.3 are omitted.

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1</th>
<th>Component 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Change in number of employees</td>
<td>.572</td>
</tr>
<tr>
<td>2</td>
<td>Turnover compared with last year</td>
<td>.791</td>
</tr>
<tr>
<td>3</td>
<td>Current level of profitability</td>
<td>.681</td>
</tr>
<tr>
<td>4</td>
<td>Recent changes in market share</td>
<td>.741</td>
</tr>
<tr>
<td>5</td>
<td>Turnover per employee</td>
<td>.939</td>
</tr>
</tbody>
</table>

\textbf{Table 6.1. Factor analysis of organisational performance construct}

Extraction Method: Principal Component Analysis
Table 6.1 shows the five items to load onto two independent components. The four 'softer' performance measures load onto component one, while the economic measure, turnover per employee loads separately onto an independent component.

Because of the organisational performance measurement items loading onto separate components, the performance measures employed in the study are treated as two independent measures; (1) 'soft' performance; (2) turnover per employee (labelled 'turnpemp'). While turnover per employee stands independently as a one-item measure and thus needs no further analysis, a further factor analysis was undertaken on the soft performance measure (see table 6.2).

Table 6.2. Factor analysis of soft performance construct

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Change in number of employees</td>
</tr>
<tr>
<td>2</td>
<td>Turnover compared with last year</td>
</tr>
<tr>
<td>3</td>
<td>Current level of profitability</td>
</tr>
<tr>
<td>4</td>
<td>Recent changes in market share</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) for the factor analysis is 0.70, indicating that the data are suitable for the analysis. While there is no generally accepted level of what constitutes an acceptable factor loading, the guidelines recommended by Hair et al. (1998) are followed (i.e. loadings greater than .30 are considered significant; loadings greater than .40 are considered more important; and loadings .50 or greater are considered to be very significant). In employing the .50 level as a cut off, the current study follows many IS researchers (e.g. Rivard and Huff, 1988; Amoroso and Cheney, 1991; Thompson et al., 1991;
Igbaria, 1993b; Igbaria et al., 1997b). While all items load onto one factor with scores higher than the cut-off of 0.5, Cronbach’s alpha score for the four items is low at .66. In order to try and increase the validity of the measure, item one was removed due to its low factor loading. This resulted in an improved Cronbach’s score of 0.70 and higher factor loadings for the three remaining items.

The final step is the confirmatory factor analysis of the proposed measurement model. Here, the items that are proposed as the most appropriate measures of business performance during the exploratory stage are specified in advance using Amos structural equation modelling software. Calculations are then undertaken in order to determine the measure’s construct reliability.

The measurement model evaluated and the construct reliability formula and calculations are presented below.

Figure 6.5. Soft performance measurement model

As is evident from figure 6.5, the confirmatory factor analysis shows all paths to be significant at the .05 level or higher. The next step is to re-evaluate the reliability of
the construct. Unlike SPSS software, Amos does not calculate the reliability as part of its output. As such, it is here calculated by hand. The following formula is used:

\[
\text{Construct reliability} = \frac{\left( \sum \text{standardised regression weights} \right)^2}{\left( \sum \text{standardised regression weights} \right)^2 + \sum \varepsilon_j}
\]

The standardised regression weights are obtained directly from the output, and \(\varepsilon_j\) is the measurement error for each indicator. The measurement error is 1.0 minus the reliability of the indicator, which is the square of the indicator’s standardised loading (Hair et al., 1998). According to Hair et al., a commonly used threshold value for acceptability is .70, although this is not an absolute standard, and values below .70 have been deemed acceptable if the research is exploratory in nature.

Using the above formula, the reliability of the business performance construct is calculated as follows:

\[
\text{Reliability}_{\text{Business performance}} = \frac{(0.810 + 0.537 + 0.575)^2}{(0.810 + 0.537 + 0.575)^2 + (1 - 0.810^2) + (1 - 0.537^2) + (1 - 0.575^2)}
\]

\[
= \frac{3.694}{3.694 + 0.344 + 0.712 + 0.670}
\]

\[
= \frac{3.694}{5.420}
\]

\[
\text{Reliability}_{\text{Business performance}} = 0.682
\]

The construct reliability figure for ‘Business performance’ falls marginally below the .70 threshold. However, at .682 it is deemed to be acceptable (see Lefebvre et al., 1995).
6.3.2. IT/IS implementation success measurement models

Two measures were constructed to measure IT/IS implementation success; (1) a measure of the organisational impact of IT/IS; and (2) a measure of user information satisfaction. The theory underpinning the selection of measurement items employed in the development of the two constructs was covered in detail in chapter four. Here, the two measures are tested for validity and reliability.

6.3.2.1. A measurement model of the organisational impact of IT/IS

In order to test the construct validity of the organisational impact measure, a factor analysis was undertaken on the data using the principal moments method of extraction (see table 6.3). The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) for the factor analysis is 0.85, indicating that the analysis is suitable for the data. Without specifying the number of factors, four factors with eigenvalues greater than one emerged.

It is evident that the 15-item measure is essentially uni-dimensional. While items 5 and 6 load marginally more highly onto factors 4 and 3 respectively, they also load onto factor 1. No other items load highly onto factors 2, 3 or 4 (the next highest factor loading being .416 loading onto organisational costs). To test the reliability of treating organisational impact as a one-factor measure, Cronbach’s alpha test was undertaken on the 15-item measure. This resulted in an alpha score of 0.85, well above the requirements necessary for such research.
Table 6.3. Factor analysis of organisational impact of IT/IS construct

<table>
<thead>
<tr>
<th>Item</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Affect of IT/IS on decision-making</td>
<td>.456</td>
</tr>
<tr>
<td>2. Affect of IT/IS on work processes</td>
<td>.597</td>
</tr>
<tr>
<td>3. Affect of IT/IS on organisational costs</td>
<td>.603 .416</td>
</tr>
<tr>
<td>4. Affect of IT/IS on firm control</td>
<td>.574</td>
</tr>
<tr>
<td>5. Affect of IT/IS on internal communication</td>
<td>.481 .513</td>
</tr>
<tr>
<td>6. Affect of IT/IS on job satisfaction</td>
<td>.487 .542</td>
</tr>
<tr>
<td>7. Affect of IT/IS on the firm's ability to provide new services</td>
<td>.549</td>
</tr>
<tr>
<td>8. Affect of IT/IS on the firm's marketing ability</td>
<td>.666</td>
</tr>
<tr>
<td>9. Affect of IT/IS on administrative efficiency</td>
<td>.613</td>
</tr>
<tr>
<td>10. Affect of IT/IS on productivity</td>
<td>.590</td>
</tr>
<tr>
<td>11. Affect of IT/IS on information access</td>
<td>.572</td>
</tr>
<tr>
<td>12. Affect of IT/IS on customer service</td>
<td>.651</td>
</tr>
<tr>
<td>13. Affect of IT/IS on practice image</td>
<td>.594</td>
</tr>
<tr>
<td>14. Affect of IT/IS on accounts/cashflow</td>
<td>.550</td>
</tr>
<tr>
<td>15. Affect of IT/IS on workload</td>
<td>.555</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

To increase the methodological rigour, items one, five and six were removed. All had factor loading scores of less than 0.5. The omission of the three items proved to worsen the reliability of the measure (with a Cronbach alpha score of 0.83 as opposed to 0.85). Because the factor loadings of the items omitted were only marginally below the cut-off point, and because their inclusion is shown to improve the overall reliability of the measure, it was decided that items one, five and six should be included in the final measure of the organisational impact of IT/IS.

Figure 6.6 shows the proposed model in its confirmatory factor analysis status. Factors one, five and six again show loadings of lower than 0.5. However, the overall reliability of the construct is high at 0.87. All paths are significant at the .01 level. The high construct reliability suggests that the IT/IS impact measurement model...
(represented diagrammatically in figure 6.6) is an acceptable measure of the organisational impact of IT/IS.

Figure 6.6. Measurement model of the organisational impact of IT/IS

All significant at $p = .01$
6.3.2.2. A measurement model of user information satisfaction

Chapter four explained the appropriation of UIS measurement items from existing IS research and their subsequent adaptation for small firms research. Furthermore, it was shown how factor analyses of existing UIS constructs had shown them to generally include three dimensions; (1) satisfaction with the information product; (2) satisfaction with IT/IS providers and services (generally called EDP services and staff in large organisation research); and (3) knowledge/involvement. For this study, constructs were developed for the first two dimensions, employing measurement items employed by previous research. The third dimension, knowledge/involvement, is viewed as an independent variable as opposed to a dependent variable, appropriating the methodological approach of Doll and Torkzadeh (1988).

Ten items used in previous UIS instruments were employed for the current study. A factor analysis was undertaken on the items, as illustrated in table 6.4 (factor loadings of less than 0.3 are omitted). The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) for the factor analysis is 0.78, indicating that the data are suitable for the analysis. Table 6.4 shows the UIS construct to separate, as expected, into two independent dimensions. These can be interpreted as; (1) satisfaction with the information product; and (2) satisfaction with IT/IS providers and services. The two independent constructs are tested for validity and unidimensionality in the following sections.
Table 6.4. Factor analysis of the UIS construct

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1</th>
<th>Component 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Ease of use</td>
<td>.692</td>
<td></td>
</tr>
<tr>
<td>2  Reliability of output</td>
<td>.621</td>
<td></td>
</tr>
<tr>
<td>3  Relevance of output</td>
<td>.801</td>
<td></td>
</tr>
<tr>
<td>4  Up-to-dateness of output</td>
<td>.729</td>
<td></td>
</tr>
<tr>
<td>5  Format of output</td>
<td>.801</td>
<td></td>
</tr>
<tr>
<td>6  Frequency of disruptions caused by IT/IS</td>
<td>.391</td>
<td>.612</td>
</tr>
<tr>
<td>7  Maintenance and back-up support</td>
<td></td>
<td>.612</td>
</tr>
<tr>
<td>8  Security of data from misappropriation and loss</td>
<td>.774</td>
<td></td>
</tr>
<tr>
<td>9  Turnaround time taken to fix IT/IS problems</td>
<td>.678</td>
<td></td>
</tr>
<tr>
<td>10 Documentation</td>
<td></td>
<td>.798</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

6.3.2.2.1. Satisfaction with the information product construct: exploratory and confirmatory testing

An independent factor analysis was carried out on items loading onto the factor interpreted as satisfaction with the information product (see table 6.5). The KMO measure of sampling adequacy was acceptable at .78. Item 6, frequency of disruptions caused by IT/IS, was dropped from the factor due to its comparatively low factor loading of 0.492. Finally, in order to evaluate the reliability of the construct, Cronbach’s test was applied. This gave an alpha score of .80.

Table 6.5. Factor analysis of satisfaction with the information product

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Ease of use</td>
<td>.730</td>
</tr>
<tr>
<td>2  Reliability of output</td>
<td>.656</td>
</tr>
<tr>
<td>3  Relevance of output</td>
<td>.817</td>
</tr>
<tr>
<td>4  Up-to-dateness (timeliness) of output</td>
<td>.686</td>
</tr>
<tr>
<td>5  Format of output</td>
<td>.830</td>
</tr>
<tr>
<td>6  Frequency of disruptions caused by IT/IS</td>
<td>.492</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis
The final stage involved undertaking a confirmatory factor analysis on the information product satisfaction measurement model described above. The measurement model was entered into Amos and output obtained. Figure 6.7 presents the output diagrammatically. As is evident, all paths are significant at the 0.01 level. The construct reliability measure for satisfaction with the information product is also well above the acceptable threshold at 0.811. As such, information product satisfaction is accepted as a reliable measure.

Figure 6.7. Satisfaction with the information product measurement model

![Diagram of satisfaction with the information product measurement model]

6.3.2.2.2. Satisfaction with IT/IS providers and services: exploratory and confirmatory testing

A factor analysis was also undertaken independently on those items forming the user satisfaction with IT/IS providers and services construct (see table 6.6). All four items have factor loadings of .661 and above. Thus it is deemed inappropriate to remove
any items from the construct. Cronbach’s test of internal reliability was also undertaken. The alpha score proved acceptable at 0.70.

Table 6.6. Factor analysis of satisfaction with IT/IS providers and services measurement items

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Maintenance and back-up support</td>
<td>.830</td>
</tr>
<tr>
<td>2 Security of data from misappropriation &amp; loss</td>
<td>.661</td>
</tr>
<tr>
<td>3 Turnaround time taken to fix IT/IS problems</td>
<td>.760</td>
</tr>
<tr>
<td>4 Documentation</td>
<td>.695</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

Following the exploratory factor analysis stage, confirmatory factor analysis was undertaken on the proposed measurement model for satisfaction with IT/IS providers and services. Figure 6.8. presents the results diagrammatically.

Figure 6.8. Satisfaction with IT/IS providers and services measurement model

All paths are significant at the .01 level. The construct reliability for satisfaction with IT/IS providers and services is also above the .70 threshold at .721. Thus, the
measurement model is considered a reliable measure of satisfaction with IT/IS providers and services.

6.3.3. IT/IS assessment and acquisition decision issues

6.3.3.1. A measurement model of IT/IS investment

The calculation of IT/IS investment per employee is described in chapter four. Investment per employee is a one-item measure and appears in the structural equation model labelled 'Invest'.

6.3.3.2. A measurement model of IT/IS sophistication and coverage

The three measures employed to measure IT/IS sophistication and coverage; (1) number of functional areas computerised; (2) sophisticated applications portfolio; and (3) software applications portfolio, were entered into an exploratory factor analysis. The three measures were tested for unidimensionality in order to ensure that all three loaded onto one factor as predicted. This indeed proved to be the case (as is shown in table 6.7).

Table 6.7. Factor analysis of IT/IS sophistication and coverage construct

<table>
<thead>
<tr>
<th>Measure</th>
<th>Component 1 (IT sophistication/coverage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of functional areas computerised</td>
<td>.953</td>
</tr>
<tr>
<td>Sophisticated applications portfolio</td>
<td>.964</td>
</tr>
<tr>
<td>Applications portfolio</td>
<td>.973</td>
</tr>
</tbody>
</table>

Cronbach's alpha test was then undertaken on the three measures as a further test of internal reliability. This produced an alpha coefficient of .925, indicating a high level of internal reliability. Confirmatory factor analysis using Amos software also showed
the measure to be reliable. All paths are significant at the .01 level and the calculated construct reliability is high at .96. As such, the construct is accepted as a reliable measure of IT/IS sophistication and coverage.

Figure 6.9. IT/IS sophistication and coverage measurement model

6.3.3.3. A measurement model of IS Planning and formalisation

Five measurement items were used to measure the level of planning and formalisation in the assessment and acquisition process. These are shown in table 6.8. A factor analysis was undertaken on the proposed construct in order to check for unidimensionality (see table 6.8). All five items loaded highly onto one factor (KMO score = .81) and further analysis showed the construct to have a good internal reliability, with a Cronbach alpha score of 0.78.
Table 6.8. Factor analysis of planning and formalisation of IT/IS acquisition measurement items

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Computer systems planning</td>
<td>.720</td>
</tr>
<tr>
<td>2 Evaluation of the existing system</td>
<td>.748</td>
</tr>
<tr>
<td>3 Written statement of requirements</td>
<td>.753</td>
</tr>
<tr>
<td>4 Cost-benefit analysis</td>
<td>.768</td>
</tr>
<tr>
<td>5 Post-purchase evaluation of benefits resulting from IT/IS purchase</td>
<td>.659</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

The five items were entered into Amos and a confirmatory factor analysis undertaken. Once again, all paths proved significant at the .01 level. The construct reliability is also well above the threshold at 0.78. Figure 6.10 shows the final IS planning measurement model.

Figure 6.10. Level of IS planning and formalisation measurement model

All paths significant at .01 level
6.3.3.4. A measurement model of the level of employee involvement

The development of a one-item measure of employee involvement was described in chapter four. This is labelled 'employee' in the structural equation model.

6.3.3.5. A measurement model of the level IT/IS Training

Three measurement items were used to measure the level of IT/IS training undertaken in small firms. These are shown in table 6.9. The KMO score is adequate at .626, while Cronbach’s alpha coefficient is 0.58. While this is slightly lower than that deemed acceptable by Lefebvre et al. (1995), one should recall that Cronbach's measure remains susceptible to constructs with few items.

Table 6.9. Factor analysis of level of IT/IS training

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Level of formal IT/IS training undertaken by the owner-manager</td>
<td>.701</td>
</tr>
<tr>
<td>2 Average number of days IT/IS training per partner and associate</td>
<td>.769</td>
</tr>
<tr>
<td>3 Average number of days IT/IS training per member of administrative and support staff</td>
<td>.741</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

The confirmatory measurement model for level of IT/IS training is shown in figure 6.11. While all paths are significant at the .01 level, the overall reliability of the confirmed model remains below the .70 threshold at .61. Again, it should be recalled that the nature of reliability measures are such that they tend to show lower reliability for constructs with fewer items. As the IT/IS training measurement model proposed consists of only three items, .61 represents an acceptable reliability score for the construct.
6.3.4. External support for IT/IS assessment and acquisition

6.3.4.1. A measurement model of consultant effectiveness

An exploratory factor analysis was undertaken on the six measures proposed as measures of consultant effectiveness (see table 6.10). All six items loaded highly onto one factor showing the measure to be essentially unidimensional. The identified factor had a KMO measure of sampling adequacy of 0.85, well above that required. As all factors loaded on to the construct at the .74 level and above, no items were omitted.

Table 6.10. Exploratory factor analysis of consultant effectiveness measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant effectiveness in performing an information requirements analysis</td>
<td>.874</td>
</tr>
<tr>
<td>Consultant effectiveness in recommending a suitable IT/IS solution</td>
<td>.949</td>
</tr>
<tr>
<td>Consultant effectiveness at managing IT/IS implementation</td>
<td>.918</td>
</tr>
<tr>
<td>Rating of consultant’s relationship with other parties in the project</td>
<td>.868</td>
</tr>
<tr>
<td>Rating or consultant ability to understand firm’s business needs</td>
<td>.740</td>
</tr>
<tr>
<td>Overall satisfaction with consultant</td>
<td>.915</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis
Cronbach's alpha test of internal reliability was applied. This gave a result of .95, again well above that required. Finally, a confirmatory factor analysis was undertaken on the exploratory measurement model proposed. This is represented diagrammatically in figure 6.12. All indicators proved to be significant at the .01 level. The construct reliability also proved high at .94. As such, the measurement model is accepted as a reliable measure of consultant effectiveness.

**Figure 6.12. Consultant effectiveness measurement model**

6.3.4.2. A measurement model of vendor effectiveness

Exploratory factor analysis was undertaken on the nine items proposed as measures of vendor effectiveness (see table 6.11). As the table illustrates, two principal factors are identified. Prior to further analysis, it was deemed necessary to interpret as much as possible the two items that loaded onto component two. Intuitively it seemed peculiar
that the two items should load onto the one factor in such opposition. Thus, in order to investigate this phenomenon, several organisations that had reported opposing levels of satisfaction over the two measures were contacted. On the basis of such investigation it was found that respondents had not fully understood the software customisation measure and, as a result, it was removed from the factor analysis.

Table 6.11. Exploratory factor analysis of vendor effectiveness construct

<table>
<thead>
<tr>
<th>Construct</th>
<th>Component 1</th>
<th>Component 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness in recommending a suitable IT/IS solution</td>
<td>.693</td>
<td></td>
</tr>
<tr>
<td>Effectiveness in customising software</td>
<td></td>
<td>-.876</td>
</tr>
<tr>
<td>Adequacy of technical support during IT/IS implementation</td>
<td></td>
<td>.812</td>
</tr>
<tr>
<td>Adequacy of training provided</td>
<td>.748</td>
<td></td>
</tr>
<tr>
<td>Vendor relationship with other parties in the project</td>
<td>.797</td>
<td></td>
</tr>
<tr>
<td>Adequacy of documentation provided</td>
<td>.717</td>
<td></td>
</tr>
<tr>
<td>Vendor's ability to understand business needs</td>
<td>.681</td>
<td></td>
</tr>
<tr>
<td>Vendor's response / turnaround time</td>
<td>.714</td>
<td></td>
</tr>
<tr>
<td>Overall satisfaction with vendor</td>
<td>.878</td>
<td></td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

A second factor analysis was thus performed with the vendor software development / customisation item omitted. The results of the analysis are shown in table 6.12 (as 'component 1 including item 2'). With vendor software development / customisation omitted, the factor analysis shows the construct to be unidimensional. However, item two, adequacy of technical support during IT/IS implementation, loads weakly onto the factor. Using 0.5 as a cut-off, item two is omitted. This is presented as 'component 1 omitting item 2' in the table. The latter factor analysis reported a KMO score of .83, well above the suggested cut-off of 0.5. The internal reliability of the construct is further confirmed by a Cronbach alpha score of .86.
### Table 6.12. Factor analysis of vendor effectiveness construct

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1 including Item 2</th>
<th>Component 1 omitting Item 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Effectiveness in recommending a suitable MIS solution</td>
<td>.704</td>
<td>.710</td>
</tr>
<tr>
<td>2 Adequacy of technical support during IT/IS implementation</td>
<td>.310</td>
<td></td>
</tr>
<tr>
<td>3 Adequacy of training provided</td>
<td>.745</td>
<td>.748</td>
</tr>
<tr>
<td>4 Vendor relationship with other parties in the project</td>
<td>.787</td>
<td>.791</td>
</tr>
<tr>
<td>5 Adequacy of documentation provided</td>
<td>.734</td>
<td>.703</td>
</tr>
<tr>
<td>6 Vendor's ability to understand business needs</td>
<td>.685</td>
<td>.696</td>
</tr>
<tr>
<td>7 Vendor's response / turnaround time</td>
<td>.704</td>
<td>.700</td>
</tr>
<tr>
<td>8 Overall satisfaction with vendor</td>
<td>.858</td>
<td>.863</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

The final stage in the development of the measurement model involves undertaking a confirmatory factor analysis on the model proposed during the exploratory phase. All paths are significant at the .01 level. The calculated reliability for the construct is .87. As such, the measurement model for vendor effectiveness is deemed reliable.

### Figure 6.13. Vendor effectiveness measurement model

![Vendor effectiveness measurement model diagram](image)

All paths significant at .01 level
6.3.4.3. Employment of external support

Two measures of the employment of external support are included in the model. These are; (1) employment of vendor support (labelled ‘vendor’); and (2) employment of consultant support (labelled ‘consult’). Both are one-item dichotomous ‘yes/no’ measures.

6.3.5. Management IT/IS characteristics

6.3.5.1. A measurement model of management support for IT/IS

A one-item measure was employed to evaluate management support for IT/IS. This is described in chapter four.

6.3.5.2. A measurement model of management IT/IS experience

An exploratory factor analysis was undertaken on the five items proposed as measures of management IT/IS experience (see table 6.13). As is evident, items 2-5 load onto component 1, while item 1, level of formal IT/IS training, loads onto component 2.

| Table 6.13. Exploratory factor analysis of the management IT/IS experience construct |
|-----------------------------------|---------------------------------|----------------|
| Item                              | Component 1                     | Component 2    |
| 1 Level of formal IT/IS training  |                                 | .742           |
| 2 Level of direct (hands-on) computer experience | .782 | |
| 3 Previous managerial IT/IS experience | .662 | |
| 4 Changed approach to computer acquisition | .606 | |
| 5 Level of IT/IS development since initial computerisation | .580 | |

Extraction Method: Principal Component Analysis
Because the level of formal IT/IS training loaded onto an independent dimension; and because it is proposed as an independent variable in the current study, it was deemed appropriate to drop it as a measure of management IT/IS experience. This results in a unidimensional measure of management IT/IS experience, as shown in the table 6.14.

Table 6.14. Exploratory factor analysis of management IT/IS experience

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Level of direct (hands-on) computer experience</td>
<td>.782</td>
</tr>
<tr>
<td>2 Previous managerial IT/IS experience</td>
<td>.662</td>
</tr>
<tr>
<td>3 Changed approach to computer acquisition</td>
<td>.606</td>
</tr>
<tr>
<td>4 Level of IT/IS development since initial computerisation</td>
<td>.580</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

While each item has an acceptable factor loading of .58 and higher and the analysis has a KMO of .65, the internal reliability of the scale is on the lower boundary at .61. This is only 0.07 lower than that used by Lefebvre et al. (1995) and the susceptibility of Cronbach's scale to constructs consisting of few items is worth reiterating. In spite of these facts, a higher alpha score would be preferred.

Finally, the exploratory measurement model proposed was entered into Amos modelling software in order to perform confirmatory factor analysis. While all paths are again significant at the .01 level, the reliability of the construct remains on the lower boundary at .61. Given the small number of items forming the construct, this is considered acceptable.
6.3.6. Organisational characteristics and resources

6.3.6.1. Organisation size

Organisation size was measured as the total number of full time personnel employed by an organisation. The variable is labelled as 'size' in the structural equation model.

6.3.6.2. Organisation IT/IS knowledge

Organisational IT/IS knowledge is measured using a one-item measure as described in chapter four. The variable is labelled 'knowledg' in the structural equation model.
6.3.7. Measurement models of indirect drivers of IT/IS implementation success

6.3.7.1. A measurement model of IT/IS learning

In order to check for unidimensionality, a factor analysis was undertaken on the three items proposed as measures of organisational learning. The results are shown in table 6.15. The KMO score for the analysis is acceptable at 0.65, and Cronbach’s measure of internal reliability is strong at 0.76

Table 6.15. Factor analysis of IT/IS learning

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Change in approach to computer acquisition and management resulting from previous acquisition interactions with IT/IS</td>
<td>.864</td>
</tr>
<tr>
<td>2. Change in approach to IS planning resulting from previous acquisition interactions with IT/IS</td>
<td>.864</td>
</tr>
<tr>
<td>3. Change in approach to decision-maker responsibility resulting from previous acquisition interactions with IT/IS</td>
<td>.726</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

The final step involved undertaking a confirmatory factor analysis on the proposed construct as well as calculating its overall reliability. All paths proved significant at the .01 level and the overall reliability of the construct was high at .76. As such, the measurement model was deemed to be a reliable measure of IT/IS learning (see figure 6.15).

Figure 6.15. IT/IS learning measurement model

All paths significant at .01 level
6.3.7.2. A measurement model of stability of the business environment

Factor analysis was undertaken in order to see if the three items proposed as measures of the stability of the business environment represented the underlying construct hypothesised (see table 6.16). As the table shows, this indeed proved to be the case. All three items loaded highly onto the factor. The KMO score and Cronbach's alpha coefficient are both adequate at .67 and .67 respectively.

Table 6.16. Factor analysis of perceived environmental stability

<table>
<thead>
<tr>
<th>Item</th>
<th>Component 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Perceived stability of the business environment</td>
<td>.775</td>
</tr>
<tr>
<td>2 Evaluation of the existing system</td>
<td>.792</td>
</tr>
<tr>
<td>3 Written statement of requirements</td>
<td>.780</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis

Finally, a confirmatory factor analysis was undertaken on the proposed measurement model. The output is represented diagrammatically in figure 6.16. Once again, all paths were significant at the .01 level. However, the reliability of the construct fell marginally short of the .70 threshold at .68. This is considered acceptable due to the small number of items in the construct.

Figure 6.16. Stability of the business environment measurement model

All paths significant at .01 level
6.3.7.3. Investment capability of the organisation

The investment capability of the organisation is measured using a one-item measure as described in chapter four. This is labelled 'affluenc' in the structural equation model.

6.3.8. Transition between step one and step two of modelling

As part of their recommended two-step approach, Anderson and Gerbing (1988b) recommend the “fixing” of the measurement model estimated in the first stage, prior to the second stage in which the structural model is estimated. According to Hair et al. (1998), the rationale of this approach is that accurate representation of the reliability of the indicators is best accomplished in two steps to avoid the interaction of measurement and structural models. Following such an approach is particularly beneficial when faced with measures that are less reliable, or theory that is only tentative.

In terms of such a two-step approach, the current study is nearing the completion of the first stage. Each measurement construct has been approached individually, with each measurement model subjected to both exploratory analysis and confirmatory testing. This results in a completed measurement model as illustrated in figure 6.17. This includes all individual measurement models used to measure the variables hypothesised to play an important role in chapter two. As is evident, the observed variables (in the rectangular boxes) generally show question numbers as opposed to the variable labels shown in the model building process above. These labels correspond with the column headings used in the data set and are necessary for the software to function. Unobserved variables (represented in ovals) maintain the same labels as listed above.
In order to fully complete stage one, the measurement model must be "fixed". In order to complete this task, the error variances and factor loadings estimated for each individual and confirmed measurement model (as shown in figures 6.5 - 6.15) are "fixed" in the final measurement model (see figure 6.17). Once the loadings and error variances are set, stage two of model development - the addition of the structural model - can be added without resulting in within-construct versus between-construct effects in estimation which can, according to Burt (1976), lead to "interpretational confounding".

6.4. Step two: construction and testing of the structural model

It is here that the completed model (see figure 6.18) is presented. The model shown on the following page is developed using the Amos structural equation modelling package. The model illustrated includes all the relationships hypothesised in chapter two. As such, it fully operationalises the hypothesised model. Hereafter it is titled Model A.

Referring to figure 3.1 in chapter three, it is evident that step seven (the completion of measurement and structural models) is now complete. As the study has reached step eight in stage one (exploratory model evaluation), its current aim is to evaluate and refine Model A in order to create a more parsimonious model that better explains the causal relationships inherent in the IT/IS assessment and adoption process in small professional firms. In order to undertake this task, exploratory model evaluation and refinement, employing theoretical and empirical means, is carried out (see steps eight and nine in figure 3.1). These steps are presented and explained in the following chapter.
Figure 6.18: Model of a completed structured equation model of IT/IS assessment and adoption in small firms
An insight into the strength of Model A is presented in table 6.17. The table presents the critical ratio for each hypothesised path as calculated by the model estimation process. Critical ratio is defined by Arbuckle (1997) as follows:

"The critical ratio is the parameter estimate divided by an estimate of its standard error. If the appropriated distributional assumptions are met, this statistic has a standard normal distribution under the null hypothesis that the parameter has a population value of zero. For example, if an estimate has a critical ratio greater than two (in absolute value), the estimate is significantly different from zero at the .05 level.” (Arbuckle, 1997, p.279)

During stage two of modelling (confirmatory model testing), a significance level of 0.025 recommended by Hair et al. (1998) is imposed resulting in a one-tailed critical ratio of ±1.96. For a path to be considered significant, its critical ratio must equal or exceed ±1.96. However, during the current stage of modelling, a more flexible approach is adopted. While critical ratios provide a useful reference, paths are not included or omitted solely on the basis of their significance level (and certainly not at the conservative significance level imposed during confirmatory model testing). Throughout the exploratory stage of modelling, theoretical considerations are regarded as important as empirical findings. This is explained in detail in chapter seven.

Table 6.17. Output from analysis of Model A

<table>
<thead>
<tr>
<th>Hypothesis No.</th>
<th>Path</th>
<th>Critical ratio</th>
<th>Regression weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>LI H1a</td>
<td>Business Performance (soft measures) ← Organisational impact of IT/IS</td>
<td>2.280</td>
<td>.266</td>
</tr>
<tr>
<td>LI H1b</td>
<td>Business Performance (soft measures) ← Information product satisfaction</td>
<td>-1.808</td>
<td>-.239</td>
</tr>
<tr>
<td>LI H1c</td>
<td>Business Performance (soft measures) ← Satisfaction with IT/IS providers and services</td>
<td>2.826</td>
<td>.335</td>
</tr>
<tr>
<td>LI H1a</td>
<td>Turnover per employee ← Organisational impact of IT/IS</td>
<td>0.623</td>
<td>.057</td>
</tr>
<tr>
<td>LI H1b</td>
<td>Turnover per employee ← Information product satisfaction</td>
<td>-0.230</td>
<td>-.012</td>
</tr>
<tr>
<td>LI H1c</td>
<td>Turnover per employee ← Satisfaction with IT/IS providers and services</td>
<td>-1.407</td>
<td>-.152</td>
</tr>
<tr>
<td>Hierarchy Level Two</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td>L11 H1a</td>
<td>Organisational impact of IS ← Level of IS investment</td>
<td>1.414 .109</td>
<td></td>
</tr>
<tr>
<td>L11 H1b</td>
<td>Information product satisfaction ← Level of IS investment</td>
<td>1.212 .117</td>
<td></td>
</tr>
<tr>
<td>L11 H1c</td>
<td>Satisfaction with IS providers and services ← Level of IS investment</td>
<td>1.548 .136</td>
<td></td>
</tr>
<tr>
<td>L11 H2a</td>
<td>Organisational impact of IS ← IS sophistication</td>
<td>2.950 .298</td>
<td></td>
</tr>
<tr>
<td>L11 H2b</td>
<td>Information product satisfaction ← IS sophistication</td>
<td>0.644 .081</td>
<td></td>
</tr>
<tr>
<td>L11 H2c</td>
<td>Satisfaction with IS providers and services ← IS sophistication</td>
<td>0.283 .088</td>
<td></td>
</tr>
<tr>
<td>L11 H3a</td>
<td>Organisational impact of IS ← Level of planning and formalisation</td>
<td>1.220 .127</td>
<td></td>
</tr>
<tr>
<td>L11 H3b</td>
<td>Information product satisfaction ← Level of planning and formalisation</td>
<td>0.146 .027</td>
<td></td>
</tr>
<tr>
<td>L11 H3c</td>
<td>Satisfaction with IS providers and services ← Level of planning and formalisation</td>
<td>1.848 .243</td>
<td></td>
</tr>
<tr>
<td>L11 H4a</td>
<td>Organisational impact of IS ← Level of employee involvement in IS acquisition decisions</td>
<td>-0.619 -.036</td>
<td></td>
</tr>
<tr>
<td>L11 H4b</td>
<td>Information product satisfaction ← Level of employee involvement in IS acquisition decisions</td>
<td>1.375 .114</td>
<td></td>
</tr>
<tr>
<td>L11 H4c</td>
<td>Satisfaction with IS providers and services ← Level of employee involvement in IS acquisition</td>
<td>-0.119 -.025</td>
<td></td>
</tr>
<tr>
<td>L11 H5a</td>
<td>Organisational impact of IS ← IS training</td>
<td>1.807 .208</td>
<td></td>
</tr>
<tr>
<td>L11 H5b</td>
<td>Information product satisfaction ← IS training</td>
<td>1.375 .179</td>
<td></td>
</tr>
<tr>
<td>L11 H5c</td>
<td>Satisfaction with IS providers and services ← IS training</td>
<td>-1.783 -.124</td>
<td></td>
</tr>
<tr>
<td>L11 H6a</td>
<td>Organisational impact of IS ← Vendor effectiveness</td>
<td>1.661 .135</td>
<td></td>
</tr>
<tr>
<td>L11 H6b</td>
<td>Information product satisfaction ← Vendor effectiveness</td>
<td>3.833 .383</td>
<td></td>
</tr>
<tr>
<td>L11 H6c</td>
<td>Satisfaction with IS providers and services ← Vendor effectiveness</td>
<td>8.711 .773</td>
<td></td>
</tr>
<tr>
<td>L11 H7a</td>
<td>Organisational impact of IS ← Consultant effectiveness</td>
<td>3.245 .366</td>
<td></td>
</tr>
<tr>
<td>L11 H7b</td>
<td>Information product satisfaction ← Consultant effectiveness</td>
<td>4.671 .567</td>
<td></td>
</tr>
<tr>
<td>L11 H7c</td>
<td>Satisfaction with IS providers and services ← Consultant effectiveness</td>
<td>1.711 .139</td>
<td></td>
</tr>
<tr>
<td>L11 H8a</td>
<td>Organisational impact of IS ← Management support for IS</td>
<td>4.272 .405</td>
<td></td>
</tr>
<tr>
<td>L11 H8b</td>
<td>Information product satisfaction ← Management support for IS</td>
<td>0.871 .099</td>
<td></td>
</tr>
<tr>
<td>L11 H8c</td>
<td>Satisfaction with IS providers and services ← Management support for IS</td>
<td>-0.681 -.025</td>
<td></td>
</tr>
<tr>
<td>L11 H9a</td>
<td>Organisational impact of IS ← Management IS experience</td>
<td>-1.293 -.212</td>
<td></td>
</tr>
<tr>
<td>L11 H9b</td>
<td>Information product satisfaction ← Management IS experience</td>
<td>-0.785 -.161</td>
<td></td>
</tr>
<tr>
<td>L11 H9c</td>
<td>Satisfaction with IS providers and services ← Management IS experience</td>
<td>-1.267 -.341</td>
<td></td>
</tr>
<tr>
<td>L11 H10a</td>
<td>Organisational impact of IS ← Organisation size</td>
<td>-0.336 -.020</td>
<td></td>
</tr>
<tr>
<td>L11 H10b</td>
<td>Information product satisfaction ← Organisation size</td>
<td>-1.442 -.120</td>
<td></td>
</tr>
<tr>
<td>L11 H10c</td>
<td>Satisfaction with IS providers and services ← Organisation size</td>
<td>0.686 .044</td>
<td></td>
</tr>
<tr>
<td>L11 H11a</td>
<td>Organisational impact of IS ← Organisational IS knowledge</td>
<td>1.724 .136</td>
<td></td>
</tr>
<tr>
<td>L11 H11b</td>
<td>Information product satisfaction ← Organisational IS knowledge</td>
<td>1.285 .115</td>
<td></td>
</tr>
<tr>
<td>L11 H11c</td>
<td>Satisfaction with IS providers and services ← Organisational IS knowledge</td>
<td>-0.050 -.016</td>
<td></td>
</tr>
<tr>
<td>Hierarchy Level Three</td>
<td>[ ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>--------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H1</strong> Level of IT/IS investment ← Management support for IT/IS</td>
<td>1.567</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H2</strong> Level of IT/IS investment ← Management IT/IS experience</td>
<td>1.493</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H3</strong> Level of IT/IS investment ← Investment capability</td>
<td>-1.237</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H4</strong> IT/IS sophistication ← Organisational IT/IS knowledge</td>
<td>1.485</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H5</strong> IT/IS sophistication ← Management support for IT/IS</td>
<td>1.811</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H6</strong> IT/IS sophistication ← Management IT/IS experience</td>
<td>3.485</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H7</strong> IT/IS sophistication ← Level of IT/IS investment</td>
<td>2.207</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H8</strong> Level of planning and formalisation ← Perceived stability of business environment</td>
<td>0.281</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H9</strong> Level of planning and formalisation ← Organisation size</td>
<td>2.396</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H10</strong> Level of planning and formalisation ← Management IT/IS experience</td>
<td>2.565</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H11</strong> Level of planning and formalisation ← Organisational IT/IS knowledge</td>
<td>0.955</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H12</strong> Level of planning and formalisation ← Management support for IT/IS</td>
<td>0.437</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H13</strong> Level of planning and formalisation ← Employment of consultant support</td>
<td>1.133</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H14</strong> Level of IT/IS training ← Investment capability</td>
<td>0.091</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H15</strong> Level of IT/IS training ← Management support for IT/IS</td>
<td>0.552</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H16a</strong> Vendor effectiveness ← Employment of vendor support</td>
<td>1.752</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H16b</strong> Consultant effectiveness ← Employment of consultant support</td>
<td>0.107</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H17</strong> Employment of consultant support ← Investment capability</td>
<td>-0.272</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H18a</strong> Employment of vendor support ← Organisational IT/IS knowledge</td>
<td>0.488</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H18b</strong> Employment of consultant support ← Organisational IT/IS knowledge</td>
<td>-0.408</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H19a</strong> Employment of vendor support ← Management IT/IS experience</td>
<td>0.108</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H19b</strong> Employment of consultant support ← Management IT/IS experience</td>
<td>-0.089</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H21a</strong> Management IT/IS experience ← IT/IS learning</td>
<td>1.950</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H21b</strong> Organisational IT/IS knowledge ← IT/IS learning</td>
<td>1.651</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H22a</strong> Organisation IT/IS knowledge ← IT/IS training</td>
<td>2.217</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H22b</strong> Organisational IT/IS knowledge ← IT/IS training</td>
<td>-0.189</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H23</strong> Management support for IT/IS ← Management IT/IS experience</td>
<td>3.538</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H24</strong> Management support for IT/IS ← Management IT/IS experience</td>
<td>-1.301</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LIII H27</strong> Investment capability ← Size</td>
<td>3.544</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Approaching Model A in terms of the three hierarchical levels presented in chapter two, it is evident that both support for and argument against hypotheses inherent in the model is apparent. Detailed evaluation and interpretation of the model is afforded
following its refinement and confirmatory model testing. At this stage, however, a concise evaluation of the Model A affords an initial insight into its ability to explain underlying processes and its support for the hypothesised relationships.

Focusing initially on hierarchy level one, table 6.17 indicates support for the hypothesised relationship between two measures of IT/IS implementation success – (1) organisational impact of IT/IS and (2) satisfaction with IT/IS providers and services – and business performance (soft measures). In contrast, a negative relationship between the third IT/IS implementation success measure - information product satisfaction - and business performance is indicated. Support for a relationship between measures of IT/IS implementation success and the second organisational performance measure - turnover per employee - prove weak.

Table 6.17 also indicates a number of primary drivers of IT/IS implementation success as part of hierarchy level two. These include; (1) IT/IS sophistication; (2) vendor effectiveness; (3) consultant effectiveness; and (4) management support for IT/IS (which formed an element in Delone's 1983 model). Less strong drivers include; (1) level of investment in IT/IS; (2) planning and formalisation of IT/IS acquisition; (3) level of IT/IS training; and (4) level of organisational knowledge.

Evident for the first time in presenting the model estimation, is that different drivers affect different measures of IT/IS implementation success. In chapter two, IT/IS implementation success was approached as a generic variable covering both the organisational impact of IT/IS and user information satisfaction-based measures of IT/IS success. In operationalising IT/IS implementation success in chapter four, it became evident that the UIS-based measure of IT/IS implementation success consisted of two dimensions; (1) information product satisfaction; and (2) satisfaction with IT/IS providers and services; while the organisational impact of IT/IS proved to
be a unidimensional construct. The findings presented in table 6.17 add further support for measures of IT/IS implementation success being employed in their unidimensional forms. Only in this way is it possible to observe which elements of IT/IS implementation success specific variables affect. Full consideration is given to the UIS construct in the following chapter.

Most of the hypothesised drivers of IT/IS implementation success prove to be supported over at least one of the three measures of IT/IS implementation success, affirming the theoretical underpinning on which the relationships between drivers of success and the generic measure of IT/IS implementation success were based. The hierarchy level two variable which, on the basis of the empirical estimation, is weakest is employee involvement in IT acquisition.

Hierarchy level three focuses upon interaction between model variables and their impact on drivers of IT/IS implementation success. Significant support for Cragg and King's (1993) model of motivators of software sophistication is evident (see figure 2.17 of chapter two). Management IT/IS experience; level of IT/IS investment; management support for IT/IS; and organisational IT/IS knowledge are all shown to influence the level of IT/IS sophistication within the small firm.

The findings also indicate that the level of IS planning undertaken in a firm is influenced by both the size of the organisation and the level of management IT/IS experience. This latter finding adds support to Fuller's (1996) recursive model of IT adoption in small firms. This is also supported by findings indicating that IT/IS learning influences both organisational IT/IS knowledge and the level of management IT/IS experience. Strong relationships are also evident between management IT/IS experience and management support for IT/IS and organisational size and investment capability.
While table 6.17. indicates strong support for a number of causal relationships hypothesised in the model, it is evident that not all relationships are significant at the .025 level employed during confirmatory modelling. It must be reiterated that it is not the aim at this stage of the modelling process to omit relationships on the basis of their significance level. Such evaluation takes place during confirmatory model testing. As is explained in the following chapter, the current aim is the refinement of the model on the basis of both theoretical and empirical justification. As such, the weakest paths will be omitted on both theoretical and empirical grounds. Following the refinement of the model in the following chapter, confirmatory model testing will be undertaken upon the final model in order to evaluate its ability to explain the underlying processes at work. This involves the collection of a second data set. After confirmatory testing, a full interpretation of the findings will be afforded.

In summary, it is evident that the current model is both complex and lacks parsimony. It is also evident that a number of hypothesised paths fail to explain underlying processes within the model. Such paths will be evaluated both empirically and theoretically in the following chapter.

6.5. Summary and Conclusion

The current chapter has focused upon steps six and seven of the recommended approach to structural equation modelling presented in figure 3.1 of chapter three. This has involved a two step approach recommended by Anderson and Gerbing (1988b) involving; (1) the construction and testing of measurement models prior to; (2) the construction and testing of the structural model. Chapter six described and explained the process, affording validity and reliability information for each construct developed to measure variables that form part of the model of IT/IS assessment and
acquisition in small firms. Each construct was shown to be satisfactory in its ability to measure the concept it was purported to measure.

The chapter concluded with a brief evaluation of the model. While in-depth analysis and interpretation is considered inappropriate at this stage due to the changes that will affect the model during the refinement stage that follows, the evaluation afforded shows aspects of the model estimation to support the sub-models and components of the model hypothesised in chapter two. Not all hypothesised paths were supported however, indicating a need for refinement of the model. The current chapter also emphasised that reliance on empirical data at this exploratory stage of model development is inappropriate. This is explained in further detail in the following chapter as is the importance of finding a theoretical and empirical balance during the model refinement process. Model refinement is undertaken within that context.
Chapter Seven – Model Respecification and Evaluation

7.1. Introduction

Chapter six described the completion of measurement models and the structural model (steps six and seven of figure 3.1) that operationalise the model of IT/IS assessment and acquisition in small professional firms presented in chapter two. Chapter seven focuses upon the evaluation and refinement of the model (steps eight and nine of the approach presented in chapter three). The primary objective of the current chapter is to re-evaluate hypothesised paths, both empirically and theoretically, in order to develop a more refined model of IT/IS assessment and acquisition in small professional firms.

The chapter is divided into three primary sections. The first focuses upon the refinement of Model A. According to Hair et al. (1998) theoretical justification is equally important as empirical evidence during the model development stage. Thus, section one is itself divided into two sub-sections. The first presents the methodology employed in order to undertake empirically driven model development, and concludes with the presentation of a model which it is argued achieves the optimum balance between simplicity and goodness of fit. The second stage re-evaluates the refined model theoretically. Here, the strength of existing argument for such relationships is discussed and whether such argument overrides the empirical findings presented and evaluated.
Section two returns to a fundamental issue raised in chapter two; namely the role of the traditional UIS measure in a model of IT/IS assessment and acquisition in small professional firms. On the basis of existing research, chapter two argued that the traditional UIS measure represents a surrogate measure for the organisational impact of IT/IS. Chapter two also showed a significant body of research to rely on the UIS measure in its one-dimensional format. However, evidence exists which indicates that the UIS measure is, in fact a multi-dimensional construct which should thus be employed as such (Melone, 1990), as in Model A. Employing the UIS measure in its one-dimensional form or employing IT/IS implementation success using several independent measures essentially represent two conflicting theories. In refining the model, it is essential that the measure of IT/IS implementation success chosen is both theoretically and empirically strong in its capacity to clearly explain underlying processes in the assessment and acquisition of IT/IS in small professional firms. Structural equation modelling enables the testing of the two independent theories in order to identify which is stronger. Thus, section two presents the stages necessary in the construction and evaluation of two competing models which represent the two conflicting theories.

Following the presentation of the two model refinement and testing exercises undertaken in sections one and two, Model B, on which confirmatory testing will be undertaken, is presented. The presentation of Model B represents the third and final section of the chapter.

7.2. Refinement of Model A

The purpose of this stage of the research is to develop an empirically supported and theoretically justified model that can be re-tested, employing a confirmatory approach
In refining Model A, it is intended that the weakest paths, both empirically and theoretically, are removed. In doing so, a clearer insight into the underlying processes occurring in small professional firms will be afforded. Because empirical and theoretical refinement are of equal importance during exploratory stages of modelling, the refinement of Model A is divided into two primary stages; (1) empirically driven model development; and (2) the theoretical justification underpinning development. These two stages are the focus of the first part of the chapter.

