INFORMATION SYSTEMS' EFFECTIVENESS AND ORGANISATIONAL PERFORMANCE

A thesis submitted for the degree Doctor of Philosophy

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ABSTRACT

For many years researchers have been troubled with the evaluation of Information Systems (IS) concluding to a lack of understanding as to the time, methods and tools for measuring the impact of IS on organisational performance. Motivated by this lacuna in the literature, this thesis explored the relationship between Information Systems' Effectiveness and Organisational Performance. The theoretical framework is based on the Delone and McLean's (D&M) IS success model which is widely adopted in the IS research. Based on a comprehensive literature review on the older and more recent studies the research framework incorporated several new items used by researchers for the measurement of the D&M dimensions.

Following a web survey on 168 Greek firms this study sheds some light into the IS field by focusing on how IS effectiveness measures affect Organisational Performance. Data for this study was collected by means of a web-link questionnaire and a sample of 700 companies of different sizes operating in various industries. Many descriptive statistics of academic and managerial importance were produced. Following a correlation analysis and Exploratory Factor Analysis, 15 factors were used for Multiple Regression analysis conducted to test a number of hypotheses around the relationship between the dependent construct (organisational performance) and the independent construct (IS effectiveness).

This thesis contributes to existing research in the following ways. First, this study extends our knowledge on IS effectiveness as we adapted and modified DeLone and McLean's model of IS success to incorporate new variables from recent research. The results indicate a significant statistical link between IS effectiveness and performance measures. Second, it provides a holistic framework for measuring Organisational Performance with financial and non-financial variables. Finally, the study presents findings from Greek companies that have adopted IS providing practioners with advice for the practices that can lead to possible and realistic benefits.

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CHAPTER 1

Context and Purpose of the Study

1.1 Introduction to the field

The academic field of Information Systems (IS) first attracted research interest in the 1960s (Langerfors, 1966) together with the emergence of applied computer science which in turn aimed at the design and implementation of data processing applications. (Avgerou, 2000). It was in the mid 70s when Langerfors explained that:

> "Information Systems (IS) are systems that provide information service. To do so they must receive information and store, access, transform, transfer and process information so as to produce the desired information service".
>
> (Langerfors, 1977, p.207)

This is probably the simplest but the most comprehensive definition in the history of this field. The Information Systems receive information, store it, transform it and transfer it. Using this definition, it can be understood that any Information System should not include the use of computers. For this reason, a new definition came into picture to describe the computer applications used for the production of the desired information: the definition of Information Technology (IT).

IT falls under the Information Systems umbrella, and "comprises both computer and telecommunications technology for the collection, storage, retrieval, reproduction, processing, diffusion, and transmission of information" (Bosworth & Triplett, 2000 cited in Swierczek & Shrestha, 2003).

From this perspective, it can be understood that the distinction between IS and IT is not clear as the social and technical nature cannot be easily separated (Symons 1991, p.186) and for this reason IS/IT are used in many studies interchangeably. Avgerou (2000) went on to argue that Information Systems are as much social systems as they are machines (Avgerou, 2000), which places the emphasis on the importance of understanding the 'soft' variables related to the social dynamics in IS implementation.

Considering these variables in the implementation of IT we borrow the definition from Davis and Olson, (1985) who "*consider IS* as *an integrated, user—machine system for providing information which utilises computer hardware, software; manual procedures; models for analysis, planning control and decision making; and a database*". In other words IS "are developed using IT to aid an individual in performing a task" (van der Heijden, 2004). According to the author, there are two groups of Information Systems: *Hedonic* and *Utilitarian*. The former are developed for pleasure and the latter to improve individual and organisational performance; among others these are: "Enterprise systems / Decision Support Systems, Knowledge Management Systems, E-commerce systems" (van der Heijden, 2004).