7.2.1. Stage one: empirically driven model development

Stage one of model development is itself divided into two sub-sections. The first focuses upon methodological issues including the selection of an appropriate modelling strategy and explanation of the model evaluation criteria employed in empirically driven model development. As a result of the model development strategy selected, a number of different models are specified. The second section involves the practical application of the model evaluation criteria described in section one. The specified models are compared and the strongest selected on the basis of the evaluation criteria.

7.2.1.1. Model development and evaluation: methodological issues

In appropriating a model development strategy, it is paramount that the researcher is sure of the objectives of the research (Hair et al., 1998). The nature of structural equation modelling (SEM) is such that if it is applied in the absence of theoretical support, it is possible that inappropriate techniques will be used in an unsuitable manner. Hair et al. (1998) assert that while the flexibility of structural equation
modelling “provides the researcher with a powerful analytical tool appropriate for many research objectives... the researcher must define these objectives as guidelines in a modeling strategy” (p.590). The following sections present recommended approaches to model development (e.g. Anderson and Gerbing, 1988; McCallum, 1995; Hair et al., 1998) and afford an insight into the process employed in the refinement stage.

7.2.1.1.1. Selection of a model development strategy
Three distinct model development strategies are proposed by Hair et al.; (1) a model development strategy; (2) a confirmatory modelling strategy; and (3) a competing models strategy. The purpose of the first strategy is to improve the model through modifications of the structural and measurement models. As Hair et al. argue, “in many applications, theory can provide only a starting point for development of a theoretically justified model that can be empirically supported. Thus, the researcher must employ SEM not just to test the model empirically but also to provide insights into its respecification” (p.592).

The second strategy is the most direct application of structural equation modelling. Here, the researcher specifies a single model and uses SEM to assess its statistical significance. The model is then accepted or rejected on that basis. While this may seem the most rigorous application of SEM, Hair et al. argue that it is in actual fact not the most stringent test. Even if the proposed model has acceptable fit by whatever criteria, ‘the researcher has not “proved” the proposed model but only confirmed that it is one of several possible acceptable models’ (p.591). It is possible that several different models have equally acceptable fits. It is here that the third strategy adds value.
The competing models strategy compares models that represent different hypothetical structural relationships. In comparing these models, the researcher is effectively evaluating competing theories, which is a much stronger test than modifying a single theory. The most common application is the nested model approach, in which the number of constructs and indicators remains constant, but the number of estimated relationships changes.

As stated, the purpose of this stage of the research is to develop a strong theoretically justified and empirically supported model that can be re-tested, employing a confirmatory approach using a second data set. The model of IT/IS assessment and acquisition in small professional firms currently proposed contains a large number of hypothesised causal relationships based upon those purported to exist in previous research. This is where appropriating the most suitable SEM model refinement strategy can add significant value. Because the larger body of previous research focuses upon single direct causal relationships, it is possible that indirect relationships have been overlooked in a number of studies, and less suitable direct relationships proposed in their place. In short, a clouded picture of the factors at work may have been presented.

Such an example exists in the context of the current study. Investment in IT/IS has been shown by previous research to impact upon the success with which IT/IS is implemented (Mitra and Chaya, 1996; Rai et al., 1997). However, such studies have generally failed to illustrate the influence of intermediate variables. It might be, for example, that increased IT/IS investment results in more sophisticated IT/IS or more training, and it is these factors that impact upon IT/IS success and not levels of investment directly. If this is proven empirically, then it may be appropriate
to remove the hypothesised direct relationships between IT/IS investment and measures of IT/IS success.

In order to achieve the objectives set out above, the competing models strategy is employed in the current study. The competing models strategy is the most effective as a means of evaluating a proposed model with alternative models over a number of model comparisons. As Hair et al. (1998, p.591) assert, "the strongest test of a proposed model is to identify and test competing models that represent truly different hypothetical structural relationships." As stated, the most common approach to the competing models strategy is the comparison of nested models (where the number of constructs and indicators remain constant, but the number of estimated relationships change). Using such a method, the initial hypothesised model (in this case Model A) is evaluated before more constraints are added (by removing hypothesised paths between variables). This established procedure allows nested models to be compared in order to identify which model, and theory, shows the best fit measure (Hair et al., 1988).

7.2.1.1.2. The definition of nested models using critical ratio criteria

In proposing nested models on the basis of output from analysis of Model A, it is paramount that the research objectives are set. As Hair et al. (1998, p.590) assert, ‘one of the most important concepts a researcher must learn regarding multivariate techniques is that there is no single “correct” way to apply them. Instead, the researcher must formulate the objectives of the research and apply the most appropriate technique in the most suitable manner to achieve the desired objectives.’ As stated above, the objective of model refinement at this stage is arrival at a model
that includes paths that are supported most strongly both theoretically and empirically from the sample and that is likely to be generalisable to other samples.

Here, another question arises. What level of precision should be applied in the refinement of the model? According to Hair et al. (1998), over reliance on empirical justification for the removal of paths, when applied in an “exploratory” manner, can cause problems. The authors argue that when SEM is applied in such a manner, “the researcher is faced with the rather high probability of falling prey to “data snooping” or “fishing” and identifying relationships that have little generalisability by simply capitalising on the relationships specific to the sample data being studied’ (p.616). It is fundamental to the current research that such a pitfall is avoided.

In order to ensure that this was so, analysis of the confirmatory type was avoided. In such analysis, relationships are strictly specified, and included or omitted on the basis of their significance (i.e. if they have a critical ratio of ±1.96 or above). The model is then accepted or rejected on the basis of whether it is supported by the data. As our analysis remains exploratory as opposed to confirmatory at this stage, relationships are more loosely recognised. This is fundamental to the competing models strategy employed. Hair et al. (1998) specifically note that the researcher should proceed with caution during this stage. “The researcher must be careful not to employ this strategy to the extent that the final model has acceptable fit but cannot be generalized to other samples or populations (p.592)”.

In practical terms, this meant that instead of refining the model to a stage where only paths with a critical ratio of greater than ±1.96 remained, several models were proposed using varying critical ratios as path omission guidelines. These models were then tested using standard model evaluation techniques. The model fit measures
employed in the evaluation of the different models are described in the following section.

7.2.1.1.3. Evaluation of nested models using goodness of fit measures

It is useful to explain parsimony at this stage as it will add an insight into model fit measures. Parsimony is a main objective in the development of any such model and is here described by Arbuckle (1997).

"Measures with relatively few parameters (and relatively many degrees of freedom) are sometimes said to be high in parsimony, or simplicity. Models with many parameters (and few degrees of freedom) are said to be complex, or lacking in parsimony.... While one can inquire into the grounds for preferring simple parsimonious models (e.g., Mulaik et al., 1989), there does not appear to be any disagreement that parsimonious models are preferable to complex ones. When it comes to parameters, all other things being equal, less is more. At the same time, well fitting models are preferable to poorly fitting ones. Many fit measures represent an attempt to balance these conflicting objectives - simplicity and goodness of fit." (Arbuckle, 1997, p.552)

In using different critical ratio cut-off points as model redefinition criteria, models with varying numbers of parameters are proposed (see table 7.1). The higher the critical ratio cut-off point, the fewer parameters, and the more narrowly refined (parsimonious, or highly constrained) the model. However, as the critical ratio cut-off point increases, the goodness of fit generally decreases.

In order to evaluate which model best represents the balance between simplicity and goodness of fit as described by Arbuckle (1997), three principal measures of goodness of fit are employed; (1) the function of log likelihood (Arbuckle, 1997); (2) the Akaike information criterion (Akaike, 1987; Arbuckle, 1997); and (3) relative chi square. Models were also evaluated on the percentage of
variance of critical output measures that was explained. The model evaluation techniques are described in the following section.

7.2.1.1.3.1. Model comparison using the function of log likelihood

Testing for model parsimony involves observing the function of log likelihood and the number of parameters for two or more structurally nested models (Arbuckle, 1997). The number of parameters is simply the number of parameters estimated. The function of log likelihood is less simple to interpret. According to Arbuckle (1997), the better a model fits the data, the smaller this statistic will be. However, there is no absolute standard for deciding when the statistic is small enough to accept the model. The function of log likelihood does, however, represent a useful means by which to compare two or more nested models.

The function of log likelihood (FLL) statistic that is given for Model A will be used as a baseline to compare nested models where constraints are imposed. Because constraints are imposed on nested models, they will not fit the data as well as the more loosely constrained baseline model. As such, the function of log likelihood will be greater for each consecutive model where paths are removed. The decisive factor is the degree to which the FLL statistic is greater. An example from Arbuckle illustrates the process:

"Model B (with a fit statistic of 1375.133 and 19 parameters) is structurally nested with the baseline model (with a fit statistic of 1363.586 and 27 parameters). In a case like this, where a stronger model (B) is being compared to a weaker model (A), the amount by which the function of log likelihood increases when you switch from the weaker model to the stronger model is an observation on a chi-square random variable with degrees of freedom equal to the difference in the number of parameters of the two models. In the example shown here, Model B's function of log likelihood exceeds that for model A by 11.547 (=1375.133 - 1363.586). At the same time, Model B requires estimating only 19 parameters while model A
requires estimating 27 parameters, for a difference of 8. In other words, if model B is correct, 11.547 is an observation on a chi square variable with 8 degrees of freedom, which on consulting a chi square table is shown to be non-significant at the .05 level. That is, we accept (at the .05 level) the hypothesis that Model B is correct. Model B can now be tested against another nested model if necessary.” (Arbuckle, 1997, p.509-510)

7.2.1.1.3.2. Model comparison using the Akaike Information Criterion (AIC)
The Akaike Information Criterion (AIC) is defined as a measure motivated by likelihood arguments. It is a function of the log of the estimated mean square error of prediction and contains a term containing the number of parameters used in the model. The AIC also imposes a penalty for overfitting. In terms of evaluating nested models, smaller AIC values represent better models (Sakamoto et al., 1986). AIC represents one of the most accurate means of comparing models (Amiss, 1996).

7.2.1.1.3.3. CMIN/DF
CMIN / DF is the minimum discrepancy divided by its degrees of freedom. According to Arbuckle (1997), this ratio is popular as a measure of goodness of fit. Some general rules of thumb are given below:
“...Wheaton et al. (1977) suggest that the researcher also compute a relative chi square ($\chi^2 / df$)... They suggest a ratio of approximately five or less “as beginning to be reasonable”. In our experience, however, $\chi^2$ to degrees of freedom in the range of 2 to 1 or 3 to 1 are indicative of an acceptable fit between the hypothetical model and the sample data.” (Carmines and McIver, 1981, p.80).
“...different researchers have recommended using ratios as low as 2 or as high as 5 to indicate reasonable fit.” (Marsh and Hocevar, 1985).

7.2.1.3.4. Percentage of variance explained

In evaluating each model, the amount of variance of critical variables in the model is also taken into account. In the model of IT/IS assessment and acquisition in small professional firms, five primary dependent variables are included. These are; (1) business performance (soft measures); (2) turnover per employee; (3) organisational impact of IT/IS (4) information product satisfaction; and (5) satisfaction with IT/IS providers and services. In evaluating nested models, it is important that following the omission of paths, the amount of variance of critical variables explained by the new model does not drop significantly.

7.2.1.2. Evaluation of competing models

On the basis of output from Model A, four subsequent models were proposed. In each model, paths were omitted according to different critical ratio values (as presented in table 6.17 in the previous chapter). The cut-off points were <±1.0 for Nested model 1; <±1.5 for Nested model 2; <±1.25 for Nested model 3; and <±1.375 for Nested model 4. Each model was proposed following the evaluation of the preceding model.

7.2.1.2.1. Evaluation of Nested model 1 versus Model A

Nested model 1 represents the most loosely constrained nested model. Paths with a critical ratio of <±1.0 were removed. This resulted in the omission of 25 paths. Goodness of fit measures for Nested model 1 are shown in table 7.1. The function of log likelihood (FLL) is the primary measure employed to evaluate Nested model 1 against Model A. Following Arbuckle’s (1997) methodology, the amount by which
The FLL increases when you switch from Model A to Nested model I is an observation on a chi-square random variable with degrees of freedom equal to the difference in the number of parameters of the two models. Here, we find that Nested model I's FLL exceeds that of Model A by 5.093 (7389.250-7384.157). At the same time, Nested model I requires estimating 136 parameters while Model A requires estimating 159 parameters, for a difference of 23. In other words, if Nested model I is correct, 5.093 is an observation on a chi square variable with 23 degrees of freedom, which is not significant at the .05 level. That is, we accept that Nested model I is correct.

Nested model I is shown to compete strongly with Model A as regards the other model evaluation measures employed. Nested model I's AIC statistic (7661.250) is lower than that of Model A (7701.157), suggesting Nested model I to be a more appropriate model. A Cmin: DF ratio of 3.05 also suggests a level of fit that is both acceptable and marginally better than for Model A. On average, the overall percentage of variance of the critical output measures (impact of IT/IS; information product satisfaction; satisfaction with IT/IS providers and services; business performance; and turnover per employee) actually increases in comparison with that explained by Model A (41.5% versus 41.4%).

7.2.1.2.2. Evaluation of Nested model 2 versus Nested model I
Because Nested model I proved strong when compared with Model A with paths removed at the \( \pm 1.0 \) critical ratio cut-off point, a further model, Nested model 2, with a higher critical ratio cut-off point of \( \pm 1.5 \) was specified. Once again, all paths with a critical ratio outside the cut-off point (i.e., \( \pm 1.5 \)) were omitted from the structural model.
In comparing Nested models 1 and 2 using the FLL, we find that *Nested model 2*’s FLL exceeds that of *Nested model 1* by 30.234 (7414.484-7389.250). At the same time, *Nested model 2* requires estimating 122 parameters while *Nested model 1* requires estimating 136 parameters, for a difference of 14. In other words, if *Nested model 2* is correct, 30.234 is an observation on a chi square variable with 14 degrees of freedom which, in this case, is significant at the .05 level. That is, we reject *Nested model 2* (with the higher critical ratio cut-off point) in favour of *Nested model 1*.

The AIC score for *Nested model 2* confirms this finding at 7663.484 against Model 1’s 7661.250. The overall percentage of variance of critical output measures explained by *Nested model 2* also falls markedly from 41.5% to below the 40% mark at 38.7%. On this basis, model 2 is rejected in favour of model 1.

### 7.2.1.2.3. Evaluation of Nested model 3 versus Nested model 1

In order to further focus in on the area where parsimony and goodness of fit measures find the best balance, a third model, *Nested model 3*, was proposed. In this model, paths with a critical ratio of <±1.25 were omitted.

In comparing Nested models 3 and 1 using the FLL, we find that *Nested model 3*’s FLL exceeds that of *Nested model 1* by 6.058 (7395.288-7389.250). At the same time, *Nested model 3* requires estimating 132 parameters while *Nested model 1* requires estimating 136 parameters, for a difference of 4. In other words, if *Nested model 3* is correct, 6.058 is an observation on a chi square variable with 4 degrees of freedom which is non-significant at the .05 level. That is, we accept that *Nested model 3* is correct.
Table 7.1. Measures of fit for Model A and nested models

<table>
<thead>
<tr>
<th>Model</th>
<th>R² (adjusted)</th>
<th>R² (unadjusted)</th>
<th>R² (predicted)</th>
<th>Adjusted R²</th>
<th>R² (predicted)</th>
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<tr>
<td>Model 1</td>
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<td>Model 2</td>
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<tr>
<td>Model 3</td>
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<td>Model 4</td>
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M.1. Productivity Drivers of IS Implementation Success in Small Professional Firms
Nested model 3 is shown to compete strongly with Nested model 1 as regards the other model evaluation measures employed. Nested model 3's AIC statistic (7659.288) is lower than that of Nested model 1 (7661.250), suggesting Nested model 3 to be a more appropriate model. On average, the overall percentage of variance of the critical output measures is only marginally lower for Nested model 3 (41.2%) than for Nested model 1 (41.5%) and Model A (42.4%). On this basis, we accept Nested model 3 as stronger than Nested model 1.

7.2.1.2.4. Evaluation of Nested model 4 versus Nested model 3
One final model was proposed. In Nested model 4, all paths with a critical ratio of \( <\pm 1.375 \) (equidistant between \( \pm 1.25 \) and \( \pm 1.5 \)) were omitted. This resulted in the estimation of 128 as opposed to 132 parameters. On the basis of the function of log likelihood calculation, Nested model 4 proved stronger than its predecessor, Nested model 3. The CMIN / DF proved to be the same as for model 3, while the AIC output was marginally higher at 7661.456 as opposed to 7659.288. The final evaluation criterion, the percentage of variance explained, showed that the reduction in parameters did not adversely affect the percentage of variance explained (with the overall variance explained dropping by less than 1% from 41.2% to 40.5%). Because the AIC and percentage of variance explained measures worsen only marginally for the reduction in parameters evident for Nested model 4, it is argued that the model achieves the optimum balance between the two objectives of any model development process – simplicity and goodness of fit. As such model 3 is rejected in favour of Nested model 4.

Nested model 2 (with a critical ratio cut-off point of \( \leq 1.5 \)) represents the next step up from Nested model 4. One final test was undertaken, comparing model 4 and
model 2. Nested model 4 again proved to be the stronger of the two models over all evaluation criteria. Perhaps most importantly, when moving from model 4 to model 2, there is a significant reduction in the percentage of variance explained. As such, model 2 is rejected a second time.

7.2.2. Stage two: theoretical justification underpinning respecification

According to Hair et al. (1998), theoretical justification is vital at all stages of structural equation modelling. We have already discussed how theory underpins the specification of the dependence relationships in the model. Such theoretical justification remains equally as important during the model refinement stage. The process of exploratory model refinement is a holistic process in which empirical considerations and theoretical justification are given equal importance (MacCallum, 1995; Hair et al., 1998). While a number of evaluation techniques have already been discussed, their primary aim is to assess model fit using empirical criteria. While this represents an important and necessary approach in removing paths with minimal empirical justification, strong theoretical support for the inclusion of a dependence relationship is as valid as empirical support during exploratory model refinement.

The preceding section presents and explains the empirically driven stage of model refinement. In this section the model refinement process is re-evaluated theoretically, focusing specifically on the dependence relationships that have been omitted as a result of empirically driven analysis. Here, the strength of existing argument for such relationships is discussed and whether such argument overrides the empirical findings presented above assessed. In some cases it may be that the weight of argument for a dependence relationship is weak and, as such, removal of the path will improve the model. However, if a significant body of existing research suggests
a strong dependence relationship that the preceding empirical analysis does not support, then we must consider whether we have solely capitalised on the relationships specific to the current data set. As explained earlier, such “data snooping” or “fishing” (Arbuckle, 1997), even if unintentional, must be avoided. Where strong theoretical support exists for the presence of a dependence relationship in conflict to the findings of our sample data, the omission of the relationship solely on empirical grounds must be reconsidered.

In appropriating Nested model 4 as the optimum model on the basis of empirical analysis, the number of paths (and thus estimated parameters) in the proposed model has been reduced substantially (see table 7.1). Each path is now re-evaluated in order to determine the degree to which theoretical justification qualifies the omission. Paths are approached in the same order as in the literature review.

7.2.2.1. Hierarchy level one: IT/IS implementation success as a driver of organisational performance
Data-driven path analysis identified two paths, which, according to the selected criteria, are eligible for omission. These are; (1) the organisational impact of IT/IS as a driver of turnover per employee; and (2) information product satisfaction as a driver of turnover per employee. In this section, the omission of these paths is reconsidered employing a theoretical perspective.

In chapter two it was hypothesised that measures of IT/IS implementation success are positively associated with measures of business success. The two labels that are central to hierarchy one represent generic terms for the individual measures which they umbrella. As explained in chapter four, two measures of business success were employed; (1) a soft measure of business performance; and (2) turnover per employee. Three measures of IT/IS implementation success were ultimately used;
organisational impact of IT/IS; and the two user information satisfaction based measures; (1) information product satisfaction; and (2) satisfaction with IT/IS providers and services. On the basis of empirically driven model refinement, two of the paths between measures of IT/IS implementation success and business performance fail to be supported; as stated, those between; (1) the organisational impact of IT/IS and turnover per employee; and (2) information product satisfaction and turnover per employee.

Research has consistently failed to show a relationship between measures of IT/IS implementation success and measures of organisational performance. This is particularly true where research has focused on financial indicators of business performance. Research remains sparse in this area. Only Cragg (1990) has evaluated the relationship between IT/IS implementation success and hard measures of business performance in small firms. The findings of the current study support those of Cragg who found that, even when implemented effectively IT/IS fails to impact strongly upon financial measures of business performance.

Hanes and Ramage (1977) point out the difficulty of isolating the effects of IT/IS from the other myriad of factors that influence business performance. This is a valid point, and illustrates why the variance explained for the business performance measures tends to be low. However, identifying the degree to which successful IT/IS implementation can contribute to business performance remains a key question for organisations that continue to invest heavily in information systems.

Three primary points of argument support the inclusion of; (1) the organisational impact of IT/IS; and (2) information product satisfaction; as drivers of turnover per employee. The first concerns the measure employed to evaluate turnover per employee. The justification behind the use of the turnover per employee measure
is presented in chapter four. Specifically, the trade-off between using a Likert scale with broad ranges which respondents found acceptable but provided imprecise data, and asking respondents to return precise financial data that pre-survey interviews suggested would result in the non-return of questionnaires (but would provide more useful information) is explained. It is proposed that further refinement of the turnover per employee measure might result in the collection of more accurate and useful data. This would reduce the measurement error and, in turn, afford a clearer picture of the relationships (or lack of) between the two measures of IT/IS implementation success and the financial indicator of performance, turnover per employee.

The second supporting argument for the inclusion of the paths is the need for further clarification of the association between measures of IT/IS implementation success and financial indicators of business performance. Where doubt exists, any opportunity to collect further data, particularly from a large sample is valuable. This is especially true where the topic is of immediate concern for a large number of organisations. Finally, the theoretical foundation, which supported the inclusion of the hypothesised paths during the building of the model, remains important. The underpinning argument is drawn from theorists who, in spite of inconclusive findings in this area, continue to argue that any benefits afforded by IT/IS should ultimately be reflected as improvements in business performance (see Alpar and Kim, 1990). Maintaining the paths between the two measures of IT/IS implementation success and a refined measure of turnover per employee will enable further evaluation of this theory.
7.2.2.2. Hierarchy level two: direct drivers of IT/IS implementation success

A number of level two paths were indentified as weak in terms of the omission criteria. These include;

(1) Information product satisfaction $\leftarrow$ Level of IT/IS investment
(2) Information product satisfaction $\leftarrow$ IT/IS sophistication
(3) Satisfaction with IT/IS providers and services $\leftarrow$ IT/IS sophistication
(4) Organisational impact of IT/IS $\leftarrow$ Level of planning and formalisation
(5) Information product satisfaction $\leftarrow$ Level of planning and formalisation
(6) Organisational impact of IT/IS $\leftarrow$ Level of employee involvement in IT/IS acquisition decisions
(7) Satisfaction with IT/IS providers and services $\leftarrow$ Level of employee involvement in IT/IS acquisition decisions
(8) Information product satisfaction $\leftarrow$ Management support for IT/IS
(9) Satisfaction with IT/IS providers and services $\leftarrow$ Management support for IT/IS
(10) Organisational impact of IT/IS $\leftarrow$ Management IT/IS experience
(11) Information product satisfaction $\leftarrow$ Management IT/IS experience
(12) Satisfaction with IT/IS providers and services $\leftarrow$ Management IT/IS experience
(13) Organisational impact of IT/IS $\leftarrow$ Organisation size
(14) Satisfaction with IT/IS providers and services $\leftarrow$ Organisation size
(15) Information product satisfaction $\leftarrow$ Organisational IT/IS knowledge
(16) Satisfaction with IT/IS providers and services $\leftarrow$ Organisational IT/IS knowledge

In the following sections, each path is re-evaluated theoretically.

7.2.2.2.1. IT/IS investment as a driver of information product satisfaction

Chapter two referred to what has become known as the "productivity paradox" – the paucity of evidence to show that IT/IS investment results in benefits that justify the expenditure involved. While empirically driven model analysis supports the hypothesising of the level of investment in IT/IS as a driver of the organisational impact of IT/IS and satisfaction with IT/IS providers and services, the third relationship – between investment in IT/IS and information product satisfaction – remains unsupported. At both a theoretical and an intuitive level, this seems logical.
Returning to the literature, it is evident that out of those studies that find support for an association between the level of investment in IT/IS and IT/IS implementation success, almost all focused on the relationship between IT spend and some measure of the organisational impact of IT/IS (which proves supported in Nested model 4). None of the studies evaluated the impact of IT/IS investment specifically upon user information satisfaction measures. As such there is little theoretical justification for retaining a path between investment and information product satisfaction.

On an intuitive level, it is logical that little support exists for IT/IS investment as a driver of information product satisfaction, even when support is evident for investment as a driver of the other UIS based measure, satisfaction with IT/IS providers and services. Information product satisfaction represents a user-oriented variable. Regardless of the level of investment in IT/IS, a user will not be satisfied with the information product unless they understand it, find it accessible and want to use it. As such, an increase in the amount spent on IT/IS will not necessarily result in a similar increase in user perception of the product. On the basis of Nested model 4, it would seem that factors such as the level of user involvement during the assessment and acquisition process and training have a more direct impact on user information product satisfaction. Due to the lack of both theoretical and empirical support for the level of IT/IS investment as a driver of information product satisfaction, the path is omitted from the model.

It is less surprising that empirical support is evident for the level of investment in IT/IS as a driver of satisfaction with IT/IS providers and services. IT/IS provision and service often comes at a cost (especially were consultants are concerned) and it is
plausible that increased investment results in a more complete and better service which, in turn, may increase satisfaction with the service rendered.

7.2.2.2.2. IT/IS sophistication as a driver of information product satisfaction and satisfaction with IT/IS providers and services

While path analysis showed strong support for IT/IS sophistication as a driver of the organisational impact of IT/IS, the hypothesised associations between IT/IS sophistication and the two UIS-based measures of IT/IS implementation success – information product satisfaction and satisfaction with IT/IS providers and services – proved weak.

At a theoretical level, these findings make sense. Returning to the literature it is evident that where researchers have evaluated the relationship between IT/IS sophistication and the organisational impact of IT/IS, findings prove consistent. In almost all cases, research identified a significant positive relationship between IT/IS sophistication and the organisational impact of IT/IS (Raymond, 1985; Kobler Unit, 1987; Cragg, 1990; Lefebvre et al., 1995; Kivijarvi and Saarinen, 1995; Choe, 1996; Reid and Hutchins, 1997; Howard, 1997; Lu and Wang, 1997). As such, it is not surprising that in the current study’s model, support is found for this relationship.

Existing findings in terms of the impact of IT/IS sophistication on UIS based measures are less consistent however. While studies of large organisations undertaken by Kivijarvi and Saarinen (1995), Choe (1996) and Lu and Wang (1997) reported a significant association between software sophistication and an overall measure of user information satisfaction (UIS), their findings prove inconclusive. The large organisational research of Law and Gorla (1996) found no association between sophistication and UIS. Most relevant to the current study were the findings of Kagan et al. (1990), whose study of small firms also failed to find a relationship.
Approaching the paths between IT/IS sophistication and information product satisfaction and IT/IS sophistication and satisfaction with IT/IS providers and services holistically, the theoretical foundations underpinning the inclusion of a path between the variables does not appear strong enough to outweigh the empirical findings. As such, the paths are omitted from the final model.

7.2.2.2.3. Planning and formalisation as a driver of organisational impact of IT/IS and information product satisfaction

Empirically driven model respecification affords little support for the level of IS planning and formalisation as a driver of either the organisational impact of IT/IS or information product satisfaction. These findings, and in particularly the former, counter those afforded by existing research.

A number of studies have been undertaken which focus upon the value of planning in small firms (Lees, 1987; Malone, 1985; Delone, 1983, 1988; Cragg, 1990; Montazemi, 1988a). Each found the level of planning and formalisation to be in some way positively associated with impact. While there are no studies that directly assess the association between planning and UIS measures, both Cragg (1990) and Delone (1983) employed level of use as an implementation success measure. Both reported planning to be directly associated with levels of information product usage.

Theoretical support for the inclusion of a path between IS planning and formalisation and the organisational impact of IT/IS remains strong. Furthermore, the empirical findings that counter the inclusion of the path are weak (the critical ratio is only marginally lower than the allocated 1.375 boundary). On this basis, it is deemed acceptable to include the path between planning and organisational impact in the final model.
While theoretical support for the inclusion of a path between planning and information product satisfaction is weaker, this is in part due to the lack of research that specifically focuses upon such an association. The findings of Cragg and Delone both suggest that planning influences the level of information product usage and intuition suggests an association is likely to exist between information product usage and information product satisfaction. On an intuitive level it also seems plausible that where an organisation has planned its IT/IS in terms of a thorough needs assessment, it is more likely to implement IT/IS that provides employees with the information they need to undertake tasks more easily. In turn, this should result in employees being more satisfied with the product that they are using than their counterparts in organisations whose lack of planning has resulted in the implementation of an IT/IS that does not meet their information needs. On these bases, it is argued that the path between information product satisfaction and level of IS planning should be included in the model.

7.2.2.2.4. Employee involvement as a driver of organisational impact of IT/IS and Satisfaction with IT/IS providers and services

Out of the three IT/IS implementation success measures, only the relationship between the level of employee involvement in IT/IS acquisition and information product satisfaction proved supported by the data. No support was evident for employee involvement as a driver of either the organisational impact of IT/IS or satisfaction with IT/IS providers and services. A review of existing findings in this area suggests that the empirical weight of evidence for the removal of the paths is stronger than the theoretical reasoning underpinning their inclusion.

The majority of research into employee involvement in the IT/IS acquisition process evaluates the impact of involvement on measures of UIS. In most UIS
measures (and particularly those used within large organisations), the information product satisfaction component forms the larger component of the overall construct. As such, findings indicate more about the impact of employee involvement on information product satisfaction than they do about the impact of involvement on satisfaction with IT/IS providers and services (more commonly referred to as satisfaction with electronic data processing staff and services in large organisational research).

Both small and large firm research consistently reports a significant positive association between the employee involvement and user information satisfaction (Lees, 1987; Montazemi, 1988a; Yap et al., 1992; Choe, 1996; and Lu and Wang, 1997). As such, it is no surprise that the current research also identifies the existence of an association between the level of employee involvement in IT/IS acquisition and information product satisfaction.

Due to the human resource nature of research in this area, existing studies focus on UIS measures as opposed to organisational impact measures of IT/IS implementation success. Furthermore, according to Delone (1988), it is only the manager/owner of a small firm who truly understands the factors that are critical to organisational success and the areas where IT/IS will add greatest value. As such, there is little theoretical argument to counter the omission of the path between involvement and organisational impact on the basis of the empirical findings. The same is true regarding the path between involvement and satisfaction with IT/IS providers and services. As alluded to above, most UIS measures are bias towards information product satisfaction and there are no studies that specifically pursue an association between employee involvement in the IT/IS acquisition process and
satisfaction with IT/IS providers and services. Intuitively, this seems logical. On this basis, both paths are removed from the model.

7.2.2.2.5. Management support for IT/IS as a driver of information product satisfaction and satisfaction with IT/IS providers and services

The study’s strong empirical support for management support for IT/IS as a driver of the organisational impact of IT/IS adds further weight to a large body of literature in the management IS area. However, hypothesised associations between the two UIS-based measures and the level of management support for IT/IS prove unsupported. Theoretical argument countering the omission of the path between management support for IT/IS and satisfaction with IT/IS providers and services is weak. However, there is theoretical evidence that argues for the inclusion of the path between management support and information product satisfaction.

While Thong et al. (1996) reported that other factors such as consultant and vendor effectiveness were significantly more important in their influence upon UIS than management support, a more recent study of computing in small firms, undertaken by Igbaria et al. (1997b), arrived at an opposing conclusion. Significantly, Igbaria’s study focused upon personal computing acceptance as the dependent variable (essentially analogous with information product satisfaction) as opposed to the more conventional multi-dimensional UIS construct employed by Thong et al. In doing so, Igbaria found that management support for IT/IS had a significant impact on personal computing acceptance. Such a recent finding focusing upon the direct association between management support for IT/IS and information product satisfaction in small firms lends considerable support for the inclusion of management support for IT/IS as a driver of information product satisfaction. Furthermore, the
empirical evidence in favour of omitting the path is comparatively weak (i.e. the critical ratio is only marginally lower than the allocated cut-off point). As such, the path between management support for IT/IS and information product satisfaction is reinstated in the model.

7.2.2.2.6. Management IT/IS experience as a driver of implementation success

While the literature is almost entirely comprehensive in its support for management IT/IS experience as a driver of IT/IS implementation success, empirical analysis undertaken in the current study does not support such findings. It should be noted, however, that the critical ratio for paths between management IT/IS experience and the organisational impact of IT/IS, and experience and satisfaction with IT/IS providers and services are only marginally lower than that deemed acceptable for inclusion in the model (see Table 6.17).

The majority of literature focuses upon how managerial IT/IS experience affects the impact that IT/IS has when implemented in an organisation. As alluded to earlier, such research is almost entirely consistent in its identification of a positive relationship between experience and impact both in large and small organisations alike (e.g. Delone, 1988; Martin, 1989; Cragg, 1990; Heikkila et al., 1991; Thong and Yap, 1995). Such findings are also put in context by Mata et al. (1995) and Fuller (1996) who assert that, each time management and an organisation proceeds through a cycle of technology assessment and acquisition, learning takes place and experience is gained. This results in the more effective implementation of technology during the following acquisition cycle.
On the basis of the strength of theoretical argument for the inclusion of a path between management IT/IS experience and the organisational impact of IT/IS, and the weakness of the empirical findings indicating that it should be omitted, it is argued that the path should be retained in the model. Perhaps of most interest is that, while the empirical evidence countering its inclusion in terms of the critical ratio is weak, the path analysis shows an association polemically opposed to that consistently shown in the body of existing literature. The findings suggest that management IT/IS experience is negatively associated with impact. As such, it is important to re-evaluate the path.

The same is true of the current study’s findings in terms of the associations between management IT/IS experience and the two UIS-based measures. In both cases a negative association is shown (although the critical ratio for the management IT/IS experience as a driver of information product satisfaction association is weak). Particularly regarding information product satisfaction, this seems to counter the findings of existing research. Lees (1987) reported satisfaction with IT and IT usage to be greater where management had prior experience of making technology acquisition decisions. Cragg (1990) also found management IT/IS experience to impact upon the level of IT/IS use in an organisation.

Focusing upon a different area of literature, it is possible to draw meaning from these findings. Yaverbaum and Nosek (1992) undertook an empirical evaluation of the effects of information system training on user satisfaction. While training is not necessarily analogous with experience, both suggest an increase in knowledge. Yaverbaum and Nosek concluded that, while IT/IS training leads to changes in user satisfaction and changes in user perceptions of IS staff and services, the end product and knowledge and involvement with the systems, the changes were not all positive.
In particular, Yaverbaum and Nosek found that improved knowledge resulting from training leads to a better understanding of the computer and, consequently, less tolerance for the user’s information product and IS staff and services. Our current findings suggest that similar relationships exist between UIS-based measures and management IT/IS experience. As such, it is deemed important to re-evaluate these paths.

7.2.2.2.7. Organisation size as driver of the organisational impact of IT/IS and satisfaction with IT/IS providers and services

While empirical support is evident for organisation size as a driver of information product satisfaction, analysis offered little support for organisation size as a driver of the organisational impact of IT/IS or satisfaction with IT/IS providers and services.

Returning to the theoretical argument underpinning the initial inclusion of the latter two paths, it is evident that findings in this area are inconsistent. Ein-dor and Segev (1979) and Choe (1996) identified a positive relationship between organisation size and measures of IT/IS implementation success. Law and Gorla (1996), on the other hand, found that smaller firms reported IT to have had a significantly greater impact on them than their larger counterparts. Such theoretical inconsistencies do not present a strong counter argument for the inclusion of paths between organisation size and organisational impact of IT/IS, and size and satisfaction with IT/IS providers and services. In the current study, where the range of organisational sizes is small (i.e. between 1 and 25), it is unlikely that size represents a significant determinant of IT/IS implementation success in terms of impact and satisfaction with IT/IS providers and services. As such, these paths are omitted from the model.
7.2.2.2.8. Organisational IT/IS knowledge as a driver of information product satisfaction and satisfaction with IT/IS providers and services

Empirical analysis supported organisational IT/IS knowledge as a driver of the organisational impact of IT/IS. However, this is not true of paths between organisational IT/IS knowledge and the two UIS-based IT/IS implementation success measures. The latter findings, and in particular the lack of support for a path between knowledge and information product satisfaction, counter theoretical foundations.

Chen (1993) asserted that in organisations involved in his study, most interviewees implied that the satisfactory implementation and use of computers was related to the level of organisational IT/IS knowledge, suggesting a positive association between knowledge and UIS. Chen's findings are empirically supported by those of Palvia et al. (1996) who found a positive association between knowledge and small business user satisfaction with IT. Theoretically, then, there is some justification for the inclusion of the paths between knowledge and the UIS measures, and particularly, that between knowledge and information product satisfaction. Because the critical ratio for the path between knowledge and information product satisfaction falls only marginally below the cut-off point, the balance of argument is in favour of the reinstatement of the path. Evidence in favour of the reinstatement of the path between knowledge and satisfaction with IT/IS providers and services is less strong. Theoretical justification seems insufficient to outweigh the complete lack of empirical support for the path.
7.2.2.3. Hierarchy level three: indirect drivers of IT/IS implementation success

In this section, paths between indirect drivers and direct drivers of IT/IS implementation success that have been shown to be empirically unsupported will be re-evaluated on theoretical grounds.

7.2.2.3.1. Drivers of investment in IT/IS

Two of the factors hypothesised as drivers of the level of investment in IT/IS; (1) management support for IT/IS; and (2) management IT/IS experience, were supported in the path analysis. However, the path between the third driver proposed – the investment capability of the organisation – and the level of IT/IS investment proved unsupported.

Strong theoretical support exists for the inclusion of a path between the investment capability of the organisation and the level of IT/IS investment. Yap et al. (1992), Kivijarvi and Saarinen (1995), Reid and Hutchins (1997) and Howard (1997), all indicate in some way that IT/IS investment is dependent on the availability of financial resources. The empirical findings of the path analysis show it to only marginally fall below the allocated cut-off point. The overriding argument thus is in favour of the inclusion of the path in the model. Analysis also shows that the association between investment capability and IT/IS investment in the current study is a negative one. This counters previous findings and warrants further investigation. As such, the path is reinstated in the model.

7.2.2.3.2. Drivers of IS planning and formalisation

Only two of the six hypothesised drivers of the level of IS planning undertaken by an organisation proved to be supported by the path analysis. These are; (1) organisation
size; and (2) management IT/IS experience. The unsupported factors are; (1) perceived stability of the business environment; (2) organisational IT/IS knowledge; (3) management support for IT/IS; and (4) employment of consultant support.

Approaching the unsupported paths theoretically, we find that there is little support for perceived stability of the business environment as a driver of IS planning. This path was initially hypothesised on the basis that the undertaking of IS planning was, for the most part, analogous with general business planning. No research had been undertaken investigating the association between stability of the business environment and the level of IS planning and, as a result, the current research proposed the inclusion of a path on the basis of findings focusing upon evidence of a relationship between perceived environmental stability and business planning at a more general level (Matthews and Scott, 1995; Fuller, 1996). The empirical findings suggest this assumption to be unfounded. As such, the path is omitted from the model.

Theoretical support for organisational IT/IS knowledge as a determinant of IS planning is also weak. The path was hypothesised on the basis of dated findings provided by Scholhammer and Kuriloff (1979). More recent studies focusing upon small organisations have suggested management IT/IS knowledge and experience to be a more important determinant of IS planning (Farhoomand and Hrycyck, 1985; Cragg and King, 1993). This is borne out in the empirical findings of the current study. The path between organisational IT/IS knowledge and the level of planning and formalisation is thus removed.

The empirical analysis also failed to provide support for management support for IT/IS as a determinant of IS planning. This opposes the findings of Cragg (1990) and Cragg and Zinatelli (1995), both of whom reported finding lower levels of IT/IS
planning to take place in firms with less managerial support for IT/IS. While these findings lend support for the inclusion of the path, on the basis of our empirical findings it is management IT/IS experience and not enthusiasm for IT/IS that proves to be the key determinant of IS planning. Management support for IT/IS is thus removed as a determinant of IS planning.

The final factor that remains unsupported as a driver of IS planning is the employment of consultant support. Cragg (1990) reported that in organisations where consultant support had been employed, more planning took place. This, he concluded, was due to the transfer of knowledge from consultant to organisation regarding best practice in terms of IT/IS acquisition. There is no research to support Cragg’s finding and the current study also fails to find support on an empirical basis. Due to the lack of theoretical and empirical evidence to support the inclusion of a path between the employment of consultant support and the level of IS planning and formalisation undertaken by an organisation, the path is omitted.

7.2.2.3.3. Drivers of IT/IS training
Both drivers of the level of IT/IS training - (1) investment capability of the organisation; and (2) management support for IT/IS - were unsupported by the path analysis. There is also a paucity of theoretical findings to support the inclusion of the paths. The findings of Cragg and Zinatelli (1995) represent the only significant findings in terms of a relationship between formal IT/IS training and management support for IT/IS. They found reduced levels of formal IT/IS training for employees in organisations where management support for IT/IS was weak. Investment capability was hypothesised as a driver of the level of IT/IS training on the basis that
it had been shown to influence investment in IT/IS. On the basis of the findings, such an assumption seems unfounded.

Theoretical support for the reinstatement of investment capability and management support as drivers of the level of formal IT/IS training undertaken in an organisation appears weak. As such, they remain omitted from the model.

7.2.2.3.4. The relationship between the employment of consultant support and consultant effectiveness.

It was hypothesised in chapter two that there would be significant associations between the employment of external support (in the form of consultants or vendors) and consultant or vendor effectiveness. Such an assumption presupposed the majority of providers of IT systems and services to provide a high level of service.

Path analysis supports the inclusion of a path between the employment of vendor support and vendor effectiveness, but failed to find empirical evidence in favour of that between consultant employment and consultant effectiveness. There is little more than case-study evidence to theoretically support the reinstatement of the path. As such, the path between the employment of consultant support and consultant effectiveness is omitted from the model. This finding suggests that there is little consistency in the level of service provided by consultants.

7.2.2.3.5. Drivers of the employment of external support

Three drivers of consultant employment were hypothesised on the basis of the literature; (1) investment capability; (2) organisational IT/IS knowledge; and (3) management IT/IS experience. Path analysis failed to support all three. The level of organisational IT/IS knowledge and management IT/IS experience were also
hypothesised to influence employment of vendor support. Again, the paths proved to be empirically unsupported.

Mingay and Peattie (1992) argued that resource-poverty can represent a major barrier to consultant support, while Cragg (1990), Cragg and King (1993) and Crabtree et al. (1995) suggested that the employment of external support (both consultants and vendors) is a byproduct of low levels of perceived in-house knowledge, both in terms of management experience and the employee knowledge pool. While intuitively these arguments appear plausible, there have been few empirical findings to strongly support them. As such, there is little theoretical justification for their inclusion and they are thus omitted from the model.

7.2.2.3.6. Drivers of organisational IT/IS knowledge

Two factors were hypothesised as drivers of organisational knowledge; (1) IT/IS learning; and (2) IT/IS training. Path analysis supported a positive association between learning and knowledge, but found little evidence of any significant association between IT/IS training and organisational IT/IS knowledge.

This latter finding counters evidence put forward by Yaverbaum and Nosek (1992) and Cragg and King (1993). Both research partnerships identified a positive association between IT/IS training and organisational knowledge. Yaverbaum and Nosek's findings are particularly relevant in terms of the current study. The authors showed that IT/IS training indirectly influenced measures of IT/IS implementation success via internal organisational knowledge. In other words, investment in training raises IT/IS knowledge levels within an organisation and this, in turn, results in the more effective use of IT/IS. With such strong theoretical support, it is argued that IT/IS training be reinstated in the model.
7.2.2.3.7. Drivers of management support for IT/IS

On the basis of the literature review, management IT/IS experience and size were hypothesised as drivers of management support for IT/IS. Nickel and Seado's (1986) finding that management experience of IT/IS within small organisations results in a more positive attitude towards computers proved to be strongly supported empirically in the current study. Organisation size was identified by Law and Gorla (1996) to influence management support for IT/IS, with support being greater in smaller firms than in large organisations. Empirical analysis in the current study shows a similar relationship, although the critical ratio proves to be marginally below the cut-off point. Because the statistical margin is small, it is argued that size should be included in the model as a determinant of management support for IT/IS. Only by undertaking further analysis will a clearer picture of the influence of size on management support for IT/IS be shown.

7.3. Evaluating the traditional UIS construct

While the empirical and theoretical model development and evaluation undertaken in the previous sections results in a more refined model of IT/IS assessment and acquisition in small firms, one final stage of exploratory analysis is required before the presentation of Model B on which confirmatory testing will be undertaken. This involves an evaluation of the potential role of the traditional UIS construct as a surrogate measure of the organisational impact of IT/IS and as a measure of IT/IS implementation success in its own right. The testing of these propositions represent the two final stages of exploratory structural equation modelling.
In order to test UIS as surrogate measure of the organisational impact of IT/IS, a traditional UIS measurement model is constructed. This is tested in the same way as measurement models were evaluated in the previous chapter. A structural model is then developed which tests the relationship between UIS and the organisational impact of IT/IS constructs. This represents the first stage in the current section. In the second stage, the explanatory strength of the UIS construct is evaluated. The primary aim is to identify whether the traditional UIS measure is a more effective means of measuring IT/IS implementation success than employing the three independent measures constructed in chapter six. Explanation is presented regarding the differences between the two structural models employed to evaluate the two constructs and the theoretical justification underpinning their development. A competing models strategy is employed in order to determine which underlying theory is most effective in its explanation of the underlying processes within small professional firms.

7.3.1. UIS as a surrogate measure of the organisational impact of IT/IS

This section of the chapter focuses upon the steps required in order to test the degree to which the traditional UIS measure can be justified as an accurate surrogate measure of the organisational impact of IT/IS. Four steps are required. First of all, the theory underpinning the development of a traditional UIS measure is presented and explained. Secondly, confirmatory testing is undertaken on the completed measurement model. The third section describes the construction of a structural model in which the UIS measure plays a central role. This structural model – termed the UIS model – enables the evaluation of the UIS measure as an indicator of the organisational impact of IT/IS. Following model estimation, the findings are
presented and the degree to which the UIS measure can be regarded as a surrogate measure of the organisational impact of IT/IS in small firms evaluated.

7.3.1.1. Development of a measurement model of UIS
In chapter four it was illustrated that the UIS measure consisted of (at least) three dimensions. These are; (1) information product satisfaction; (2) satisfaction with electronic data processing staff and services; and (3) knowledge/involvement. In order to evaluate the degree to which the UIS measure is suitable as a surrogate for measures of organisational impact, the development of a traditional measurement model of UIS such as that described above is necessary.

In Model A, all of the above concepts are measured independently. Information product satisfaction and satisfaction with IT/IS providers and services (the small firm adaptation of satisfaction with EDP staff and services) are measured independently as indicators of IT/IS implementation success, while knowledge and employee involvement are also measured individually and represent independent variables in the model. In order to develop a traditional UIS measurement model, the three individual constructs are combined as shown in figure 7.1.

**Figure 7.1. Traditional measurement model of UIS**
7.3.1.2. Confirmatory testing of the UIS measurement model

Due to the nature of the UIS measure, the evaluation of the UIS measurement model is here approached differently from that of measurement models presented in the previous chapter. The main reason for this is that we already know that the measurement model is constructed using three independently interpretable dimensions. Due to its specification on theoretical as opposed to empirical grounds, it is inappropriate to undertake exploratory factor analysis on the items from which the measurement model is constructed. These have already been specified (as illustrated in figure 7.1). It is important, however, to undertake confirmatory analysis upon the UIS measurement model in order evaluate its meaningfulness.

**Figure 7.2. UIS measurement model**

- Ease of use
- Reliability of output
- Relevance of output
- Up-to-dateness of output
- Format of output
- Maintenance and back-up support
- Security of data
- Turnaround time to fix IT problems
- Documentation
- Organisational knowledge
- Employment involvement in IT assessment and acquisition
- Satisfaction with the information product
- Satisfaction with IS providers and services
- Knowledge / Involvement
- UIS

\[ * p = 0.05, ** p = 0.01 \]
Two of the three dimensions of UIS; (1) information product satisfaction; and (2) satisfaction with IT/IS providers and services; have already been evaluated using confirmatory techniques, and shown acceptable construct reliability (see chapter six). The third dimension – knowledge / involvement – has not yet been evaluated for internal reliability. Analysis indicates, however, that the construct’s internal reliability is low at only 0.136.

The next stage involves the evaluation of the strength of the overall UIS measurement model (see figure 7.2 above). The initial prognosis is poor. Paths between both knowledge and involvement and UIS (critical ratio = 1.322) and satisfaction with IT/IS providers (C.R. = 1.266) and UIS prove to be non-significant. Only that between information product satisfaction is supported (C.R. = 4.268). The measure also proves unstable in that the supported path between information product satisfaction and the UIS measure exceeds 1.0. while the other two paths (while non-significant) have much lower correlations. This can be remedied by fixing the negative error variance to a very small positive value (i.e.0.005) (see Hair et al., 1998). While this approach meets the practical requirements of the estimation process, it only masks underlying problems and, as such, any results should be approached accordingly (Hair et al., 1998). Hair et al. suggest that the best approach where such escalated standardized correlations occur is to eliminate the offending construct from the measurement model. This cannot be done effectively here, however, as the UIS measurement model would become inconsistent with previous UIS constructs in terms of its constituent dimensions.

An accurate and useful estimate of the overall reliability of the construct becomes difficult due to the non-significance of the paths between satisfaction with IT/IS providers and services and UIS and knowledge/involvement and UIS. The
escalated standardised loading of satisfaction with the information product also adds to the problem. In spite of the problems in calculating an accurate estimate of reliability for the UIS construct, it is evident from the weaknesses described above that it is internally inconsistent. This supports theory and findings presented in chapters four and six respectively that the UIS construct is multi-dimensional. The importance of uni-dimensional constructs in research, and specifically in structural equation modelling as expounded by Anderson and Gerbing (1988) and Hunter and Gerbing (1982), has already been explained. As such, it is evident that incorporating the UIS construct in its traditional multi-dimensional format in a structural equation model will introduce weaknesses into the modelling process. Any findings must thus be approached with caution.

7.3.1.3. Constructing a structural model incorporating UIS
In order to undertake a meaningful evaluation of the value of UIS as a surrogate for organisational impact, it is fundamental that the study is consistent in including all three dimensions in one overall UIS construct. It is this fact that leads to the development of the structural model incorporating the traditional UIS measure as constructed earlier. The UIS model is presented in figure 7.3.

In this model, the knowledge/involvement dimension of the UIS measure is developed employing two variables from Model A initially employed as independent variables. This new dimension is then included as a dimension of UIS alongside information product satisfaction and satisfaction with IT/IS providers and services (see dimensions highlighted in blue).
7.3.1.4. UIS as a surrogate measure of the organisational impact of IT/IS

Estimation of the UIS model using Amos results in the findings presented in table 7.2. As is evident, analysis shows the UIS measure to be a poor indicator of both measures of business performance. Both paths prove to be non-significant at both critical ratio levels of 1.96 (i.e. at the .025 level) and 1.375 (the cut-off point employed in exploratory model development in part one). This is not surprising given the internally unstable nature of the UIS construct.

In spite of the instability of the UIS construct, analysis indicates a significant and comparatively strong correlation between UIS and the organisational impact of IT/IS (correlation = 0.435). This lends some support to those studies that argue that UIS is a meaningful surrogate for the organisational impact of IT/IS (e.g. Ives et al., 1983; Montazemi, 1988a; Palvia, 1996). However, it also lends support to Wong and
Phelps (1997) who argue that, while the UIS measure captures the main dimensions of individual effectiveness, it cannot alone capture the whole meaning of IT/IS impact due to its focus upon individual rather than organisational efficiency. This proves to be the case here. While the UIS measure is correlated with organisational impact of IT/IS (correlation = 0.435), UIS fails to influence performance at the organisational level.

Table 7.2. Output for UIS model

<table>
<thead>
<tr>
<th>Hypothesis No.</th>
<th>Path</th>
<th>Critical ratio</th>
<th>Regression weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 H2a</td>
<td>UIS→ Business performance (soft)</td>
<td>-0.385</td>
<td>-.049</td>
</tr>
<tr>
<td>L1 H2b</td>
<td>UIS→ Turnover per employee</td>
<td>-0.993</td>
<td>-.128</td>
</tr>
<tr>
<td>L1 H3</td>
<td>UIS←→ Organisational impact of IT/IS</td>
<td>2.958</td>
<td>.435</td>
</tr>
</tbody>
</table>

These findings suggest that, while elements of the UIS measure are reflected in the organisational impact of IT/IS - possible candidates are areas such as job satisfaction and information access which are interpretable as both UIS and impact measurement items - it is improbable that it is those elements that contribute to overall organisational performance. In other words, while there is some support for UIS as a surrogate for the organisational impact of IT/IS, the findings suggest that the UIS measure is more strongly correlated with aspects of the organisational impact of IT/IS measure that tend toward individual level effectiveness and satisfaction rather than those that contribute to overall organisational performance.
7.3.2. Evaluating the explanatory strength of the UIS model

In the previous section, a structural model incorporating the UIS construct in its traditional form was constructed. In this section, the UIS model is examined in order to evaluate whether a model employing a UIS measure in its traditional form is stronger in its explanatory power than a model employing UIS measures divided into their individual uni-dimensional components (as presented in hierarchy one of Model A). Evaluating the UIS model also provides a test of Doll and Torkzadeh's (1988) assertion that the variables Knowledge and Employee involvement are more usefully employed as independent variables than dependent variables forming a dimension of the UIS construct.

In order to evaluate the UIS model, it is tested against a model based upon Model A, entitled Model A component (see figure 7.4). Model A component illustrates the components of the UIS model in their original format as presented in Model A. As such, it is nested with the UIS model. This enables the employment of a competing models strategy in order to evaluate the two models and, in particularly, assess the usefulness of the UIS model.

In the following section, the basis of the Model A component model is presented and the differences between it and the UIS model described. The justification underpinning the employment of a competing models strategy is indicated prior to the presentation and interpretation of the findings.

7.3.2.1. A competing structural model: the Model A component

In chapters one and four, it was explained that UIS measures generally have three core dimensions (Doll and Torkzadeh, 1988; Palvia, 1996; and Wong and Phelps, 1997). These are; (1) satisfaction with the information product; (2) satisfaction with
IT/IS providers and services; and (3) knowledge / involvement. Factor analysis presented in chapter six (see table 6.4) afforded further support for the argument that the UIS measure consisted of such dimensions. Two factors interpreted as; (1) information product satisfaction; and (2) satisfaction with IT/IS providers and services, were identified. The third possible factor, knowledge and involvement, was deliberately omitted from the UIS-based IT/IS implementation success measure due to the more useful role of knowledge and involvement dimensions as independent variables in the model. This appropriates the methodological approach of Doll and Torkzadeh (1988). This underpinning theory and analysis led to the development of Model A. The Model A component presented in figure 7.4 represents a sub-component of Model A.

As is evident from Model A as illustrated in figure 6.18 and its component presented in figure 7.4, the UIS-based IT/IS implementation success measures; (1) information product satisfaction; and (2) satisfaction with IT/IS providers and services; are employed as individual uni-dimensional measures of IT/IS implementation success alongside the organisational impact of IT/IS construct. Knowledge and Employee involvement (labelled employee) are employed as independent variables as recommended by Doll and Torkzadeh (1988). Direct paths are also hypothesised between information product satisfaction and satisfaction with IT/IS providers and services and the two measures of business performance, instead of being channeled through the intermediate concept "UIS". All constructs are employed in their uni-dimensional forms. This is fundamental to a methodologically rigorous approach to such modelling (Hunter and Gerbing, 1982; Anderson and Gerbing, 1988).
7.3.2.2. Comparison of the structural models: recommended approach

The two structural models (*Model A component* and *UIS Model*) represent two alternative formulations of the underlying theory, a perfect basis, according to Hair *et al.*, to employ a competing models strategy. Reiterating Hair *et al.* (1998, p.591), 'the strongest test of a proposed model is to identify and test competing models that represent truly different hypothetical structural relationships. When comparing the models, the researcher comes much closer to a test of competing “theories”'. In
employing the competing models strategy in the evaluation of the two structural models presented in figures 7.3 and 7.4, the theory underpinning the employment of the UIS measure in its traditional form is tested against research and findings presented earlier in the current study that indicate that it should be employed divided into its constituent uni-dimensional measures. Evaluating the two models will provide an indication of which is most informative and meaningful in explaining the underlying processes.

7.3.2.3. Comparison of the UIS model and Model A component
The two models were evaluated using the same approach employed earlier in the chapter. This initially involved the examination of path significance using critical ratio. The two models were also compared using goodness of fit measures including; (1) function of log likelihood; (2) Akaike Information Criterion (AIC); and (3) the percentage of variance explained, as described in the previous chapter.

Statistical comparison of the two models indicates that the Model A component is stronger than the UIS model over all measures. The function of log likelihood for the UIS model is higher (at 3667.277) than that of the Model A component (3497.311). The UIS model requires estimating 46 parameters while the Model A component requires estimating 49, for a difference of 3. In other words, if the UIS model is stronger than the Model A component, then 173.966 (3667.277-3497.311) is an observation on a chi square variable with 3 degrees of freedom, which is significant at the .05 level. This indicates that the UIS model is, in actual fact, considerable weaker in its explanation of the underlying processes than the Model A component version. This finding is further supported by the Model A component's lower AIC statistic (3595.311 as opposed to 3743.277).
The UIS construct also fails to explain any of the variance of either measure of business performance. Any variance explained by the model is due to the presence of the significant path between organisational impact of IT/IS and business performance (soft), which also represents an integral part of the Model A component. In the Model A component (see figure 7.4), 15% of the variance of business performance is explained, indicating that in dividing the UIS measure into its independent uni-dimensional factors and treating Knowledge and Employee involvement as independent variables, the model explains considerably more of any changes in performance. As such, there is little evidence to support the inclusion of a UIS measure.

7.3.2.4. Evaluation of the traditional UIS construct: conclusions drawn

The findings are strong in their lack of support for the traditional UIS measure as a meaningful measure of IT/IS implementation success. While the findings indicate that there is a degree of association between UIS and the organisational impact of IT/IS, it is evident that UIS is in no way an exact "surrogate" for the organisational impact of IT/IS measure. The findings presented here support those of Wong and Phelps (1997) in suggesting that UIS is, by its nature, tailored to the measurement of effectiveness at the individual level as opposed to the organisational level. As such, it appears that those aspects of the impact measure that reflect UIS, fail to influence organisational performance. As Gatian (1994) explains, the general argument employed by advocates of UIS as a measure of the organisational impact of IT/IS is that satisfied users should perform better than dissatisfied users and if the system helps users perform better, then it will have a greater impact. Such an impact should, according to Ives et al. (1983) result in changes in organisational effectiveness.
The current findings, however, support critics of UIS as a measure of IT/IS success, who suggest that satisfaction and job performance may not be correlated (e.g. Galletta and Lederer, 1989; Melone, 1990). Critics have also indicated that assuming job satisfaction and user information satisfaction as analogous is problematic (Gatian, 1994). As Gatian argues, an employee can enjoy their job and hate an information system, or hate their job and love an information system. As such, the argument put forward that satisfied IS users will necessarily perform better in their job and, in turn, drive positive changes in organisational effectiveness (in terms of the impact of IT/IS or overall organisational performance) is regarded as questionable.

The failure of the UIS measure to provide a meaningful explanation of how successful IT/IS implementation impacts upon business performance has already been discussed. In the Model A component, where the components of the UIS construct are employed independently, a much more meaningful picture of the underlying processes is presented. Here, a significant proportion of the variance in business performance (soft) is explained, and evidence indicating which components of UIS are the most significant drivers of performance is afforded. It appears, then, that it is the multidimensional nature of the UIS measure that causes problems. In chapter six, the importance of uni-dimensional constructs was stressed. To restate the assertion of Anderson and Gerbing (1988b, p.414), "a necessary condition for assigning meaning to estimated constructs is that measures that are posited as alternate indicators has only one underlying trait or construct in common." Analysis shows the UIS construct to be, by its very nature, multidimensional, consisting of (at least) three independent dimensions. As the current findings illustrate, such internal weaknesses are not only problematic in themselves, but they also impact upon the meaningfulness of the overall model.
It is evident that in evaluating the UIS construct, partial support has been afforded for its use as a measure of the organisational impact of IT/IS. However, in terms of its ability to meaningfully explain the underlying process hypothesised as fundamental to hierarchy one of the model, the UIS construct appears to be inadequate. When employed as independent dimensions, with Knowledge and Employee involvement as independent variables, elements of the UIS measure prove to be significantly more useful in explaining the underlying processes. As such, the possibility that a model of IT/IS acquisition employing the UIS construct might be more meaningful, is rejected. Thus, the study retains its focus upon independent measures of IT/IS implementation success as originally hypothesised in Model A.

7.4. Respecification of the model: Model B

The current chapter has focused upon two fundamental stages necessary in the refinement and evaluation of Model A. The first stage involved the refinement of the model using a two-pronged approach of; (1) empirical analysis; and (2) theoretical justification. According to Hair et al. (1998), such an approach is fundamental to the development of a theoretically justified and empirically supported model on which confirmatory testing, using a second data set, can be undertaken. The end result is a model that represents a synthesis of the strongest theoretical and empirical findings. The second stage of analysis centred upon the evaluation of the traditional UIS measure. In particular, the objective was to identify whether the traditional UIS role should be represented as part of the model, or whether the three independent measures of IT/IS implementation success proposed were more effective in their explanation of underlying processes. The two underlying theories were tested and the traditional UIS measure shown to be weak in its explanatory power. As a result, it was
concluded that the UIS measure in its traditional format should play no part in the model.

The end result of the final stages of exploratory analysis is the respecification of Model A based upon the findings presented. It is hypothesised that the respecified model – entitled Model B - will be strong in its explanatory and predictive strength regarding the underlying processes that take place in the assessment and acquisition of IT/IS in small firms. Figure 7.5 presents Model B diagrammatically. The paths illustrated by dotted lines are those that were hypothesised in Model A, but are now omitted from the analysis on the basis of theoretical and empirical considerations. Paths represented in black are those paths that are re-hypothesised and are to be tested in the confirmatory stages of analysis. The table presented in Appendix 7.1 indicates the comparative strengths of the paths that are re-hypothesised as well as those that are omitted from Model B. These weightings are only indicative, however, as the model remains exploratory at this stage. The next stage of the research involves the collection of a second sample of data that will be employed in the confirmatory testing of the model. Only after this has been completed is it valid to interpret the findings of the model.

A nested version of Model B was also re-evaluated empirically in order to see how its parsimony compared with Nested model 4. With a function of log likelihood of 7390 (compared with 7405 for Nested 4) for 138 parameters (as opposed to 128) and an AIC score of 7666 (as opposed to 7661), Model B proves to be empirically weaker than Nested model 4. However, it is empirically weaker by the smallest of margins. More importantly, the newly specified Model B is stronger theoretically then Nested model 4.
7.5. Summary and conclusions

Chapter seven plays a valuable role in the exploratory modelling process. The primary objective of the chapter was to evaluate Model A in order to develop a more refined model based on the strongest empirical and theoretical evidence. In order to undertake this task, a two-pronged approach recommended by Hair et al. (1998) was appropriated. Following the identification of empirically weak paths, paths highlighted for omission were re-examined theoretically. Where theory and empirical findings countered one another, finding a balance between theoretical justification and empirical findings proved critical. Relying too heavily on empirical results without considering theoretical underpinnings can lead the researcher astray. As Arbuckle (1997) asserts, the researcher must not be over-reliant on the findings of the current data set if pitfalls such as “data snooping” or “fishing” are to be avoided. In the current analysis, Arbuckle’s recommendations have been followed. The result is the specification of the refined model, Model B. In its synthesis of the strongest empirical and theoretical underpinnings, it is proposed that Model B will be strong in its explanatory and predictive strength regarding the underlying processes that take place in the assessment and acquisition of IT/IS in small professional firms.

The refinement stage of the chapter also proved valuable in its clarification of the differences between the various measures of business performance and IT/IS implementation success. In chapter two, business performance and IT/IS implementation success were employed as generic labels for underlying indicators (evident in existing research) that measure those concepts. In chapter four, justification for the employment of two measures of business performance; (1) business performance (soft measures); and (2) turnover per employee; and three measures of IT/IS implementation success; (1) the organisational impact of IT/IS; (2)
information product satisfaction; and (3) satisfaction with IT/IS providers and services, was presented.

On the basis of the empirical analysis of *Model A*, and the theoretical re-examination of weak causal relationships, the difference between the employment of measures of business performance and IT/IS implementation success at the generic level (as introduced in chapter two), and the employment of individual measures as independent indicators of performance and IT/IS implementation success (as presented in chapter four), becomes fully apparent. In particular, empirical analysis indicates that, where support is indicated for a variable as a driver of one measure of IT/IS implementation success, it does not guarantee that it will be a driver of the other measures of IT/IS implementation success. Thus it is apparent, particularly regarding the three measures of IT/IS implementation success, that each measure evaluates success from a slightly different perspective. In doing so, the model exposes the subtleties that exist within the process of assessment and acquisition and highlights specific areas of IT/IS implementation where driving forces add value.

Section two of the chapter, which focused upon the evaluation of the traditional UIS construct, affords further evidence for the use several uni-dimensional measures of IT/IS implementation success. Two competing models were evaluated. The first employed the traditional UIS construct, consisting of the three core dimensions; (1) information product satisfaction; (2) satisfaction with IT/IS providers and services; and (3) knowledge / involvement. The second employed the three UIS dimensions in their independent one-dimensional forms. Information product satisfaction and satisfaction with IT/IS providers and services were employed alongside the impact of IT/IS on the organisation construct as three independent measures of IT/IS implementation success. The knowledge / involvement construct
fulfilled the role of an independent variable hypothesised as a driver of IT/IS implementation success as opposed to a measure of IT/IS implementation success as recommended by Doll and Torkzadeh (1988).

The findings indicated that the UIS construct is internally weak and unreliable as a measure of IT/IS implementation success. In terms of its ability to meaningfully explain the underlying process hypothesised as fundamental to hierarchy one of the model, the UIS construct appears to be inadequate. However, when employed as independent dimensions, with Knowledge and Employee involvement as independent variables as recommended by Doll and Torkzadeh (1988), elements of the UIS measure prove to be significantly more useful in explaining the underlying processes. As a result of analysis, the proposition that employing the UIS construct in the model of IT/IS acquisition might afford more meaningful findings, is rejected. Thus, the study retains its focus upon independent measures of IT/IS implementation success as originally hypothesised in Model A.

The objective of the current chapter was the refinement of Model A, based upon strong theoretical and empirical underpinning, in order to develop a stronger and more parsimonious model on which confirmatory testing can be undertaken using a second data set. Critical to this objective was the need to avoid solely capitalising on the relationships specific to the current data set. However, the purpose of the model, or indeed any model, is to explain as concisely as is possible the existence of processes or relationships. While the need to reduce a model to its most concise is unnecessary, and indeed to be avoided, during the exploratory phase, finding the balance between a model which is generalisable and has a degree of conciseness and has strong theoretical underpinning can prove difficult. The culmination of this chapter, Model B, is an example of such a model.
The next step of the research is to undertake confirmatory testing on *Model B*. The following chapter focuses upon the steps needed in the transition from exploratory modelling (now complete) to confirmatory modelling. Once these are complete, confirmatory testing of the model is undertaken. The findings of the confirmatory testing are presented in chapter nine. Chapter nine also includes interpretation of the findings and presents a taxonomy of IT/IS implementation success in small professional firms.
Chapter Eight – Construct Refinement, Data collection and Examination, and Re-testing of Measurement Models

8.1. Introduction

Chapters one through seven have presented the methodology behind, and the findings of, exploratory modelling using structural equation modelling. The end result is Model B, a model of IT/IS assessment and acquisition in small firms, based on both theoretical underpinnings and empirical findings. Due to the exploratory approach recommended by Hair et al. (1998) and followed in the development of Model B, it is proposed that Model B obtains a balance between both generality and conciseness underpinned by empirical findings and theoretical justification. In order to test the explanatory strength of Model B, the research moves from exploratory modelling, now complete, to confirmatory testing of the model (see figure 8.1, based upon figure 3.1). The current chapter focuses upon the steps necessary in order to make this transition. As such, the structure mirrors the stages illustrated in figure 8.1.

Figure 8.1. Research steps in the employment of confirmatory model testing using SEM (based on figure 3.1)
Confirmatory model testing requires the use of a second data set. It is proposed that if the relationships hypothesised as forming *Model B* are accurate, then paths between variables will be supported when tested using the new data set. If the findings of confirmatory testing mirror the empirical findings of exploratory analysis, then this also suggests that the model is not specific to the exploratory data set but generalisable to a larger population. This is an important point given the concerns raised during the examination of the first data set. Collection of a second set of data requires certain assumptions to be met, but also facilitates improvements in measurement models where required. These steps are covered in the current chapter.

As stated, the collection of a second sample of data enables the refinement of measures employed in the model. While analysis undertaken in chapter six indicated that the majority of measurement models met the requirements of the research, the surfacing of measurement error, particularly regarding financial measures (e.g. turnover per employee,) was noted. Where measurement models had fewer indicators the reliability was also marginally below the cut-off point (Hair *et al.*, 1998). The first section of the chapter re-evaluates the measurement models and proposes refinements where problems are identified.

The second section focuses upon the survey methodology employed in the collection of the second data sample. Specific attention is given to the overall profile of the sample and how it compares with overall profession profile statistics and the profile of the first data sample. The impact of the profile analysis findings on the generality of the findings is afforded. The third section of the chapter proceeds through the process of data examination. The step-by-step process recommended by Hair *et al.* (1998) and described as “an investment in multivariate insurance” is
employed as it was for the analysis of the first data set. This process includes both univariate and multivariate data examination.

Finally, each measurement model is re-evaluated using confirmatory factor analysis and reliability testing. This enables the evaluation of each measurement model both independently for the second data set, and across data sets. This facilitates a better understanding of the reliability and consistency of each measure and its potential performance in the overall model.

8.2. Construct refinement

The collection of a second sample of data enables the further development and improvement of measurement models that proved weak following the analysis of data resulting from the initial data collection stage. In the following sections, refinements made to measures employed in the initial survey are presented. The following section focuses upon modifications made to multi-item measures, while the section thereafter focuses upon the problems inherent in the financial indicators used in the development of Model B and how such problems have been addressed.

8.2.1. Refinement of multi-item measures

Analysis of the multi-indicator measurement models presented in chapter six showed each model to be adequate in its ability to measure the variable concerned. The majority of measurement models were close to or above the commonly accepted reliability score of 0.70 (Hair et al., 1998). However, it was proposed that where reliability of a measure fell markedly below 0.70, improvement of the measurement model would be beneficial to the research.
Table 8.1 presents the reliability for each multi-item measurement model following analysis of the first data set (detailed findings are presented in chapter six). As is evident, only two measures; (1) level of IT/IS training undertaken; and (2) management IT/IS experience; fall markedly below the 0.70 score. As such, both measurement models were modified prior to the collection of the second data set.

Table 8.1. Reliability scores for each multi-item measurement model

<table>
<thead>
<tr>
<th>Multi-item measurement model</th>
<th>No. of indicators</th>
<th>Reliability (first data sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Performance (soft measure)</td>
<td>3</td>
<td>0.68</td>
</tr>
<tr>
<td>Organisational impact of IT/IS</td>
<td>15</td>
<td>0.87</td>
</tr>
<tr>
<td>Information product satisfaction</td>
<td>5</td>
<td>0.81</td>
</tr>
<tr>
<td>Satisfaction with IT/IS providers and services</td>
<td>4</td>
<td>0.72</td>
</tr>
<tr>
<td>IT/IS sophistication and coverage</td>
<td>3</td>
<td>0.96</td>
</tr>
<tr>
<td>Level of IS planning and formalisation</td>
<td>5</td>
<td>0.78</td>
</tr>
<tr>
<td>Level of IT/IS training undertaken</td>
<td>3</td>
<td>0.61</td>
</tr>
<tr>
<td>Consultant effectiveness</td>
<td>6</td>
<td>0.94</td>
</tr>
<tr>
<td>Vendor effectiveness</td>
<td>7</td>
<td>0.87</td>
</tr>
<tr>
<td>Management IT/IS experience</td>
<td>4</td>
<td>0.61</td>
</tr>
<tr>
<td>IT/IS learning</td>
<td>3</td>
<td>0.76</td>
</tr>
<tr>
<td>Stability of the business environment</td>
<td>3</td>
<td>0.68</td>
</tr>
</tbody>
</table>

The level of IT/IS training consisted initially of a three-item measure incorporating; (1) number of days training per partner and associate; (2) number of days training per administrative and support staff; and (3) level of formal management IT/IS training. In modifying the measure, it was concluded that the third item - level of formal management training - should be dropped as it did little more than replicate the first item - number of days training per partner and associate. The two remaining items; (1) number of days training per partner and associate; and (2) number of days training per administrative and support staff are considered an accurate numeric representation of the level of training undertaken in small firms. As such, it was decided that the two
measures should be aggregated to form an overall level of IT/IS training measure and entered directly into the model as an observed variable.

The level of management IT/IS experience measure also required modification due to its low reliability score. Two further items proposed as measures of IT/IS management experience were added to the measure; (1) duration of IT/IS use; and (2) self-perceived management IT/IS experience. Duration of IT/IS use was employed by Montazemi (1988), Cragg (1990), and Palvia et al. (1994) as a measure of management IT/IS experience. The second addition, self-perceived management IT/IS experience, follows the findings of Dess and Robinson (1984) who argue that subjective measures can provide reliable and useful information.

8.2.2. Refinement of financial performance and investment indicators

In chapter seven, the possibility of measurement error surfacing regarding the measure of turnover per employee was put forward as a possible cause for minimal support for paths leading to the financial measure of performance. The initial measure as employed in Model B was based upon argument expounded in chapter four. The problems inherent in requesting precise financial information often regarded as confidential by the respondent were presented (i.e. non-completion of the questionnaire) and on that basis, a Likert scale was developed which measured broad categories of turnover. However, in employing less precise measures, measurement error can arise, and it is proposed that this may have contributed to the results regarding the turnover per employee measure. It is proposed that measurement error may have also have arisen regarding the measure of IT/IS investment as similar broad financial ranges were used.
Both measures employed measurement scales consisting of non-uniform sub-ranges. This can also cause problems as the measure increases in value (i.e. as units range from near zero to thousands to hundreds of thousands) because there is a naturally wider range of possible responses (Hair et al., 1998). In order to improve both measures, it was proposed that smaller, and equally scaled sub-ranges within the overall range were necessary. Consideration of the potential problems of requesting overly specific information remained important.

As a point of departure, the profile data from the first data set was examined in terms of turnover and financial indicators of IT/IS investment. For turnover, only one organisation returned a turnover of more than £1 million. As such, it was proposed that the main focus of the measure should be a range from zero to one million pounds. The next step involved the consideration of the sub-ranges within the overall range. As stated, in the measure employed in the development of Model B, unequal ranges were employed. In dividing the responses by the number of employees within the organisation to give an indication of turnover per employee, the potential for measurement error is further exacerbated.

To counter this problem, uniform units were proposed within the overall range. In practical terms, units of £100,000 were employed, ranging from zero to £1 million. As such, the measure covers the main range required, and, it is proposed, provides a more detailed picture of business performance without requesting information of a precision that would deter respondents. The same methodological approach was taken in the refinement of the measure of investment in IT/IS.

The other measures employed in the model are considered satisfactory. As such, no others were modified. In section four of the current chapter, confirmatory factor analysis is repeated on each measurement model including those where
refinements have been made, in accordance with the recommendations of Hair et al. (1998). This enables an evaluation of the reliability of each measurement model in terms of the second (confirmatory) data set as well as the consistency of reliability over both samples of data. This follows the presentation of the data collection process and the examination of data.

8.3. Secondary data collection (the confirmatory survey)

8.3.1. The sampling process

The process recommended by Burns and Bush (1998) and employed in the collection of the first data set was repeated for the second data set. The target sample for the second data collection exercise was identical in profile to that of the first, consisting of; (1) architects; (2) dentists; (3) solicitors; and (4) veterinary surgeons. This methodology was followed in order to maintain as high a degree of consistency between the first and second samples as possible, thus limiting potential causes of changes in findings emanating from the two data sets. The same size restrictions were also maintained, with target firms employing 25 or fewer employees.

In terms of the size of the target sample, the guidelines proposed by Bentler and Chou (1987), Boosma (1987) and Hair et al. (1998) are again followed. Hair et al. suggest that a sample size of 200 is the ideal, independent of original sample size. Model testing becomes difficult where sample sizes exceed 400 (Hair et al.). Due to the complexity of Model B, it is proposed that a sample size of between two and three hundred is the optimum.

The actual firms targeted differ from the first sample. The collection of a second data set independent from the first is necessary in order to test the strength of the proposed model (Hair et al., 1998). Using systematic sampling as before, firm
addresses were downloaded from the yellow pages database (1999). As before the starting point was random. As an integral part of the systematic sampling procedure, selected firms were checked against those tagged during the first data collection exercise in order to avoid duplication. If a firm allocated for selection was the same as one selected for the first target sample, the drop-down substitution method was adhered to. While this method proved time consuming, it was necessary to avoid any duplication in sampling.

In terms of sample frame error, the same sources of error are possible as was the case during the obtaining of a population listing for primary data collection. Organisations listed which no longer operate are the first source of error, while organisations in operation that are either new or have not yet registered with yellow pages is the second source.

8.3.2. The survey instrument

A questionnaire methodology was again employed. The length of the questionnaire was dramatically reduced (see appendix 8.1). This influenced the drawing of the sample as explained in the following section.

8.3.3. Mailing Process

While in the collection of the first sample of data, it was deemed necessary to phone respondents prior to the mailing of the questionnaire, for the second data collection exercise it was proposed that the cost of pre-mailing phone calls would outweigh the benefits in terms of response rate. The questionnaire was significantly shorter than that used for the first survey and the cover letter contained information regarding how
the previous survey had helped in the production of reports which were of direct
benefit to the professions concerned. It was proposed that both these factors would
facilitate the return of questionnaires and reduce the need for prior contact.

Oversampling was again employed in order that sufficient responses were
obtained. Equal numbers of questionnaires (500) were mailed to each profession,
mirroring the approach taken in the first data collection stage. This accounted for the
possibility of a large non-response rate. As in the first mail shot, an A4 envelope was
mailed first class to each firm that had agreed to participate. The envelope contained
a questionnaire, a cover letter, and freepost addressed envelope for respondents to
return their questionnaire.

8.3.4. Survey response rate

The response rate for the secondary mail shot is shown in table 8.2. As is evident, the
overall response rate is adequate for modelling purposes and the level of
oversampling justified. With a total of 315 returned questionnaires, the sample size is
also large enough to cushion the deletion of cases with missing data and any cases
deemed detrimental to the analysis. As is evident, there are a balanced number of
respondents across professions (chi-square, \( p = 0.431 \)).

<table>
<thead>
<tr>
<th>Profession</th>
<th>Questionnaires mailed</th>
<th>Questionnaires returned</th>
<th>Final response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture</td>
<td>500</td>
<td>87</td>
<td>17.4%</td>
</tr>
<tr>
<td>Dentistry</td>
<td>500</td>
<td>85</td>
<td>17.0%</td>
</tr>
<tr>
<td>Law</td>
<td>500</td>
<td>70</td>
<td>14.0%</td>
</tr>
<tr>
<td>Veterinary</td>
<td>500</td>
<td>73</td>
<td>14.6%</td>
</tr>
<tr>
<td>Total</td>
<td>2000</td>
<td>315</td>
<td>15.6%</td>
</tr>
</tbody>
</table>

9 The first questionnaire had also been employed to collect additional data on the levels of IT use on
small firms for the production of professional reports.
8.3.5. Validation of the sample

In this section, profile data on the responding practices are presented and compared with the profile of the first data set and overall profession profiles.

Table 8.3 presents the size profile statistics for the second data set compared with that of the first sample and profile statistics obtained from the Yellow Pages Database (1999). As is evident from the table, the overall size profile statistics for the second sample vary from those of the professional profile (chi-square, $p = .00$) as well as the previous sample (chi-square, $p = .001$). It should be recalled from chapter five that analysis between the sample profile and the profession profile includes inherent error due to the different categorisations employed in the size profiles examined. More importantly, as explained in chapter five, such analysis does not compare like with like in terms of the generality of the data set to the intended population. The profession profile includes all firms listed within the yellow pages according to profession and size. The sample drawn is of computer users within each profession categorised by size. Research undertaken by Gallup (CPA, 1997) presented in chapter five showed smaller firms within the small firm range defined to be slower in the adoption of technology than larger firms within that range. As such, given the IT-oriented nature of the questionnaire, it is to be expected that fewer small firms and more large firms within the small firm range are likely to respond. This is illustrated in the response rate shown in table 8.3.
Table 8.3. A comparison of sample and profession profiles for data sets 1 and 2 (prior to case omission)

<table>
<thead>
<tr>
<th>Profession</th>
<th>Practice size</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1-5</td>
<td>6-10</td>
<td>11-25</td>
<td>&gt;25</td>
<td>Sample profile 11-20</td>
<td>Sample profile 11-25</td>
<td>Sample profile &gt;20</td>
<td>Sample profile &gt;20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Architects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile (1997)</td>
<td>3,647</td>
<td>69%</td>
<td>1,056</td>
<td>20%</td>
<td>381</td>
<td>7%</td>
<td>217</td>
<td>4%</td>
<td>5,301</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>First sample profile</td>
<td>52</td>
<td>74%</td>
<td>10</td>
<td>14%</td>
<td>6</td>
<td>8%</td>
<td>3</td>
<td>4%</td>
<td>71</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Profession profile (1999)</td>
<td>3,784</td>
<td>70%</td>
<td>1,013</td>
<td>19%</td>
<td>372</td>
<td>7%</td>
<td>258</td>
<td>4%</td>
<td>5,427</td>
<td>100%</td>
<td></td>
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<tr>
<td>Second sample profile</td>
<td>47</td>
<td>54%</td>
<td>15</td>
<td>18%</td>
<td>14</td>
<td>16%</td>
<td>11</td>
<td>12%</td>
<td>87</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Dentists</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile (1997)</td>
<td>5,356</td>
<td>58%</td>
<td>3,044</td>
<td>33%</td>
<td>752</td>
<td>8%</td>
<td>97</td>
<td>1%</td>
<td>9,249</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>First sample profile</td>
<td>37</td>
<td>57%</td>
<td>24</td>
<td>36%</td>
<td>5</td>
<td>7%</td>
<td>0</td>
<td>0%</td>
<td>66</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Profession profile (1999)</td>
<td>5,569</td>
<td>60%</td>
<td>2,717</td>
<td>30%</td>
<td>745</td>
<td>8%</td>
<td>173</td>
<td>2%</td>
<td>9,204</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Second sample profile</td>
<td>22</td>
<td>26%</td>
<td>26</td>
<td>31%</td>
<td>31</td>
<td>36%</td>
<td>6</td>
<td>8%</td>
<td>85</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Solicitors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile (1997)</td>
<td>5,260</td>
<td>46%</td>
<td>3,022</td>
<td>26%</td>
<td>1,930</td>
<td>17%</td>
<td>1,278</td>
<td>11%</td>
<td>11,490</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>First sample profile</td>
<td>19</td>
<td>38%</td>
<td>16</td>
<td>31%</td>
<td>11</td>
<td>21%</td>
<td>5</td>
<td>10%</td>
<td>51</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Profession profile (1999)</td>
<td>5,331</td>
<td>45%</td>
<td>3,090</td>
<td>26%</td>
<td>1,882</td>
<td>16%</td>
<td>1,482</td>
<td>13%</td>
<td>11,785</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Second sample profile</td>
<td>20</td>
<td>28%</td>
<td>25</td>
<td>36%</td>
<td>16</td>
<td>23%</td>
<td>9</td>
<td>13%</td>
<td>70</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Vets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile (1997)</td>
<td>1,474</td>
<td>53%</td>
<td>778</td>
<td>28%</td>
<td>478</td>
<td>17%</td>
<td>59</td>
<td>2%</td>
<td>2,789</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>First sample profile</td>
<td>20</td>
<td>25%</td>
<td>21</td>
<td>25%</td>
<td>36</td>
<td>43%</td>
<td>5</td>
<td>6%</td>
<td>82</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Profession profile (1999)</td>
<td>1,648</td>
<td>57%</td>
<td>761</td>
<td>27%</td>
<td>323</td>
<td>11%</td>
<td>116</td>
<td>5%</td>
<td>2,848</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Second sample profile</td>
<td>17</td>
<td>23%</td>
<td>20</td>
<td>28%</td>
<td>29</td>
<td>39%</td>
<td>7</td>
<td>10%</td>
<td>73</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small firm profile (1997)</td>
<td>15,737</td>
<td>56%</td>
<td>7,900</td>
<td>27%</td>
<td>3,541</td>
<td>12%</td>
<td>1,651</td>
<td>5%</td>
<td>28,829</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>First sample profile</td>
<td>128</td>
<td>48%</td>
<td>71</td>
<td>26%</td>
<td>58</td>
<td>21%</td>
<td>13</td>
<td>5%</td>
<td>270</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Small firm profile (1999)</td>
<td>16,332</td>
<td>56%</td>
<td>7,581</td>
<td>26%</td>
<td>3,322</td>
<td>11%</td>
<td>2,029</td>
<td>7%</td>
<td>29,264</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Second sample profile</td>
<td>106</td>
<td>34%</td>
<td>86</td>
<td>27%</td>
<td>90</td>
<td>28%</td>
<td>33</td>
<td>11%</td>
<td>315</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

(Source for profession profile statistics: Yellow Pages database, 1997; 1999)

Of perhaps more concern is the difference between the sample drawn compared with that drawn in 1997 in terms of overall size characteristics. However, if one examines the difference between the profession profiles for 1997 and 1999 (Yellow Pages Database), then it is evident that a significant difference in terms of the size profile also exists \((p = .00)\), even though in percentage terms the changes appear comparatively small (in both cases, large sample sizes are likely to increase the chances of a chi-square test showing a significant difference). Evidence and
explanation for such change was sought from the Department of Trade and Industry (DTI) in conjunction with the Government Statistical Office's (GSO) small and medium enterprise statistics for the UK, 1997; 1998 (1998; 1999). However, a number of problems prevent a satisfactory explanation. First of all, the DTI does not offer a detailed categorisation of firms by profession. Instead, sectors such as manufacturing and construction are provided. This prevents any reasonable level of comparison. Secondly, the DTI (1998, p.5) note three additional problems faced in acquiring precise information regarding small firms; (1) there is no single source of estimates of the business population; (2) the SME statistics are published 18 months after the start of the reference year, and thus reflect long delays in the reporting of business births and deaths and the time taken to record employment in all existing enterprises; and (3) the estimates provided take account of the very small businesses that do not appear on the official business register, and since they are estimated using survey data the reliability of the statistics is lower for the smallest size class.

The main point is that obtaining exact information on the intended population (both in terms of the size profile statistics and the number of firms within each size category that uses computers) is not possible. Consequently, direct and precise evaluation of the collected sample using the profession profiles as a reference frame gives little indication of the validity of the sample and is of little benefit to the overall analysis. In the context of the DTI findings, the Yellow Pages profiles suggest that a number of small business births and deaths occur over time. Similarly, firms both increase and decrease in size over time. Given the reliability difficulties and delays encountered in the reporting of such fluctuations, direct comparisons between and across profession and sample profiles become increasingly difficult and impractical.
Concern about the internal balance of professions was expressed for the first data sample in chapter five. The aim as presented in chapter five was to select four professions which it is intended afford a balanced view of processes in small professional practices as a group. It was noted that an imbalance in cases from each profession might cause problems in terms of a bias towards a specific profession in the findings. However, the alternative was the omission of further cases from the entire sample. Given the strong theoretical approach underpinning the development of Model B, it is argued that a moderate imbalance in data for each profession would not strongly influence overall model findings as no paths were removed solely upon empirical grounds.

The findings of a chi-square test focusing upon the response rate across professions for the second data sample have been presented and show no significant difference between the level of response across professions (chi-square, \( p = 0.431 \)). Furthermore, a chi-square test focusing upon response rates for each profession across both samples found no significant difference regarding the number of firms responding (\( p = .253 \)). This suggests that the balance across professions over the two samples is similar, and the possibility of any differences in model findings generated solely by internal inconsistencies in between-sample profiles is therefore reduced. As stated in chapter five, the primary objective of the research is to identify factors that appear strong and consistent in their influence over the way and success with which IT/IS is implemented over a cross-section of professions. Because the proportional balance of professions over the two samples does not vary significantly then support is lent to the probability that the balance of findings will also be internally consistent.

Finally, the sample was evaluated in terms of the respondent within the organisation. Surveys were again targeted at managing partners within the
organisations as it was assumed that their knowledge of their organisation would be the greatest. Chart 8.1 shows the percentage of responses per job title. As in the first sample (see chapter five), managing partners, partners with a specific interest in IT, and practice managers completed the majority of questionnaires. As such, it is proposed that an accurate and informed picture of decision-making and processes within small professional practices is afforded.

**Chart 8.1. Respondent by job title**

![Chart 8.1](image)

A chi-square test was undertaken in order to investigate the degree of similarity between the respondent profiles for the first and second samples. Analysis showed there to be no significant difference regarding the profiles ($p = 0.68$). This again provides evidence of internal consistency. As a result, the possibility of changes in findings emanating from response variation caused by obtaining information from significantly different people within the organisation should be at a minimum.

In section 8.4 the data are examined and once again cases omitted which fail to fulfil the criteria imposed. As such, further commentary on the sample is presented following the omission of cases.
8.4. Examining the data

A number of steps were undertaken in chapter five in order to examine the first data sample. These steps, recommended by West et al. (1995) and Hair et al. (1998) involve; (1) missing data analysis; (2) outlier detection; (3) evaluation of normality; and (4) assessment of linearity. An explanation of these techniques is presented in chapter five. In the following sections the second data sample is examined in the same way and findings presented. The aim of such analysis is to determine that the data meets the assumptions necessary for the employment of structural equation modelling. Only where cases are identified as being severely detrimental to analysis is any action taken. The necessary steps are presented in the following section.

8.4.1. Omission of firms with over 25 employees

The small professional firm definition put forward by Keeble et al. (1992) was employed as with the first sample. As such, all firms with more than 25 employees are omitted from the analysis. This resulted in the deletion of 33 cases.

8.4.2. Missing data analysis

Due to the reduced length of the questionnaire, there was a significant reduction in the degree of missing data. However, it was deemed important to repeat the missing data analysis recommended by Hair et al. (1998), and as undertaken in stage one of modelling.

Regarding the first data set, a consistent pattern of missing data emerged in which more data were missing where firms where smaller and turnover was less. Missing data analysis of the second data set failed to identify this pattern. On the basis of the analysis, where data were missing, they were missing completely at
random. The one exception to this rule was for the three IT/IS implementation success measures; (1) impact of IT/IS on the organisation; (2) information product satisfaction; and (3) satisfaction with IT/IS providers and services. A consistent pattern of missing data emerged across all three variables. For all three, missing data were more likely to occur in firms with; (a) less management support for IT/IS; and (b) less sophisticated IT/IS. Initial analysis also shows a strong correlation between management support for IT/IS and the level of IT/IS sophistication. As such, the pattern of missing data makes intuitive sense. Where there is less management support for IT/IS there also appears to be less sophisticated IT/IS. It is plausible that respondents with less sophisticated IT/IS are less likely to respond to questions on the effectiveness of their IT/IS.

8.4.2.1. Dealing with missing data

The approach to missing data employed in chapter five is replicated for the current data set. As such, cases where data are missing on the three IT/IS implementation success measures are deleted. This results in the deletion of 57 cases.

While case deletion is the recommended approach (Hair et. al, 1998), the drawback is that any deletion of cases may impact upon the generality of the findings. This proves to be the case here. It has already been identified that those firms failing to respond to the three IT/IS implementation success measures are generally less sophisticated in their use of technology and have less management support for technology within their organisations. In deleting those cases then, the findings become less generalisable for the complete spectrum of small professional practices. Instead, there is a tendency towards those that are more sophisticated in their IT/IS use and have greater management support for IT/IS. However, because of the pivotal
role that the three IT/IS implementation variables perform in the model, case deletion where data are missing remains the recommended approach (Hair et al., 1998). The findings must, however, be approached with caution.

Table 8.4. Comparison of sample profiles following omission of missing data and firms >25 employees

<table>
<thead>
<tr>
<th>Profession</th>
<th>Practice size</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-5</td>
<td>6-10</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Architects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile (1997)</td>
<td>3,647</td>
<td>72%</td>
</tr>
<tr>
<td>First sample profile</td>
<td>73</td>
<td>78%</td>
</tr>
<tr>
<td>Profession profile (1999)</td>
<td>3,784</td>
<td>70%</td>
</tr>
<tr>
<td>Second sample profile</td>
<td>41</td>
<td>63%</td>
</tr>
<tr>
<td>Dentists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile (1997)</td>
<td>5,356</td>
<td>58%</td>
</tr>
<tr>
<td>First sample profile</td>
<td>12</td>
<td>53%</td>
</tr>
<tr>
<td>Profession profile (1999)</td>
<td>5,569</td>
<td>60%</td>
</tr>
<tr>
<td>Second sample profile</td>
<td>19</td>
<td>29%</td>
</tr>
<tr>
<td>Solicitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile (1997)</td>
<td>5,260</td>
<td>51%</td>
</tr>
<tr>
<td>First sample profile, S</td>
<td>10</td>
<td>39%</td>
</tr>
<tr>
<td>Profession profile (1999)</td>
<td>5,331</td>
<td>45%</td>
</tr>
<tr>
<td>Second sample profile</td>
<td>9</td>
<td>22%</td>
</tr>
<tr>
<td>Vets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession profile (1997)</td>
<td>1,474</td>
<td>53%</td>
</tr>
<tr>
<td>First sample profile</td>
<td>12</td>
<td>23%</td>
</tr>
<tr>
<td>Profession profile (1999)</td>
<td>1,648</td>
<td>57%</td>
</tr>
<tr>
<td>Second sample profile</td>
<td>10</td>
<td>20%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small firm profile (1997)</td>
<td>15,737</td>
<td>56%</td>
</tr>
<tr>
<td>First sample profile, S1</td>
<td>71</td>
<td>48%</td>
</tr>
<tr>
<td>Small firm profile (1999)</td>
<td>16,332</td>
<td>56%</td>
</tr>
<tr>
<td>Second sample profile, S2</td>
<td>79</td>
<td>36%</td>
</tr>
</tbody>
</table>

(Note: the first sample profile is given prior to the omission of case 121. Hence S, n = 149)

Because of the number of cases omitted at this stage, the sample is re-examined in order to identify whether case omission has had a significant impact upon the overall profile of the sample. Table 8.4 presents the sample profile following the deletion of
firms with more than 25 employees and cases with significant levels of missing data regarding the dependent variables. The problems of drawing direct comparisons between sample profiles and profession profiles have been noted. Profession profiles are presented in the table for reference purposes, but further statistical comparisons are not made as such an approach is deemed inappropriate. Comparisons are made, however, between sample two before and after data omission, and between samples one and two following data omission.

The first test undertaken was a chi-square test in order to evaluate the degree to which the omission of cases changed the internal balance of professions within the sample. Analysis indicates the omission of cases is comparatively proportional across professions ($p = .740$). Further chi-square testing also shows no significant difference between the number of respondents from each profession forming the sample following the omission of cases ($p = .057$). As a result, the second sample can at this stage be regarded as internally balanced. This is congruent with the aims of the research as presented in chapter five. The four professions selected were chosen as it was proposed that they would afford a balanced view of processes in small professional practices as a group. Given the resource conditions faced it was argued that obtaining data from four professions in as equal proportions as possible would provide a picture of those factors and conditions that are generic across small professional practices and have greatest influence on the success with which IT/IS is implemented.

Because the second sample maintains internal balance while the first was shown to be unbalanced, problems regarding the internal inconsistency between samples one and two arise. This is proven by a chi-square test focusing upon response rates for each profession across both samples identifying a significant
difference regarding the number of firms from each profession responding \((p = .004)\). The primary implication is that any change in results emanating from exploratory model testing and confirmatory model testing may be a result of inconsistencies between the two samples. However, because the testing of Model A and the subsequent development of Model B was based strongly upon theoretical underpinnings, fewer demands were made of empirical data. The objectives of the entire model development process are counter to those that might result in important decisions being made solely on the basis of empirical criteria. As stated in the preceding chapter, the objective of the model development process employed is to develop a model with the support of empirical data but which does not capitalise solely on the specific data set. Fundamental to such objectives is the ability of the model to be generalised to other samples and, where possible, other populations.

Because such an approach was employed in the development of Model B, it is argued that an imbalance between professions forming the first sample is unlikely to result in significant changes in the model. However, because the second stage of modelling — confirmatory modelling — which is employed to test Model B is based solely upon empirical findings, it is important that the second sample is congruent with the objectives of the research. Because it is intended that the findings give a rounded (and non profession-biased) picture of IT/IS implementation in small professional firms, a sample which is as balanced (and non profession-biased) as is possible given the resource conditions is required. It is argued that this has been achieved in the collection of the second data set.

Analysis was also undertaken in order to evaluate whether the omission of missing data cases and firms with more than 25 employees had a significant impact in terms of the individual responding within the organisation. As explained earlier in the
study, the main objective was to target managing partners or practice managers as it was proposed that they would be most knowledgeable regarding decision-making within the organisation. This strategy proved successful in the collection of the first data sample as well as the second prior to case omission. Chi-square analysis shows no significant change in the profile of respondents as a result of data omission \((p = .093)\). This is perhaps unsurprising as missing data analysis did not suggest a pattern of missing data related to the respondent within the organisation. Further analysis also indicates that there is no significant difference between the respondent profile of the first and second data samples following case omission \((p = .151)\). Consequently, the possibility of changes in findings arising as a result of differences in the two respondent profiles is reduced.

The next analysis undertaken on sample two was a comparison of the pre case-omission and post case-omission samples focusing upon the firm size profiles of each. Once again, a chi-square test indicated there to be no significant difference between sample profiles before and after case omission. This is perhaps also unsurprising as missing data analysis failed to identify a pattern of missing data relating to firm size. The findings suggest that the profile of the sample in terms of respondents per size category remains consistent after the omission of cases. This again reduces the possibility of introducing bias into the findings as a result of the data examination process.

The final analysis compared the internal size category profiles of the first and second data samples following the omission of cases. A chi-square test indicated the two samples to be significantly different in this respect \((p = .031)\). While this is not surprising given significant changes also in the profession profiles (as recorded by the Yellow Pages Database, 1997; 1999), it does raise implications which must be noted.
The primary concern is the move away from internal consistency between the two samples regarding their size profiles. As a result, it is possible that any change in results emanating from exploratory model testing and confirmatory model testing may be a result of inconsistencies between the two samples. However, as argued earlier, because the testing of Model A and the subsequent development of Model B is based strongly upon theoretical underpinnings and generalising to the specific data set is strongly avoided, it is unlikely that significant differences are likely to emanate from small differences in the overall profile. However, it remains possible that such differences may influence findings and, as such, the findings should be approached accordingly.

The outcome of stage one of modelling – exploratory modelling – is Model B, based on a combination of theoretical underpinnings and empirical findings. Data snooping and the capitalising on relationships specific to the first data sample were strongly avoided. Because of the model development strategy and exploratory approach appropriated in stage one, it is argued that Model B retains a high level of generality. As a result, it is believed that the potential problems identified in chapter five and earlier in the current chapter regarding the first data set are unlikely to be realised.

In recognising Model B as a model with a high degree of generality, it is important in the next step of analysis to test its generality using the second sample of data. In employing the second data sample for confirmatory model testing, it is important that the data are representative of the population to which it is intended that the model generalise, namely small professional firms. This final section will evaluate the degree to which this is so.
The primary objective of the current thesis is to identify those conditions and factors that most strongly influence the successful implementation of IT/IS in small professional practices. It is not intended that the findings are generalisable to specific professions. Such analysis is outside the remit of the current study. The aim of the research is to identify those conditions and factors that are generic, influencing the implementation and use of technology irrespective of profession boundaries. To this end, the data sample to be used for confirmatory model testing has advantages and disadvantages. Focusing first of all on its limitations, the degree to which the four professions selected are representative of a larger group of small professional firms is not known and can only be established by subsequent testing of the model using data from different professions. The professions selected were chosen because they have a number of generic similarities as a result of operating in the professional service sector. However, the fields in which they work differ precluding where possible a profession-biased perspective. For these reasons the assumption is made that conditions and factors which are identified across the four professions are likely to be of a type which are found in a variety of small professional practices, hence increasing the generality of the findings. With this in mind, an advantage of the sample to be employed for confirmatory model testing is its internal balance. As indicated earlier, there is no significant difference between the number of respondents from each profession. In preventing a non-profession bias the sample is congruent with the aims of the research.

The final issue regarding the generality of the sample is the size profile of respondents. The problems encountered in making accurate comparisons between the sample profile and the intended population have already been discussed. In short, accurate data against which the sample can be compared does not exist. As a result,
the current study relies on a profession profile formed by combining profession profiles for the four professions selected (Yellow Pages Database, 1997; 1999) as a benchmark. However, the intended population is not the four professions as a group, but small professional firms as a whole. Secondly, as discussed in chapter five, the Yellow Pages lists firms irrespective of whether they are computerised or not. Because the survey targets computer users, and because existing research (e.g. CPA, 1997) indicates that smaller firms within the small firm size range are slower in their adoption of technology, it is not surprising that the sample skews towards larger firms within the size range defined. Profile statistics on SMEs published by the Department of Trade and Industry (1998; 1999) provide no further helpful information in terms of obtaining an industry wide picture. While information according to industry sectors is provided, the sectors are wide-ranging in scope and inappropriate in terms of the current analysis.

It is proposed that the sample can be generalised to computerised small professional practices as intended. However, such an assumption cannot be made with certainty. Exact profile comparisons cannot be made and, as a result, it is inappropriate to assert with incomplete knowledge that the size profile is an accurate reflection of that of small professional practices as a whole. The possibility of sample frame error arising remains a possibility and the findings should be approached accordingly.

A final concern in terms of the generality of data emanates from missing data analysis undertaken in chapter eight. According to analysis, missing data occurred more frequently across the three measures of IT/IS implementation success in firms with; (a) lower management support for IT/IS; and (b) less sophisticated IT/IS. Because deleting cases where data are missing on important dependent variables is
necessary, the overall sample profile changes as a result. In this case, the final sample contains firms where management is on average more supportive of IT/IS, and the level of technology implemented is slightly higher, than one might expect from a random sample. Again, the generality of findings should be approached accordingly.

8.4.3. Outliers

In chapter five, two techniques recommended by West et al. (1995) Hair et al. (1998) were employed in the identification of potential outliers. These were; (1) univariate detection; and (2) multivariate detection.

8.4.3.1. Univariate detection of potential outliers

Univariate analysis of variables was undertaken as described in chapter five. As before, "item parcels" were formed from items proposed as measures of each of the variables in order to afford a more representative picture of outliers for each variable (West et al., 1995). Variables were formed from the measurement models employed in the development of Model A and illustrated in figure 6.17, but with modifications where made as described earlier in the chapter.

Table 8.5 presents the findings of outlier analysis. Five of the variables; (1) IT/IS sophistication and coverage; (2) level of employee involvement in IT/IS acquisition; (3) vendor effectiveness; (4) IT/IS learning; and (5) investment capability; contain no outliers. As in chapter five, where potential outliers are identified, a closer scrutiny of their type is warranted. Reiterating the recommendations of Hair et al. (1998), the ideal is to identify only those outliers that are detrimental to the overall analysis: outliers should be retained if the researcher feels that they represent a valid segment of the population.
8.4.3.1.1. Outlier identification: hierarchy level one

Five potential lower boundary outliers were identified regarding the variable business performance. As the normal probability plot illustrated in figure 8.2 indicates, the lower boundary outliers do not stray significantly from the overall pattern. As such, they are not considered to be truly distinct from the rest of the sample. It is argued on this basis that the five outliers represent a valid segment of the population.

Table 8.5. Identification of outliers

<table>
<thead>
<tr>
<th>Variable</th>
<th>Outlier case no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business performance (soft measures)</td>
<td>162, 45, 52, 182, 32 (lower)</td>
</tr>
<tr>
<td>Turnover per employee</td>
<td>4, 7, 68, 201, 77, (upper)</td>
</tr>
<tr>
<td>Organisational impact of IT/IS</td>
<td>125, 109, 58 (lower), 60, 46, 81, 41 (upper)</td>
</tr>
<tr>
<td>Information product satisfaction</td>
<td>21 cases (lower), 13, 26, 43, 45, 46, 49, 79 (upper)</td>
</tr>
<tr>
<td>Satisfaction with IT/IS providers and services</td>
<td>87, 222, 45, 188, 216, 207, (lower), 46 (upper)</td>
</tr>
<tr>
<td>IT/IS investment per employee</td>
<td>45, 13 (upper)</td>
</tr>
<tr>
<td>IT/IS sophistication and coverage</td>
<td>None</td>
</tr>
<tr>
<td>IS planning and formalisation</td>
<td>2, 18, 31, 37, 46, 54, 60, 76, 92, 130, 160, 185, 186, 200, 214, 220 (upper)</td>
</tr>
<tr>
<td>Level of employee involvement in acquisition</td>
<td>None</td>
</tr>
<tr>
<td>Investment in IT/IS training</td>
<td>43, 45, 46, 58, 67, 106, 122, 124, 154, 155, (upper)</td>
</tr>
<tr>
<td>Vendor effectiveness</td>
<td>None</td>
</tr>
<tr>
<td>Consultant effectiveness</td>
<td>22, 63, 124, 179, 214 (lower)</td>
</tr>
<tr>
<td>Management support for IT/IS</td>
<td>57, 58, 109, 118, 125 (lower)</td>
</tr>
<tr>
<td>Management IT/IS experience</td>
<td>58 (lower), 202, 81, 46, 208 (upper)</td>
</tr>
<tr>
<td>Organisational IT/IS knowledge</td>
<td>62, 147 (lower)</td>
</tr>
<tr>
<td>IT/IS learning</td>
<td>None</td>
</tr>
<tr>
<td>Organisation size</td>
<td>None (size range pre-defined)</td>
</tr>
<tr>
<td>Investment capability</td>
<td>None</td>
</tr>
<tr>
<td>Perceived environmental stability</td>
<td>Omitted from the Model B</td>
</tr>
</tbody>
</table>

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Five potential upper boundary outliers are identified for turnover per employee. While four of these can be regarded as an extension of the overriding pattern, the fifth, case 7, is significantly removed from that pattern. As such, case 7 is truly distinct from the remainder of the sample. This is illustrated in figure 8.3.
Figure 8.4 shows the normal probability plot of turnover per employee with case 7 removed. As is evident, there is a high degree of congruence between the expected values and the actual values. The remaining four outliers are maintained as it is argued that they form part of a pattern and are, as such, an important segment of the overall sample.

**Figure 8.4. Normal probability plot of turnover per employee (case 7 omitted)**

Three potential lower and four potential upper boundary outliers were identified in the analysis of the variable measuring the impact of IT/IS on the organisation. The normal probability plot for the variable is illustrated in figure 8.5. Of particular concern are the three lower outliers. These appear outside the general pattern of data and are thus distinct from the remainder of the sample. It is proposed that these cases are more likely to be detrimental than beneficial to the analysis and thus should be deleted from the data set.
Figure 8.5. Normal probability plot of IT/IS impact

Figure 8.6 shows the normal probability plot for the impact of IT/IS on the organisation with the three lower boundary outliers removed. As is evident, significant congruence exists between the expected normal and the observed values. The consistency of the pattern of findings is also increased. As such, it is argued that the deletion of the outlier cases is beneficial to the overall analysis.
Figure 8.7 shows the normal probability plot for the variable *information product satisfaction*. As is evident from table 8.4, there are 21 lower boundary outliers and 6 upper boundary outliers. While there are a considerable number of outliers, figure 8.7 shows that all the outliers form part of an overriding pattern of data. None stand out as being truly distinct from the rest of the sample. As such, omitting cases would be a questionable approach. In forming part of an overall pattern, the outliers are as important in the information they provide about the sample as those cases which are not outside the upper and lower boundaries. It is argued that they represent a valid segment of the population that are unsatisfied or very satisfied with the information product.

### Figure 8.7. Normal probability plot of information product satisfaction

![Normal probability plot](image)

Seven outliers were evident in the data set regarding the variable satisfaction with IT/IS providers and services (see the normal probability plot in Appendix 8.2). Congruent with the findings for the previous variable, the outliers formed part of an overall pattern. As such, no cases were considered for deletion.
8.4.3.1.2. Outlier identification: hierarchy levels two and three

In undertaking univariate analysis on variables that form hierarchy levels two and three, it is evident that five have no potential outliers. These are: (1) IT/IS sophistication and coverage; (2) level of employee involvement in IT/IS acquisition; (3) vendor effectiveness; (4) IT/IS learning; (5) investment capability. For these variables, all cases cluster around the expected normal line in the probability plots (see appendix 8.2). The parameters of organisation size are pre-determined while the variable environmental stability is omitted from Model B. There are, however, a number of variables where potential outliers are identified (see table 8.4). These are evaluated in this section.

Figure 8.8 illustrates the normal probability plot for the level of IT/IS investment per employee. Two potential outliers are identified at the upper boundary. Again the question arises as to whether these outliers should be omitted from the analysis. The chart suggests that they are at the extreme of an overall curved line. One would expect investment in IT/IS per employee to generally adhere to such a pattern. As the number of employees increases, less investment is required per employee due to economies of scale. As such, the measure is unlikely to be linear.

Closer scrutiny of the two outlier cases shows consistency over a number of related responses. In both cases, the two firms perceive IT/IS to be fundamental to the organisation and believe investment in technology to be paramount. This, is reflected in the IT/IS investment per employee output shown in the chart below. While the two outliers represent less than one per cent of the overall sample, it is argued that they reflect a proportion of organisations in the overall population to which the findings are intended to be generalisable. As such, it is argued that the two cases are retained.
While outliers are identified on several more variables including; (1) the level of IS planning and formalisation; (2) the level of investment in IT/IS training; (3) consultant effectiveness; (4) management support for IT/IS; (5) management IT/IS experience; and (6) the level of organisational IT/IS knowledge; normal probability plots (see appendix 8.2.) show such outliers to form part of the overall pattern of the data set for each variable. None of the outliers appear to be truly distinct from the remainder of the sample and thus fail to demonstrate the characteristics of outliers that should be eliminated. None of the cases, with the exception of the four deleted (7, 58, 109, 125) were considered extreme enough to warrant deletion. The four deleted cases were only omitted because they were sufficiently distinct from the remainder of the sample as to be detrimental to the overall analysis and weaken the generality of the findings. In all other instances, the observations identified as potential outliers seem similar enough to the remaining observations to be retained in the analysis. Removing them would result in the deletion of valuable information and be of detriment to the overall analysis.
8.4.3.2. Multivariate detection of outliers

In chapter five, Mahalanobis $D^2$ measure was employed as a multivariate means of identifying outlier cases. Here we repeat the analysis on the new data set. This involves two steps as before. First of all, the hierarchy level one dependent variables (business performance and turnover per employee) are employed as dependent variables with those variables hypothesised in Model B to influence the performance measures input as independent variables. In the second stage, the hierarchy level two dependent variables [(1) IT/IS impact; (2) information product satisfaction; and (3) satisfaction with IT/IS providers and services] are employed as dependent variables in the analysis, while all level two and three variables hypothesised to influence the three dependent variables are input as independent variables.

In the first test, 12 potential outliers were identified. However, as the normal probability graph for the level one variables illustrates (see figure 8.9), all outliers represent components in an overall pattern of findings. None appear truly distinct from the remainder of the sample and, as such, it is deemed inappropriate to remove any cases from the analysis.

Figure 8.9. Normal probability plot of Mahalanobis' $D^2$ using performance variables as the dependent variable
Figure 8.10 shows the normal probability plot for stage two of the Mahalanobis $D^2$ analysis. Here the IT/IS implementation success variables are employed as dependent variables. While twelve potential outliers are identified, only two (cases 45 and 87) appear to be significantly distinct from the remainder of the sample. A review of the univariate outliers displayed in table 8.4 shows case 45 as an outlier on 5 variables while case 87 also appears as a univariate outlier. While the current methodology has tended towards maintaining outlier cases where they are shown to be an extension of a pattern, cases 87 and, in particular, 45 are consistent in their extremity and this may introduce artificial bias into the findings. Because the two cases have been identified as outliers by both univariate and multivariate outlier detection, it is proposed that they be deleted from the sample as they may be detrimental to the analysis.

**Figure 8.10. Normal probability plot of Mahalanobis’ $D^2$ using IT/IS implementation success as the dependent variables**

Figure 8.11 shows the normal probability plot for the Mahalanobis $D^2$ analysis with the two offending cases removed. As is evident, there is a better congruence between the expected normal and the observed distribution of the data set. The remaining
outliers are consistent with the overall pattern of the data and, as such, it is argued that they should be retained.

Figure 8.11. Normal probability plot of Mahalanobis' $D^2$ using IT/IS implementation success as the dependent variable (cases 45 and 87 removed)

8.4.3.3. Retention or deletion of outliers
As a result of univariate and multivariate outlier detection analyses, six cases have been omitted from the sample (7, 45, 58, 87, 109 and 125). All were deemed to be truly distinct from the remainder of the sample and as such detrimental to the overall analysis. The omission of the six cases has the byproduct of improving the internal balance of the sample in terms of number of respondents from each profession \((\text{chi-square}, p = .124)\)

While a number of variables have extreme observations, none of the cases (other than those omitted) were considered extreme enough over a number of variables to be considered truly unrepresentative of the population. In all instances, the remaining cases, even where designated as potential outliers, were sufficiently
congruent with the overall pattern of data to be retained in the analysis. Because it is believed that the cases identified represent a segment of the population, they must be retained if one is to ensure the generality of findings. Reiterating the advice of Hair et al. (1998), as outliers are deleted, the researcher may improve the multivariate analysis, but limit its generality. As such, the researcher must use caution in the trade-off between the two.

8.4.4. Normality

The next step in the "investment in multivariate analysis insurance" as recommended by Hair et al. (1998) is the examination of normality for each variable included in the model. As in chapter five, a graphical analysis of each variable using normal probability plots was undertaken. The plots for each variable are presented in appendix 8.2.

In section 5.4.4 the advantages and disadvantages of attempting to "fix" normality problems were discussed. The outcome was a methodological approach where only those variables that deviated substantially from the norm were transformed in order to prevent bias being introduced into the findings. Reiterating Norusis' (1998) assertion regarding multivariate data analysis, it is sufficient for the majority of statistical tests that the data are approaching normality. Furthermore, the findings of West et al. (1995) suggest that tampering with distributions in an attempt to improve normality can introduce artificiality into the analysis, and thus problems during the interpretation stage.

Analysis of the first data set resulted in only one variable - IT/IS investment per employee - needing to be transformed. A review of the normal probability plots for the second data set (presented in appendix 8.2) results in the same finding. Once
again, the variable IT/IS investment per employee is problematic (see figure 8.8 in the current chapter). Its positive skew mirrors that of the variable’s distribution in the previous data set. Figure 8.12 shows IT/IS investment per employee following logarithmic transformation. As with the first data set, the logarithmic transformation significantly improves the shape of the data. The need for the logarithmic transformation of IT/IS investment per employee in the second data set is also advantageous in that it results in total consistency in the treatment of data across the two data sets. This facilitates the comparison of model analyses across the two data sets if necessary.

**Figure 8.12. Normal probability plot of IT/IS investment per employee (log)**

Comparing distributions for each of the other variables across the two data sets also shows consistencies across the two samples. This is encouraging as it suggests that the findings of the first sample (in terms of general distribution) are not solely specific to that sample. In observing indications of similar distributions for specific variables in the second sample as in the first, further evidence is provided that the data are not sample-specific but generalisable to a larger population.
In conclusion, it is evident from the normal probability plots presented in appendix 8.2 that the variables (with the exception of IT/IS investment per employee) do not deviate sufficiently from the normal to warrant transformation. It is also evident that the normal probability charts for the second sample ‘mirror’ those of the first. This indicates a level of consistency across samples and suggests that the findings are indeed generalisable to a larger population. Finally, in treating the second data set in exactly the same way as the first (i.e. in undertaking a logarithmic transformation on IT/IS investment per employee while employing all other variables in their original format), the comparison of model analyses across data sets is facilitated.

8.4.5. Linearity

The final stage of data examination involved the assessment of each relationship for linearity. Relationships hypothesised as part of the model were evaluated once again using scatterplots. Where relationships proved significant between variables, a visual inspection of the charts failed to reveal any apparent significant non-linear relationships. A further inspection of the scatterplots and evaluation of correlation coefficients also showed a high level of consistency with those presented for the first data sample. This provides a tentative initial indication that underlying processes evident in firms in the initial data set are also evident in firms that represent the second data set.

8.4.6. Final sample size

Following the removal of firms with more than 25 employees, cases with significant levels of missing data and the six outliers identified as likely to be detrimental to
analysis, the final sample to be employed for confirmatory modelling is \( n = 219 \). As stated in chapters three and five, Hair et al. (1998) argue that while maximum likelihood estimation (the most common SEM estimation procedure) has been found to provide valid results with sample sizes as small as 50, it is generally accepted that the minimum sample size to ensure appropriate use of structural equation modelling is 100 to 150. Ultimately, Hair et al. recommend 200 cases as the ideal sample size. Boosma (1987) agrees that as sample sizes approach 100 or fewer cases, false inferences become increasingly likely and as a result recommends a sample of at least 200 cases. Given such recommendations, the sample employed for confirmatory model testing is regarded as satisfactory.

8.5. Re-testing measurement models

Following examination of the data, confirmatory factor analysis was repeated on each measurement model in order to test its level of reliability, both independently and across the two data sets. Measurement models were tested in their initial format and then, where modifications were made, in their amended format (see appendix 8.3). The findings are presented in table 8.6.

As is evident from the analysis, the majority of measurement models show acceptable levels of reliability across both data sets. In particular, measurement models including; (1) organisational impact of IT/IS; (2) information product satisfaction; (3) IT/IS sophistication and coverage; (4) IS planning and formalisation; (5) consultant effectiveness; (6) vendor effectiveness; and (7) IT/IS leaning; all show high levels of reliability across both samples. While reliability falls just below 0.70 for Business performance, the reliability score of 0.69 is considered acceptable. The
reliability of the measure satisfaction with IT/IS providers and services is lower for the second data sample, dropping from 0.72 to 0.66. While this is not alarming, it suggests that the measure is not entirely stable and could benefit from further attention in future research.

Table 8.6. Reliability levels for measurement models across data sets

<table>
<thead>
<tr>
<th>Multi-item measurement model</th>
<th>No. of indicators</th>
<th>Reliability (1st data set)</th>
<th>Reliability (2nd data set)</th>
<th>Modification</th>
<th>Reliability after modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Performance (soft measure)</td>
<td>3</td>
<td>0.68</td>
<td>0.69</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>Organisational impact of IT/IS</td>
<td>15</td>
<td>0.87</td>
<td>0.85</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>Information product satisfaction</td>
<td>5</td>
<td>0.81</td>
<td>0.82</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>Satisfaction with IT/IS providers and services</td>
<td>4</td>
<td>0.72</td>
<td>0.66</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>IT/IS sophistication and coverage</td>
<td>3</td>
<td>0.96</td>
<td>0.90</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>Level of IS planning and formalisation</td>
<td>5</td>
<td>0.78</td>
<td>0.82</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>Level of IT/IS training undertaken</td>
<td>3</td>
<td>0.61</td>
<td>0.52</td>
<td>Compound numeric measure</td>
<td>-</td>
</tr>
<tr>
<td>Consultant effectiveness</td>
<td>6</td>
<td>0.94</td>
<td>0.91</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>Vendor effectiveness</td>
<td>7</td>
<td>0.87</td>
<td>0.85</td>
<td>None</td>
<td>-</td>
</tr>
<tr>
<td>Management IT/IS experience</td>
<td>4</td>
<td>0.61</td>
<td>0.47</td>
<td>Two items added</td>
<td>0.63</td>
</tr>
<tr>
<td>IT/IS learning</td>
<td>3</td>
<td>0.76</td>
<td>0.71</td>
<td>None</td>
<td>-</td>
</tr>
</tbody>
</table>

The measure level of IT/IS training is employed in its observed variable format. As such a reliability score is inappropriate. Management IT/IS experience is evaluated following the addition of two further items as described in section 8.2.1. Confirmatory factor analysis showed a satisfactory level of uni-dimensionality for the measure (see appendix 8.3, figure 8.3.9b). However, the overall reliability of the figure remains at the lower boundary at 0.63 (although much improved upon the reliability score for the unmodified model using the second data sample). While this is considered acceptable, it is acknowledged as a potential weakness and further research into the development of a reliable measure of management IT/IS experience is warranted. Finally, refinements made to the two financial indicators; (1) turnover;
and (2) level of IT/IS investment proved to be effective. The refinements resulted in the retrieval of more precise information and there was no evidence to indicate that the employment of 'tighter' scales resulted in an increase in question refusals.

8.6. Summary and conclusions

Chapter eight proceeded through the preparatory steps required in order to undertake confirmatory analysis on the model. These steps, illustrated in figure 8.1, mirror the steps undertaken in chapter five to ensure that the data meet all the assumptions necessary for structural equation modelling to be applied effectively.

The first stage of this process involved the refinement of measurement models which were shown to be comparatively weak. The measure of the level of IT/IS training was modified resulting in a numeric measure which, it is argued, accurately describes the amount of training undertaken within the small firm. The measurement of management IT/IS experience was also modified, with the addition of a further two items. Finally, the two financial measures; (1) turnover; and (2) IT/IS investment were modified. Sub-ranges were reduced and made consistent over the entire range of the measure. This reduced the potential for measurement error as well as problems in calculating turnover and investment per employee.

Prior to the re-testing of measurement models, data examination was undertaken consistent with that employed in chapter five. Examination included; (1) missing data analysis; (2) outlier analysis; (3) univariate and multivariate analysis of normality; and (4) analysis of linearity. Following the omission of firms with more than 25 employees and cases with significant amounts of missing data, the sample was reduced to 225 cases. Analysis was undertaken examining the internal consistency between data sets following case omission. While profile inconsistencies
were identified between the two data sets, it was argued that these would not be significantly detrimental to model development given the methodology employed. Fewer demands are made on the first data sample because theoretical arguments remain integral to the process. As a result, Model B is developed is such a way that it retains a high level of generality. Consequently, it is argued that changes emanating from small differences in sample profiles are unlikely to be problematic. It is important to note, however, that such variations are possible and that findings should be approached in this context.

The primary objective of the current study is to identify those conditions and factors that are generic, influencing the implementation and use of technology across profession boundaries. Analysis indicated the second sample of data to be internally balanced in terms of the number of respondents from each of the selected professions. As a result, it is argued that profession bias is kept to a minimum congruent with the objectives of the research. This is particularly important regarding the second sample, as the confirmatory modelling strategy employed in stage two of modelling (for which the second data sample is used) is based solely upon empirical findings. A balanced cross-profession sample is likely to improve the generality of the findings.

Outlier analysis identified six cases that were considered to be potentially detrimental to analysis. These were removed. Normality and linearity analysis found little evidence of significant deviation from the assumptions that must be met to undertake modelling. Only one variable, IT/IS investment per employee, was transformed in order to improve its normality. This mirrored the approach taken with the first data sample. As such, the potential for cross-sample comparisons is facilitated. Furthermore, observation of the normal probability plots and bivariate correlations showed distributions and findings for the second sample to mirror those
of the first. This indicates a degree of consistency over the two data sets and suggests that the findings are likely to be generalisable to a larger population.

The final sample size following the omission of the six outliers is \( n = 219 \). Boosma (1987) and Hair et al. (1998) argue that a sample size of 200 or greater is the ideal. Given such recommendations, the current sample size is considered acceptable in the context of the confirmatory model testing to be undertaken.

Following data examination, the measurement models were re-tested using confirmatory factor analysis. Measurement models including; (1) organisational impact of IT/IS; (2) information product satisfaction; (3) IT/IS sophistication and coverage; (4) IS planning and formalisation; (5) consultant effectiveness; (6) vendor effectiveness; and (7) IT/IS leaning; all show high levels of reliability across both samples. Reliability fell just below 0.70 for the business performance, and satisfaction with IT/IS providers and services measures. While the addition of two additional items improved the overall reliability of the management IT/IS experience measure, reliability remained at the lower boundary required for research of this type. While the measure is considered acceptable, it is proposed that it warrant further attention in future research.

In the current chapter the important process of data examination was undertaken as well as the refinement of measures that proved weak. The end result is a data set that meets the assumptions necessary to undertake confirmatory modelling. The next step is the re-testing of Model B employing the second data set. As stated earlier, Model B is a model of IT/IS assessment and acquisition in small professional firms which finds a balance between generality and conciseness underpinned by empirical findings and theoretical justification. It is the end result of the exploratory modelling process. In undertaking confirmatory testing on the model, where the
model is tested solely on empirical grounds, the degree to which Model B accurately and clearly explains the underlying processes which occur is tested. This step is taken at the beginning of the following chapter. Following the testing of the model, the findings are interpreted and the degree to which the model proves accurate commented upon. This is done in the context of existing research. The final stage is the presentation of a taxonomy of IT/IS implementation success in small professional firms.
Chapter Nine – Interpretation of Confirmatory Model
Testing and Presentation of a Taxonomy of IT/IS Implementation Success in Small Professional Firms

9.1. Introduction

In chapter two, a model of IT/IS assessment and acquisition was presented on the basis of the findings of existing research. Chapter three introduced the research strategy and chapters four and five afforded information on how data was collected from small professional firms. Chapter six focused upon the building of the structural model used to test the degree to which data collected from the sample supports the model hypothesised in chapter two, while in chapter seven the proposed model was refined employing a two-pronged empirical and theoretical approach. Chapter seven also evaluated the usefulness of the traditional UIS construct, finding it to be inadequate and inappropriate when employed as a uni-dimensional measure of IT/IS implementation success. In so doing, it was confirmed that the study should maintain its focus upon independent measures of IT/IS implementation success as originally hypothesised in Model A. The culmination of the exploratory modelling stage, which reached its fruition in chapter seven, was Model B. In its synthesis of the strongest theoretical and empirical underpinnings, it is proposed that Model B is strong in its explanatory and predictive strength regarding the underlying processes that take place in the assessment and acquisition of IT/IS in small professional firms.

In order to undertake confirmatory testing on Model B, the collection of a second data set was necessary. Chapter eight focused on the collection of the second
data set and proceeded through the necessary stages of data examination and measurement model re-testing. The current chapter represents the culmination of the two-stage modelling process initially described in chapter three. Exploratory modelling is complete and the second data set meets all the assumptions necessary for the undertaking of confirmatory model analysis.

Confirmatory testing of Model B and the presentation of findings form the first part of the current chapter. Following the presentation of findings, the model is interpreted. In order to afford a clear picture of the role of each variable in the model, the findings are approached in a similar format to their initial presentation in the literature review in chapter two. This is done in the context of existing research. While interpretation is based upon the findings of confirmatory model testing, the findings of exploratory modelling are also alluded to where appropriate. This adds additional insight facilitating the interpretation of the model. Such interpretation forms the second part of the current chapter.

As illustrated in chapter two, the model proposed in the current study is based not only on simple relationships between variables, but also on models developed by researchers in the IS field. Such models tend to be limited in scope, focusing on specific areas of IT/IS implementation in small firms. Fuller (1996), for example, focused upon the learning process while Thong et al. (1994; 1996) evaluated the roles of management and external IT/IS support in the IT/IS assessment and acquisition process. Approaching the current model in its entirety enables the contextualisation of existing models as well as the positioning of independent paths identified in previous research. This affords a broader picture of events and shows how specific areas of the implementation process interact with one another. The contextualisation of models represents the penultimate section of the chapter.
Chapter nine concludes with the presentation of a taxonomy of IT/IS implementation success in small professional firms based upon the findings of confirmatory model testing. The taxonomy presented is a structured hierarchy congruent with that developed in chapter two (see figure 2.4). The hierarchy classifies variables according to their level of influence. Hierarchy level one focuses upon the relationship between measures of IT/IS implementation success and measures of organisational performance. Level two centres upon direct drivers of IT/IS implementation success while level three presents indirect drivers of implementation success. In chapter two, the position of variables within the taxonomy and thus their position in the model hypothesised was based upon the findings of existing research. While the taxonomy presented in the final section of the current chapter is congruent with that presented in chapter two in terms of its hierarchical structure, the positioning of variables within that structure is shown to differ.

The primary aim of the current study is to present as a result of modelling a model of IT/IS assessment and acquisition in small professional firms that clearly explains interactions and underlying processes. In terms of model development this involves giving due consideration to intermediate and contextual variables frequently absent in existing IS research (Miller, 1978; Yap et al., 1992; Thong et al., 1996). In terms of developing an accurate taxonomy, this means employing structural equation modelling to evaluate the ‘true’ position of variables in the IT/IS implementation process. As will become evident, a number of variables reported as direct drivers of IT/IS implementation success in actual fact play a more supporting role as indirect drivers. In the taxonomy presented in the final section of the current chapter, the position of variables is reviewed according to the interpretation of the findings of
confirmatory model testing. In taking this approach, a more accurate picture of the true position of variables in the implementation process is afforded.

9.2. Confirmatory testing of Model B

Confirmatory testing of the model represents the final stage of the modelling process as illustrated in figures 3.1 and 8.1. Confirmatory testing differs from exploratory model testing in that analysis is based solely upon empirical findings (Hair et al., 1998). Using this method, paths are accepted or rejected depending on whether or not they are statistically significant. Hair et al. (1998) suggest that, given the statistical properties of maximum likelihood estimates (employed in the current study) and its characteristics at smaller sample sizes, the researcher should be conservative in specifying a significance level, choosing smaller levels (0.025 or 0.01) rather than the more traditional 0.05 level. In accordance with the recommendations of Hair et al., the 0.025 significance level is employed. For a path between two variables to be considered significant at the 0.025 level, it must exceed a critical ratio of ± 1.96 (± 2.33 at the 0.01 level; or ± 2.58 at the 0.005 level) (Kanji, 1993). If a path’s critical ratio is lower than ± 1.96, then a significant relationship is not considered to exist between the two variables joined by the path. Figure 9.1 presents the findings of confirmatory model testing diagrammatically.
9.2.1. Model evaluation

Statistical evaluation of the model proves difficult. As before, the Amos software employed produces a function of log likelihood and an Akaike Information Criterion (AIC) output. Such output is valuable in comparing competing models, but of little use in evaluating absolute fit as no test of statistical significance can be performed. Even if Amos produced a chi-square measure enabling statistical testing, decisions made on that basis can be unreliable (Hu and Bentler, 1995). Hair et al. (1998) point out the sensitivity of the chi-square measure to sample size differences, especially where the sample size exceeds 200 respondents.

"As sample size increases, this measure has a greater tendency to indicate significant differences for equivalent models. If the sample size becomes large enough, significant differences will be found for any specified model. Moreover, as the sample size nears 100 or goes even lower, the chi-square test will now show acceptable fit (nonsignificant differences in the predicted and observed input matrices), even when none of the model relationships are shown to be statistically significant." (Hair et al., 1998, p.655).

A more rigorous test of the model is possible by comparing it with other nested models, as undertaken in the development of Model B in chapter seven. However, it is not the intention of the current study to further develop the model. Model development has been undertaken during the first stage of modelling. Stage two - confirmatory modelling - intends to identify those factors that prove significant in their influence on measures of IT/IS implementation success and as well as on other factors included in the model across both modelling exercises. The role of such conditions and factors within the IT/IS implementation process is then interpreted in order to afford a more practical picture of the relationships which appear to exist in small professional firms.

According to Hair et al. (1998), the most obvious examination of the structural model fit involves the evaluation of the significance of the proposed paths. As is evident
from figure 9.1, the majority of paths hypothesised are supported at the conservative 0.025 significance level with a high proportion of those paths supported at the 0.005 significance level. This provides strong support for overall structural model fit.

The degree to which hypothesised variables explain changes in dependent variables is also of paramount importance. A model is of little value if it does not explain underlying processes with some degree of success. In this respect Confirmed Model B also proves to be strong. As presented throughout the study, the primary objective of the research is to identify conditions and factors which influence IT/IS implementation success. Focusing upon the three individual measures of IT/IS implementation success employed, Confirmed Model B explains 54% of the variance of the organisational impact of IT/IS, 41% of information product satisfaction, and 91% of satisfaction with IT/IS providers and services. To put this in context, Cragg (1990) explained 20% of variance in IT/IS implementation success in his model of small firm IT/IS success. As perhaps expected, the model is less successful in explaining changes in business success. The model explains only 5% of changes in business performance (soft measures) and 3% of changes in turnover per employee. However, as Hanes and Ramage (1977) point out, the impact of IT/IS represents only one of many factors which influence organisational performance.

Finally, due to the confirmation of interactions between drivers of IT/IS implementation success hypothesised in Model B, the model also explains a significant proportion of variance in a number of variables specified as drivers of IT/IS implementation success. For example, the model explains 52% of the variance in IT/IS sophistication and coverage, 24% of changes in the level of formalised IS planning undertaken and 20% of changes regarding the level of management IT/IS experience. At the lower regions of the proportion of variance explained, 15% of management support for IT/IS is explained, 14% of the level of organisational IT/IS knowledge, 8% of the changes in the level of IT/IS
investment and 3% of the investment capability of the organisation. Where the variance of a variable explained is lower, this tends to be a byproduct of fewer variables hypothesised to interact with the variable concerned.

The main aim of the current research is to explain as great a proportion of variance in the three measures of IT/IS implementation success as possible through the identification of influential conditions and factors. In explaining a high proportion of the variance of satisfaction with IT/IS providers and services, over half of the variance of the impact of IT/IS at the organisational level, and over 40% of variance of satisfaction with the information product, it is evident that the model is strong in its explanatory power. This is particularly noticeable when the percentage of variance of IT/IS implementation success explained by confirmed model B is compared with that of previous studies such as Cragg's (1990).

In the following sections, the manner in which variables interact with one another, and impact upon the variance of the three measures of IT/IS implementation success, is analysed and interpreted.

9.3. Interpretation of the model

While figure 9.1 presents the findings of confirmatory model testing at the broadest level, approaching each variable independently facilitates interpretation as well as a deeper understanding of the role fulfilled by each variable. Consequently, the interpretation of findings is structured in a similar manner to the initial review of variables presented in chapter two. This involves approaching the variables in terms of their hypothesised hierarchical roles. Interpretation opens with the evaluation of hierarchy level one which focuses upon identified relationships between measures of IT/IS implementation success and measures of business performance. Hierarchy level two identifies and evaluates direct
drivers of the three measures of IT/IS implementation success employed. Finally, the third hierarchical level focuses upon indirect drivers of IT/IS implementation success.

In the following interpretation, hierarchy level one is approached independently. Hierarchy levels two and three are approached simultaneously. As will become evident, several variables hypothesised as direct drivers fail to be confirmed as such. Approaching hierarchy levels two and three simultaneously facilitates interpretation and enables the more accurate classification of each variable in terms of its position in the process of IT/IS assessment and acquisition.

9.3.1. Hierarchy level one: IT/IS implementation success and business performance

Hierarchy level one attempts to identify relationships between the three IT/IS implementation success measures — (1) organisational impact of IT/IS; (2) information product satisfaction; and (3) satisfaction with IT/IS providers and services - and the two measures of business performance — (1) business performance (soft measures); and (2) turnover per employee. Imposing the strict critical ratio cut-off point of ± 1.96, the testing of Model B fails to support any of the hypothesised paths between the IT/IS implementation success measures and the measures of business performance (see figure 9.2).

If the critical ratio cut-off point is relaxed marginally, there is some support for the relationship between the organisational impact of IT/IS and turnover per employee. The critical ratio for the path between the two variables is 1.94, only marginally below the cut-off point. This indicates that where the organisational impact of IT/IS is greater, financial rewards are reaped in terms of the level of turnover per employee. However, the borderline significance of the relationship repels bold commentary on the degree to which this is the case. Further analysis also shows that changes in the organisational impact of IT/IS explain
only 0.6% of the variance of turnover per employee. As such, irrespective of whether the critical ratio cut-off point is relaxed or not, the effect of organisational impact on turnover per employee remains negligible.

Figure 9.2. Hierarchy one including path weightings

The hierarchy level one findings for the most part replicate the empirical findings of the exploratory analysis undertaken in chapter six (see table 6.17). Only the paths between organisational impact of IT/IS and business performance, and satisfaction with IT/IS providers and services and business performance, were empirically supported at the exploratory stage. All other level one paths were re-hypothesised on the basis of case study findings (e.g. Yetton, 1994; Sanctosus, 1995) as well as the idealistic theoretical belief commonly espoused that, benefits afforded by IT/IS should ultimately be reflected as improvements in business performance (Alpar and Kim, 1990). The findings of the
confirmatory modelling process question the validity of employing such underpinnings as a basis for modelling.

As explained above, the empirical findings are not entirely consistent over both the exploratory and confirmatory analyses. The empirical findings of the exploratory modelling stage identified comparatively strong relationships between the organisational impact of IT/IS and business performance (critical ratio = 2.280, path weight \( r = .266 \)) and satisfaction with IT/IS providers and services and business performance (C.R. = 2.826, \( r = .355 \)). Support for these relationships failed to be repeated in the confirmatory analysis of Model B. Such inconsistency between the empirical findings of confirmatory model testing and those of exploratory model testing suggests a continued need for research into the impact of IT/IS implementation success on business performance.

Previous research has proven inconsistent in its findings regarding the relationship between IT/IS and generic measures of business performance (e.g. Cron and Sobol, 1983; Cragg, 1990; Lovemann, 1994; Kivijarvi and Saarinen, 1995). While this is partly the result of research attempting to draw a direct relationship between IT/IS ownership and organisational performance as opposed to IT/IS implementation success and business performance, empirical studies that measure the latter have also proved to be inconclusive (e.g. Cragg, 1990). As is evident, the findings of the current study are entirely congruent with such inconsistent findings. Moreover, the findings of confirmatory analysis of Model B add further to the significant body of empirical research that has consistently failed to find conclusive proof of tangible organisational performance benefits emanating from IT/IS.

Overall, the three IT/IS implementation success measures explain only 5% of the variance of business performance (soft) and 3% of turnover per employee. Given that it is difficult to isolate the effect of IT/IS on organisational performance from the many variables and factors that influence performance, this finding is perhaps as expected. In spite of this,
it is evident from the findings that successfully implemented information technology and systems appear not to contribute significantly to either soft or numeric measures of business performance. Once again, Solow's (David, 1990) observation that "we see computers everywhere but in the productivity statistics" appears to hold true. One possible explanation is that the relationship between IT/IS implementation success and organisational performance may not be as direct as is hypothesised in Model B. For example, further intermediate variables may exist between IT/IS implementation success and organisational performance that help identify and explain a relationship. The identification and measurement of such variables may result in more informative and consistent research findings in this area.

Kivijarvi and Saarinen (1995), Lefebvre et al. (1995) and Mahmood (1997) argue that the benefits of IT/IS take time to permeate through the organisation. Reductions in the cost of technology have made computers much more accessible for the small business. As a result, there has, over recent years, been a significant increase in the numbers of small firms investing in technology (Reid and Hutchins, 1997). Following the argument put forward by Kivijarvi and Saarinen, Lefebvre et al. and Mahmood, it is possible that while computerisation may have taken place recently in a number of organisations, the benefits afforded by IT/IS may not yet have impacted at the organisational performance level. While an organisation may have implemented technology successfully in terms of its impact on the organisation and satisfaction with the technology and the services of suppliers, a lag may exist between successful implementation and identifiable benefits in terms of the overall performance of the business. Longitudinal research may add value in this area.

In conclusion, the findings of confirmatory analysis undertaken on Model B fail to support the hypothesised paths between measures of IT/IS implementation success and measures of business performance. In comparing the empirical findings of exploratory
modelling and confirmatory modelling, inconsistencies arise. While at odds with case study findings and idealistic theories that argue that benefits afforded by IT/IS should ultimately be consistently reflected as improvements in business performance, the findings of the current study are entirely congruent with empirical studies in this area (e.g. Cragg, 1990; Lovemann, 1994; Kivijarvi and Saarinen, 1995). Such studies show little consistent tangible evidence of organisational performance-level benefits emanating from IT/IS.

9.3.2. Hierarchy levels two and three: drivers of IT/IS implementation success

As explained earlier, hierarchy levels two and three are approached simultaneously in order to facilitate interpretation and identify more accurately the roles fulfilled by individual variables in the IT/IS implementation process. Variables are approached in the same order as in chapter two. However, as will become evident, the role of several variables hypothesised as direct drivers of IT/IS implementation success is questioned.

9.3.2.1. IT/IS assessment and acquisition decision issues

IS assessment and acquisition decision issues, as presented in chapter two, included a number of variables hypothesised as direct drivers of IT/IS implementation success. These included; (1) the level of IT/IS investment; (2) IT/IS sophistication and coverage; (3) IS planning and formalisation; (4) the level of employee involvement in IT/IS assessment and acquisition; (5) the level of IT/IS training undertaken; and (6) external support effectiveness. Each is approached in turn in the following sections.

9.3.2.1.1. IT/IS investment

In the literature review presented in chapter two, an overview was given into the small body of research that has attempted to identify a direct relationship between the level of IT/IS
investment undertaken by an organisation and the success with which IT/IS is implemented. The larger body of research that focuses upon a direct association between IT/IS investment and organisational performance is also evaluated. The collective findings of such research fail to explain coherently or conclusively the relationship between IT/IS investment and the impact of IT/IS on an organisation. In spite of such ambiguities, it seems reasonable that increased IT/IS investment within the small organisation will, as reported in case study research undertaken by Malone (1985), Yetton et al. (1994) and Naylor and Williams (1994), improve the success with which IT/IS is implemented. Paths were hypothesised on this basis.

Exploratory model analysis offered empirical support for the relationships between IT/IS investment and two measures of IT/IS implementation success; (1) the organisational impact of IT/IS; and (2) satisfaction with IT/IS providers and services. However, as is evident from figure 9.1, confirmatory model testing failed to confirm the re-hypothesised paths. In both cases, the critical ratios fell well below the cut-off point required for the identification of path significance (see Appendix 9). The path hypothesised between IT/IS investment and information product satisfaction remained unsupported at the exploratory stage of modelling. During the re-evaluation of the path undertaken in chapter seven, the theoretical and intuitive justification for the path appeared weak. As such, it was omitted from Model B.

The findings of exploratory and confirmatory model analysis undertaken in the current study are congruent with the large body of empirical research that has failed to find conclusive proof of a direct association between IT/IS investment and measures of IT/IS implementation success. They also show a lack of empirical support for case study research that suggests that increased investment is a primary driver of IT/IS implementation success in small firms (Malone, 1985; Yetton et al., 1994; and Naylor and Williams, 1994). Such
findings recall a quotation from Henderson and Lentz (1996, p.245) presented in chapter two. The authors argue that “learning the relationship between IT investment and organisational performance is critical to improving organisational effectiveness. Yet the link between IT initiatives and business value is rarely clear, direct or immediate.”

Perhaps the most relevant point in terms of the current research findings is Henderson and Lentz’s reference to the link between IT/IS investment and organisational impacts of IT/IS being distant. The implication is that intermediate variables are likely to exist within that relationship. This notion is developed by Grover et al. (1996) who argue that other factors may cloud the relationship between IT/IS investment and IT/IS acquisition success. Esther and Brooke (1995) suggest that management practices and prioritisations as opposed to pure reliance on IT/IS investment is a main factor which influences the success with which IT/IS is implemented. The authors conclude that it is inappropriate to focus solely upon IT/IS investment as an independent variable in the IT/IS acquisition-impact relationship. Instead, intermediate variables which may more clearly explain underlying processes in the IT/IS investment-IT/IS implementation success relationship should be identified and included.

The implication is that direct paths hypothesised between investment and IT/IS implementation success, while based upon existing research, are in fact theoretically weak. Criticism of over reliance on simple relationships with little regard for intermediate or contextual variables raised in previous IS research (e.g. Yap et al., 1992; Thong et al., 1996) appears particularly valid when approaching the impact of IT/IS investment on measures of IT/IS implementation success independently. Fortunately, the employment of structural equation modelling enables a more holistic evaluation of the way specific variables interact with other variables within a model.
In figure 9.3, the direct paths between investment and measures of IT/IS implementation success which proved to be unsupported by confirmatory model testing are omitted. The emphasis turns instead to the presence of intermediate paths in the investment–implementation success relationship. Both exploratory and confirmatory model testing identify IT/IS sophistication to fulfill such a role. The identification and inclusion of the level of IT/IS sophistication as an intermediate factor also facilitates a more meaningful interpretation of findings. The findings suggest that increased investment results in a higher level of IT/IS sophistication and coverage which, in turn, is reflected positively in the overall impact that IT/IS has upon the organisation. The strong empirical and intuitive support for such a relationship clearly outweighs that in favour of a direct relationship between investment and IT/IS implementation success.

Had analysis supported the direct paths between IT/IS investment and measures of IT/IS implementation success, the findings would be more difficult to interpret. While the indirect relationship between IT/IS investment and the organisational impact of IT/IS may
be reflected in a direct association between the two variables (although not evident in the current analysis), a direct association could also be interpreted as an indication of management attempting to justify IT/IS expenditure. In other words, where management has invested more in technology, it may report IT/IS in a more positive light than is representative in order to suggest that the benefits of investment justify the cost. The findings, however, afford no evidence to suggest that response bias, underpinned by management attempts to justify IT/IS investment, actually occurs.

Figure 9.3 also presents those factors upon which the level of investment in IT/IS is contingent. On the basis of studies undertaken by Yap et al. (1992), Kivijarvi and Saarinen (1995), Reid and Hutchins (1997) and Howard (1997), it was hypothesised that organisational investment capability would represent a strong predictor of investment in IT/IS. This proved not to be the case. The findings indicate that management support for IT/IS plays a far more important role in terms of influence on IT/IS expenditure. This represents an important finding in its implication that management support is a primary driver of investment in IT/IS irrespective of an organisation’s investment capability. Where organisations have failed to invest in IT/IS then, it is more likely that this is the direct result of management perceiving IT/IS to be of little benefit, or feeling alienated by technology, than being a condition imposed by resource constraints.

A review of the literature also suggested that where management is more experienced regarding IT/IS, higher levels of resources are likely to be invested in technology implementation (e.g. Senn and Gibson, 1981; Doukidis et al., 1994; Thong and Yap, 1995). However, this path is not supported by confirmatory testing of Model B. Management IT/IS experience proves, however, to be a driver of management support for IT/IS, which, as described above, also influences the level of investment in IT/IS. Again, this proves to be a path route that more clearly explains the underlying process. The
findings suggest that, where management has more experience of IT/IS, management perception of IT/IS as an enabler of organisational improvements develops. The end-result is an increase in the level of resources invested in IT/IS.

In conclusion, confirmatory analysis of Model B failed to support several direct associations. The hypothesised relationships between IT/IS investment and measures of IT/IS implementation success remained unsupported as did the direct relationship hypothesised between management IT/IS experience and IT/IS investment. However, a holistic approach to analysis (illustrated in figure 9.3) identified intermediate variables that were significant and proved to more clearly explain the underlying processes. Investment in IT/IS was identified as a direct driver of IT/IS sophistication, while the level of IT/IS sophistication proved to have a direct bearing upon the organisational impact of IT/IS.

Investment in IT/IS remained uninfluenced by the investment capability of the organisation. Instead, investment in IT/IS was shown to be partially influenced by the level of management support for IT/IS. This highlights the importance of management characteristics in the assessment and acquisition of IT/IS in small professional firms. The findings suggest that where management perceives IT/IS to be a useful business tool, resources will be invested in IT/IS irrespective of the investment capability of the organisation.

9.3.2.1.2. IT/IS sophistication and coverage

As alluded to in the previous section, the level of IT/IS sophistication and coverage stands out as a primary driver of the organisational impact of IT/IS (see figure 9.3). The measure evaluates the level of IT/IS sophistication within an organisation as well as the degree to which IT/IS solutions are used to support different functional areas. The findings of confirmatory analysis indicate that the level of IT/IS sophistication and coverage plays an
important role in terms of how strongly IT/IS impacts upon the small professional firm in terms of organisational-level benefits ($r = .270$). This is consistent with the empirical findings of exploratory analysis (where $r = .298$). These findings strongly support existing literature in this area (e.g. Kobler unit, 1987; Cragg, 1990, Lefebre et al., 1995; Reid and Hutchins, 1997; Howard, 1997). Intuitively they also prove meaningful. One might expect that in an organisation that employs a higher level of computerisation encompassing a larger proportion its functions, operational-level benefits will be greater than in organisations that are less computerised.

Paths between IT/IS sophistication and the two UIS-based measures; (1) information product satisfaction; and (2) satisfaction with IT/IS providers and services, were removed at the exploratory stage of modelling. Exploratory model analysis and evaluation showed both measures to be uninfluenced by the level of IT/IS sophistication. These findings join the body of inconclusive research in this area (e.g. Kagan et al., 1990; Law and Gorla, 1996; Choe, 1996; Lu and Wang, 1997).

It is, perhaps, unsurprising that little cohesion is evident in this area. For example, intuitively, it can be reasoned that IT/IS sophistication could influence information product satisfaction either positively or negatively. A sophisticated system might provide all the data the user requires in an appropriate format, and thus improve user satisfaction. However, it is equally plausible that with increasing sophistication, the user may feel more alienated from the computer and thus feel higher levels of overall dissatisfaction.

There is also little intuitive reasoning as to why there should be a link between the level of IT/IS sophistication and satisfaction with IT/IS providers and services. While studies such as that undertaken by Kivijarvi and Saarinen (1995) were successful in identifying a relationship between UIS measures and IT/IS sophistication, thus implying a degree of linkage between IT/IS sophistication and satisfaction with IT/IS providers and
services, the majority of findings in this area are, again, both inconclusive and inconsistent. Our findings fail to add meaningfully to this body of research.

In their investigation of drivers of software sophistication in small firms, Cragg and King (1993) identified four primary factors upon which the level of software sophistication and coverage was contingent. First of all, they found that a lack of organisational IT/IS knowledge discouraged the consideration of other applications and improvements to existing IT/IS environments. This was particularly evident at the management level, where management ignorance (interpretable as a lack of management IT/IS experience) proved to be a significant barrier to progression from anything but standard applications. Thirdly, in organisations in which management perceived IT/IS to be of little benefit, information systems remained at a comparatively basic level. Finally, the financial strength of the organisation proved to be an inhibitor of IT/IS advancements, with financially weak organisations proving reluctant to expand their applications portfolio via investment in IT/IS.

In figure 9.4 four factors supported by confirmatory model testing as drivers of IT/IS sophistication are presented. These are; (1) management IT/IS experience; (2) management support for IT/IS; (3) organisational IT/IS knowledge; and (4) the level of IT/IS investment. Management IT/IS experience, in particular, proves to be a strong driver, impacting upon IT/IS sophistication both directly and through intermediate variables. It is evident that the findings of the current research replicate those of Cragg and King (1993). The current model only differs in that investment in IT/IS is hypothesised as a direct driver of sophistication as opposed to the investment capability of the organisation. Management characteristics, including both management IT/IS experience and management support for IT/IS both play a pivotal role in the process of IT/IS advancement in small professional firms. Finally, as reported by Cragg and King (1993), organisational IT/IS knowledge
proves to be a motivator of IT/IS sophistication. These findings also replicate the empirical findings of exploratory analysis undertaken earlier in the study.

**Figure 9.4. IT/IS sophistication as a primary driver of the organisational impact of IT/IS**

All paths significant at the .005 level

Interpretation of the findings suggests that as a result of gaining IT/IS experience, management becomes aware of the level of IT/IS necessary in order to meet organisational objectives. However, the ability to purchase the required technology remains contingent upon management support to make the necessary investment. This represents a cost-benefit decision for management. If support is sufficient, then the investment will be made, the technology purchased, and this will lead to an increase in the organisational impact of IT/IS. The findings suggest that because management IT/IS experience also drives management support for IT/IS, investment is likely to occur. In other words, where management accrues experience from interaction with IT/IS, it learns that IT/IS can afford benefits to justify the expenditure resulting from investment in technology. As a result resources are invested in IT/IS. This again illustrates the central role of management with IT/IS experience.
In conclusion, strong empirical support is evident for IT/IS sophistication and coverage as a powerful driver of the organisational impact of IT/IS. This finding indicates that in small professional firms where the level of technology is more sophisticated and a higher level of functions are computerised, management perceive increased organisational benefits emanating from IT/IS. A number of drivers of IT/IS sophistication were also empirically supported. These were; (1) management IT/IS experience; (2) management support for IT/IS; (3) level of investment in IT/IS; and (4) organisational IT/IS knowledge. Such findings are congruent with Cragg and King’s (1993) model of IT motivators and inhibitors in small manufacturing firms.

9.3.2.1.3. IS planning and formalisation

Paths were hypothesised between the level of IS planning undertaken by a firm and IT/IS implementation success on the basis of a number of previous studies which have reported evidence of such a relationship (e.g. Delone, 1983; Malone, 1985; Lees, 1987; Cragg, 1990; Lee and Kim, 1992; Choe, 1996). In spite of strong theoretical support for the presence of positive paths between IS planning and the three measures of IT/IS implementation success, neither the empirical findings of exploratory analysis or confirmatory analysis found evidence to support the positive relationships hypothesised (see figure 9.1).

While the path between the level of IS planning and the organisational impact of IT/IS remained non-significant, the paths between planning and the two UIS-based measures; (1) information product satisfaction; and (2) satisfaction with IT/IS providers and services proved to be significant, although at the lower regions in terms of the critical ratio (see figure 9.1 and Appendix 9). More importantly, the paths between IS planning and the two UIS-based measures prove to be negative. This suggests that where firms undertake
more IS planning, they actually report lower levels of satisfaction with both the information product and IT/IS providers and services.

In figure 9.5 the findings of confirmatory model testing are presented diagrammatically. The relationships between measures of IS planning and measures of IT/IS implementation success are indicated. Drivers of IS planning are also presented. Interpreting these findings proves to be difficult. As stated, several studies have reported evidence of a direct association between IS planning and IT/IS implementation success, and there are an even greater number of prescriptive articles which laud the benefits of IS planning in small and large organisations alike (e.g. Bergeron and Raymond, 1992; Hogbin and Thomas, 1994; Prince, 1994; Lederer and Sethi, 1996).

Management expectations may be one cause for the lack of evidence to support a path between IS planning and the organisational impact of IT/IS, and the negative paths between IS planning and the UIS-based measures. For example, where management has undertaken detailed planning, their knowledge and experience of IT/IS is likely to be greater and as such, their expectations from IT/IS may also increase. If the perceived benefits of IT/IS fail
to meet the expectations of management, then the outcome is likely to be poor perceptions regarding IT/IS implementation success. Findings which indicate no relationship between planning and measures of IT/IS implementation success, or indeed negative relationships, would thus be a plausible outcome.

If this was the case, and heightened management expectations were a by-product of increased management IT/IS experience, then one might also expect to see a negative relationship between management IT/IS experience and measures of IT/IS implementation success. As is evident from figure 9.5, this is not the case. Significant (although borderline) positive paths exist between management IT/IS experience and the two UIS-based measures; (1) information product satisfaction; and (2) satisfaction with IT/IS providers and services. This suggests that potential bias in management perception resulting from increased interaction with IT/IS does not substantially affect perception of IT/IS implementation success. This also holds true for the third of the three IT/IS implementation success measures, the organisational impact of IT/IS. As illustrated in figure 9.5, there is no evidence to support a direct path between management IT/IS experience and the organisational impact of IT/IS. As a result, it is difficult to uphold the argument that the apparent failure of IS planning to benefit the organisation in terms of IT/IS implementation success results from increased management expectations resulting from the planning process.

Perhaps a more plausible explanation is that the planning process does not in fact add significant tangible value in terms of IT/IS implementation success. Undertaking components of planning such as; (1) evaluation of an existing system; (2) producing a written statement of requirements; (3) undertaking a cost-benefit analysis; and (4) undertaking post-purchase evaluation, may help an organisation formalise and codify the process of IT/IS assessment and acquisition. However, it may not, in fact, result in the
technology chosen differing in any way from an organisation that does not formalise its procedures. In other words, while an organisation that has undertaken formal IS planning may have detailed written plans regarding future IT/IS implementation, management in an organisation which undertakes no formal planning may have an equally clear (albeit informal) idea of the technology necessary for the future success of the firm. While such organisations may differ significantly in their approach to IT/IS implementation, the actual outcome in terms of IT/IS implementation success may not differ significantly.

The small firm context may also play an important role in terms of the underlying relationships. It is plausible that in smaller firms, planning may be detrimental to IT/IS implementation success. Small size enables the immediate identification of IT/IS needs as well as facilitating rapid implementation. Such ability to move quickly is likely to enhance an organisation's ability to perform in a competitive environment. Formal planning can slow down and constrain the implementation process and prevent an organisation from fully realising the advantages afforded by its size. The end result may be less satisfaction with the information product and the services of providers, and less evidence of IT/IS impacting upon the organisation. However, as the size of the organisation increases, the ability to act quickly, possible in smaller organisations, is eroded. Planning becomes necessary as larger IS platforms are required, user requirements are more difficult to ascertain, and the potential for logistical problems in the implementation process increase.

The findings of the current research support such interpretation. The empirical findings of exploratory research and confirmatory model testing both indicate a significant positive relationship between organisational size and the degree of IS planning undertaken within an organisation. This supports the findings of Mcfarlane et al. (1983) and Lyles et al. (1993). Mcfarlane suggested that the larger and more complex an organisation becomes, the greater the need for, and evidence of, formal planning activities. The findings suggest that
while increased levels of planning and formalisation do not appear to positively influence IT/IS implementation success, planning does appear to be a precondition of increased organisational size. In other words, planning is essentially a reactive tool, employed in order to cope with the increased complexity that is inherent in larger organisations as opposed to a proactive tool, employed to improve the success with which IT/IS is implemented.

The findings also indicate that increased levels of planning are employed where management is experienced regarding the process of IT/IS assessment and acquisition. This relates back to the ideas expounded by Fuller (1996) in his learning model of IT adoption in small firms. Fuller argues that the process of IT/IS assessment and implementation is both iterative and cyclic, and with each cycle, management proceeds along a learning curve. In learning from previous interaction with IT/IS, or formal IT/IS training, management IT/IS experience accrues and this is reflected in the way management approaches future interaction with IT/IS. Fuller’s assertions are reflected in figure 9.5. IT/IS learning and training are direct drivers of management IT/IS experience and, as management IT/IS experience increases, management’s approach to IT/IS assessment and acquisition changes. This is manifest in an increase in the levels of formalised IS planning undertaken within the organisation.

Fuller argues that the application of learning from interaction with IT manifest in increased levels of IS planning results in more successful IT/IS implementation. While there is no evidence to support the final step in the process in either the empirical findings of exploratory analysis or the findings of confirmatory model testing, it is plausible that IS planning impacts upon other performance or organisational effectiveness measures that are not employed in the current research. For example, increased levels of formalised IS planning may be related to perceived management or organisational control over
information systems both in terms of requirements or budgetary spending. While this may not drive implementation success as such, it may impact upon the organisation in other positive ways.

Prior to confirmatory testing of Model B and the support shown for hierarchy level three variables presented above, several additional variables were hypothesised to influence the level of IS planning undertaken in small professional firms. These included; (1) the perceived stability of the business environment; (2) organisational IT/IS knowledge; (3) management support for IT/IS; and (4) the employment of consultant support. All were omitted following exploratory analysis due to weak theoretical and empirical support.

Matthews and Scott (1995) reported the level and sophistication of planning undertaken in small firms to decline with increasing environmental uncertainty. Their study focused upon general management planning as opposed to IS planning specifically. This may explain why the current study found no support for a relationship between the level of IS planning undertaken by an organisation and the degree to which management regarded their environment as uncertain. This finding also indicates that IS planning is not regarded as being of significant strategic importance as a facilitator to cope with environmental uncertainty in small professional firms. Nor, indeed does it appear that increased environmental uncertainty hinders an organisation’s ability to plan future IT acquisitions. This, perhaps, adds further support to the finding that investment is not influenced by the actual investment capability of the organisation. In other words, the model suggests that current and future uncertainties, whether financial or environmental, do not significantly influence IT/IS planning and investment decisions. In both cases, management characteristics represent the critical difference, strongly supporting the findings of Powell and Dent-Micallef (1997).
According to the findings, organisational IT/IS knowledge and the employment of consultant support also have no influence upon the level of IS planning. Scholhammer and Kuriloff (1979) found that low levels of in-house IT/IS knowledge impeded IS planning, while Cragg (1990) reported that significantly more planning occurred in organisations where consultants had been previously employed. Cragg’s finding suggests that a transfer of knowledge takes place between the consultant and the small firm manager regarding best approaches to IT/IS assessment and acquisition and this results in the employment of increased levels of IS planning. The current study finds no evidence to support either relationship. Planning is generally regarded as a management exercise and, as such, it is not surprising that organisational knowledge is shown to be unrelated. This interpretation is also borne out by the path analysis that indicates that management experience significantly influences the level of planning undertaken.

Path analysis also fails to support Cragg and Zinatelli’s (1995) finding that lower levels of IS planning and formalisation take place in firms with lower levels of management support for IT/IS. Approaching these findings intuitively, it is plausible that, while in some cases, support for IT/IS may result in a planned approach to implementation, in others it might equally result in the planning process being bypassed altogether. Enthusiasm may result in a management urgency to purchase technology with little knowledge of whether it can be applied in the pursuit of organisational goals. This is illustrated in Huff and Munro’s (1985) technology-driven model in which management’s approach to IT/IS assessment and acquisition entirely bypasses the planning process. As such, planning and management support can be viewed both empirically and intuitively as independent. Management IT/IS experience, however, constrains and channels support for IT/IS, and proves to be a critical driver of planning.
In conclusion, the findings of confirmatory model testing failed to support the hypothesised positive relationships between the level of IS planning undertaken in an organisation and the three measures of IT/IS implementation success. While the path between planning and organisational support was non-significant at the chosen significance level, significant but weak negative relationships were evident between IS planning and the two UIS-based measures of IT/IS implementation success.

The possibility of management expectations being heightened as a result of management proceeding through the planning process was explored, but found to be improbable due to the lack of any negative relationships between management IT/IS experience and the three measures of IT/IS implementation success. A more plausible explanation argued that IS planning in fact fails to add significant value in terms of IT/IS implementation success. For smaller firms, formalised planning may in actual fact represent a barrier to the quick implementation of IT/IS and may, as a result, prevent such firms from remaining ahead of the competition.

Support was also evident for Fuller's (1996) learning model of IT adoption in small firms. IT/IS learning and training prove to be direct drivers of management IT/IS experience and, as management IT/IS experience increases, management’s approach to IT/IS assessment and acquisition changes. Such change is manifest in an increase in the levels of formalised IS planning undertaken within the organisation. Fuller argues that the application of learning from interaction with IT/IS manifest in increased levels of IS planning results in more successful IT/IS implementation. While there is no evidence to support the final step in the process, it is plausible that IS planning impacts upon other performance or organisational effectiveness measures that are not employed in the current research.
9.3.2.1.4. Level of employee involvement in the acquisition process

Exploratory and confirmatory model testing failed to support hypothesised paths between the level of employee involvement in the IT/IS assessment and acquisition process and; (1) the organisational impact of IT/IS; or (2) satisfaction with IT/IS providers and services. Taking a reverse perspective, this is, to a degree, supported by the literature. While Lees (1987) reported a positive association between employee involvement and the impact of IT/IS, the significant weight of argument suggests that it is involvement at the management level that adds significant value in terms of overall organisational advantages (e.g. Sabherwal and King, 1995; Powell and Dent-Micallef, 1997). It is management within the small firm that is best positioned to identify organisational needs and areas where IT/IS can afford significant organisational-level benefits (Doukidis et al., 1994). Furthermore, management tends to retain responsibility for the selection of IT/IS provision and services. As such, it is unsurprising that management involvement in the acquisition of IT/IS is a primary driver of IT/IS implementation success, while employee involvement is of little consequence.

The findings are not so clear-cut regarding the hypothesised relationship between employee involvement in IT/IS assessment and acquisition and information product satisfaction. Lees (1987), Montazemi (1988a), and Yap et al. (1992) all found evidence of a relationship between employee involvement in IT/IS acquisition and user information satisfaction. The suggestion is that where employees have been involved in the implementation process, they have helped identify specific user requirements. This in turn increases their satisfaction with the implemented information product as it is better tailored to their individual information requirements. It is also possible that in being involved in the assessment and acquisition process, users feel less alienated from the technology implemented and, as a result, feel more satisfied with the information product.
While exploratory analysis found empirical evidence to support the path between employee involvement in IT/IS assessment and acquisition and information product satisfaction, confirmatory model testing failed to uphold support for the relationship. In attempting to identify a relationship between employee involvement in IT/IS implementation and information product satisfaction, the implication is that one is attempting to identify whether employee involvement increases end-user satisfaction with the information product. In the current study, however, management mainly responded to the questionnaire and, as a result it is management’s perception of information product satisfaction as opposed to that of the employee.

The nature of small firms is such that in many cases the distinction between management and the employee becomes increasingly blurred. This results in problems in evaluating employees independently of management. Furthermore, in small firms, management is often the primary user of technology (Doukidis et al., 1994). As such, in evaluating changes in user satisfaction as a result of involvement in IT/IS implementation in the small firm, evaluating management satisfaction is often a necessity. It is argued here that contextual difficulties faced in the measurement of the impact of employee involvement in IT/IS implementation upon user satisfaction in small professional firms are likely to result in inconsistent findings. In order to determine whether employee involvement alters employee satisfaction with the information product, it is recommended that further research is undertaken in this area.

To conclude, while the findings suggest that employee involvement in IT/IS assessment and acquisition fails to impact upon all three measures of IT/IS implementation success, more research is warranted in this area. It is argued that management characteristics play a more important role in the process, as it is management that is best positioned to identify organisational needs and areas where IT/IS can afford significant
organisational-level benefits. Management is also responsible for the selection of a suitable IT/IS provider. As such it is not surprising that exploratory analysis failed to find support for a path between employee involvement and satisfaction with IT/IS providers and services.

Finally, while exploratory analysis found support for employee involvement as a driver of information product satisfaction, confirmatory model testing failed to uphold such support. It is argued that such inconsistency is to be expected, as it is management's perception of the information product that is recorded and not that of the employee. This is inconsistent with research in this area and the results should be approached as such. In conclusion, it is suggested that the findings regarding the relationship between employee involvement in the IT/IS implementation process and information product satisfaction are inconclusive. Further research is recommended.

9.3.2.1.5. Level of IT/IS training

While the literature in this area is inconclusive, the larger body points towards training as a driver of IT/IS success (e.g. Igbaria et al., 1997b; Montazemi, 1988b). Igbaria et al. summarise the findings in this area in their assertion that, "individuals without adequate training are likely to experience problems using the system. Since they are struggling, they may actually believe that the system is too hard to use and that the performance benefits of usage are outweighed by the efforts of using it..." (p.295). The findings of Mahmood and Mann (1993) suggest that, even where adequate systems are in place, if management and employees are lacking in operational knowledge, then the full potential of possible system benefits will not be realised. As such, technology will fail to impact significantly on the organisation.

All three paths between IT/IS training and the three measures of IT/IS implementation success were re-hypothesised in Model B following exploratory model
analysis. Confirmatory model testing of Model B, however, failed to support any of the three paths at the 0.025 significance level (see figure 9.1). While this suggests a lack of direct association between the amount of IT/IS training undertaken within an organisation and IT/IS implementation success, figure 9.6 indicates that IT/IS training remains influential, albeit indirectly, through its impact upon intermediate variables which, in turn, impact upon the three measures of IT/IS implementation success.

**Figure 9.6. IT/IS training as an indirect driver of IT/IS implementation success**

As illustrated in figure 9.6, two variables - (1) the level of organisational IT/IS knowledge; and (2) management IT/IS experience - play important intermediate roles between training and IT/IS implementation success. The findings suggest that where organisations undertake more IT/IS training, they report higher levels of organisational IT/IS knowledge. This is reflected in increased information satisfaction and the increased impact of IT/IS on the organisation. These findings reflect those of Igbaria *et al.* (1997b) alluded to earlier which suggest that, where individuals are exposed to training, their knowledge will increase and as
a result they will be less likely to have problems using the information system. Higher levels of satisfaction with the system are likely to result. The findings also provide evidence that in increasing levels of organisational IT/IS knowledge, IT/IS training is an indirect driver of the organisational impact of IT/IS. Knowledge fostered through training appears to result in employees having a more developed awareness of how they might better employ IT/IS in the pursuit of organisational objectives. Such findings are congruent with those of Mahmood and Mann (1993) who argue that, "as more is spent on the training of employees... the better the employees are expected to be at what they do, thereby pushing the organisation to a higher level of performance."

The second intermediate variable driven by IT/IS training is management IT/IS experience. The findings of confirmatory model testing provide strong support for a path between the two variables, suggesting that as IT/IS training is undertaken, management accrues experience and knowledge. Management IT/IS experience in turn influences other intermediate variables that add value in terms of IT/IS implementation success. These include; (1) management support for IT/IS; and (2) the level of IT/IS sophistication. The main point is that while direct relationships between training and IT/IS implementation success are not supported, the findings support those of researchers who identified indirect links between training and IT/IS implementation success (e.g. Mahmood and Mann, 1993; Guimares et al., 1996; Igbaria et al., 1997b). The findings indicate that training adds value in its development of knowledge and management experience within the organisation. Such knowledge transfer becomes a driver of IT/IS implementation success in developing the ability of employees to apply and use technology more effectively in the pursuit of organisational objectives and in improving management's approach to IT/IS decision-making.
The findings also add further fuel to criticism expounded by a number of writers (e.g. Yap et al., 1992; Thong et al., 1996) regarding an over-reliance on simple relationships while failing to give due consideration to the possibility of intermediate or contextual variables evident in much IS research. Once again, the findings of the current study suggest that the researcher should be cautious in hypothesizing paths between variables if those paths do not seem to clearly explain what is occurring. While analysis may present some support for such relationships, a more holistic approach to modelling, where full attention is given to the possibility of intermediate variables, is likely to afford stronger empirical results and facilitate a more thorough understanding of underlying processes.

9.3.2.1.6. External support for IT/IS assessment and acquisition

Thong et al. (1994, p.210) reported that “small businesses have more problems in IT/IS implementation and are more dependent on external expertise in the forms of consultants and vendors, compared with large businesses.” As such, it was hypothesised that external support would play a critical role in the process of IT/IS assessment and acquisition in small professional firms. The current research also investigated whether small firms employed dedicated IS personnel. This proved not to be the case and the employment of internal IS personnel was omitted as a variable from the current study.

For the most part, strong support is intimated for both forms of external support - (1) vendor support; and (2) consultant support - as key drivers of IT/IS implementation success. The one exception is the failure to find evidence to support the path hypothesised between vendor effectiveness and the organisational impact of IT/IS (see figure 9.7). This is in stark contrast to the strong support for the path between consultant effectiveness and the impact of IT/IS. On the basis of these findings it would appear that even where vendors are considered effective by management, no value is added in terms of organisational level
benefits. Where consultants are employed and considered effective by management, significant organisational-level benefits are reported.

In the context of previous research, these findings prove of particular interest. While the finding that consultant effectiveness is positively associated with the organisational impact of IT/IS supports a large body of research (e.g. Soh et al, 1992; Thong et al., 1994, 1996; Igbaria et al., 1997b), the lack of support for vendor effectiveness as a driver of organisational IT/IS impact counters such studies. For example, Thong et al. (1994; 1996) compared small firms in order to determine whether organisations that employed consultants differed in their level of IT/IS implementation success when compared with those that had employed vendor support. They found that small businesses employing the vendor only approach reported a greater impact of IT/IS on the organisation than their consultant-employing counterparts. They also found the ability of vendors to provide consultancy was on a par with that provided by consultants.

Figure 9.7. External support effectiveness as driver of IT/IS implementation success

** Significant at the .005 level
----- Non-significant
In this respect, the current study’s findings oppose those of Thong et al. The consultant approach was shown to be strongly associated with the impact of IT/IS on the organisation \((r = .34)\) while vendor effectiveness failed to impact significantly at the organisational level. It is argued, however, that this makes intuitive sense. As explained in chapter two, the main priority for consultants is to provide support at the organisational and managerial level, identifying needs and recommending IT/IS that can afford significant operational and competitive advantages to the organisation. Vendors, on the other hand, are generally responsible for the provision of technology as requested by management. Vendors are less likely to undertake an organisational needs analysis prior to the provision of the product and, as such, responsibility for selecting technology that will impact positively on the organisation generally remains with management rather than with the vendor.

The result of the two different approaches results in a significant difference in terms of the outcome. Where organisations employ consultants, expert knowledge in terms of the identification and application of technology that will best meet the needs of the organisation is transferred. In such organisations, management report increased organisational impacts emanating from IT/IS. Where a vendor-only approach is taken, such organisational level benefits fail to materialise. Input is limited to the technological level and precludes analysis of how such technology should be applied to meet the objectives of the organisation.

Consultants also prove to lead the way in terms of the direct influence of support effectiveness on information product satisfaction \((r = .41\) as opposed to vendor effectiveness where \(r = .25\)). This directly supports the findings of Yap et al. (1992). What proves to be of particular interest is that, while consultants are shown to be most effective in terms of their ability to afford organisational-level advantages and implement information products successfully, they are rated significantly worse than vendors regarding satisfaction with
them as providers of systems and services ($r = .41$ as opposed to $r = .85$ for vendors). These findings prove consistent over both exploratory and confirmatory model testing.

Two possible explanations are offered for this mismatch. First of all, it is possible that management have specific cost-benefit expectations when they choose to employ a consultant. In his study of consultant support in small firms, Lees (1987) reported that where consultants were employed, organisations tended to underestimate the costs to be incurred. It is possible then, that while management have rated a consultant as effective in terms of the systems that have been implemented, when it comes to rating overall satisfaction with consultants as a provider of IT/IS services, they are less generous. The second explanation concerns the orientation of the satisfaction with IT/IS providers and services measure. The measure is derived from conventional UIS measures and is thus oriented more strongly towards the provision of products and technical services as opposed to organisational level output measures that might more reasonably reflect satisfaction with consultant support. Consultants are thus at a disadvantage when evaluated with this measure.

On the basis of the findings vendor effectiveness is particularly strongly correlated with satisfaction with IT/IS providers and services (adding further support to the latter explanation afforded above). Put into context, the current study’s findings make theoretical and intuitive sense. They suggest that consultants are more effective than vendors in the delivery of support that facilitates the implementation of IT/IS in such a way that it adds significant value at the organisational and management level. While vendors fail to impact at this level, they are strong in their ability to provide technical service and back-up support, which is equally necessary for the on-going operation of an organisation. Both consultants and vendors have an important role to play in the assessment and acquisition process. While
their roles converge in certain areas, their core strengths differ and, as such, small firms should approach them accordingly.

The current study also investigates drivers of external support effectiveness as well as variables influencing the decision to select either consultant or vendor assistance. In order to measure the consistency of external support effectiveness, the degree to which employment of vendor or consultant support was associated with effectiveness was evaluated. While exploratory analysis indicated vendor employment to be related to vendor effectiveness, confirmatory model testing failed to uphold support for the relationship. The path between consultant support and consultant effectiveness was omitted after exploratory analysis failed to find evidence to support its inclusion. These findings suggest significant inconsistency in the quality of external support.

This supports findings reported by Yap et al. (1992). Yap et al. made a strong distinction between external support effectiveness and the act of employing external support. While they found the effectiveness of external IT/IS support to be associated with measures of UIS and organisational impact, Yap et al. reported that the act of employing external support, in itself, did not improve chances of satisfaction. These findings suggest that small firms should select their vendor or consultant with care if they want to reap the potential benefits.

In Model A, it was hypothesised that levels of management IT/IS experience and organisational IT/IS knowledge would influence whether or not vendors or consultants would be employed to assist in the assessment and acquisition of IT/IS. The suggestion was that where knowledge and experience was lacking, management would be more reliant on external IT/IS support (as argued by Thong et al., 1994; 1996). However, the findings of exploratory analysis provided no support for such paths (see figure 9.8). As a result, they were omitted prior to the presentation of Model B. These findings indicate that the
employment of external support in either form occurs irrespective of levels of either management experience or organisational knowledge. As such, there is little evidence to indicate what motivates the employment of external support by small organisations. It is proposed that this may also prove to be contingent upon management characteristics - more specifically, management predilection to employ external support and delegate tasks to outsiders. Finally, because the employment of consultant support can represent a significant investment, the investment capability of the organisation was hypothesised in initial stages of research as a factor upon which the employment of consultant support was contingent (based upon the findings of Mingay and Peattie, 1992). However, exploratory analysis failed to support this assertion.

Figure 9.8. Drivers of external support

Earlier in the chapter, the lack of evidence to support a path between investment capability and actual investment in IT/IS was described. Instead, confirmatory path analysis indicated that management support for IT/IS was a critical factor in the investment decision. If management were supportive of IT/IS, then resources would be invested irrespective of the firm's investment capability. While not hypothesised as part of the current model, it is
possible that management support for IT/IS may also be a critical factor in an organisation’s choice to invest in consultant support. Independent data examination also suggests that this may be the case. Strong support is evident for a path hypothesised between management support for IT/IS and the employment of consultant support (see figure 9.8). Congruent with the findings regarding investment in IT/IS, it would appear that where management perceives IT/IS to be of benefit to the organisation, investment in consultant support is likely to occur irrespective of the investment capability of the organisation. It is recommended that this path be included in future models.

Finally, it was considered in the absence of research in the area, that a relationship might exist between external support effectiveness and the level of IT/IS sophistication and coverage implemented within the small professional firm. In other words, where external support is employed and deemed effective, more technology is employed which, as illustrated, is a primary driver of the organisational impact of IT/IS. Exploratory modelling undertaken peripherally to the main modelling process indicated that this was not the case. No significant relationship existed between either vendor or consultant effectiveness and the level of IT/IS sophistication. As indicated by the findings of confirmatory model testing, both consultant effectiveness and the level of IT/IS sophistication are direct drivers of the organisational impact of IT/IS. Because peripheral modelling suggests that the two are independent, the implication is that where consultants are effective, it is not through the application of higher levels of technology, but through a more informed application of technology irrespective of the level of sophistication and coverage. This provides further evidence of the contribution which effective consultants can make in terms the effective implementation of IT/IS at the organisational level.

In conclusion, confirmatory testing of Model B for the most part showed the effectiveness of external support to contribute significantly to the three measures of IT/IS
implementation success. The one exception proved to be the relationship between vendor effectiveness and the organisational impact of IT/IS. Approached holistically, the findings indicate vendors and consultants to contribute to IT/IS implementation success in different areas congruent with their general objectives. Consultants are more effective than vendors in the delivery of support that facilitates the implementation of IT/IS in such a way that it adds significant value at the organisational level. The distinction between vendors and consultants becomes increasingly blurred when measuring ability to provide a satisfactory information product. Vendors, on the other hand, appear stronger in their ability to provide technical service and back-up support. All three elements of IT/IS implementation success are important. While the roles of consultants and vendors converge in certain areas, their core strengths differ. Organisations should assess their support needs and approach the most appropriate external assistance accordingly.

9.3.2.2. Management characteristics

Some of the most consistent findings to emanate from small firm research centre upon the elevated role of management within small organisations (e.g. Delone, 1988; Cragg, 1990; Cragg and Zinatelli, 1995; Thong et al., 1996). In this section, the findings of confirmatory model testing regarding the role of; (1) management support for IT/IS; and (2) management IT/IS experience, are evaluated. As will become evident, both play a central role in the successful implementation of IT/IS. However, their position as direct drivers of IT/IS implementation success is questioned.

9.3.2.2.1. Level of management support for IT/IS

Weill’s (1992) assertion that strong management support for IT/IS leads to superior “conversion effectiveness” (the way IS is converted to productive outputs) and thus better
performance for the same level of IT/IS investment, concisely summarises the body of literature that focuses upon the management support – IT/IS output relationship (e.g. Ginzberg, 1981; Neo, 1988; Powell and Dent Micallef, 1997). The current study supports Weill’s assertion in that management support is shown to directly impact upon both the organisational impact of IT/IS and information product satisfaction (see figure 9.9). In particular, where management support for IT/IS is shown to be high, the benefits in terms of the impact of IT/IS on the organisation are greater ($r = .38$). Analysis at the exploratory stage failed to support a path between management support for IT/IS and satisfaction with IT/IS providers and services. A lack of theory to support the path resulted in its omission prior to the presentation of Model B.

While strong direct associations are evident between management support for IT/IS and the two measures of IT/IS implementation success; (1) information product satisfaction; and (2) the organisational impact of IT/IS, it is argued that these paths do not fully explain the underlying process. The direct paths suggest that where management support for IT/IS is stronger, management will report higher levels of information product satisfaction as well as IT/IS to have more positively impacted on the organisation. It is difficult, however, to interpret the motivating factors behind increased IT/IS implementation success when focusing independently upon the direct paths. Interpretation presented earlier in this chapter indicates that interaction between management support for IT/IS and other factors plays a significant role, and intuition suggests that intermediate variables must exist within the management support for IT/IS – IT/IS implementation success relationship. Management support alone cannot influence the success with which IT/IS is implemented. Support for IT/IS must be manifest is some tangible way for it to drive implementation success.

An exception to this rule is where management support for IT/IS results in response bias in terms of measures of IT/IS implementation success. Management support for the
implementation of IT/IS is an indication of a positive attitude towards technology. Where such a positive attitude exists, it is possible that management will be more enthusiastic in its response to items measuring satisfaction with technology and the impact that IT/IS has had upon the organisation. This may result in a false indication of the degree of success with which IT/IS is implemented as well as introduce confusion regarding 'true' drivers of success. Further analysis indicates that changes in the level of management support for IT/IS explain only 4% of variance of the organisational impact of IT/IS and only 1% of satisfaction with the information product. In conclusion, it is possible that the small changes in measures of IT/IS implementation success that result directly from changes in management support for IT/IS are caused by response bias. These changes are, however, minimal. Other factors, as illustrated throughout the current chapter, also influence information product satisfaction and the organisational impact of IT/IS and it is to these that attention is now turned.

Figure 9.9 presents a more holistic approach to the role management support plays in the process of IT/IS assessment and acquisition in small professional firms. As is evident, management support for IT/IS influences the organisational impact of IT/IS indirectly via IT/IS sophistication. The findings suggest that where management is supportive of IT/IS, the degree to which processes are supported by sophisticated IT/IS increases. As shown in earlier analysis, this higher level of sophistication benefits the organisation in terms of its overall impact. Path analysis also shows investment in IT/IS to be directly related to IT/IS sophistication. Thus, while a direct path exists between management support for IT/IS and IT/IS sophistication, as alluded to earlier, a more intuitively meaningful path may be that which suggests that management support for IT/IS leads to increased investment in IT/IS. As more resources are invested in IT/IS, the level of IT/IS sophistication and coverage increases. This ultimately results in IT/IS impacting more strongly upon the organisation.
According to Markus (1983) and Thong et al. (1996), small firm owner/managers are in a position to allocate resources as they see fit and are, therefore, the driving force behind computerisation in small firms. Where small businesses are managed by individuals or teams with a positive attitude towards IT/IS, technology is more likely to be adopted (Abdul-Gader and Kozar, 1995; Thong and Yap, 1995) and the organisation is more likely to report higher levels of success and satisfaction emanating form IT/IS (Law and Gorla, 1996). As illustrated in figure 9.9, the findings of confirmatory model testing add support to such findings.

**Figure 9.9. Management IT/IS support as a driver of IT/IS implementation success**

In stage one of modelling, exploratory analysis examined other manifestations of management support for IT/IS which were hypothesised to influence the success with which IT/IS is implemented. These included; (1) the level of planning employed; and (2) the level of IT/IS training undertaken in the organisation. Exploratory analysis failed to find empirical evidence to support a path between management support for IT/IS and the level of planning undertaken within the organisation, contradicting the findings of Cragg and
Zinatelli (1995). Exploratory analysis indicated that management IT/IS experience, as opposed to enthusiasm for IT/IS, was the key determinant of IS planning. Exploratory analysis also failed to find evidence supporting management support for IT/IS as a driver of IT/IS training within the organisation (again opposing the findings of Cragg and Zinatelli, 1995). Due to weak theoretical and empirical support for the path, it was removed prior to the presentation of Model B.

Management IT/IS experience proved to be a strong driver of management support for IT/IS, sustaining Nickel and Seado’s (1986) finding that increased IT/IS experience results in a more positive attitude towards computers as well as components of Davis’ technology acceptance model (1989). This finding suggests that through interaction with IT/IS, management feels less alienated by technology and becomes more aware of its potential benefits. This increased trust is reflected in the management perception that IT/IS can afford significant operational advantages within the organisation. As shown in figure 9.9 and earlier in the chapter, such support results in increased investment in IT/IS. Finally, confirmatory model testing failed to support the hypothesised path between organisational size and management support for IT/IS. The empirical foundations upon which the path was re-stated were weak. However, it was argued that including the path in confirmatory model testing would give a clearer picture of the significance of the path. This appears to be the case. While the findings counter those of Law and Gorla (1996), it is evident that little empirical or theoretical evidence exists to support organisational size as a driver of management support for IT/IS.

In conclusion, while several manifestations of management support for IT/IS, hypothesised as intermediate variables in the management IT/IS support – implementation success relationship failed to be supported, confirmatory analysis showed management support for technology to be a critical driver of investment and IT/IS sophistication within
an organisation. Re-iterating interpretation presented earlier in the chapter, it was proposed that the path from management support for IT/IS through investment to IT/IS sophistication most clearly explains the underlying processes. Approached holistically the path suggests that if management support for IT/IS increases, so, in turn, will each of the intermediate variables, resulting ultimately in the increased organisational impact of IT/IS. As such, management support for IT/IS is an important driver of the impact of IT/IS at the organisational level.

The findings also indicate that management support for IT/IS directly influences the organisational impact of IT/IS and information product satisfaction. Because of the directness of the relationships hypothesised, it is suggested that the findings show little more than response bias resulting from management enthusiasm regarding IT/IS. Further analysis showed the direct paths to explain a small proportion of the variance of the two measures of IT/IS implementation success. As such, it is argued that misinterpretation caused by measurement error is minimal.

9.3.2.2.2. Management IT/IS experience

A number of studies reported a positive association between management IT/IS experience and measures of IT/IS implementation success (e.g. Delone, 1988; Heikkila et al., 1991; Thong and Yap, 1995; Mata et al., 1995). The implication is that in organisations where management has undergone significant levels of interaction with IT, experience is gained which enables more successful implementation. This is manifest in the increased impact of IT/IS upon the organisation and higher levels of satisfaction with both the information product and the services of IT/IS providers.

Contrary to the findings described above, confirmatory testing of Model B failed to find evidence to support a direct relationship between management IT/IS experience and the
organisational impact of IT/IS. This counters the empirical findings of exploratory model testing. Confirmatory model testing did, however, indicate support for paths between management IT/IS experience and the other two IT/IS implementation success measures – (1) information product satisfaction; and (2) satisfaction with IT/IS providers and services (see figure 9.10). These findings are congruent with the findings of several previous studies that have found that higher levels of management IT/IS experience result in higher levels of user satisfaction (e.g. Lees, 1987; Cragg, 1990). The implication is that where management has experience of the process of assessment and acquisition they will be better placed to select appropriate technologies through a more informed dialogue with IT/IS providers and services.

Figure 9.10. Management IT/IS experience as a primary driver of IT/IS implementation success

![Diagram of Figure 9.10]

* Significant at the .025 level
--- Non-significant paths

The empirical findings of exploratory model testing were diametrically opposed to the findings of confirmatory analysis, finding a significant negative association between management IT/IS experience and the two UIS-based measures; (1) information product satisfaction and; (2) satisfaction with IT/IS providers and services. While such findings countered those of the larger body of research in this area, they mirrored the findings of
research undertaken by Yaverbaum and Nosek (1992). Yaverbaum and Nosek reported that, while increased levels of management IT/IS knowledge and experience lead to changes in user satisfaction and changes in user perceptions of IS staff and services, such changes are not necessarily positive. Their findings suggest that increased managerial knowledge and experience results in a better understanding of IT and its potential as well as more defined expectations in terms of the services provided by IT/IS support. The end-product is increased management dissatisfaction as products and providers fail to meet the standards expected of them by small firm management.

The main point to be emphasised is that, while both the empirical findings of exploratory and confirmatory analysis and the explanations afforded are valid, the findings are diametrically opposed. Such inconsistency is problematic and shows a level of instability in the impact that management IT/IS experience has upon the two UIS-based measures. The failure of confirmatory analysis to support the management IT/IS experience – IT/IS impact relationship, while the empirical findings of exploratory modelling indicated a strong relationship between the two variables is further evidence of instability. It is argued that a possible cause for such inconsistency is that the direct paths hypothesised between management IT/IS experience and the three measures of IT/IS implementation success are theoretically weak. While studies have found evidence of a direct relationship between management IT/IS experience and implementation success, overall, the findings remain inconsistent. As shown above, there are plausible interpretations of the relationship between management IT/IS experience and IT/IS implementation success irrespective of whether the relationship is positive or negative.

Once again, the criticisms put forward by researchers who believe there to be too much over-reliance on simple relationships with little regard for intermediate or contextual variables are significant (e.g. Yap et al., 1992; Thong et al., 1996). It is argued that the
hypothesised paths between management IT/IS experience and the three IT/IS implementation success measures are based on such research. Both inconsistent findings and intuition suggest that management IT/IS experience, in itself, is not a direct driver of IT/IS implementation success, but instead is more likely to influence IT/IS implementation success through intermediate variables (in much the same way as management IT/IS support). Identifying and evaluating the role of tangible output resulting from increased management IT/IS experience may also more clearly explain underlying processes.

Following the findings of Yaverbaum and Nosek (1992), it is evident that the interpretation of direct relationships between management IT/IS experience and measures of IT/IS implementation success must be approached with caution. It is probable that such paths will not give a 'true' picture of the influence of management IT/IS experience on IT/IS implementation success due to their focus upon single relationships and disregard for potential intermediate variables. It is apparent from Yaverbaum and Nosek's (1992) research that a direct relationship between management IT/IS experience and IT/IS implementation success is more likely to indicate the degree to which management perception of IT/IS within the organisation meets management expectations than show how management IT/IS experience can drive IT/IS implementation success. In order to determine a more accurate indication of the impact of management IT/IS experience, attention must be given to the presence of intermediate variables in the management IT/IS experience – IT/IS implementation success relationship.

Figure 9.11 illustrates the indirect influence of management IT/IS experience on measures of IT/IS implementation success. As is evident, confirmatory analysis of Model B supports several paths that show management IT/IS experience to have a significant positive influence on implementation success through intermediate variables. This is where structural equation modelling is particularly useful in affording a clearer picture. For example,
management IT/IS experience is strongly associated with management support for IT/IS (supporting the findings of Nickell and Seado, 1986). In turn, the relationship between management support for IT/IS and information product satisfaction and the organisational impact of IT/IS is confirmed, as presented in the previous section. The impact of management support on other variables that impact upon IT/IS implementation success was also discussed. These are not illustrated in figure 9.11 in order to avoid over-complication.

Management IT/IS experience also influences organisational impact of IT/IS indirectly through its impact upon IT/IS sophistication. As described earlier, these findings suggest that where greater management experience exists, organisations implement a higher level of technology (supporting the findings of Cragg and King, 1993). In turn, more sophisticated and wide-ranging IT/IS results in increased benefits at the organisational level. This adds to the findings of a number of studies in this area (e.g. Raymond, 1985; Cragg, 1990; Lefebvre et al., 1995; Kivijarvi and Saarinen, 1995). Finally, confirmatory model testing reaffirmed management IT/IS experience as a fundamental driver of IS planning ($r = .45$), supporting the findings of Cragg (1990) and Cragg and Zinatelli (1995) who identified increased levels of formalised IS planning in small firms where management IT/IS experience was higher.

Figure 9.11. Management IT/IS experience as an indirect driver of IT/IS implementation success

** Significant at the .005 level

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Turning attention to those factors that influence management IT/IS experience, path analysis shows IT/IS management experience to be strongly influenced by both IT/IS training and IT/IS learning (supporting the findings of Beach, 1980 and Henderson and Lentz, 1996). This also adds support to Fuller’s (1996) learning model of IT adoption in small firms. Each time management proceeds through the cycle of assessment and adoption, it learns how to improve upon the process. This accumulation of experience is reflected in an improved ability to identify and express needs, and implement technology that is better at meeting those needs. Earlier in the chapter it was suggested that Fuller’s model was reflected in the paths from leaning and training, through management IT experience, to IS planning. This is illustrated in figure 9.11. However, it is also possible that as a result of interaction with IT, management accrues experience that gives it the confidence to computerise more functions and implement more sophisticated technology. In this way, experience accrued from learning thorough interaction with IT and training impacts on information product satisfaction and the organisational impact of IT/IS via more sophisticated and more wide-ranging technology. Either interpretation lends support to Fuller’s model in confirming the importance of continued learning and its positive impact upon management’s decision-making ability.

In conclusion, interpretation of the direct paths between management IT/IS experience and measures of IT/IS implementation success (presented in figure 9.10) led to the supposition that the hypothesised paths were based on weak underpinning theory. Conflicting findings both in existing research and across the empirical findings of the current study support such argument. Following the assertions of researchers in the IS field (e.g. Yap et al., 1992; Thong et al., 1996), the focus was turned to the presence of intermediate variables in the management IT/IS experience – IT/IS implementation success relationship.
The findings indicate that management IT/IS experience positively influences several intermediate factors in the management experience – implementation success relationship and, as such, remains a driver, albeit indirect, of implementation success. In particular, the findings showed management IT/IS experience to be a significant driver of both management support for IT/IS and the level of IT/IS sophistication implemented. These findings are consistent with both the empirical findings of exploratory model analysis undertaken earlier in the current study and existing research. Thus, the presence of management support for IT/IS and the level of IT/IS sophistication and coverage in the management IT/IS experience – implementation success relationship has a firm theoretical grounding supported by strong and consistent empirical support. Consequently, it is argued that figure 9.11, in which direct paths between management IT/IS experience and measures of IT/IS implementation are removed, represents a more accurate model of the role of management IT/IS experience in the assessment and acquisition process.

9.3.2.3. Organisational characteristics and resources

The final group of variables classified as direct drivers of IT/IS implementation success fall into the category of organisational characteristics and resources. These are; (1) organisational size; and (2) the level of organisational IT/IS knowledge. The findings of confirmatory model testing are interpreted in the following sections.

9.3.2.3.1. Organisation size

Exploratory path analysis failed to support the relationships hypothesised between organisation size and the two measures of IT/IS implementation success; (1) the organisational impact of IT/IS; and (2) satisfaction with IT/IS providers and services. The inconsistencies in the underpinning literature are described in chapter seven. In short, while
several studies report significant relationships between the size of an organisation and measures of IT/IS implementation success (e.g. Ein-dor and Segev, 1979; Choe, 1996; Law and Gorla, 1996), the direction of the relationships identified are frequently diametrically opposed. Due to the variability of theoretical argument and the lack of empirical support for the retention of the paths, both were omitted.

These findings contradict the findings of researchers who have identified significant relationships between organisational size and IT/IS success. Lees (1987) and Choe (1996) found that respondents in larger firms reported greater user and organisational level benefits emanating from IT/IS. Law and Gorla (1996) on the other hand, reported greater levels of satisfaction with IT/IS in firms that were smaller. As indicated, there is no definitive reason as to why size should effect the successful implementation of technology either positively or negatively. Thus, the findings of the current study contribute to the inconclusive body of research in this area.

Exploratory analysis did, however, support a direct path between organisation size and satisfaction with the information product. As such, the path was retained in Model B prior to confirmatory testing. This finding suggests that in larger organisations, users are less likely to be satisfied with aspects of the information system. While such a finding is plausible, confirmatory model testing found no support for such a relationship. This is perhaps unsurprising given the inconsistent findings regarding the other two measures of IT/IS implementation success as well as the failure of previous research to identify conclusive links between the size of an organisation and measures of IT/IS implementation success.

The criticisms of Miller (1978), Yap et al. (1992, and Thong et al. (1996) again appear valuable in the interpretation of these findings. Their suggestion that much IS research fails to identify and evaluate the role of intermediate variables could explain the
failure of confirmatory model testing to identify significant paths between organisational size and measures of IT/IS implementation success. As explained, there is no definitive reason as to why changes in organisational size should be reflected in measures of IT/IS implementation success. This may be because the relationship drawn between size and success fails to clearly explain the underlying process. It is argued that some tangible manifestation related to organisational size must be evident which in turn drives changes in IT/IS implementation success.

Existing research alludes to several variables which may fulfill an intermediate role in the size-IS implementation success relationship. These include; (1) the level of IS planning undertaken by a firm; (2) the investment capability of the organisation; and (3) management support for IS. Mcfarlane et al. (1983) and Lyles et al. (1993) found IS planning to be positively associated with organisational size. It was argued that as organisations increase in size, the planning of IS becomes a necessity in order to cope with the increased demands of users and logistical problems which can arise in the implementation of systems to support larger numbers of end-users. As indicated earlier, confirmatory model testing confirmed organisational size as a driver of planning (see figure 9.12). Planning did not, however, play an intermediate role between size and IT/IS implementation success as hypothesised. The findings failed to support a positive path between planning and the three measures of IT/IS implementation success.

Choe et al. (1996) asserted that the positive association between organisation size and IT/IS implementation success is in fact a by-product of the positive association between size and organisational investment capability. In other words, because larger organisations have more funds available to invest in technology they purchase more, which results in their systems outperforming those of their smaller resource-constrained counterparts. The first component of Choe et al’s. findings is supported by confirmatory modelling; larger
organisations appear to have more resources available for IT/IS investment. However, as illustrated in figure 9.12, the findings also indicate that the level of resources invested in IT/IS is not related to investment capability. As described earlier in the chapter, the decision to invest in IT/IS appears to be independent of an organisation's investment capability. Management support for IT/IS plays a more critical role in the investment decision. These findings suggest that Choe's supposition may not fully explain the underlying process.

Figure 9.12. Organisation size as a driver of IT/IS implementation success

Finally, Law and Gorla (1996) argued that the increased levels of IT/IS implementation success reported in smaller organisations were in fact a byproduct of increased management support for IT/IS evident within such firms. As is evident, the current study failed to confirm the hypothesised relationship. This is perhaps unsurprising: there is no intuitive reason as to why management should have a predilection towards IT contingent upon the size of an organisation. It is recommended that future research strive to identify and evaluate further intermediate variables related to organisational size that may more clearly
identify and explain a relationship between size and success, if, indeed, such a relationship exists.

In conclusion, the findings indicate that while the size of an organisation does not appear to influence IT/IS implementation success either directly or indirectly, it does impact upon both the level of resources available for IT/IS investment as well as the manner in which management approach the planning of IS. As described earlier, the findings suggest that increased levels of planning are employed to help management cope with the complexities that result from increased organisational size. Finally, while larger organisations appear to have increased resources available for investment in IT/IS, the level of actual investment in IT/IS undertaken by the organisation remains independent of resource availability. Management support for IT/IS represents the motivating factor, again emphasising the importance of management in the process of IT/IS assessment and acquisition in small professional firms.

9.3.2.3.2. Organisational IT/IS knowledge

Both exploratory and confirmatory model testing provided support for organisational knowledge as a direct driver of information product satisfaction and the organisational impact of IT/IS (see figure 9.13). This supports the findings of Chen (1993) and Palvia (1996) in this area. The findings suggest that where organisations are rich in terms of IT/IS knowledge, individuals within the organisation are better placed to employ IT/IS effectively to meet individual information needs and organisation-level objectives. Exploratory analysis failed to find support for knowledge as a driver of satisfaction with IT/IS providers and services. As such, the path was omitted prior to confirmatory testing of Model B. It is argued that selection of an IT/IS provider is a management decision and, as such, organisational IT knowledge has limited input.
The level of organisational IT/IS knowledge proves to be strongly influenced by both IT/IS training and learning. This supports the findings of Henderson and Lentz (1996) and Fuller (1996). Fuller (p.31) argues that, “learning – in the sense of a growing understanding of how to use technology, how to employ it and how to avoid mistakes – characterises the successful cases of implementation.” The findings of the path analysis reiterate the proposition put forward by Fuller. The presence of learning results in increased IT/IS knowledge which, in turn, is reflected in successful IT/IS implementation. These findings are also congruent with those that indicate learning and training to be an important driver of management IT/IS experience.

Henderson and Lentz (1996) provide a useful quote which facilitates the interpretation of the underlying processes presented in figure 9.13. “Organisational learning,...that is, learning from past experience, is difficult because no two events are alike... Yet, having deployed strategic IT initiatives, the organisation may acquire some knowledge and insights which are useful for deploying other IT initiatives.” Figure 9.13 mirrors the assertions of Henderson and Lentz. As a result of interaction with technology as well as more formal IT/IS training, levels of IT/IS knowledge within the organisation
increase. The current findings suggest that such knowledge is manifest in the approach taken regarding the level of IT/IS sophistication implemented. The findings also make sense in terms of the impact of organisational IT/IS knowledge on information product satisfaction. Where increased levels of IT/IS training is undertaken, there is a proportional increase in the level of IT/IS knowledge within the organisation. As a result, users feel less alienated by technology resulting in an increase in information product satisfaction within the organisation.

As is evident, the findings presented in figure 9.13 illustrate the importance of organisational learning within the process of IT/IS assessment and acquisition. The findings at the organisational knowledge level also reflect those at the managerial level where learning driven by interaction with IT and formal training is also shown to play a fundamental part in the implementation process.

9.4. Contextualisation of existing models of IT/IS implementation in small professional firms

While a significant proportion of the model was hypothesised on the basis of independent relationships identified in previous research, the model of IT/IS assessment and acquisition in small professional firms was also based upon several more holistic models presented by researchers in the IS field. As explained at the beginning of the chapter, such models tend not only to be scarce, but also limited to specific areas of the IT/IS implementation process.

During the interpretation of findings presented, reference is made to specific models which form sub-models in the model of IT/IS assessment and acquisition in small professional firms presented in the current study. While this affords a picture of the degree to which existing models are supported, it only provides a micro-view of interactions in its focus upon a specific area of the implementation process. A primary aim of the current
study was to review existing literature, including studies which present models of small firms IT/IS implementation, and develop a model based on existing findings which enables the testing and contextualisation of small firm research to date. In particular, it was deemed valuable to small firm IS research to approach IT/IS implementation research in a holistic manner. In so doing, the way in which existing models interact with one another, as well as the positioning of independent relationships identified in existing research, can be observed. This affords a broad, all-encompassing view of drivers of IT/IS implementation success in small firms.

Figure 9.14 presents the findings of confirmatory testing of Model B a second time. All paths significant at the .005 significance level are included. The four paths significant at the .025 level as illustrated in figure 9.1 are omitted. These include the paths running from management IT/IS experience, and IS planning, to the two measures of IT/IS implementation success; (1) information product; and (2) satisfaction with IT/IS providers and services. Interpretation afforded earlier in the chapter suggested that these paths were not only empirically weak, but also lacked strength in their explanatory power.

Figure 9.14 contextualises three models which focus upon IT/IS implementation in small firms. These are: (1) Fuller’s (1996) recursive learning model of IT implementation in small firms; (2) Cragg and King’s (1993) model of motivators and inhibitors of technological evolution in small firms; and (3) Thong et al.’s (1996) model examining the impact of external and management IT support on IT/IS implementation in SMEs. These represent three of the main models to emanate from small firm IS research. They are also interesting in their foci on three predominantly independent areas of IT/IS implementation. As is evident, Fuller focuses upon the place of learning in the IT/IS implementation process; Cragg and King (1993) focus upon technological evolution in the small firm, while Thong et al. (1996) evaluate the influence of external support mechanisms. While the three models
are essentially independent, the findings suggest that they complement one another, interacting in such a way that a deeper, as well as broader, understanding of the implementation process is afforded.

**Figure 9.14. Contextualisation of existing models supported by confirmed model B**

![Diagram](image)

**Key to sub-models**
- Fuller (1996)
- Cragg & King (1993)
- Thong et al. (1996)
- Associations drawn from other studies

All paths are significant at the .005 level

In chapter two, the tangible manifestations hypothesised to result from management and organisational learning were changes in the level of technology implemented and an increase in the level of formalised IS planning employed. Both paths are supported in the confirmed model. The organisational level benefits hypothesised do not, however, emanate as a result of increased planning, presenting conflict with the final stage of Fuller’s model.
Benefits are reported, however, where increased computerisation takes place driven by previous management and organisational interaction with IT. Partial support is thus evident for Fuller’s entire model, although further research into the manifestations of learning within the organisation is recommended.

Cragg and King’s (1993) model of motivators and inhibitors of computerisation in small firms is also strongly supported by the confirmed model. Congruent with Cragg and King’s findings, support is indicated for all four drivers of IT/IS sophistication – (1) level of investment in IT/IS; (2) management IT/IS experience; (3) organisational IT/IS knowledge; and (4) management support for IT/IS. Cragg and King, however, regard their research as limited in its capacity to explain underlying processes. Specifically, they perceive its failure to approach small firm IS evolution as a process where changes take place over time, influenced by individual, organisational and environmental factors as a weakness. As a result, they advocate a need for future research to focus upon motivators of small firm technological evolution in this way. Modelling undertaken in the current study appropriates this approach.

The contextualisation and synthesis of previously independent models, such as those of Fuller (1996) and Cragg and King (1993), creates a model which accommodates the role of change as an integral component in the implementation process. While Cragg and King’s model focuses upon direct drivers of IT/IS sophistication, Fuller’s model uncovers interaction and evolution within the organisation that indirectly drives implementation through learning. Areas of synthesis between the two models illustrate how the learning process drives change in terms of both levels of management experience and organisational IT/IS knowledge. In turn, such change is manifest in increased levels of IS planning (as hypothesised by Fuller), increased management support for IT/IS which proves to be a driver of investment in IT/IS, and ultimately a higher level of IT/IS sophistication and
coverage. As illustrated in figure 9.14, the end-product of the process is an increase IT/IS implementation success.

Thong et al. (1996) developed a model of management IT/IS support and external IT/IS support in the context of IT/IS implementation in small firms. As is evident, their model proves to be comparatively independent of other underlying processes taking place in the small firm. Their findings indicate that external support effectiveness, whether vendor or consultant based, and management support for IT/IS, directly influences information product satisfaction (labelled user satisfaction in their study) as well as the overall impact of IT/IS within the organisation. More specifically, structural equation modelling indicated that vendor support strongly influences IT/IS implementation success, while the influence of consultant support proves to be considerably less strong.

**Confirmed Model B** lends support to the findings of Thong et al. (1996). Both vendor and consultant effectiveness impact upon measures of IT/IS implementation success. Furthermore, support is evident for paths between management support for IT/IS and the organisational impact of IT/IS and information product satisfaction.

The findings of the confirmed model differ from those of Thong et al. (1996) in terms of the comparative impact of vendor effectiveness and consultant effectiveness on the measures of IT/IS implementation success. Thong et al. reported vendor effectiveness to more strongly influence IT/IS implementation success. However, confirmatory model testing undertaken in the current study indicates that the impact of vendors and consultants differs depending upon the measure of IT/IS implementation success employed. Consultants impact more strongly at the organisational level, while vendors appear stronger in their ability to provide technical service and back-up support. As explained earlier, such findings are congruent with the general objectives of each support group.
It is evident from figure 9.14 that external support has a significant role to play in the IT/IS implementation process. The greatest weakness of Confirmed Model B is its failure to identify drivers of external support effectiveness. Exploratory and confirmatory modelling failed to identify the employment of external support as a driver of external support effectiveness, and even if such a relationship had been confirmed, drivers of the employment of external support hypothesised in the current study prove unsubstantiated. In Model A, three factors hypothesised to influence whether external support was employed were proposed. These included; (1) the level of organisational IT/IS knowledge; (2) the level of management IT/IS experience; and (3) the employment of dedicated IS personnel. None of the small firms responding employed dedicated IS personnel, and on the basis of findings it appeared that small firms employed external support irrespective of levels of management or organisational knowledge or experience. Investment capability of the organisation was also hypothesised as a driver of consultant support due to the significant investment that such support can represent. Again, no support was evident for such a relationship.

The findings presented above indicate a lack of progress in terms of the breaching of the gap between internal organisational processes and characteristics and the valued added by external support. A tentative move in this direction is, however, afforded by analysis undertaken peripherally to the testing of Model B. Additional analysis showed management support for IT/IS to play an important role in an organisation’s decision to employ consultant support. These findings are analogous with the findings of analysis undertaken to identify drivers of IT/IS investment: management support was shown to be the decisive factor irrespective of an organisation’s investment capability.

While the relationship identified between management support for IT/IS and the employment of consultant support is external to the main modelling process, it represents a
possible link between internal organisational processes and characteristics and the employment of external support. Other possible factors, such as predilection of management to employ outsiders, should also be examined in future modelling exercises. Ultimately, the aim of research in this area should be to identify and evaluate the role of specific variables which breach the gap between internal organisational processes and external support effectiveness. In doing so, research will build a clearer and more coherent picture of the manner in which internal factors drive IT/IS implementation success through the employment of external support.

Finally, modelling also evaluated other models including those of Igbaria et al. (1997), Cragg (1990) and Delone (1983). Confirmatory modelling provided support for Igbaria et al.’s model which showed management support for IT/IS, external support and IT/IS training to influence measures of IT/IS implementation success. However, it is argued that Igbaria’s model is, like a number of others, over reliant on simple relationships. Once again, direct paths are drawn between variables with little attempt to identify intermediate variable that might give a ‘true’ picture of the underlying processes.

Support for models presented by Delone (1983) and Cragg (1990) was less forthcoming. While this is partially a result of the variables employed, Delone also failed to give due credence to the possibility of intermediate variables. In spite of both models failing to find direct support in the findings of confirmatory model testing, both are confirmed to a degree in their allusion to the importance of small firm management in the implementation process. The findings of confirmatory model testing affirm the central role that management represents in the IT/IS assessment and acquisition process.
9.5. A taxonomy of IT/IS implementation success in small professional firms

In chapter two, a taxonomy of IT/IS assessment and acquisition was developed in order to assist in the classification of the fragmented findings of IS research (see figure 2.4). The taxonomy presented was a hierarchical structure consisting of three levels. Level one focused upon the relationship between measures of IT/IS implementation success and measures of business performance. Hierarchy level two attempted to identify variables which directly influenced the success with which IT was implemented in small firms, while the final hierarchy identified and evaluated indirect drivers of IT/IS implementation success. On the basis of the findings of existing research, variables were placed in the most appropriate position in the hierarchy. This facilitated in the development of Model A and its refined version, Model B. In some cases, however, the findings of existing research were not clear-cut regarding the optimum positioning for a variable. In such cases, modelling enabled variables to be positioned as both direct and indirect drivers of IT/IS implementation success simultaneously. The employment of structural equation modelling then enabled the identification of paths which best explained the underlying process. Thus, identifying the ‘best fit’ position for a variable in effect represented a test of opposing theories as presented by the literature.

Figure 9.15 presents a taxonomy of IT/IS assessment and acquisition in small professional firms congruent with that presented in chapter two. However, the position of variables in the taxonomy is based upon the findings of Confirmed Model B as opposed to hypothetical relationships based upon existing literature which formed Model A. As such, the position of variables within the taxonomy has been identified and evaluated on the basis of the modelling process. This affords a clearer picture of the true role which variables play in the assessment and acquisition of IT/IS in small professional firms. Congruent with the
objectives of the research, it also presents a picture of those variables that most strongly drive the success with which IT/IS is implemented.

Figure 9.15. A hierarchical taxonomy of drivers of IT/IS implementation success

In the following sections, the positioning of variables in the revised taxonomy is presented and evaluated. This enables the reader to view at a glance those variables that are shown to drive IT/IS implementation success directly and those upon which drivers of IT/IS success are themselves contingent. The importance of specific variables as well as the identification of internal groupings is also presented. Finally, evaluation compares the positioning of variables in the revised taxonomy with their hypothesised positions based upon the review
of the literature presented in chapter two. Interpretation is afforded where the position of variables differs between the two models.

As stated, hierarchy level one focuses upon the relationship between measures of IT/IS implementation success and measures of organisational performance. It was hypothesised that where higher levels of IT/IS implementation success were reported, organisational-level performance benefits would emanate. The current study represents one of few to focus upon the relationship between IT/IS implementation success and measures of business performance as opposed to investment in IT/IS and business success. The employment of measures of IT/IS implementation success was based upon the assertions of academics who argued that other factors, which are part and parcel of IT adoption and use, play a critical role in IT/IS success. Floyd and Zahra (1991) encapsulate the thinking behind this body of work. They assert that overall, using IT, *per se*, does not guarantee improvements in organisational performance. They argue that such benefits are far more likely where proper and effective implementation procedures are in place. The implication is, as reflected in the hierarchy, that certain factors will contribute to successful IT/IS implementation which will, in turn, result in organisational performance benefits emanating from IT/IS. If such factors are not in place, and systems are implemented ineffectively, then performance benefits are unlikely to occur.

In spite of such a proposition, structural equation modelling failed to find significant evidence to support measures of IT/IS implementation success as drivers of organisational performance. Interpretation of this finding was presented at the beginning of chapter nine. It was concluded that the findings of the current study in this area join the significant body of empirical research that has consistently failed to find conclusive proof of tangible organisational level benefits emanating from IT/IS. In conclusion, it would appear that hierarchy one of the model is weak, and as such level one of the taxonomy remains
hypothetical. Empirical modelling fails to support the idealistic theoretical belief espoused by academics such as Alpar and Kim (1990) that benefits afforded by IT/IS should ultimately be reflected as improvements in business performance.

This raises some important issues for the small professional firm. In failing to find evidence of a direct association between measures of implementation success and measures of business performance, justification for the implementation of technology appears to diminish. It has been argued, however, that such an association is difficult to identify due to the host of other factors that can influence business performance. While the successful implementation of technology may in fact contribute tangibly to organisational performance, it might be that organisational performance is affected by other factors such as market conditions, resulting in inaccurate and inconsistent findings regarding the IT/IS implementation success-business performance relationship. Finally, it is also suggested that a time lag may exist between the implementation of IT/IS and the observation of organisation performance level benefits. Thus, while recent investment in IT/IS may have taken place, and successful implementation completed, this may not be reflected in business performance measures for some time.

In its failure to identify a significant relationship between measures of IT/IS implementation success and business performance, the current study has failed to provide a firm indication of the value of IT. While this is consistent with a host of studies in this area, the three IT/IS implementation success measures, and in particularly the organisational impact of IT/IS construct, suggest that firms are reaping significant perceived organisational-level rewards from IT/IS. It is evident that information technology will continue to play a fundamental part in the way business is undertaken, and, given the rapid pace of development over the past decade, the role of IT/IS is likely to increase dramatically in the years to come (Hepworth, 1994; Pollard and Hayne, 1998). While the current
findings fail to confirm the relationship between IT/IS implementation success and organisational performance, it is argued that firms that fail to keep up with technological developments may find themselves at a significant disadvantage as technology becomes embedded in the way organisations operate.

These findings also return full circle to the definition of implementation success as presented at the beginning of chapter two. It was argued that it remains open to debate as to whether what is regarded by management as perceived IT/IS-driven benefit can and should be regarded as IT/IS implementation success in objective terms. In failing to identify a significant relationship between measures of IT/IS implementation success and measures of organisational performance, the notion of IT/IS implementation success as success in objective terms (and certainly financial) remains questionable. However, financial performance benefits may not be the only by-product of successful IT/IS implementation for which small firms are seeking. From interviews undertaken with partners within small professional firms (see Proudlock et al., 1998), several individuals regarded IT/IS as a time saving device which would enable them to work fewer hours. Where such motivations are a driving factor, successful IT/IS implementation may occur. However, it is unlikely to be associated with any increase in measures of organisational performance. As such, it is argued that IT/IS implementation success can be regarded as such, irrespective of its association with organisational performance.

Level two of the taxonomy focuses upon direct drivers of IT/IS implementation success. Variables identified as direct drivers of success on the basis of the existing research included; (1) the level of IT/IS investment; (2) the level of IT/IS sophistication and coverage; (3) the employment of formal IS planning; (4) the level of employee involvement in the acquisition process; (5) investment in IT/IS training; (6) the employment of external IT/IS support; (7) management support for IT/IS; (8) management IT/IS experience; (9)
organisation size; and (10) the level of organisational IT/IS knowledge. Following evaluation and interpretation of the findings of confirmatory model testing, only four of the hypothesised drivers are supported as primary drivers of IT/IS implementation success. These are: (1) organisational IT/IS knowledge; (2) the level of IT/IS sophistication and coverage; (3) vendor effectiveness; and (4) consultant effectiveness (see figure 9.15). The remaining variables; (1) level of IT/IS investment; (2) investment in IT/IS training; (3) management support for IT/IS; and (4) management IT/IS experience, are identified by structural equation modelling to fulfill a more supportive role as indirect drivers of implementation success. This represents a significant re-positioning of variables within the taxonomy.

The reason behind the re-positioning described above is found in the criticisms of Miller (1978), Yap et al. (1992) and Thong et al. (1996) alluded to throughout the chapter. These authors criticise much existing IS research for its reliance on the measurement of simple relationships with little regard for the possible existence of intermediate or contextual variables that may play a fundamental role in the explanation of underlying processes. The current study employed such criticisms as a point of departure in the development of a model of IT/IS assessment and acquisition which gives due consideration to intermediate and contextual variables. As explained earlier, where the literature proposed conflicting theories regarding the positioning of variables, the model was developed in such a way as to test each theory and identify the one which best explained the underlying process.

In general, the paths which proved unsupported by model testing were those which failed to account for intermediate or contextual variables as described by Miller (1978), Yap et al. (1992) and Thong et al. (1996). Such paths tend to link intangible qualities such as management IT/IS experience with measures of IT/IS implementation success without
giving due considering to the tangible manifestation of such qualities which are in fact the ‘real’ drivers of implementation success. The ability of structural equation modelling to evaluate paths simultaneously exposes relationships that are weak in their explanatory power, and enables the identification of intermediate variables that facilitate a deeper understanding of underlying processes.

Closer scrutiny of the four confirmed direct drivers of implementation success suggests they can be classified into two primary categories. These are; (1) internal drivers of success; and (2) external drivers of success. Organisational IT knowledge and the level of IT/IS sophistication and coverage are classified as internal drivers of IT/IS implementation success. As described earlier in the chapter, organisational IT/IS knowledge impacts strongly upon both the organisational impact of IT/IS and information product satisfaction, indicating that where increased levels of organisational IT/IS knowledge are evident, organisations can implement and apply IT/IS more effectively at both the user level and the organisational level. The level of technology sophistication and coverage is also identified as a strong internal driver of the overall impact of IT/IS on the organisation. Where organisations implement higher levels of technology, increased levels of organisational-level benefits appear to emanate from IT/IS.

External support effectiveness – be it vendor of consultant based – is classified as an external driver of IT/IS implementation success. Interpretation afforded earlier described the nature and the impact of both consultant and vendor effectiveness on the three measures of IT/IS implementation success. Consultant effectiveness proved to be the most powerful driver of IT/IS implementation success, strongly influencing all three measures. This suggests that if an able consultant is employed, significant benefits at all levels of IT/IS implementation are likely to occur. Vendor effectiveness fails to influence the overall impact of IT/IS on the organisation, suggesting that the services offered by vendors preclude
any analysis of how IT/IS can be implemented in the pursuit of organisational level goals. Vendors are successful, however, in their provision of technology and support at the user level. Where vendors are reported to be effective, organisations report increased levels of satisfaction with the information product and the services of IT/IS providers.

While level two of the taxonomy codifies those variables shown to directly drive IT/IS implementation success, level three identifies those that have an indirect impact. Direct drivers of success can be viewed to an extent as being contingent upon the existence of indirect drivers due to their influence on the entire process of IT/IS assessment and acquisition. Indirect drivers of IT/IS implementation success represent underlying characteristics and change processes that occur within the organisation. Two fundamental areas of influence are evident. These are; (1) the influence of management within the organisation; and (2) the influence of learning within the organisation. Management characteristics (management IT/IS experience and management support for IT/IS) play a central role, albeit indirect, in the successful implementation of IT/IS. As illustrated in figure 9.15, the level of computerisation within an organisation, identified as a significant driver of the organisational impact of IT/IS, is motivated strongly by management. Without management support and experience in place, investment in IT/IS is likely to be lower resulting in the slower evolution of IS within the organisation. Consequently, fewer organisational level benefits emanating from IT/IS will be realised.

While not hypothesised in the model, interpretation undertaken in section 9.3.2.1.6. raised the possibility that management support for IT/IS influenced decision-making regarding the employment of consultant support. Exploratory analysis, undertaken peripherally to modelling, established that such a relationship did indeed exist. Thus, where management support for IT/IS exists, organisations are more likely to employ consultant support irrespective of other factors such as level of organisational IT/IS knowledge,
management IT/IS experience, or the investment capability of the organisation. While this further emphasises the central role of management in the process of IT/IS assessment and acquisition, it also represents a link between internal and external drivers of IT/IS implementation success. Further research is required in order to identify those factors that influence the decision to employ external IT support. The tentative findings afforded above suggest that management attitudes may again play a fundamental role.

In showing management to play a central role in the implementation process, the findings of confirmatory model testing are entirely congruent with those of researchers that have investigated the role of management within the small firm context. Reiterating the findings of Doukidis et al. (1994, p.22), "senior managers/owners in small firms play a uniquely important part in the running of the small business, and their personal influence has a much wider impact than their counterparts in larger firms... The chief executive of an SB [small business] may well be the main information user and decision maker and he/she needs to be involved directly in any computerisation." The findings also indicate that where management support for IT/IS is evident, investment in IT/IS will occur irrespective of the investment capability of the organisation. This emphasises the overriding importance of management characteristics in the acquisition process.

The role of learning within the organisation appears equally critical as an indirect driver of IT/IS implementation success. IT/IS learning, accrued through both interaction with IT and formal IT/IS training, is fundamental in its raising of both organisational IT/IS knowledge and management IT/IS experience. This raising of IT/IS knowledge and experience across the organisation in turn impacts both directly and indirectly upon IT/IS implementation success supporting a number of studies in this area (Yaverbaum and Nosek, 1992; Cragg, 1993; Fuller, 1996; Henderson and Lentz, 1996). These findings also provide empirical support for the findings of Naylor and Williams (1994) and Proudlock et al.
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(1998) who reported IS evolution within the small firm to be contingent upon management competence to derive and apply learning from previous interaction with IT. Approached holistically, the findings suggest that in the absence of the interaction of learning and the transfer of knowledge throughout the organisation, IS evolution would slow, and the ability of management and individuals within the organisation to apply technology effectively in the pursuit of organisational goals would diminish. Once again the end-product is fewer organisational level benefits emanating from IT/IS and increased dissatisfaction with technology.

The findings regarding levels two and three and the classification of variables within each level also raise issues for the small professional firm. In particular, the primary concern for any organisation seeking organisational-level benefits from technology must be the embedded nature of a number of variables that play a fundamental role in the implementation process. The elevated significance of management can represent either a significant barrier or motivator in this area. As alluded to earlier, the nature of the small firm is such that management perceptions and characteristics essentially dictate decision-making within the organisation. The organisation represents an extension of the owner/manager’s beliefs and as such, developments and processes within the organisation are inextricably linked to management and are thus firmly embedded within the organisation. As illustrated in the taxonomy, both direct and indirect drivers of IT/IS implementation success are contingent upon management IT/IS experience and support. Thus, where management IT/IS support and experience is absent, IT/IS success would appear to be less likely to transpire.

Because of their embedded nature, changing management characteristics is problematic and potentially time consuming. However, interaction between indirect drivers of IT/IS implementation success confirmed by modelling indicates that it is possible.
Management support for IT/IS can increase as a result of experience gained through learning from interaction with technology as well as more formalised IT/IS training. Thus the value of learning within the organisation fulfils a fundamental role in the change process. However, it is maintained that for management perception to alter, management must be open to IT/IS as potentially beneficial as well as open and able to learn as a result of interaction with IT/IS. Previous research (Proudlock, 1998) has shown such factors to be essential to successful IS evolution within the organisation.

Finally, while the taxonomy presented in figure 9.15 suggests that the employment of able external support, and particularly consultant support, enables successful IT/IS implementation in the absence of the necessary internal conditions, this interpretation must be approached with caution. The decision to employ external support almost certainly emanates from management. As illustrated earlier, peripheral analysis indicated management support for IT/IS to be a key driver regarding the employment of consultant support. Thus, the employment of external support, whether effective or not, remains a condition inextricably linked to internal organisational characteristics and processes, and more specifically, the attitudes of the owner/manager. Further research is required in this area in order to clarify the conditions under which external support is employed.

In conclusion, the classification of variables within the taxonomy affords an understanding of the roles which different variables play in the IT/IS implementation process. Direct drivers of IT/IS implementation success were classified into two categories. Organisational IT/IS knowledge and the level of IT/IS sophistication and coverage were classified as internal drivers of IT/IS implementation success, while vendor and consultant effectiveness were codified as external drivers of implementation success. Similarly, indirect drivers of IT/IS implementation success were divided into two broad categories. These were; (1) the influence of management within the organisation; and (2) the influence
of learning within the organisation. The fundamental importance of these factors as the seeds from which direct drivers of IT/IS implementation success grow was presented. Finally, while the findings presented in the taxonomy suggest that it is difficult to identify business performance benefits emanating from IT/IS, IT/IS implementation success measures suggest that technology can afford significant benefits to the organisation.

The revised taxonomy also indicates that several variables previously hypothesised as direct drivers of IT/IS implementation success actually play a more supportive role in the process as indirect drivers. It is argued that the literature on which unsupported paths were hypothesised for the most part failed to give due consideration to the potential role of intermediate or contextual variables. Due to the inclusion of intermediate and contextual variables in models A and B, structural equation modelling afforded a more accurate indication of the true positioning of variables.

While direct drivers of IT/IS implementation success are clearly visible as a result of modelling, the taxonomy illustrates how direct drivers of success are contingent upon the existence of specific contextual conditions regarding indirect drivers. In the absence of such conditions, IT/IS implementation success is unlikely to transpire. The findings suggest that some of the most deeply embedded factors, such as management attitudes, are amongst the most critical in their overall influence on the implementation process. While the findings indicate that such characteristics are not necessarily static, it is evident that significant input, in terms of learning or interaction with IT within the organisation, is necessary in order to create conditions conducive to successful IT/IS implementation. Such change can take time and is dependent on management’s capacity to accept change.
9.6. Summary and conclusions

Chapter nine represents the culmination of the modelling process. At the beginning of the chapter, the findings of confirmatory testing on Model B, a model proposed on the basis of its strong theoretical and empirical underpinnings, were presented. The findings showed significant support for a number of paths, while some remained unsupported. Evaluation of the model indicated that it explained only a small proportion of the variance of the two measures of business performance; (1) business performance measures (soft); and (2) turnover per employee. However, it was argued that such a finding is to be expected as other factors outside the technological domain also influence the performance of an organisational. Confirmed Model B proved to be more effective in its explanation of the three measures of IT/IS implementation success. The model explained 54% of the variance of the organisational impact of IT, 41% of changes in information product satisfaction, and 91% of the variance of satisfaction with IT/IS providers and services. This compares favourably with the model proposed by Cragg (1990) which explained 20% of variance in small firm IT/IS implementation success. Furthermore, the majority of paths supported are confirmed at the .005 level suggesting the findings to be strong.

The larger part of the chapter focused upon the interpretation of paths supported by Confirmed Model B. In chapter two, variables were classified according to their most appropriate position on the basis of exiting research. A taxonomy was developed to facilitate this process. This resulted in a three level hierarchical model in which variables were hypothesised as either direct or indirect drivers of IT/IS implementation success. In some cases, the literature proved unclear as to the most appropriate position for a variable. In such cases, all possible alternatives were included in the model in order to enable structural equation modelling to identify the path which best described the underlying processes. As such, structural equation modelling represented a test of competing theories.
The identification of the most appropriate paths represented a major aspect of the interpretation stages covered in the current chapter. Throughout the chapter the criticisms of Miller (19978), Yap et al. (1992), and Thong et al. (1996) are alluded to. The authors criticise the large body of IS research which fails to identify and evaluate the role of intermediate or contextual variables in the implementation process. Such studies, they argue, are over reliant on simple relationships and present findings which fail to explain underlying processes. In including and evaluating competing theories via structural equation modelling, the findings of the current research add significant support to the assertions of the academics cited above. As illustrated in the interpretation stages of analysis, in a number of cases direct paths between intangible qualities such as management IT/IS experience and measures of IT/IS implementation proved unsupported. Where paths are directed through an appropriate intermediate variable (in most cases a tangible manifestation of the intangible quality) significant paths are identified and a more coherent explanation of the underlying process afforded.

Approaching each variable independently, as is done throughout the chapter, affords an insight into, and deeper understanding of, the true role of variables. However, such a microscopic view of IT/IS implementation fails to illustrate the role of variables in the implementation process as a whole. Model A was hypothesised upon several existing models focusing upon IT/IS implementation in small firms. As alluded to during the chapter, such models tend to be limited in scope and focus upon specific areas of the implementation process. An aim of the current research was to contextualise existing research and show where interaction between existing models occurs. The contextualisation of models was presented in the penultimate section of the current chapter. In particular, it was shown how Fuller’s (1996) model of IS learning and Cragg and King’s (1993) model of IS evolution interacted in a manner which illustrated the changing nature of IT/IS in the
small professional firm. Significant support was also evident for Thong et al.’s (1996) model focusing upon management support for IT/IS and the effectiveness of external support.

In the final stage of the chapter, a revised taxonomy of IT/IS implementation in small professional firms was presented. Identical in structure to that developed to facilitate the classification of the fragmented findings of existing research in chapter two, the revised taxonomy re-positions variables according to their most appropriate positioning based upon the findings of confirmatory model testing. As described earlier, the testing of competing theories via structural equation modelling results in a more accurate picture of events. This is evident in the revised taxonomy where a significant proportion of variables initially hypothesised as direct drivers of IT/IS implementation success are re-positioned as indirect drivers.

As a result of modelling, four direct drivers of IT/IS implementation success are identified. These are; (1) consultant effectiveness; (2) vendor effectiveness; (3) organisational IT/IS knowledge; and (4) the level of IT/IS sophistication and coverage employed in the organisation. The first two factors were subsequently grouped as external drivers of IT/IS implementation success, while the latter two are regarded as internal drivers. All four factors contribute significantly to one or more of the three measures of IT/IS implementation success.

Five indirect drivers of IT/IS implementation success were identified as a result of modelling. These include; (1) level of IT investment; (2) investment in IT training; (3) IT/IS learning; (4) management support for IT/IS; and (5) management IT/IS experience. Within the five variables, it was argued that two broad categories were evident which had a significant impact on the degree of success with which IT/IS is implemented in the small professional firm. These were; (1) the influence of management within the organisation;
and (2) the influence of learning within the organisation. The taxonomy suggests that in the absence of conducive management characteristics, such as management support for IT/IS and management IT/IS experience, higher level drivers will fail and benefits emanating from IT/IS are less likely to occur. The same is true regarding the role of learning in the organisation. Not only does learning, through both formal training and interaction with IT/IS, raise levels of organisational knowledge which in turn enables employees to use IT/IS more effectively in the pursuit or organisational objectives, it also proves fundamental in its impact upon management. The findings suggest that management gains experience through learning which, in turn, drives IS evolution within the organisation.

While the findings suggest that positive change is possible within the organisation, it is evident that change, where necessary may be slow. In particular, the impact of management support for IT/IS is believed to be central to the successful implementation of IT/IS in the small professional firm. However, as described in the final section of the chapter, management attitudes represent one of the most deeply embedded aspects of an organisation. Given the elevated importance of management in the small firm, such attitudes can permeate the organisation presenting a significant if not insurmountable obstruction to the successful introduction and evolution of IS. As the findings suggest, learning driven by training or interaction with IT can overcome some obstacles, but only if management is receptive to initial interaction with technology and has the capacity to learn from such interaction.

Finally, due to the lack of evidence to support factors hypothesised as drivers of external support effectiveness, the taxonomy suggests that the employment of able external support, and particularly consultant support, enables the successful implementation of IT/IS irrespective of internal conditions within the organisation. It is argued, however, that this is not the case. As illustrated earlier, peripheral analysis indicated management support for
IT/IS to be a key driver regarding the employment of consultant support. While not included in the model, it would appear that the employment of external support, whether effective or not, remains a condition inextricably linked to internal organisational characteristics and processes, and more specifically, the attitudes of the owner/manager. Further research is required in this area in order to clarify the conditions under which external support is employed.

In conclusion, Confirmed Model B, and the revised taxonomy based upon the findings of modelling, afford an insight into those factors that both directly and indirectly influence measures of IT/IS implementation success in small professional firms. Existing research is tested via structural equation modelling and the findings contextualised. The modelling effort suggests that the criticisms of Yap et al. (1992) and Thong et al. (1996) are entirely justified. Weak support for a number of direct paths indicated a lack of regard for contextual and intermediate paths. While structural equation modelling enabled the identification of such variables, it is recommended that future research review its approach and give more attention to the way in which variables interact with one another. In doing so, more consistent and coherent findings are likely to result and a clearer picture of underlying processes afforded.
Chapter Ten – Research Synopsis, Limitations and Recommendations for Future Research

10.1. Introduction

The primary objective of this thesis was to develop a model of IT/IS assessment and acquisition in small professional firms based upon existing theory which identifies and explains influential factors and interactions inherent in the process of IT/IS implementation. In evaluating existing research via structural equation modelling, the current study aimed to identify at what level specific factors influenced IT/IS implementation success. The development of a model underpinned by existing theory also enabled the contextualisation and evaluation of existing small firm IS research. Through confirmatory model testing, the findings of existing research were evaluated and an insight afforded into the way in which existing models and findings in the small firm IS field interact with one another as part of the broad process of IT/IS assessment and acquisition in small professional firms.

The preceding chapters present the basis, methodology, findings and interpretation of research into drivers of IT/IS implementation success in small professional firms. In the current chapter, a discussion of the limitations is presented in the context of which the findings should be approached. The chapter concludes with a presentation of the implications of the findings for small firm management and policy makers as well as their theoretical significance. Recommendations for future research are presented throughout the chapter where appropriate.
10.2. Limitations

The study has highlighted a number of weaknesses evident in existing IS research in the small and large firm arena. It is important that potential weaknesses and limitations of the current research are also presented and discussed in order to give a balanced view of the context in which the findings should be approached. Limitations are divided into two broad categories; (1) empirical limitations; and (2) model limitations.

10.2.1. Empirical limitations

This section focuses on potential empirical limitations. These are divided into two categories; (1) measurement limitations; and (2) limitations regarding the level of generality. The first part of this section provides an insight into measurement limitations.

Although the results of Confirmed Model B generally support those paths hypothesised in Model B, the use of self-report scales to measure the study variables may account for some of the results obtained. Studies have found, for example, that measures of user satisfaction are associated with attitudes towards computers (e.g. Lucas, 1978). However, findings and interpretation presented during chapter nine suggest that the impact of potential bias stemming from respondent characteristics such as management support for IT/IS is in fact minimal. Management support explained 4% of the variance in the organisational impact of IT/IS and 1% of information product satisfaction. While it is argued that respondent bias does not adversely or significantly effect the findings, it is accepted that the findings would be enhanced by the use of objective measures for each variable. Such an approach is, however, difficult.

The accuracy of self-report scales in obtaining financial and investment data from small firms also remains open to debate. Argument for their use was afforded in chapter four. Dess and Robinson (1984) described the significant problems inherent in obtaining
accurate and consistent objective financial information from small firms. On the basis of their research, Dess and Robinson, and Govindarajan and Fisher (1990) indicate subjective measures of organisational performance to be an acceptable and accurate alternative. Dess and Robinson argue that, “although the objective measure(s) would be preferred... a researcher might consider using a subjective perceptual measure... under two specific conditions: (1) accurate objective measures are unavailable, and (2) the alternative is to remove the consideration of performance from the research design” (p.171). The current study faced such conditions and, as a result, subjective self-report measures were employed. In spite of findings which suggest subjective measures to afford an accurate reflection of organisational performance and investment, it is impossible to validate the degree to which this is so in the current study. The findings must be approached accordingly.

Measures can almost always be improved. It is recommended that future research continue to evaluate measures in order to facilitate the provision of the most accurate information possible. The majority of the constructs used in the current study show high levels of reliability across both data sets. Furthermore, items employed in the development of constructs are mostly appropriated from existing research. This increases their chances of being valid indicators of the concept they are purported to measure. Two measures fall just below the recommended 0.70 cut-off point regarding their level of uni-dimensionality for the second data set. These are; (1) business performance; and (2) satisfaction with IT/IS providers and services. The management IT/IS experience measure also proves to be inconsistent. While the addition of two further items improves the reliability, it still falls below 0.70 for both data sets. It is recommended that further research focus upon the construction of a more reliable measure of management IT/IS experience.

Due to problems with negative error variances (as described in chapter seven), several measures employ one-item measures. These include; (1) management support for
IT; (2) investment capability of the organisation; (3) employee involvement in IT assessment and acquisition; and (4) level of organisational IT knowledge. Support is afforded for these measures as the pattern of data and model findings for each variable are relatively consistent across data sets. In spite of this, it is recommended that future research should ideally employ multi-item constructs in modelling as recommended by Grover et al. (1997). Employing multi-item measures will increase the reliability of findings.

In chapters five and eight the congruence of the data with assumptions which must be met in order to apply multivariate techniques was evaluated. A number of issues were raised. The approach to data evaluation recommended by Hair et al. (1998) was carefully followed. However, the optimum approach to be taken in the event of the identification of non-normal variables was less clear-cut. Several methods designed to remedy non-normal variables are presented in chapter five. As is evident, all have their inherent problems. While texts and papers (e.g. West et al., 1995; Hair et al., 1998) were approached for guidance, recommendations regarding the most appropriate methodology were elusive. In order to make an informed decision, advice was sought through personal communication with Dr. William Black, author of ‘Structural Equation Modeling’ in Hair et al. (1998). On the basis of advice afforded, only one variable - investment per employee - was transformed. Furthermore, due to its consistent skew over both data sets, the same transformation was undertaken on the variable in both data sets. This resulted in the consistent treatment of data across the two data sets. It remains possible that the impact of marginal non-normality of variables plays a role in the modelling process. The degree to which this is so is difficult to ascertain.

The final measurement limitation centres upon differences between samples one and two bought about as a result of the data collection process. Two primary concerns arise. The first is the timing of data collection. As explained in the research, two samples of data
(exploratory and confirmatory) were collected at different stages during the course of the research. It is possible that changes within the small firm environment take place between the two data collection points that in some way influence the findings and bring about changes in the second sample of data in relation to the first.

The second concern is that the samples are different regarding both the internal balance of professions and firm size profiles. As a result, it is possible such differences will be reflected in different findings at the two stages of analysis. However, as explained throughout, the model development methodology employed in stage one of the process should reduce the likelihood of such problems arising. The main objective of stage one of modelling is the development of a model based strongly on underpinning theory moderated by empirical data. Such an approach can increase the risk of the researcher falling prey to over-refining the model to a degree that it explains only the specific data set and cannot be generalised to other samples or populations. However, the guidelines provided by Hair et al. (1998) to avoid such difficulties were followed closely in the current study. Empirical findings were employed with a 'relaxed' significance level imposed and all paths that failed to meet the required significance level were re-evaluated on theoretical grounds. As such, empirical findings provided a guide: borderline path omission decisions were not made on an empirical basis.

Because of the approach described above, it is argued that small imbalances regarding the internal profile of the sample (as well as other small sample specific characteristics) are unlikely to dramatically or adversely influence the final outcome of the model development process, namely Model B. Similarly, it is also unlikely that small differences in profile between the two samples are likely to explain differences in the findings at the two stages of research, although it must be noted that such differences remain a possible contributing factor. On reflection, it is more plausible that paths re-hypothesised
in *Model B* which are not supported in *Confirmed Model B* are the result of an over-
emphasis on theoretical foundations. For example, several paths between measures of IT/IS
implementation success and business performance were retained in *Model B* solely on
theoretical grounds. Such paths failed to have empirical support at either the exploratory or
confirmatory model stages. This is indicative of a number of paths and adds support for the
internal consistency of the two samples.

While Hair *et al.* (1998, p.194) argue that the most appropriate empirical validation
approach involves testing a model on a new sample, a possible alternative approach is the
collection of a sample of data of adequate size to perform split-sample (or split-half)
analysis. One half of the data sample can be randomly selected and employed for the
purposes of exploratory modelling, and the second half used in confirmatory testing of the
model developed. This avoids the possible introduction of measurement error resulting
from longitudinal contextual changes and between sample inconsistencies. Such a method
was not built into the research design employed for the current research. However, with the
benefit of hindsight and awareness of the potential error arising from the employment of two
independent samples as described in the course of the thesis, such a method may be
advantageous (although the generality of the findings are likely to be reduced).

Internal inconsistencies between the two samples have been raised as a point of
concern. However, between-sample inconsistencies may in fact serve to strengthen the
generality of the findings. If such differences do exist, where conditions and factors
proposed in *Model B* (employing the first data set) are supported by *Confirmed Model B*
(employing the second data set), then this is further strong evidence that the findings are not
specific to a single data set but can be generalised to other samples and populations.

Such arguments are to a certain degree unnecessary. Comparison of the normal
probability plots for each variable across the two data sets show a high degree of similarity,
and the majority of paths in Model B which were supported empirically are also supported in Confirmed Model B. Such factors suggest a high degree of similarity across the two samples. It was also feared that improvements made to measurement models prior to confirmatory testing may also contribute to any changes in model findings across the two data sets. However, the same arguments as put forward above regarding potential sample differences also apply. A comparison of normal probability plots across the two data samples, as well as arguments put forward above regarding the strong theoretical approach employed during exploratory model testing, again suggest that such changes are likely to be minimal.

A second issue regarding empirical limitations is the generality of findings. As explained in chapter five, the primary objective of the study is to identify those conditions and factors that are most influential in terms of the successful implementation of technology in small professional firms. Resource conditions were such that four professions were selected for this task. These were selected on the basis that they had inherent differences emanating from the professions in which they operated, but generic similarities typical of professional service firms. Given the resource conditions faced it was argued that obtaining data from four professions in as equal proportions as possible would provide a picture of those factors and conditions that are generic across small professional practices and have greatest influence on the success with which technology is implemented. The degree to which the four professions selected as a group accurately represent small professional practices as a whole is not, however, known. Further testing of the model, employing data drawn from different professions is required.

The current study adopts a cross-section approach, employing several professions in an attempt to provide an overall picture of the most influential conditions and factors in the IT/IS implementation process. However, research focusing upon between-profession
differences would add value to research in this area. The current research draws out common themes across professions. Of equal interest would be research into the differences between professions and how and why these arise.

It is accepted given the resource constraints which limit the number of professions from which information can be sought, that the generality of the findings may be limited. As stated at the beginning of the study, no claims are made regarding the precision of findings to specific professions. Such analysis is outside the remit of the current study. Nor are any bold claims made that the four professions selected, as a group, exactly reflect conditions and processes in small professional service firms as a population. The primary objective of the research has been to identify those factors that appear strong and consistent in their influence over the way and success with which IT/IS is implemented across a cross-section of professions. Through the identification of generic conditions and factors which influence the IT/IS implementation process in the group of professions selected, it is proposed that the findings are likely to be relevant and, as such, generalisable, to other professions. In identifying a number of conditions and factors as fundamental to IT/IS implementation success in small professional firms that have previously been recognised as important by previous research (undertaken in different professions and different industries), weight is added to this argument. To this end, the model appears to have a degree of universality. It remains acknowledged, however, that the sample chosen does not facilitate precise generalisation, and as such, any attempt to directly apply the findings to other professions and industries must be approached with caution.

A final concern in terms of the generality of data emanates from missing data analysis undertaken in chapter eight. According to analysis, missing data occurred more frequently across the three measures of IT/IS implementation success in firms with; (a) lower management support for IT/IS; and (b) less sophisticated IT/IS. Because deleting
cases where data are missing on important dependent variables is necessary, the overall sample profile changes as a result. In this case, the final sample contains firms where management is on average more supportive of IT/IS, and the level of technology implemented is slightly higher, than one might expect from a random sample. Again, the generality of findings should be approached accordingly.

Justification for the selection of the four professions has been presented. It is argued that in choosing the four different professions, a balanced view of consistent underlying processes occurring in small professional practices is afforded. As stated earlier, further testing of the model employing data drawn from other professions will support or refute this claim. The degree to which the findings can be generalised outside the professional service firm domain to small firms as a whole is also unknown. However, support for a number of factors identified by existing research undertaken with small firms across a wide range of industry sectors suggests that the findings are likely to afford a valuable insight into the IT/IS assessment and acquisition process in small firms irrespective of the industry. Further model testing drawing on different data sources from different industries would afford a greater insight into the level of generality of the model outside the specified domain. Due to the sample being entirely UK based, the degree to which the findings are generalisable to small firms outside the UK is also unclear. Given the fundamental role of management characteristics in the IT/IS implementation process, research into the degree to which management approaches to IT/IS implementation vary according to nationality may add significant value in achieving a more international dimension to the research.

The degree to which the findings can be generalised outside the small firm context is also questioned. The findings are drawn from small firms (with 25 or fewer employees). During chapters one and two, reference was made to the substantial differences that exist between organisations of different sizes. Reiterating the views of Welsh and White (1981),
small businesses are not little big businesses. The characteristics and conditions that typify the small organisation are very different from those of the large organisation and result in paradigms and prescriptions appropriate for one, being inappropriate or redundant for the other.

The differences between the traditional management information systems and end-users computing environment in large organisations and the small firm IT/IS user environment as presented by Palvia (1996) were discussed in chapter four. In the large organisation, a management information systems department typically exists which oversees the planning, implementation and use of IT/IS. Significant amounts of resource are available and invested in IT/IS. At the opposite end of the size range, small firms have limited resources and rarely employ dedicated IS personnel. Employees within the firm, and ultimately its management, are responsible for making IT/IS decisions and for deciding the degree to which external expertise (in the form of vendors, consultants and trainers) is required. The small firm context is a very different one where the experience and attitude of management has a far greater influence over the firm than is true in the large organisation.

The model developed and tested in the current study is small-firm specific. It focuses upon relationships hypothesised to exist in the small firm context, and is tested using data drawn from small firms. Given the fundamental contextual differences between large and small organisations reiterated above, it seems unlikely that Confirmed Model B can be generalised to large organisations with confidence. It is argued that separate research streams are necessary in order to provide an informative insight into underlying processes in either environment. Future research into areas of divergence and convergence between the two environments would be illuminating. However, attempts to develop a model generalisable to both small and large organisations simultaneously are likely to result in little more than incoherent and inconclusive findings.
10.2.2. Model limitations

The final group of limitations falls under the broad umbrella entitled model limitations. These limitations are related to the capacity of the model to fully explain the underlying processes occurring in the assessment and acquisition of IT/IS in small professional firms. **Confirmed Model B** explains 62% of the variance of IT/IS implementation success (averaged over the three measures of success employed). While this is high when compared with other models, there remains 38% of variance which remains unexplained. This indicates a need for future research to identify and evaluate variables which are not hypothesised as part of the model which may contribute to IT/IS implementation success.

Amongst the main findings of confirmatory modelling is a failure to find evidence of a significant relationship between measures of IT/IS implementation success and measures of business performance. Suggested reasons for the lack of relationship include; (1) the host of other factors that may impact upon business performance; (2) the possibility of a time lag before benefits emanating from IT/IS impact at the organisational performance level; and (3) the possibility of intermediate variables in the IT/IS implementation success – organisational performance relationship. While at odds with case study findings and idealistic theories that argue benefits afforded by IT/IS should be consistently reflected as improvements in business performance, the findings of the current study reflect the findings of the larger body of research in this area. Such studies show little tangible evidence of organisational performance-level benefits emanating from IT/IS. While the difficulties involved in the identification of this relationship have been approached, it is recommended that future research evaluate different techniques in the quest for the identification of a positive relationship between the two. If, as suggested, a time lag exists between successful IT/IS implementation and the identification of organisation performance benefits, then
research must account for this in its development of an appropriate measurement tool. Longitudinal research may afford a clearer picture as to whether this is the case.

A longitudinal research design would also be valuable in confirming causal links among the study variables. SEM cannot be viewed as "causal modelling". As Hoyle and Panter (1995, pp. 175-176) state, "the conditions for establishing causality are no different when data are analyzed using SEM than when they are analyzed using correlation, multiple regression, or analysis of variance". Causality is, however, inferred due to the model development process employed. In chapter two, Model A was developed on the basis of causal relationships identified by previous research. As such, these same causal relationships were tested in Confirmed Model B. While SEM does not give an indication of directionality, causal inferences are drawn from the theoretical underpinnings. Further research is required, however, in order to confirm (or refute) the inferred causal links.

A further limitation of Confirmed Model B is its failure to identify drivers of external support effectiveness. Exploratory and confirmatory modelling failed to identify the employment of external support as a driver of external support effectiveness, and even if such a relationship had been confirmed, drivers of the employment of external support hypothesised in the current study prove unsubstantiated. As a result, external support effectiveness appears to be independent of driving factors. However, analysis undertaken peripherally to modelling indicated that management support for IT/IS was a strong driver of the employment of consultant support. Thus it appears once again that management characteristics play a fundamental part in the process. It is recommended that future research examine this area of the IT/IS implementation process in order to determine how and why external support is employed during the IT/IS implementation process. Factors such as management predilection to employ an "outsider" may play an important part in the
process. As such, identifying the role that management traits play in the process is likely to afford a revealing insight into the manner in which small firms operate.

The fundamental importance of management in the IT/IS implementation process cannot be overly stressed: investment in IT/IS and the evolution of IS within the organisation are contingent upon management attitude towards IT/IS. Management characteristics are also amongst the most deeply embedded small-firm characteristics and, as such, can be difficult to change. This can represent a significant barrier to change within an organisation. Modelling indicates, however, that organisational learning, accrued through interactions with IT/IS and formal training, represents a change catalyst. As such, the small firm is not necessarily static in its approach to IT/IS. Management change, and subsequently organisational change, can occur if management is open to IT as potentially beneficial as well as receptive to learning resulting from interaction with IT/IS. Future research focusing upon management, change and the management of knowledge within the small firm would add significant value to research in the small firm IS arena.

Finally, it must be reiterated that while Confirmed Model B is the outcome of a rigorous exploratory and confirmatory modelling process, the final model is only one of a number of model alternatives. In employing the confirmatory modelling strategy, modelling identifies those paths between variables that are significant and strongest in their explanation of the underlying process. However, it is possible that other models, in which additional variables and relationships not identified or evaluated in Confirmed Model B are included, may more accurately describe the IT/IS assessment and acquisition process in small professional firms. As MacCallum (1995. P.17) states, "there will virtually always be other models that fit the data to exactly the same degree, or very nearly so, thereby representing models with different substantive interpretation but equivalent fit to the observed data." As such, the findings presented in this thesis should not be regarded as final.
Instead, they should be approached as a point of departure from which further research is undertaken in order to improve and develop understanding of the factors and interactions that are central to IT/IS implementation process in small professional firms.

10.3. Implications for small professional firm management

The critical role of management in the development and day-to-day operation of the small business has been discussed throughout the course of the current study. Due to the characteristics of the small firm, management has an elevated role, guiding developments across the organisation and influencing the approach and attitudes of employees within it.

The findings of this research are applicable to both management and employees within the small firm. However, it is the role of management to enable change within the organisation and implement strategies and guidelines on the basis of conclusions drawn from this work. There are a number of important findings to emanate from the research, as discussed in detail in chapter nine. This section presents the main implications of the findings for management within the small professional firm.

10.3.1. Consider what the organisation intends to achieve through IT/IS

The findings indicate that the successful implementation of IT/IS does not result in significant increases in organisational performance. As such, management should not implement IT/IS in the hope that it will be the answer to performance shortcomings. While the findings suggest that those organisations that have successfully implemented IT/IS perceive it to have improved many of their work processes, there is no evidence to suggest that it has contributed to overall performance. It would appear that other factors contribute sufficiently strongly to measures of organisational performance to mask any potential contribution emanating from IT/IS. Management should not, however, regard this as a
reason to avoid the implementation of IT/IS. It is envisaged that organisations will become increasingly reliant on their ability to operate and communicate electronically. While this may not contribute to performance, it is likely that organisations which fail to ‘keep up’ technologically will find themselves becoming increasingly isolated.

It is possible that the findings of the current study fail to account for a ‘lag’ between the implementation of IT/IS and subsequent changes in organisational performance. As such, it is possible that performance benefits do in fact occur as a result of IT/IS implementation. However, a period of time exists between investment and impact at the organisational performance level. If this is the case, then organisations must remain wary that the benefits of investment in technology may not be immediate, if indeed, they occur at all.

While the current study fails to find evidence that successful IT/IS implementation drives organisational performance, there is significant evidence to suggest that technology can be of benefit across the organisation in other ways. The majority of firms responding to the survey indicated that the implementation of IT/IS had been beneficial in terms of its impact upon work processes, employee satisfaction, efficiency, the image of the organisation, its marketing ability and so forth. Management should monitor the impact of IT/IS implementation accordingly.

In summary, management should consider the following;

- Do not implement IT/IS as a ‘quick fix’ for organisational performance shortcomings;
- Recognise that the benefits of IT/IS implementation may take time to transpire if, indeed, they transpire at all;
- Consider carefully what you intend to achieve through the implementation of IT/IS;
- Recognise that fluctuations in organisational performance caused by other factors may mask any benefits afforded by IT/IS;
10.3.2. The role of management is critical

The role that management plays in the implementation of IT/IS in the small firm cannot be stressed enough. The findings indicate that management that has experience of IT/IS is more likely to acknowledge the value of IT/IS within the organisation and invest capital accordingly. The outcome is significantly more effective IT/IS. Thus, it is critical, if technology is to be implemented successfully in the small firm, that management gains experience of IT/IS. This can be achieved through personal use ("learning by doing") either at home or at work and/or by attending suitable IT/IS courses. Alternatively, an acquaintance or colleague who is a technology enthusiast may be able to provide valuable one-to-one tuition. It is acknowledged that time is a limited commodity for the manager of the small firm: thus, the recognition of the potential benefits of investing time in IT/IS learning is critical.

It is recommended that management should endeavour to;

- Learn the capabilities of IT/IS and how it can be applied in the workplace to improve work processes;
- Learn how technology can increase the speed and efficiency of communications with other organisations and the customer;
- Learn how technology can improve the marketing ability and image of the organisation;
- Make the use of technology a part of everyday work;
- Harness the enabling capabilities of IT/IS, not fear them.

The achievement of these objectives represents the first, and largest step, towards the successful implementation of IT/IS. In the absence of management IT/IS experience and
support, the road to IT/IS success will be much longer and much more difficult to navigate and the possibility of failing to reach the intended destination, much greater.

10.3.3. IT/IS training and learning should be embedded in the organisation

IT/IS training and learning should be integral to business operations for both management and employees. The findings indicate that where IT/IS learning and training occurs within the organisation, the end result is of significant benefit to the organisation as a whole. More specifically, where training and learning takes place, both management and employees within the organisation are more knowledgeable regarding the use of IT/IS. Through training and learning, management gains experience which enables the better identification and implementation of appropriate technologies to meet the needs of the organisation. Through training and learning, employee IT/IS knowledge is raised, resulting in the more efficient and effective employment of IT/IS in the pursuit of organisational objectives.

In accordance with the findings presented above, it is recommended that management should:

- Implement systems which identify IT/IS knowledge gaps across the organisation;
- Ensure that employees are not afraid to admit gaps in their knowledge, but instead embrace the opportunity to increase their level of IT/IS skills through training and learning;
- Ensure that all levels of the organisation participate in learning programmes, from management through to administrative staff.
- Recognise that while the cost of training may be high in terms of lost fee-earning time and the employment of a trainer, the benefits of training are likely to outweigh such costs significantly.

In becoming a ‘learning’ organisation, the knowledge of management and employees can develop as information systems employed by the organisation evolve. Embracing learning and change will enable the organisation to remain at the forefront of technological
developments and ensure that it is best placed to succeed in an increasingly technology-dependent environment.

10.3.4. Consider the employment of external IT/IS support

The employment of external IT/IS support can be of significant benefit to the small firm. The findings indicate that where strategic input is required in terms of the identification of appropriate IT/IS for a specific organisation, the employment of IT/IS consultants can add significant value. Where the needs of the organisation are restricted to the purchase, implementation and after-sales support of IT/IS, then vendors provide a valuable service.

The tendency for management to select IT/IS informally, relying on their own knowledge and that of friends and acquaintances has been noted. While this may reduce the costs involved in the selection and implementation of IT/IS, it increases the risk of implementing technology which fails to meet the needs of the organisation. Obtaining the advice of an external body can mitigate against such risk. It is vital, however, that management works closely with external support. It is critical if IT/IS is to be implemented successfully, that the consultant or vendor has an in-depth understanding of organisational requirements. In the absence of such an understanding, the employment of external support is likely to prove costly.

Finally, the findings of the current study suggest that the employment of external support, per se, is unlikely to be of benefit to the organisation implementing technology. Thus, it is critical that management are cautious in their selection of external support. While specific consultants and vendors are shown to add significant value in terms of IT/IS implementation success, others are regarded as costly and of no benefit to the organisation. This presents a difficult situation for management intending to employ external support. It is recommended that management endeavour to find out as much as possible about potential
support before agreeing a contract. Scrutinise their history; contact previous clients and ensure that appropriate agreements in terms of intended outcomes are in place before work begins. In short, do all possible to ensure that the risks involved in employing external support are mitigated against.

In summary, management should:

- Consider the employment of external support in the selection and implementation of IT/IS;
- Be aware of the risks involved in employing external support;
- Seek in-depth information on a potential support provider before entering into a contract;
- Ensure that the vendor or consultant has an in-depth understanding of organisational requirements before the identification and implementation of technologies.

10.3.5. Dissemination and operationalisation of management implications

Throughout the course of the research, interest has been shown by professional bodies and institutions in the findings of the study and their implications. Reports produced on the basis of the research have been made available on the Department of Trade and Industries Multimedia and Information Directorate’s web site. Findings have also been published in the *Journal of Information Technology* (1998) and *Journal of Small Business and Enterprise Development* (1999).

The role of management in the enablement and implementation of strategies and guidelines which address the implications drawn from the findings of this research has been discussed. It is essential that management takes a lead in this process, both through the personal use of IT/IS and through the implementation of suitable structures throughout the organisation which enable successful implementation and use of IT/IS. It is management, and management alone, that holds the key to successful IT/IS implementation within the small firm.
10.4. Implications for policy makers

Since the beginning of this research, there has been a significant growth in interest in the use of IT/IS in small firms. In particular, the government has implemented structures which are designed to support the small firm in the purchasing and use of technology. This is seen as a way in which the UK can increase its competitiveness in the European and global market. Public bodies and institutions, such as the DTI, the Institute of Management and Business Link are offering training and support, as well as financial incentives specifically to small firms to support the better use of IT/IS (Institute of Management, 1999).

At the same time, the benefits of communicating via information technology are also becoming more apparent for the small firm. Rana (1999), for example, reports on a project called Future Focus which provides online access to a "virtual classroom" providing tailored business, management and IT/IS training for small and medium-sized enterprises. Similarly, Caswell (1997) reports on an online conference provided for small accounting firms in the U.S. Transactions over the Internet are increasing at a rapid level giving businesses the capability to procure and sell products and services from the desktop. In spite of such dramatic advances in technology, the cost of computer hardware has fallen dramatically over recent years, while speed and capacity have grown along with the availability of affordable, easy-to-use, off-the-shelf software. In short, this enables small firms to take advantage of technology more than ever before.

As stated, a number of policies and initiatives have been implemented which help the small business. The findings of the current study provide evidence that a need exists for such support. The findings also identify specific areas in which focused support might add significant value. Implications for policy makers drawn from the findings of the current study are presented as follows.
10.4.1. Provision of financial support for small businesses implementing IT/IS
In spite of the falling costs of technology, small businesses continue to face financial constraints. As such, the cost of technology represents the first major barrier for small firms considering the implementation of IT/IS. The government has already taken steps to alleviate this problem, allowing small businesses to offset the costs of IT/IS purchases in their accounts. The provision of support grants should be further encouraged to facilitate the procurement of appropriate technology by the small business.

European regional development funding is already provided which enables small businesses, particularly in rural or developing regions, to purchase IT/IS at a lower cost. Financial support is also available towards the development of internet web-sites, enabling the small business to market their products and services on a global scale with little capital outlay. Any such support that reduces barriers to IT/IS developments in the small business is welcomed. While management attitude to IT/IS is frequently the primary barrier to IT/IS implementation, the cost of technology is often used as the main reason for failing to implement technology. The provision of appropriate funding removes this rationale.

10.4.2. Provision of support for management
As alluded to above, management attitude to IT/IS is a major barrier to the implementation of technology in the small firm. Without the support of top management, the implementation of IT/IS is unlikely to transpire. As such, strategies are needed which raise small firm management’s awareness of the value of IT/IS. Fortunately, a number of such strategies are already in place. One example is the DTI's information society initiative, which publishes a number of brochures introducing concepts such as the using the Internet, electronic data interchange as well as other applications.
While publicity campaigns raise awareness, there remains no substitute for “learning by doing” and expert tuition. As such, it is recommended that initiatives be encouraged which enable small business management to view and experiment with systems in a learning environment. Seminars and training courses are obvious mediums through which such learning can take place. Again, these should be provided at low cost and at convenient locations and times if they are to be attended by management. They also need to be publicised effectively if they are to attract the target audience. Local authorities, or the newly formed Small Business Service (SBS) provide adequate forums for such events and should be actively encouraged to support small businesses in this manner. In reality, private sector organisations are often better placed to provide such a service, and where this is the case, appropriate initiatives and funding should be made available.

Support should also be encouraged beyond the first-time implementation of IT/IS. Developments are occurring at a rapid pace in the technology field. While such developments offer substantial benefits for the small firm, the jargon and mystique surrounding them can be overwhelming for management within the small organisation. The mystique surrounding the term ‘e-commerce’ is such an example. Many small businesses only have a vague notion of the realities of e-commerce. Thus, while there are significant advantages to be gained from performing business-to-consumer and business-to-business transactions over the internet, few small businesses are in a position to implement the technology to enable this process, or understand the operational implications of following such a course of action. Again, European regional development funding has been made available for businesses who require assistance in understanding and implementing e-commerce solutions. Such initiatives should be actively encouraged.
10.4.3. Provision of a network of recognised consultants and vendors

The findings of the current study indicate that where the 'right' vendor or consultant is employed, significant benefits regarding the implementation of IT/IS are realised. However, the main problem faced by the small business seeking support is the identification of the 'right' support provider. An initiative which could add value in this area is the introduction of a recognised network of consultants and vendors. Support organisations could be public or private sector based, but all must seek approval from a governing body. Appropriate channels could then be implemented to ensure that agreed standards are met, offering the small business security which does not currently exist.

Initiatives, such as that provided by the European Regional Development Fund, where selected private sector organisations offer part subsidised IT/IS consultancy to small businesses, is a step in the right direction. Further initiatives need to be put in place. The ultimate objective should be the provision of subsidised consultancy for the small business using a network of recognised consultants and vendors working to agreed standards. This goal is yet to be achieved.

10.4.4. Small firm support: a continued need

In recent years the contribution of small firms to the economy as a whole has been more fully recognised than ever before. The result has been the implementation of policies and guidelines to help UK and European businesses improve their competitiveness. This implementation of support structures has coincided with significant developments in technology and a realisation that such developments can support small businesses in their quest for greater competitiveness. The end result is the provision of subsidised support for small firms planning to implement technology. While a number of effective policies are in place, the current study indicates that further support is required for small firms.
particular, the education of management is essential if the implementation of technology is
to occur in the small business. Future strategies should be developed accordingly.

10.5. Theoretical significance of the research findings

The development of Confirmed Model B affords a valuable insight into the IT/IS implementation process in small professional firms. Relationships are identified and interactions exposed which facilitate a deeper understanding of the underlying processes that impact upon an organisation's ability to successfully implement information technology and systems. Confirmed Model B has its origins in the findings of the diverse and fragmented body of IS research introduced in chapter two. Due to its combining and contextualisation of independent research studies, the model affords a substantially broader picture of IT/IS assessment and acquisition in small firms than presented in previous research. Furthermore, the wide-ranging scope of the confirmed model is not at the expense of its depth. Consideration is given to the role of intermediate and contextual variables in the implementation process. The end-result is a rich tapestry of relationships and interactions which exposes underlying processes which are fundamental to the successful evolution of IS in small organisations.

While Confirmed Model B is of significant value in its advancement of understanding of the IT/IS implementation process in small professional firms, the findings emanating from modelling also expose the inadequacies of some existing research. In its contextualisation and critique of existing research, the current study questions the way in which existing research should be considered and affords a valuable insight into the way in which future research in the IS domain should be approached. Miller (1978), Yap et al. (1992), Thong et al. (1996) and Byrd and Marshall (1997) criticised existing research for its
failure to give due consideration to the possibility of intermediate or contextual variables. In testing conflicting theories using structural equation modelling, the current study further exposes the existence of a large body of literature which fails to afford an accurate picture of events that take place in small firms. Relationships continue to be drawn between factors which do not fully explain the underlying processes that occur. This presents a misleading picture for practitioners and a weak basis upon which to develop future research in the IS development field.

The traditional approach to academic research contributes to this problem. Researchers base their modelling efforts on existing research, fearing to hypothesise intuitively reasonable relationships without theoretical underpinning. However, as Hair et al. (1998, p.592) state, “theory can provide only a starting point for development of a theoretically justified model that can be empirically supported.” While the current study does not advocate the testing of paths hypothesised in the absence of theoretical underpinning, it is recommended that the researcher select paths to be tested with caution. Does there appear to be a missing link in a relationship? Would the presence of an intermediate factor better explain the underlying process? Are direct relationships identified between intangible qualities and output measures without considering the tangible manifestation of such qualities? If the answers to such questions are yes, then the researcher should strive to identify the missing factor. If empirical evidence supporting the hypothesising of a path is absent in existing research, then the researcher should look for research recommendations which propose that such a relationship may exist. Failing that, the researcher should raise the possibility of such a relationship in his/her own research. The cumulative research tradition remains important. However, as indicated in the current study, research within that tradition should not go unquestioned.
The current study also exposes the weaknesses of research which employs the UIS construct in its traditional form. In spite of claims that the UIS measure is a meaningful “surrogate” for both the organisational impact of IT/IS and changes in organisational effectiveness (Ives et al., 1983) the findings are strong in their lack of support for the UIS as either a meaningful measure of IT/IS implementation success or an indicator of the affect of IT/IS on organisational performance. Such findings question the theory underpinning the employment of the traditional UIS measure in existing research. Significantly, modelling exposes the internal weaknesses inherent in the UIS measure. By its very nature, the UIS measure is multidimensional. Internal conflict resulting from the construct’s multi-dimensional nature is not only problematic in itself, but also impacts upon the meaningfulness of any model employing the UIS construct. As a result, employing UIS in its traditional form as a uni-dimensional output measure will, at best, afford a clouded picture of events. It is recommended that future research avoid employing the UIS measure or its derivatives in their traditional form.

A strength of the model developed in the current study is its employment of three independent uni-dimensional measures of IT/IS implementation success. Such an approach is rare, with most studies employing a single measure of IT/IS success, or a conglomerate measure which employs multi-dimensional measures of IT/IS success in a uni-dimensional format. Analogous with the problems inherent in employing the traditional UIS measure, the end result is inconsistent findings and models which fail to explore and identify the subtleties inherent in the IT/IS acquisition process. In employing multiple uni-dimensional measures of IT/IS implementation success, a much richer picture of the subtleties inherent in the implementations process is afforded. It becomes clear that different factors inherent in the IT/IS implementation process drive different components of IT/IS implementation
success. Consequently, it is possible to identify where and how individual factors influence specific areas of IT/IS implementation success.

The current study continues in the research tradition in its employment of proven measures of IT/IS implementation success. In doing so, it adds to the cumulative body of research in the IS adoption arena. However, in questioning and evaluating the construction of the IT/IS implementation success measures and, in particular, the usefulness of the UIS measure, the current study sheds light on current and past practice in IS research. It is argued that the measurement of IT/IS implementation success is a multi-dimensional concept and must, therefore, be measured as such. Only in employing several independent uni-dimensional measures of IT/IS implementation success can the researcher identify the subtlety and variety of underlying processes inherent in small firm IT/IS assessment and acquisition. Previous and future research should be approached accordingly.

The current study also adds strong support for structural equation modelling as a valuable data analysis tool. The two-stage modelling process employed in the current study is strongly recommended. Exploratory model testing is undertaken on the hypothesised model using an initial data set. At this stage, theoretical underpinnings remain as important as empirical findings. A balance between the two is essential in order to avoid the modification of the model to a stage where it is only applicable to the specific data set. However, refinement of the model during exploratory model should result in the removal of paths which fail to meet specified criteria. The outcome is a modified version of the original hypothesised model. The second stage of structural equation modelling involves the confirmatory testing of the model. Here, a second data set is employed for model testing and paths are accepted or rejected purely on empirical grounds. This stage represents a more strict application of model testing and results in final model in which only statistically significant paths are identified.
Sample size issues also remain an important issue in the application of structural equation modelling. As stated in chapter three, too small a sample is likely to result in a failure to identify significant relationships when, in reality, they exist, while too large a sample will result in significant associations being identified where they do not exist. Hair et al.'s (1998) guideline that an optimum sample size of 200 should be employed was followed in the course of the current study. Examination of the findings suggests that structural equation modelling performed well using a sample of this size. It is argued, however, that any researcher embarking on the use of structural equation modelling select their sample size with caution. There remains uncertainty in the SEM field regarding the optimum sample size. Future research should approach the use of SEM accordingly.

The strength of structural equation modelling in examining a series of dependence relationships simultaneously and, in particular, its capacity to include dependent variables which become independent variables in subsequent dependence relationships, is of significant value. Had structural equation modelling not been employed in the current study, the identification, and more importantly, the contextualisation of relationships, would have been impossible. In essence, SEM enabled the testing of a complex theoretical model: on a broader level, SEM enabled the development of a systematic and holistic view of the research question. In this way, SEM can help the researcher avoid many of the pitfalls faced by those who have failed to approach the identification of dependence relationships in the context in which they exist. In doing so, it enables an approach to research that accounts for 'real-life' situations rather than one which views single dependence relationships as existing in a vacuum. While the sound application of SEM involves a demanding learning curve for the first-time user, its use is strongly recommended by the current author.

In conclusion, the work undertaken in this thesis provides a new perspective regarding the current state of small firm IT/IS research. Existing research is appraised and
questions asked regarding its thoroughness. The value of research employing the UIS measure is also questioned and it is argued that the findings should be approached with caution. Finally, a clearer picture of the position of variables within the overall process as well as the way in which variables and existing models interact is afforded. It is evident, however, that there is a need for continued research within the small firm IS field in order to further clarify the impact of specific factors upon the success with which information systems are implemented.

10.6. Conclusion

Chapter ten opened with a presentation of the limitations of the research. It is important that the findings of the study are approached and generalised in the context of the limitations presented. Implications for management and policy makers, and the theoretical significance of the research are presented. Throughout the chapter, recommendations are afforded for future research.

Few models exist that present a holistic picture of IT/IS assessment and acquisition in small firms. As the thesis has indicated, the larger body of research focuses upon the evaluation of simple relationships with little regard for intermediate or contextual variables. The end result is a lack of clarity in terms of the holistic nature of the process at work. Reiterating Miller's (1978) assertion, "there appears to be too much faith in simple didactic relationships, while seldom is any reference made to the different contexts which might influence the strength and even the direction of the relationships." The findings presented in this thesis suggest that such criticism remains as relevant today as twenty years ago. The model proposed and interpreted in the current study appropriates Miller's criticism as a point of departure in its contextualisation and evaluation of a number of factors in a way that recognises that micro interactions occur as part of a bigger picture. In testing the proposed
model, a clearer picture is afforded of the true nature of interactions, how they contribute to IT/IS implementation success, and, ultimately, their impact on measures of organisational performance. The weakness of existing literature that fails to afford due consideration to the existence of intermediate and contextual variables is also exposed.

Melone (1990, p.78) called for the employment of multiple measures of IT/IS effectiveness in order to “emphasize the subjectivity inherent in the selection of single effectiveness criterion and to point out the limitations in using criterion generated from a single model”. In the current thesis, Melone’s assertions are tested. The value of the traditional UIS measure, as employed by a significant body of existing research, is tested against a model employing the components of UIS in their independent forms. In testing the theoretical basis underpinning the employment of the UIS measure, the current study exposes the problems inherent in the employment of the measure in its traditional form. Employed as a single measure, UIS also fails to illustrate the different facets of IT/IS implementation success and how specific areas of the implementation process influence specific measures of success. In employing several uni-dimensional constructs, as recommended by Melone, comparison across studies is facilitated and future research can replicate and build upon findings. Ultimately, this improves the chances of the development of the long-awaited cumulative tradition in IS research which is currently lacking.

The completed model – **Confirmed Model B** – represents the culmination of the modelling process undertaken in the thesis. According to Delone and McLean (1992), “to be useful, a model must be both complete and parsimonious. It must incorporate and organize all of the previous research in the field, while, at the same time be sufficiently simple so that it does not get caught up in the complexity of the real-world situation and thus lose its explanatory value.” It is argued that in its contextualisation of existing IS research and the identification of direct and indirect drivers of IT/IS implementation success, the
current study meets the criteria identified by Delone and McLean. The current study is the first to afford a coherent organisation of existing small firm IS research while, at the same time indicating how variables identified as important in previous literature interact with one another as part of the underlying process. In its identification and organisation of drivers of IT/IS implementation success, Confirmed Model B presents a simplified view of the underlying processes which occur during the implementation of IT/IS in small professional firms. Such contextualisation offers a useful foundation and guide for future small firm IS research. Future research should consider the de-construction of the model, and re-focus once again on specific elements. Continued in-depth research will afford a deeper understanding of processes and interactions and benefit future modelling efforts.

Finally, as a result of the employment of structural equation modelling, a more accurate picture of the ‘true’ roles which variables play in the implementation process is afforded. This is a quality missing from much IS research. It is hoped that future research will continue in this tradition and strive to identify and evaluate the role of variables during the implementation process giving due consideration to the possibility of intermediate and contextual variables. Only in doing so will future research develop a more accurate insight into and explanation of the underlying processes which drive the successful evolution of IS in small firms.
References


M.J. Proudlock - Drivers of IS Implementation Success in Small Professional Firms


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Appendices
Appendix 5.1. Pilot survey questionnaire
**IT Questionnaire**

"Information Technology" refers to the broad range of technologies involved in information processing and handling, such as computer hardware and software and telecommunications. "Information Systems" refers to the combination of IT elements into a working system.

### Section One: General practice profile data

1.1 Please enter the job title of the person completing the form
- □ Managing Partner
- □ Associate
- □ Partner Vc IT

1.2 Please indicate all locations where your firm has its own offices
- □ North East England
- □ North West England
- □ Midlands
- □ Yorkshire & Humberside

1.3 When was your firm established?
- □ Before 1940
- □ 1940s
- □ 1950s

1.4 Please indicate the size of your practice
- □ 1-5 employees
- □ 6-10 employees
- □ 11-25 employees

1.5 Please indicate the number of personnel in your practice fulfilling the following roles
- □ Partners
- □ Administrative Staff
- □ Associates
- □ Others

### Section Two: IT staff

2.1 Do you employ any staff whose sole responsibility is for IT related work?
- □ Yes
- □ No
- □ No, but planning to recruit

2.2 If yes to the above, how many staff are employed full time on IT related matters?
- □ 1
- □ 2
- □ 3
- □ 4
- □ More than 5

2.3 Please include the categories of staff included in the staffing number above
- □ IT Manager
- □ Programmers
- □ IT Trainers
- □ Data Administrator
- □ User Support/Helpdesk
- □ Networking/Communications specialist
- □ Hardware specialist

### Section Three: Business / IS Planning / IS decisions

3.1 Has your firm a business plan?
- □ Yes, we have a documented plan
- □ Yes, but it is informal
- □ No, we run the firm on a day-to-day basis

3.2 If your firm has a documented business plan, how long ago was it created / updated?
- □ Within the last year
- □ 1-2 years ago
- □ More than 3 years ago

3.3 Has your firm an IS plan?
- □ Yes, we have a documented plan
- □ Yes, but it is informal
- □ No, we purchase IT if and when it is needed

3.4 If your firm has a documented IS plan, how long ago was it created / updated?
- □ Within last year
- □ 1-2 years ago
- □ More than 3 years ago
### 3.5 Who makes IT decisions?
- Managing Partner
- Other Partner
- Partner/Vc IT
- Partner/Vc Finance
- Board of partners
- IT Manager
- Administrator
- IT committee

### 3.6 Is the IS function approached in the same way as other functions (e.g. marketing, HRM, etc.)?
- Yes
- No

### 3.7 If no, in what way does the approach taken differ?

### 3.8 What percentage of time do you spend on IT planning, decision-making, etc.?
- 0%
- 1-20%
- 21-40%
- 41-60%
- 61-80%
- 81-100%

### 3.9 Which statement best describes your firm's view of IT?
- IT is fundamental to the success of a firm
- IT is important to the success of a firm
- IT supports a firm to a degree
- IT is largely peripheral to the running of an organisation

### 4. Section Four: Managerial Knowledge, experience & attitudes

#### 4.1 Please indicate your year of birth
- Before 1930s
- 1930s
- 1940s
- 1950s
- 1960s
- 1970s

#### 4.2 If there is more than one senior partner, please indicate the average age of all partners
- 30-39yrs
- 40-49yrs
- 50-59yrs
- 60-69yrs

#### 4.3 How many years' personal experience do you have with computers?
- None
- 1yr
- 2yrs
- 3yrs
- 4yrs
- 5yrs
- 6-10yrs
- More than 10yrs

#### 4.4 Do you have a computer at home?
- Yes
- No

#### 4.5 How much formal IS training have you had?
- No formal IS training
- Less than 10 days full time equivalent (FTE)
- Between 10-20 days FTE
- More than 20 days FTE

#### 4.6 How much prior direct (hands-on) computer experience have you?
- No previous experience
- Some experience (<10 previous occasions)
- Moderate experience (10-50 previous occasions)
- Considerable experience (>50 previous occasions)

#### 4.7 Do you enjoy working with computers
- Yes, I love working with computers
- Yes, I like working with computers
- Undecided
- No, I do not like working with computers
- No, I hate working with computers

#### 4.8 How much previous managerial IS experience have you?
- Previous managerial involvement with IS Implementation
- No previous involvement
4.9 What have been the biggest deterrents to your use of IT? (You may choose three)
- Insufficient time
- Poor training/support
- Budgetary constraints
- Lack of keyboard skills
- Lack of access to computer
- Poor systems
- Nothing
- Lack of interest/apathy
- Lack of knowledge/experience
- No use for it in my job

5 Section Five: The Nature of the Business Environment
5.1 How stable is your business environment?
- Very stable
- Unstable
- Stable
- Very unstable

5.2 Do you have sufficient customers / clients?
- Yes, we have more than enough
- No, we would like more
- Yes, we have sufficient
- No, we have few

5.3 How far ahead can you plan with confidence?
- One month
- Six months
- Two years
- Three months
- One year
- Five years

6 Section Six: Organisation Performance
6.1 Have there been any significant changes in the number of full time employees when comparing this year’s total with last years?
- There has been an increase
- There has been no change
- There has been a decrease

6.2 If there has been an increase or a decrease in the number of employees, please indicate by how many the number has changed
- By 1-5 employees
- By 6-10 employees
- By more than 20

6.3 Please indicate your firm’s turnover for the last financial year
- Under £50,000
- £50,000-£99,999
- £100,000-£249,000
- £250,000-£499,999
- £500,000-£749,999
- £750,000-£999,999
- £1 million - £2.49 million
- £2.5 million - £5 million
- More than £5 million

6.4 How does this compare with last year?
- Increased
- Same
- Decreased

6.5 How profitable would you say your firm is at the moment?
- Very profitable
- Breaks even
- Profitable
- Losing money

6.6 Please indicate your recent total market changes
- We have more customers than last year
- We have the same number of customers as last year
- We have fewer customers than last year

6.7 If you have more clients than last year, has IT enabled that growth
- Yes, IT has been fundamental to our market growth
- Undecided
- No, IT has been of little help
- Yes, IT has helped us grow
- No, IT has not contributed to our growth

7 Section Seven: IT Spend
7.1 How much did your firm spend on software in the last 12 months?
- Nil
- up to £999
- £1,000-£4,999
- £5,000-£9,999
- £10,000-£19,999
- More than £20,000

7.2 How much did your firm spend on hardware and networking/communications in the last 12 months?
- Nil
- up to £999
- £1,000-£4,999
- £5,000-£9,999
- £10,000-£19,999
- More than £20,000
7.3 How much did your firm spend on maintenance and support of all computer systems in the last 12 months?
- Nil
- up to £999
- £1,000-£4,999
- £5,000-£9,999
- More than £10,000

7.4 How much did your firm spend upon IT consultancy in the last 12 months?
- Nil
- up to £999
- £1,000-£4,999
- £5,000-£9,999
- More than £10,000

7.5 Please indicate the average level of investment made in IT training per job position in 1996
- Partners and associates
  - None
  - 1 day
  - 2 days
- Administrative and support staff
  - None
  - 1 day
  - 2 days

7.6 How has your firm’s total investment in information systems compared with original budget estimates?
- We have spent less than expected
- Our estimates have been accurate
- We have spent more than expected

8 Section Eight: IS Infrastructure

8.1 How many computer terminals do you have?
- 1-5
- 6-10
- 11-15
- 16-20
- 21-30
- 31-40
- 41-50
- More than 50

8.2 Are they stand-alone, or connected via a network?
- Stand-alone
- Networked

8.3 What Operating and Network Operating Systems are used in your firm?
- Windows NT
- Windows 95
- Unix
- Novell Netware
- AppleTalk
- OS/2
- MSDOS
- Other

8.4 Which of the following are currently computerised?
- Word processing
- Drafting
- Modelling
- Surveying
- Electronic diary
- Recording and handling client payments
- Maintaining client accounts and billing
- Fee calculation and costing
- Accounts
- Desktop publishing / practice literature
- Spreadsheet applications
- Database applications
- Visualisation
- Videoconferencing
- CD ROM (library facilities)
- General groupware applications (e.g. Lotus Notes)
- Document imaging
- Plotting

8.5 Which word processing packages do you currently use?
- Wordperfect
- MS Word
- Other (please state)
8.6 What database systems are currently used?
- Informix
- Oracle
- Access
- Paradox
- SQL Server
- Other (please state)

8.7 Do you use architecture-specific practice management software?
- Yes
- No

8.8 If yes, please state the software used?

8.9 Do you use CAD?
- Yes
- No

8.10 What CAD package do you use?
- 3D Studio Max
- Archicad
- Architrion
- Arkey
- Autocad LT
- Autocad R13
- Caddie
- Drawing Express
- Reflex
- Fastcad
- Imagineer
- μGDS Drifter
- μProfsnl
- MicroGDS Plus
- Microstation
- Minicad
- Modeller
- Modelshop
- Powerdraft
- Review
- Speedikon
- Spirit
- Star
- Vellum
- Other (please state)

8.10a What were the objectives for installing CAD?
- To enable exchange of data with surveyors, and other contributors to design project
- Reducing the amount of paper in the office
- Reducing design time
- Easy access to designs
- To meet client expectations
- Other (please state)

8.10b Were your firm's objectives achieved?
- Yes, all firm objectives were achieved
- Some firm objectives were achieved
- None of the firm's objectives were achieved
- Too early to comment

8.11 How integrated are the various applications (e.g. word processing, database, accounting etc.) within your system?
- Fully integrated
- Partially integrated
- Not at all integrated

8.12 What percentage of your staff use e-mail for communicating internally within the firm?
- 0%
- 1-10%
- 11-25%
- 26-50%
- 51-100%

8.13 What percentage of your staff use e-mail for communicating externally with clients and intermediaries?
- 0%
- 1-10%
- 11-25%
- 26-50%
- 51-100%

8.14 Which e-mail system is used?
- Wordperfect Office / Groupwise
- LINK
- Microsoft Office / MS Mail
- Internet
- Lotus ccMail
- LIX
- Lotus Notes
- Other (please state)

8.15 Do you have internet access?
- Yes
- No
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If yes, please indicate the value of each of the following to your firm?

<table>
<thead>
<tr>
<th>Question</th>
<th>Extremely valuable</th>
<th>Valuable</th>
<th>Undecided</th>
<th>Of little value</th>
<th>Of no value</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.16 Marketing your firm's services</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8.17 Searching for information / data</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8.18 Using user-groups or newsgroups</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8.19 Communicating via e-mail</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8.20 Purchasing goods and services</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8.21 Access to on-line services</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

8.22 Do you use Electronic Data Interchange (EDI)?

- [ ] Yes
- [ ] No

8.23 If yes, with whom do you exchange data?

- Financial institutions
- Customers / clients
- Surveyors
- Associations / regulatory bodies
- Suppliers
- Other organisations

8.24 If you use EDI, what benefits have you found?

- None
- Improved trading relationships
- Improved cash flow
- Improved accountability and data tracking
- Improved transaction time
- Increased customer satisfaction
- Financial savings
- Simpler business processes
- Improved data accuracy
- More effective use of personnel

Section Nine: IS Knowledge / Experience / Stage of Growth

9.1 When did your firm first implement computers?

- During 1970s
- 1980-84
- 1985-89
- 1990-94
- 1995

9.2 Are you still using your first computer system?

- Yes
- Yes, but significantly upgraded
- No, it has been totally replaced

9.3 How many employees have begun using computers since initial computerisation?

- None
- 1-5
- More than 20
- 6-10

9.4 How would you rate your firm in terms of in-house IT knowledge?

- Highly knowledgeable
- Knowledgeable
- Average
- Unknowledgeable
- Highly unknowledgeable

9.5 Have you ever changed the way you acquire information technology?

- Yes
- No

9.6 Have you had a bad experience regarding IT acquisition?

- Yes
- No

9.7 If yes, please state

9.8 Have you ever changed the way you manage information technology?

- Yes
- No

9.9 Have you had a bad experience regarding IT management?

- Yes
- No

9.10 If yes, please state

9.11 How has your experience affected your approach to IT acquisition and IT management?

- More formalised
- Same
- Less formalised
9.12 How has your experience affected your approach to IT planning?
- More formalised planning
- Same
- Less formalised planning

9.13 How has your experience affected who makes IT decisions?
- No change
- Decisions are now taken by consultants
- Greater collaboration with consultants
- Less collaboration with consultants
- Decisions are taken internally, but are now committee based
- Decisions are now taken by single internal 'expert'

9.14 How has your experience affected your approach to IT research?
- No change
- More research is undertaken
- Less research is undertaken
- Wider variety of sources used
- Increased use of consultants
- Less use of consultants
- Increased investigation of other practices

10 Section Ten: IS Implementation approach - selection decision-making process

10.1 When completing the following section, please answer in terms of the most recent IT purchase your firm has made.

10.2 What was the IT product purchased?

10.3 What means of IS implementation strategy was chosen?
- **Internal**: IS internally developed
- **Contract management**: IS developed together by internal and outside resources
- **Contracting**: IS developed mainly by outside resources (e.g. consultant)
- **Tailored package**: Off-the-shelf software package that was modified extensively
- **Package**: Off-the-shelf software (not modified)

10.4 Was the IT purchase in a formal IS plan?
- Yes
- No

Please indicate the degree to which the following activities were formally undertaken as part of your firm's IT purchase.

<table>
<thead>
<tr>
<th>Process not</th>
<th>Process formally</th>
</tr>
</thead>
<tbody>
<tr>
<td>undertaken</td>
<td>undertaken</td>
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<tr>
<td>1</td>
<td>2</td>
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<td>1</td>
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</tr>
</tbody>
</table>

10.5 IS planning

10.6 Evaluation of existing IS

10.7 Written statement of requirements

10.8 Cost-benefit analysis

10.9 Post-purchase evaluation of benefits resulting from purchase

10.10 If a statement of requirements was written, who wrote it?
- Someone within the firm
- Someone outside the firm
- A combination of the above

10.11 Please indicate which statement best describes your firm's approach to its last IT purchase.
- Technology was identified first, followed by an organisational problem to which it could be applied
- IT was purchased as and when needed. The identification of business needs and the scanning of technology was informal
- Technology adoption began with the identification and prioritisation of issues at the senior partner level, then proceeded to more and more detailed levels of analysis
- The purchase was made in accordance with our firm's long-range IS plan. Formal evaluation, planning and analysis were fundamental to the approach.
10.12 What was your firm’s initial reason to computerise? (please tick the main reason only)

- Information overload
- Anticipated firm growth
- Competitive improvement
- The quality of modern hardware and software
- High operating costs
- The popularity of computers
- The low price of computers
- Other

<table>
<thead>
<tr>
<th>How influential were the following factors upon your purchase of IT?</th>
<th>No Influence</th>
<th>Considerable Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.13 Availability of an integrated hardware / software package</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.14 Compatibility with existing hardware / software</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.15 Ease of use / user-friendliness</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.16 Price</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.17 Popularity of product</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.18 Provision of technical support</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.19 Experience of using products developed by the same vendor</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.20 Reputation of the vendor</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.21 Vendor’s knowledge of your specific business applications</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.22 Advice of family, friends or other acquaintances</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.23 Advice from user groups</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.24 Consultant advice</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.25 Sales representative</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.26 Advise from subordinates</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.27 Advice from in-house “experts”</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.28 Advise from end-users</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.29 Counterparts in other organisations</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.30 IS literature (e.g. IS trade magazines, product leaflets, etc.)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.31 Exhibitions (e.g. IS or trade exhibitions)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10.32 Pressure from organisations with which you transact</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

10.33 What was the main benefit you hoped to obtain through the IT purchase?

- General administrative efficiency
- Increased productivity
- Better and faster information access
- Improved customer service
- Accuracy of records/claims
- Improved practice image
- Accounts/cashflow
- Enhanced management control & decision-making

10.34 Did competitive pressure encourage your firm to make the IT purchase?

- Yes
- No

11 Section Eleven: Management / employee involvement

11.1 Please indicate which statement best describes the senior partner’s involvement in IS.

- The senior partner(s) is remote from the computer resource, and is uninvolved in key decisions relating to its development or operation
- The senior partner(s) is involved in a managerial, supervisory capacity, and identifies goals and sets targets
- The senior partner(s) is closely involved in implementation, and takes part in detailed choice and/or design decisions
- The senior partner(s) is directly involved technically, and takes part in programming or spreadsheet development
- The senior partner(s) routinely interacts directly, hands-on with IS

11.2 How involved were the firm’s employees in defining IS needs?

- Not involved
- Overseeing role only
- Closely involved
- Not involved
- Overseeing role only
- Closely involved

11.3 How involved were the firm’s employees when selecting the system?

- Not involved
- Overseeing role only
- Closely involved
11.4 How involved are the firm's employees in planning further IT developments?

- Not involved
- Overseeing role only
- Closely involved

12 Section Twelve: IS Risk Management

In terms of your last IT purchase, please indicate which IT adoption strategies best describe your firm

12.1
- We delayed the acquisition of a product until it had proven itself in the market place
- We purchased industry-standard and market-leading hardware and software
- We purchased off-the-shelf software
- We purchased cutting edge IT
- We built on our current system using IT hardware and software which we know and have had experience with
- We purchased IT on the back of expert advice
- IS decisions were committee-based
- We attempted to purchase new IT ahead of competitors in the hope of gaining competitive advantage

12.2 Is the IS purchase covered via maintenance and other such contracts?

- Yes, it is totally covered via the contract
- Yes, it is partially covered by the contract
- No, but it is maintained by in-house staff
- No, it is not covered by the contract

12.3 Did you transfer from your manual system / previous computerised system in one step, or in stages?

- In one step
- In stages

13 Section Thirteen: Consultant Support / Effectiveness

13.1 Have you used an I.T. consultant before?

- Yes
- No

13.2 Would you like to make greater use of I.T. consultancy services?

- Yes
- No

13.3 If yes, what factors prevent you?

- Cost
- Internal resistance
- Loss of control / loss of information when consultants leave
- The lack of standards against which consultants are qualified

13.4 Why would / did you employ consultant support?

- Lack of in-house expertise or experience in that area
- Problems in recruiting skilled or experienced staff
- The need for an objective, independent external view
- Consultants can be more cost effective than in-house solutions
- To resolve arguments
- Lack of time or resources

13.5 For what functions would / did you hire a consultant?

- Training
- Application analysis / design
- Programming / building
- Strategic / feasibility studies
- Network design / planning
- Systems management
- Software planning
- Hardware planning

13.6 Where would / do you find out about consultants?

- Recommendations
- Direct sales contacts
- National press
- By ringing around
What would / do you look for when choosing a consultancy firm?

<table>
<thead>
<tr>
<th>Item</th>
<th>Unimportant</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.7 Impression given by consultant</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13.8 Geographical location</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13.9 Rapid availability</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13.10 Reputation / prestige of the firm</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13.11 Price</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13.12 Specialisation</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13.13 Size of consulting firm</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13.14 Proven track record of consultant</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

If you have used a consultancy,

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.16 How effective was your consultant in performing an information requirements analysis?</td>
<td>Very effective</td>
</tr>
<tr>
<td>13.17 How effective was your consultant in recommending a suitable computerisation solution?</td>
<td>Very effective</td>
</tr>
<tr>
<td>13.18 How effective was your consultant at managing IS implementation?</td>
<td>Very effective</td>
</tr>
<tr>
<td>13.19 How would you relate your consultant's relationship with other parties in the project (e.g. senior partners, employees, vendors, etc.)?</td>
<td>Excellent</td>
</tr>
<tr>
<td>13.20 How would you rate your consultant's ability to understand your firm's business needs?</td>
<td>Cooperative</td>
</tr>
<tr>
<td>13.21 How would you describe your consultant?</td>
<td>Candid</td>
</tr>
</tbody>
</table>

Was the IS implementation completed on time?

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.23 Was the IS implementation completed on time?</td>
<td>No, it over-ran the completion date</td>
</tr>
<tr>
<td>13.24 How accurate was your consultant's cost estimation?</td>
<td>Inaccurate, the overall cost was greater than estimated</td>
</tr>
<tr>
<td>13.25 Overall, how satisfied were you with your consultant?</td>
<td>Very satisfied</td>
</tr>
</tbody>
</table>

Section Fourteen: Vendor Support for IS purchases

<table>
<thead>
<tr>
<th>Item</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.1 How many vendors would / did you approach before selecting a preferred vendor?</td>
<td>1, 3, 5</td>
</tr>
<tr>
<td>14.2 For what activities other than IT purchase would / do you employ a vendor?</td>
<td>Information requirements analysis, Recommending a suitable computerisation solution, Software development / customisation</td>
</tr>
<tr>
<td>14.3 How effective was your vendor in recommending a suitable computerisation solution?</td>
<td>Very effective</td>
</tr>
<tr>
<td>14.4 How effective was your vendor's software development / customisation?</td>
<td>Very effective</td>
</tr>
<tr>
<td>14.5 The adequacy of technical support during IS implementation was...</td>
<td>Excellent</td>
</tr>
<tr>
<td>14.6 The quality of technical support is...</td>
<td>Excellent</td>
</tr>
<tr>
<td>14.7 The adequacy of training provided is / was...</td>
<td>Excellent</td>
</tr>
</tbody>
</table>
The relationship of the vendor with other parties in the project (e.g., senior partners, employees, consultant, etc.) is...

The adequacy of documentation provided by the vendor is...

The vendor's response / turnaround time (i.e., the amount of time it takes for the vendor to respond to a request for service or action) is...

How would you rate your vendor's ability to understand your firm's business needs?

Was the IS implementation completed on time?

Overall, how satisfied are you with your vendor?

In terms of ease of use, our systems are...

In terms of having the flexibility to add new functions, our systems are...

The reliability of output information provided by our systems (i.e., the consistency and dependability of output information) is...

The relevance of output information provided by our systems (i.e., the degree of congruence between what the user requires and what is provided) is...

The up-to-dateness of information provided by our systems is...

The format of the output (i.e., the material design of the layout and display of the output contents) is...

The security of data from misappropriation or unauthorised alteration or loss is...

In terms of frequency of disruption caused by IS problems, our systems are...

The turnaround time taken to fix IS problems is...

The documentation (e.g., product descriptions, user manuals, etc.) supplied with our systems are...

The maintenance and back-up support included in the contract is...

How IT affected decision-making?

How has your information system affected work processes?

How has your information system affected organisational cost?

How has your information system affected firm control?

How has your system affected internal communication?

How has the use of IT affected job satisfaction?

How has IT affected your firm's ability to provide new services?

How has IT affected your firm's marketing ability?

How has IT affected workload?
<table>
<thead>
<tr>
<th>Question</th>
<th>Agree</th>
<th>StrONGLY Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.10 IT has proved too costly</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.11 IT has proved too time consuming</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.12 It has been easy to motivate and train staff</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.13 Too much time is needed for initial data entry / set up</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.14 Staff have too much control</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.15 IT has proved restrictive</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.16 IT has failed to meet some of our requirements</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.17 IT has created many problems</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.18 The benefits afforded by the information system outweigh the costs involved</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16.19 Do you consider the IT currently employed in your firm to be used to its full potential?</td>
<td></td>
<td>Yes, it is used to its full potential</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adequate, but there is some scope for improvement</td>
<td></td>
<td>There is considerable scope for improvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>General administrative efficiency</td>
<td></td>
<td>Accuracy of records/claims</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased productivity</td>
<td></td>
<td>Improved practice image</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Better and faster information access</td>
<td></td>
<td>Accounts/cashflow</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improved customer service</td>
<td></td>
<td>Enhanced management control &amp; decision-making</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.20 What is the main benefit which has resulted from the use of IT?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 5.2. Exploratory survey questionnaire
Section One: Profile data

1.1 Please enter the job title of the person completing the form
- Managing Partner
- IT Manager
- Associate
- Practice Manager
- Partner i/c IT

1.2 Please indicate the total number of personnel in your practice

Section Two: Performance Data

2.1 Please indicate your firm's turnover for the last financial year
- Under £50,000
- £50,000-£99,999
- £100,000-£249,000
- £250,000-£499,999
- £500,000-£749,999
- £750,000-£999,999
- £1 million - £2.49 million
- £2.5 million - £5 million
- More than £5 million

2.2 How does this compare with last year?
- Increased
- Same
- Decreased

2.3 How profitable would you say your firm is at the moment?
- Very profitable
- Profitable
- Breaks even
- Losing money

2.4 Please indicate your recent total market changes
- We have more customers than last year
- We have the same number of customers as last year
- We have fewer customers than last year

2.5 If you have more customers than last year, what has enabled that growth?
- New computer systems
- Existing computer systems
- New staff
- Increase in target market size
- Increase in number of services offered
- Increased marketing

Section Three: Computer Use

3.1 Does your firm / practice use computers?
- Yes
- No

If you do not use computers, please go to question 3.32

3.2 Are your computers stand-alone, or connected via a network?
- Stand-alone
- Networked

3.3 What Operating and Network Operating Systems are used in your firm?
- Windows NT
- MSDOS
- Novell Netware
- Windows 95
- Apple OS
- Other (please state)
- OS/2
- AppleTalk
3.4 Which of the following are currently computerised?

| ☐ Word processing | ☐ Accounts |
| ☐ Design | ☐ Spreadsheet applications |
| ☐ Surveying | ☐ Database applications |
| ☐ Electronic diary | ☐ Computer design ‘walkthroughs’ |
| ☐ Recording and handling client payments | ☐ Videoconferencing |
| ☐ Maintaining client accounts and billing | ☐ CD ROM (library facilities) |
| ☐ Fee calculation and costing | ☐ General groupware applications (e.g. Lotus Notes) |
| ☐ Desktop publishing / practice literature | ☐ Document imaging |
| ☐ Plotting |

3.5 Which word processing packages do you currently use?

- ☐ Wordperfect
- ☐ MS Word
- ☐ Other (please state)

3.6 What database systems are currently used?

- ☐ Access
- ☐ Paradox
- ☐ Other (please state)

3.7 Do you use CAD?

- ☐ Yes
- ☐ No

3.8 If yes, what CAD package do you use?

- ☐ 3D Studio Max
- ☐ Fastcad
- ☐ Review
- ☐ Archicad
- ☐ Imagineer
- ☐ Star
- ☐ Autocad LT
- ☐ Microstation
- ☐ Vellum
- ☐ Autocad R13
- ☐ Minicad
- ☐ VisualCADD
- ☐ Caddie
- ☐ Modeller
- ☐ Other
- ☐ Drawing Express
- ☐ Powerdraft

3.9 If other, please specify.

3.10 What were the objectives for installing CAD?

- ☐ To enable exchange of data with and other contributors to design project
- ☐ Reducing the amount of paper in the office
- ☐ Reducing design time
- ☐ Easy access to designs
- ☐ To meet client expectations
- ☐ Other (please state)
- ☐ Controlling the quality of design work
- ☐ Sharing design work within the department
- ☐ De-skilling some of the work
- ☐ Improving the profitability of work

3.11 Were your firm’s objectives achieved?

- ☐ Yes, all firm objectives were achieved
- ☐ Some firm objectives were achieved
- ☐ None of the firm’s objectives were achieved
3.12 How integrated are the various applications (e.g. word processing, database, accounting etc.) within your system?  
- Fully integrated  
- Partially integrated  
- Not at all integrated

3.13 Do your staff use e-mail for communicating internally within the firm?  
- Yes  
- No

3.14 Do your staff use e-mail for communicating externally with clients and intermediaries?  
- Yes  
- No

3.15 Do you have internet access?  
- Yes  
- No

<table>
<thead>
<tr>
<th>Question</th>
<th>Extremely valuable</th>
<th>Valuable</th>
<th>Undecided</th>
<th>Of little value</th>
<th>Of no value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.16 Marketing your practices' services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.17 Searching for information / data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.18 Using user-groups or newsgroups</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.19 Communicating via e-mail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.20 Purchasing goods and services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.21 Access to on-line services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.22 Do you use Electronic Data Interchange (EDI)?  
- Yes  
- No

3.23 If yes, with whom do you exchange data?  
- Financial institutions  
- Clients  
- Suppliers  
- Associations / regulatory bodies  
- Surveyors  
- Other organisations

If you use EDI, how has it affected  
- Significantly improved  
- Improved  
- Undecided  
- Worsened  
- Significantly worsened

3.24 Cash flow?  
- | Significantly improved | Improved | Undecided | Worsened | Significantly worsened |
3.25 Transaction times?  
- | | | | | |
3.26 Organisational costs?  
- | | | | | |
3.27 Data accuracy?  
- | | | | | |
3.28 Trading relationships?  
- | | | | | |
3.29 Accountability and data tracking?  
- | | | | | |
3.30 Client satisfaction?  
- | | | | | |
3.31 Business processes?  
- | | | | | |
3.32 If you have not implemented computers, what has prevented you from doing so?  
- Lack of financial resources  
- Lack of computer knowledge  
- The costs of computers outweigh the benefits  
- Computers would be of little benefit to the firm / practice  
- Lack of time

If your practice uses information technology, please continue the questionnaire.  
If you have not implemented IT, please return only Section A of the questionnaire.  
Thank you.

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Section Four: Computer systems staff

4.1 Do you employ any staff whose sole responsibility it is to implement and support computers and computer technology within your practice?  
☐ Yes  
☐ No  
☐ No, but planning to recruit

If you answered yes to the above question, please continue with the next question. If you answered no, please go to Section Five.

4.2 How many staff are employed full time on computer related matters?  
☐ 1  
☐ 2  
☐ More than 2

Section Five: Computer systems planning & decision-making

5.1 Has your firm a business plan?  
☐ Yes, we have a documented plan  
☐ Yes, but it is informal  
☐ No, we run the firm on a day-to-day basis

5.2 Has your firm a computer systems plan?  
☐ Yes, we have a documented plan  
☐ Yes, but it is informal  
☐ No, we purchase computer technology if and when it is needed

5.3 Who makes decisions about the selection and implementation of computers?  
☐ Managing Partner  
☐ Other Partner  
☐ Partner in Charge of Finance  
☐ Adminstrator  
☐ Board of partners  
☐ Computer systems committee

5.4 Is the computer systems function approached in the same way as other functions (e.g. marketing, finance, etc.)?  
☐ Yes  
☐ No

5.5 If no, in what way does the approach taken differ?

5.6 Which statement best describes your firm's view of computer technology?  
☐ Computer technology is fundamental to the success of a firm  
☐ Computer technology is important to the success of a firm  
☐ Computer technology supports a firm to a degree  
☐ Computer technology is largely peripheral to the running of an organisation

5.7 What have been the biggest deterrents to your use of computers?  
☐ Insufficient time  
☐ Poor training/support  
☐ Budgetary constraints  
☐ Lack of keyboard skills  
☐ Lack of access to computer  
☐ Poor systems  
☐ Nothing  
☐ Lack of interest/apathy  
☐ Lack of knowledge / experience  
☐ No use for it in my job
Section Six: Computer systems spending

6.1 How much did your firm spend on computer technology (including hardware, software, communications technology and so on) in the last 12 months?

- Nil
- up to £999
- £1,000-£4,999
- £5,000-£9,999
- More than £10,000

6.2 How much did your firm spend on maintenance and support of all computer systems in the last 12 months?

- Nil
- up to £999
- £1,000-£4,999
- £5,000-£9,999
- More than £10,000

6.3 How much did your firm spend upon computer systems consultancy in the last 12 months?

- Nil
- up to £999
- £1,000-£4,999

6.4 Please indicate the average level of investment made in computer training per job position in 1996

- None
- 1 day
- 2 days
- More than 10 days

Section Seven: Computer experience & growth stage

7.1 How would you rate your firm in terms of in-house computer knowledge?

- Highly knowledgeable
- Knowledgeable
- Average
- Unknowledgeable
- Highly unknowledgeable

7.2 Have you ever changed the way you acquire computers?

- Yes
- No

7.3 Have you had a bad experience regarding computer acquisition?

- Yes
- No

7.4 If yes, please state

7.5 Have you ever changed the way you manage computer systems?

- Yes
- No
M. J. Proudlock - *Drivers of IS Implementation Success in Small Professional Firms*

Section Eight: Computer systems implementation approach - selection decision-making process

When completing the following section, please answer in terms of the most recent computer technology purchase your firm has made. If for any reason you feel that the approach to your most recent purchase differed significantly from what you would consider to be your normal approach, please refer to a more typical purchase.

8.1 What was your firm's initial reason to computerise? (please tick the main reason only)

- Information overload
- Anticipated firm growth
- Competitive improvement
- The quality of modern hardware and software
- High operating costs
- The popularity of computers
- The low price of computers
- Other

8.2 Did competitive pressure encourage your firm to make the computer technology purchase?

- Yes
- No
Section Nine: Management/employee involvement

9.1 How involved were the firm’s employees in the computer systems selection process?
- Not involved
- Overseeing role only
- Closely involved

9.2 Please indicate which statement best describes the senior partner’s involvement in computers.
- The senior partner(s) is remote from the computer resource, and is uninvolved in key decisions relating to its development or operation
- The senior partner(s) is involved in a managerial, supervisory capacity, and identifies goals and sets targets
- The senior partner(s) is closely involved in implementation, and takes part in detailed choice and/or design decisions
- The senior partner(s) is directly involved technically, and takes part in programming or spreadsheet development
- The senior partner(s) routinely interacts directly, hands-on with computers

Section Ten: Computer systems adoption strategy

In terms of your last computer technology purchase, please indicate which computer technology adoption strategies best describe your firm

10.1
- We delayed the acquisition of a the product until it had proven itself in the market place
- We purchased industry-standard and market-leading hardware and software
- We purchased off-the-shelf software
- We purchased cutting edge computer technology
- We built on our current system using computer hardware and software which we know and have had experience with
- We purchased computer technology on the back of expert advice
- Computer systems decisions were committee-based
- We attempted to purchase new computer technology ahead of competitors in the hope of gaining competitive advantage

10.2 Is the computer technology purchase covered via maintenance and other such contracts?
- Yes, it is totally covered via the contract
- Yes, it is partially covered by the contract
- No, but it is maintained by in-house staff
- No, it is not covered by the contract

Section Eleven: Consultant support/effectiveness

Please answer this section only if you have employed the services of a computer consultant. If you have not used a consultant, please go to Section 12 on the next page.

11.0 Do you employ the services of a consultant?
- Yes
- No

11.1 Would you like to make greater use of computer systems consultancy services?
- Yes
- No

11.2 If yes, what factors prevent you?
- Cost
- Internal resistance
- Loss of control/loss of information when consultants leave
- The lack of standards against which consultants are qualified
11.3 For what functions did you hire a consultant?

- Training
- Application analysis / design
- Programming / building
- Strategic / feasibility studies
- Network design / planning
- Systems management
- Software planning
- Hardware planning

11.4 How effective was your consultant in recommending a suitable computerisation solution?

- Very effective
- Effective
- Undecided
- Ineffective
- Very ineffective

11.5 How effective was your consultant at managing computer systems implementation?

- Excellent
- Fair
- Undecided
- Poor
- Very poor

11.6 How would you rate your consultant's ability to understand your firm's business needs?

- Excellent
- Fair
- Undecided
- Poor
- Very poor

11.7 Overall, how satisfied were you with your consultant?

- Very satisfied
- Satisfied
- Undecided
- Unsatisfied
- Very unsatisfied

Section Twelve: Vendor support for computer technology purchases

Please answer this section only if you have employed the services of a computer vendor. If you have not used a vendor, please go to Section 13 on the next page.

12.1 Do you employ the services of a vendor?

- Yes
- No

12.2 For what activities other than computer technology purchase did you employ a vendor?

- Information requirements analysis
- Recommending a suitable computerisation solution
- Training
- Software development / customisation

12.3 How effective was your vendor in recommending a suitable computerisation solution?

- Very effective
- Effective
- Undecided
- Ineffective
- Very ineffective

12.4 How effective was your vendor's software development / customisation?

- Excellent
- Fair
- Undecided
- Poor
- Very poor

12.5 The adequacy of technical support during computer systems implementation is / was...

- Excellent
- Fair
- Undecided
- Poor
- Very poor

12.6 The adequacy of training provided is / was...

- Excellent
- Fair
- Undecided
- Poor
- Very poor

12.7 The adequacy of documentation provided by the vendor is / was...

- Excellent
- Fair
- Undecided
- Poor
- Very poor

12.8 How would you rate your vendor's ability to understand your firm's business needs?

- Excellent
- Fair
- Undecided
- Poor
- Very poor

12.9 The vendor's response / turnaround time (i.e. the amount of time it takes for the vendor to respond to a request for service or action) is...

- Excellent
- Fair
- Undecided
- Poor
- Very poor

12.10 Overall, how satisfied are you with your vendor?

- Very satisfied
- Satisfied
- Undecided
- Unsatisfied
- Very unsatisfied
Section Thirteen: Quality of the computer systems
The following section will let us know what you think about the quality of your computer system. Please tick the box that best describes how you feel about your firm's computer systems.

13.1 In terms of ease of use, our systems are...

13.2 The reliability of output information provided by our systems (i.e. the consistency and dependability of output information) is...

13.3 The relevance of output information provided by our systems (i.e. the degree of congruence between what the user requires and what is provided) is...

13.4 The up-to-dateness of information provided by our systems is...

13.5 The format of the output (i.e. the material design of the layout and display of the output contents) is...

13.6 The security of data from misappropriation or unauthorised alteration or loss is...

13.7 In terms of frequency of disruption caused by computer problems, our systems are...

13.8 The turnaround time taken to fix computer problems is...

13.9 The documentation (e.g. product descriptions, user manuals, etc.) supplied with our systems are...

13.10 The maintenance / back-up support included in the contract is...

Section Fourteen: Impact of computer systems on the Organisation
The following section will let us know what you think about the impact computer systems have had in your organisation. Please tick the box that best describes how you feel computers have affected processes within your organisation.

14.1 How have computers affected decision-making?

14.2 How has your computer system affected work processes?

14.3 How has your computer system affected organisational costs?

14.4 How has your computer system affected firm control?

14.5 How has your system affected internal communication?

14.6 How has the use of computers affected job satisfaction?

14.7 How have computers affected your firm's ability to provide new services?

14.8 How have computers affected your firm's marketing ability?

14.9 How have computers affected your firm's general administrative efficiency?

14.10 How have computers affected productivity?

14.11 How have computers affected information access?

14.12 How have computers affected customer service?
14.13 How have computers affected the accuracy of records and claims?
14.14 How have computers affected practice image?
14.15 How have computers affected accounts / cashflow?
14.16 How have computers affected workload?
14.17 Computers have proved too costly
14.18 Computers have proved too time consuming
14.19 It has been easy to motivate and train staff
14.20 Too much time is needed for initial data entry
14.21 Staff have too much control
14.22 Computers have proved restrictive
14.23 Computers have failed to meet some of our requirements
14.24 Computers have created many problems
14.25 The benefits afforded by the computer system outweigh the costs involved
14.26 Do you consider the computer system currently employed in your firm to be used to its full potential?
Appendix 5.3. Normal probability plots for model variables (data set 1)
5.3.1. Business performance

5.3.2. Turnover per employee

5.3.3. Impact of IT/IS on the organisation

5.3.4. Information product satisfaction

5.3.5. Satisfaction with IT/IS providers and services
5.3.6. IT/IS investment per employee

5.3.6b IT/IS investment per employee (logarithm)

5.3.7. IT/IS sophistication

5.3.8. IS planning and formalisation

5.3.9. Level of employee involvement

5.3.10. Investment in IT/IS training

5.3.11. Vendor effectiveness

5.3.12. Consultant effectiveness
5.3.13. Management support for IT/IS

5.3.14. Management IT/IS experience

5.3.15. Organisation IT/IS knowledge

5.3.16. IT/IS learning

5.3.17. Investment capability

5.3.18. Environmental stability
Appendix 7.1. *Model B*: rehypothesised paths and regression weights
<table>
<thead>
<tr>
<th>Hypo. no.</th>
<th>Path</th>
<th>Re-hypothesised</th>
<th>Regression weight</th>
</tr>
</thead>
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<td>Business Performance (soft measures) ← Organisational impact of IT/IS</td>
<td>✓</td>
<td>0.266</td>
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<tr>
<td>LI H1b</td>
<td>Business Performance (soft measures) ← Information product satisfaction</td>
<td>✓</td>
<td>-0.239</td>
</tr>
<tr>
<td>LI H1c</td>
<td>Business Performance (soft measures) ← Satisfaction with IT/IS providers and services</td>
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<td>LIII H27</td>
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</table>

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Appendix 8.1. Confirmatory survey
Section one: profile data

Please enter the job title of the person completing the questionnaire.

☐ Managing partner
☐ Associate
☐ Partner l/c IT
☐ IT Manager
☐ Practice Manager

A.1 Please indicate the total number of personnel in your practice fulfilling the following roles:

Fee-earners (i.e. partners and associates)

☐ Non-fee-earners (i.e. administrative staff etc.)

2.1 Do you employ any staff whose sole responsibility is to implement and support computers and computer technology within your practice?

☐ Yes
☐ No
☐ No, but planning to recruit

Section two: software use

C.5 Which of the following are currently computerised?

☐ Word processing
☐ Voice recognition software
☐ Electronic diary
☐ Database applications
☐ Document imaging
☐ Completing FP17DCs/quotations
☐ Desktop publishing
☐ Client/patient reminder system
☐ Fee calculation and costing
☐ Maintaining client accounts and billing
☐ Recording and handling client payments
☐ Accounts
☐ Wages
☐ Spreadsheet applications
☐ Videoconferencing
☐ Access to Internet / World Wide Web
☐ Internal e-mail

☐ External e-mail
☐ CD ROM (library facilities)
☐ Profession-specific functions
☐ Design (CAD)
☐ Surveying
☐ Computer design ‘walkthroughs’
☐ Plotting
☐ Intra oral photographs
☐ Clinical charting
☐ Clinical records
☐ Legal forms
☐ Document management/text retrieval
☐ Computerised specialisms
☐ Text assembly
☐ Computer linked imaging equipment

Section three: training

7.4 How would you rate your practice in terms of in-house computer knowledge?

☐ Highly knowledgeable
☐ Knowledgeable
☐ Average
☐ Unknowledgeable
☐ Highly unknowledgeable
6.4 Please indicate the average level of investment made in computer training per job position in the last 12 months

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<thead>
<tr>
<th></th>
<th>Partners and associates</th>
<th>Administrative and support staff</th>
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<tbody>
<tr>
<td>0</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>1-2 days</td>
<td>1-2 days</td>
</tr>
<tr>
<td>2</td>
<td>3-4 days</td>
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<tr>
<td>6</td>
<td>More than 10 days</td>
<td>More than 10 days</td>
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Section four: computer systems planning
Please indicate the degree to which the following activities are formally undertaken as part of your practice's computer technology purchases.

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<th>Process not undertaken</th>
<th>Process undertaken but not formalised</th>
<th>Process undertaken and formalised</th>
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<tr>
<td>8.4</td>
<td>Computer systems planning</td>
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<td>8.5</td>
<td>Evaluation of existing computer system</td>
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<td>8.6</td>
<td>Written statement of requirements</td>
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<td>8.7</td>
<td>Cost-benefit analysis</td>
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<td>8.8</td>
<td>Post-purchase evaluation of benefits resulting from purchase</td>
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Section five: employee involvement

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<th>How involved are your employees in the selection and implementation of computer technology?</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Not involved</td>
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Section six: consultant support/effectiveness

<table>
<thead>
<tr>
<th>11.1</th>
<th>Have you employed a computer consultant at any stage of the process of selecting and implementing computer technology?</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

If you have not employed a consultant, please go to Section 7 on the next page. If you have, please answer the following questions.

| 11.13 | How effective was your consultant in performing an information requirements analysis? |
|       | Very effective | Effective | Undecided | Ineffective | Very Ineffective |
| 11.14 | How effective was your consultant in recommending a suitable computerisation solution? |
| 11.15 | How effective was your consultant at managing computer systems implementation? |
|       | Excellent | Fair | Undecided | Poor | Very poor |
| 11.16 | How would you rate your consultant's relationship with other parties in the project (e.g. senior partners, employees, vendors, etc.)? |
| 11.17 | How would you rate your consultant's ability to understand your practice's business needs? |
|       | Very effective | Effective | Undecided | Ineffective | Very Ineffective |

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Overall, how satisfied were you with your consultant?

Section seven: vendor support/effectiveness

11.1 Have you employed vendor services at any stage of the process of selecting and implementing computer technology?

If you have not used a vendor, please go to Section 8. If you have, please answer the following questions.

12.3 How effective was your vendor in recommending a suitable computerisation solution?

12.4 How effective was your vendor’s software development / customisation?

12.5 The adequacy of technical support during computer systems implementation is / was...

12.6 The adequacy of training provided is / was...

12.7 The relationship of the vendor with other parties in the project (e.g. senior partners, employees, consultant, etc.) is / was...

12.8 The adequacy of documentation provided by the vendor is / was...

12.9 How would you rate your vendor’s ability to understand your practice’s business needs?

12.10 The vendor’s response / turnaround time (i.e. the amount of time it takes for the vendor to respond to a request for service or action) is...

12.12 Overall, how satisfied are you with your vendor?

Section eight: quality of the computer system

The following section will let us know what you think about the quality of your computer system. Please tick the box that best describes how you feel about your practice’s computer systems.

13.1 In terms of ease of use, our systems are...

13.2 The reliability of output information provided by our systems (i.e. the consistency and dependability of output information) is...

13.3 The relevance of output information provided by our systems (i.e. the degree of congruence between what the user requires and what is provided) is...

13.4 The up-to-dateness of information provided by our systems is...

13.5 The format of the output (i.e. the material design of the layout and display of the output contents) is...

13.6 The security of data from misappropriation or unauthorised alteration or loss is...
13.7 In terms of frequency of disruption caused by computer problems, our systems are...
13.8 The turnaround time taken to fix computer problems is...
13.9 The documentation (e.g. product descriptions, user manuals, etc.) supplied with our systems are...
13.10 The maintenance / back-up support included in the contract is...

It is intended that a senior partner in the practice completes this section, or that person who is ultimately responsible for computer systems decisions.

Section nine: management approach to computer technology

Which statement best describes your approach to investment in computer technology?

☐ I invest heavily in computer technology
☐ I am prepared to invest some money in computer technology
☐ I try to avoid spending money on computer technology where possible
☐ I never spend money on computer technology

Which statement best describes your practice's view of computer technology?

☐ Computer technology is fundamental to the success of a practice
☐ Computer technology is important to the success of a practice
☐ Computer technology supports a practice to a degree
☐ Computer technology is largely peripheral to the running of an organisation

How much formal computer training have you had?

☐ No formal computer training
☐ Less than 10 days full time equivalent (FTE)
☐ Between 10-20 days FTE
☐ More than 20 days FTE

How much direct (hands-on) computer experience have you?

☐ No previous experience
☐ Some experience (<10 previous occasions)
☐ Considerable experience (>50 previous occasions)

How much previous managerial computer systems experience have you?

☐ Previous managerial involvement with computer systems implementation
☐ No previous involvement
☐ Yes
☐ Yes, but significantly upgraded
☐ No, it has been totally replaced

Are you still using your first computer system?

☐ Yes
☐ No

Have you ever changed the way you acquire computers?

☐ Yes
☐ No

How long have you been using computers?

☐ Less than 2 years
☐ Between 2-4 years
☐ Between 4-6 years
☐ Between 6-8 years
☐ 8 – 10 yrs
☐ 10 – 12 yrs
☐ 12 - 14 yrs
☐ More than 14 years
Section ten: investment in computer systems

6.1/6. How much did your practice spend on computer technology (i.e. hardware, software, communications technology etc.) over the last 12 months?
- Nil
- Less than £2k
- £2k - £4k
- £4k - £6k
- £6k - £8k
- £8k - £10k
- £10k - £12k
- £12k - £14k
- £14k - £16k
- £16k - £18k
- £18k - £20k
- More than £20k

Please include any additional expenses such as maintenance and support contracts in this figure.

B.3 Please indicate your practice’s turnover for the last financial year
- Less than £40k
- £40k - £60k
- £60k - £80k
- £80k - £100k
- £100k - £200k
- £200k - £300k
- £300k - £400k
- £400k - £500k
- £500k - £600k
- £600k - £700k
- £700k - £800k
- £800k - £900k
- £900k - £1 million
- More than £1 million

B.4 How does this compare with last year?
- Increased
- Same
- Decreased

B.5 How profitable would you say your practice is at the moment?
- Very profitable
- Profitable
- Breaks even
- Losing money

B.6 Please indicate your recent total market changes
- We have more customers than last year
- We have the same number of customers as last year
- We have fewer customers than last year

Section eleven: change of approach

7.8 Have you ever changed the way you manage computer systems?
- Yes
- No

7.11 Has experience affected your approach to computer acquisition and computer management?
- Yes
- No

7.12 Has experience affected you approach to computer systems planning?
- Yes
- No

7.13 Has experience affected who makes computer systems decisions?
- Yes
- No

7.14 Has experience affected your approach to computer systems research?
- Yes
- No
Section twelve: Impact of computer systems on the organisation

The following section will let us know what you think about the impact computer systems have had in your organisation. Please tick the box that best describes how you feel computers have affected processes within your organisation.

<table>
<thead>
<tr>
<th>Question</th>
<th>Significantly Improved</th>
<th>Improved</th>
<th>Undecided</th>
<th>Worsened</th>
<th>Significantly worsened</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.1 How have computers affected decision-making?</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>14.2 How has your computer system affected work processes?</td>
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<tr>
<td>14.3 How has your computer system affected organisational costs?</td>
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<tr>
<td>14.4 How has your computer system affected practice control?</td>
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<tr>
<td>14.5 How has your system affected internal communication?</td>
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<tr>
<td>14.6 How has the use of computers affected job satisfaction?</td>
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<tr>
<td>14.7 How have computers affected your practice's ability to provide new services?</td>
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<tr>
<td>14.8 How have computers affected your practices marketing ability?</td>
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<tr>
<td>14.9 How have computers affected you practice's general administrative efficiency?</td>
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<tr>
<td>14.10 How have computers affected productivity?</td>
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<tr>
<td>14.11 How have computers affected information access?</td>
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<tr>
<td>14.12 How have computers affected customer service?</td>
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<tr>
<td>14.13 How have computers affected the accuracy of records and claims?</td>
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</tr>
<tr>
<td>14.14 How have computers affected practice image?</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>14.15 How have computers affected accounts / cashflow?</td>
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<td></td>
</tr>
<tr>
<td>14.16 How have computers affected workload?</td>
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</tr>
</tbody>
</table>

Thank you for completing the questionnaire. Please return it in the freepost addressed envelope provided.
Appendix 8.2. Normal probability plots for the model variables (data set 2)
Figure 8.2.1. Business performance

Figure 8.2.2. Turnover per employee (case 7 omitted)

Figure 8.2.3. IT/IS impact (outliers removed)

Figure 8.2.4. Information product satisfaction

Figure 8.2.5. Satisfaction with IT/IS provider and services
Figure 8.2.13. Management support for IT/IS

Figure 8.2.14. Management IT/IS experience

Figure 8.2.15. Organisational IT/IS knowledge

Figure 8.2.16. IT/IS learning

Figure 8.2.17. Investment capability
Appendix 8.3. Measurement model confirmatory factor analysis (data set 2)
Figure 8.3.1. ‘Soft’ performance measurement model

* $p = 0.05$, ** $p = 0.01$
Figure 8.3.2. Measurement model of the organisational impact of IT/IS
Figure 8.3.3. Satisfaction with the information product measurement model

Figure 8.3.4. Satisfaction with IS providers and services measurement model
M. J. Proudlock - Drivers of IS Implementation Success In Small Professional Firms

**Figure 8.3.5. IT/IS sophistication and coverage measurement model**

![Diagram of IT/IS sophistication and coverage measurement model]

All significant at .01 level

**Figure 8.3.6. Level of IS planning and formalisation measurement model**

![Diagram of Level of IS planning and formalisation measurement model]

All significant at .01 level
Figure 8.3.7. Consultant effectiveness measurement model

Figure 8.3.8. Vendor effectiveness measurement model

All significant at .01 level
Figure 8.3.9a. Management IT/IS experience measurement model

Figure 8.3.9b. Management IT/IS experience measurement model (with added items)
Change in approach to computer acquisition

Change in approach to IS planning

Change in approach to IS decision-making responsibility

IT/IS learning

All significant at .01 level

Figure 8.3.10. IT/IS learning measurement model
Appendix 9.1. Output from *Model B* confirmatory analysis
<table>
<thead>
<tr>
<th>Hypoth. No.</th>
<th>Path</th>
<th>Critical ratio</th>
<th>Regression weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hierarchy Level One</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LI H1a</td>
<td>Business Performance (soft measures) ← Organisational impact of IT/IS</td>
<td>1.224</td>
<td>0.111</td>
</tr>
<tr>
<td>LI H1b</td>
<td>Business Performance (soft measures) ← Information product satisfaction</td>
<td>1.139</td>
<td>0.119</td>
</tr>
<tr>
<td>LI H1c</td>
<td>Business Performance (soft measures) ← Satisfaction with IT/IS providers and services</td>
<td>0.924</td>
<td>0.093</td>
</tr>
<tr>
<td>LI H1a</td>
<td>Turnover per employee ← Organisational impact of IT/IS</td>
<td>1.939</td>
<td>0.150</td>
</tr>
<tr>
<td>LI H1b</td>
<td>Turnover per employee ← Information product satisfaction</td>
<td>-1.881</td>
<td>-0.168</td>
</tr>
<tr>
<td>LI H1c</td>
<td>Turnover per employee ← Satisfaction with IT/IS providers and services</td>
<td>0.563</td>
<td>0.049</td>
</tr>
<tr>
<td><strong>Hierarchy Level Two</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LI H2a</td>
<td>Organisational impact of IT/IS ← IT/IS sophistication</td>
<td>2.964**</td>
<td>0.270</td>
</tr>
<tr>
<td>LI H2a</td>
<td>Organisational impact of IT/IS ← Level of IT/IS investment</td>
<td>-0.284</td>
<td>0.065</td>
</tr>
<tr>
<td>LI H5a</td>
<td>Organisational impact of IT ← IT/IS training</td>
<td>-1.410</td>
<td>0.005</td>
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<tr>
<td>LI H5b</td>
<td>Information product satisfaction ← IT/IS training</td>
<td>0.857</td>
<td>0.158</td>
</tr>
<tr>
<td>LI H6a</td>
<td>Organisational impact of IT/IS ← Vendor effectiveness</td>
<td>-1.504</td>
<td>-0.101</td>
</tr>
<tr>
<td>LI H6b</td>
<td>Information product satisfaction ← Vendor effectiveness</td>
<td>3.365**</td>
<td>0.254</td>
</tr>
<tr>
<td>LI H7a</td>
<td>Organisational impact of IT/IS ← Consultant effectiveness</td>
<td>4.464**</td>
<td>0.344</td>
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<tr>
<td>LI H7b</td>
<td>Information product satisfaction ← Consultant effectiveness</td>
<td>4.783**</td>
<td>0.407</td>
</tr>
<tr>
<td>LI H8a</td>
<td>Organisational impact of IT/IS ← Management support for IT/IS</td>
<td>4.606**</td>
<td>0.360</td>
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<tr>
<td>LI H8b</td>
<td>Information product satisfaction ← Management support for IT/IS</td>
<td>2.697**</td>
<td>0.190</td>
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<tr>
<td>LI H9a</td>
<td>Organisational impact of IT/IS ← Management IT/IS experience</td>
<td>0.918</td>
<td>0.325</td>
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<tr>
<td>LI H9b</td>
<td>Information product satisfaction ← Management IT/IS experience</td>
<td>2.002*</td>
<td>0.177</td>
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<tr>
<td>LI H10b</td>
<td>Information product satisfaction ← Organisation size</td>
<td>-0.371</td>
<td>-0.067</td>
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<tr>
<td>LI H11a</td>
<td>Organisational impact of IT/IS ← Organisational IT/IS knowledge</td>
<td>4.153**</td>
<td>0.310</td>
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<tr>
<td>LI H11b</td>
<td>Information product satisfaction ← Organisational IT/IS knowledge</td>
<td>2.884**</td>
<td>0.190</td>
</tr>
</tbody>
</table>
### Hierarchy Level Three

| LIII H1 | Level of IT/IS investment ← Management support for IT/IS | 3.012** | 0.220 |
| LIII H2 | Level of IT/IS investment ← Management IT/IS experience | 0.633 | 0.137 |
| LIII H3 | Level of IT/IS investment ← Investment capability | 1.210 | 0.079 |
| LIII H4 | IT/IS sophistication ← Organisational IT/IS knowledge | 3.747** | 0.192 |
| LIII H5 | IT/IS sophistication ← Management support for IT/IS | 3.649** | 0.281 |
| LIII H6 | IT/IS sophistication ← Management IT/IS experience | 6.118** | 0.437 |
| LIII H7 | IT/IS sophistication ← Level of IT/IS investment | 5.941** | 0.312 |
| LIII H9 | Level of planning and formalisation ← Organisation size | 2.914** | 0.202 |
| LIII H10 | Level of planning and formalisation ← Management IT/IS experience | 5.456** | 0.449 |
| LIII H16a | Vendor effectiveness ← Employment of vendor support | -0.607 | -0.050 |
| LIII H21a | Management IT/IS experience ← IT/IS learning | 4.440** | 0.371 |
| LIII H22a | Management IT/IS experience ← IT/IS training | 3.301** | 0.243 |
| LIII H21b | Organisational IT/IS knowledge ← IT/IS learning | 3.505** | 0.252 |
| LIII H22b | Organisational IT/IS knowledge ← IT/IS training | 4.262** | 0.270 |
| LIII H23 | Management support for IT/IS ← Management IT/IS experience | 4.974** | 0.380 |
| LIII H24 | Management support for IT/IS ← Size | 0.524 | 0.034 |
| LIII H27 | Investment capability ← Size | 2.680** | 0.179 |

* = path significant at the 0.025 level  
** = path significant at the 0.005 level