Ever since the early days of adoption, researchers focused on a number of questions regarding the development, use and implication of computer applications. The IT advances have a direct impact on all studies influencing scientists and practitioners across a number of disciplines and raising a number of questions of a socio-economical nature. As a consequence, the field has attracted the attention of practitioners and academics due to its links with the engineering and social science disciplines (Laudon, 1986; Avgerou, Siemer and Bjorn-Andersen, 1999). Moreover, there is consensus regarding the scope and variety of social issues pertinent to technology and management since the IS applications are "the prime driver and enabler of business strategy for many organizations" (Ives et al., 2002). This is discussed in the following paragraph.

1.2 Information Systems and Business Studies

Perhaps a good starting point when trying to explore IS in the business context is the definition provided by Avison and Fitzgerald (2003, p. xi):

> *"*The effective design, delivery, use and impact of information [and communication] technologies in organisations and society.*"*
>
> Avison and Fitzgerald (2003, p. xi):

This definition is useful as it contains the building blocks of IS, that is: the use of technology when we consider modern IS in the business environment (Davis & Olson, 1985). The use of IT includes various terms like "*computer information systems, business computing science, information, decision support systems, electronic data processing etc"* (Carey et al., 2004 p.359).

However, recent research in IS addresses many other concepts involved in the use of Information Systems which offers a more organisational and social focus. In an attempt to provide an all-inclusive definition, the UK Academy for Information Systems argued that:

> *"*The study of information systems and their development is a multidisciplinary subject and addresses the range of strategic, managerial and

> operational activities involved in the gathering, processing, storing, distributing and use of information, and its associated technologies, in society and organisations".
>
> (UKAIS: 1995)

This is a much broader approach as it refers to the use of the technologies while placing an emphasis on the business activities and the ensuing interaction between man/machinery for organisational decision making (Davis, 1974). This has since evolved into the discipline of 'Management Information Systems' (MIS) (Laudon & Laudon, 2003).

The literature in IS and business studies is rich and is explored in greater detail in chapter 2. Despite the variety of approaches when categorising IS research, it is obvious that there is a lot of potential new research opportunities in future IS studies, which will provide insight on how academics and managers understand and implement older and emerging technologies. "*The domain defined by the development, use and application of information systems by individuals and organisations is far too large for IS research*" and there are, therefore, many research opportunities (Baskerville & Myers, 2002).

These concepts are discussed in more detail in chapter 2 along with other related concepts from the literature on Information System discipline. It was, however, deemed necessary to provide a brief introduction to the field for the reader's better understanding. This dissertation focuses on a specific research topic from the IS discipline: the impact of IS on organisational performance.

The research framework is introduced in the following section.

1.3 Presenting the research framework

The ability of an organisation to exploit the capabilities / benefits offered by IS became the key motivator of this thesis which aims at exploring the relationship between IS effectiveness and Organisational Performance (see fig.1).

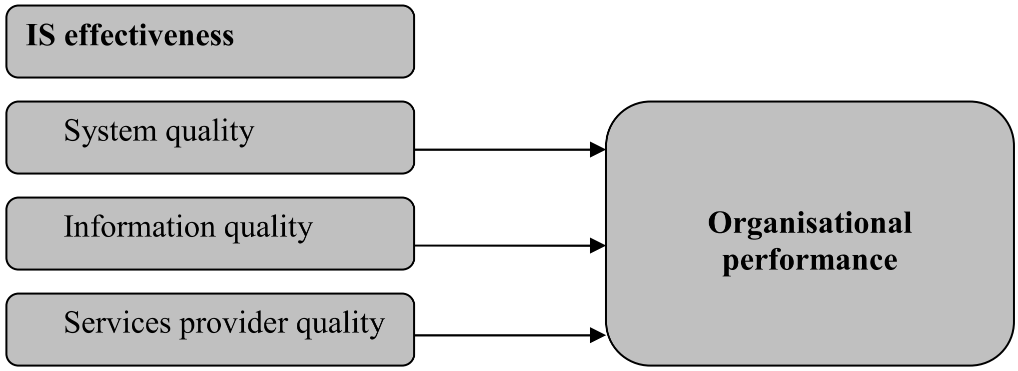


Figure 1.1 the research framework

Looking at Figure 1, it is understood that the dissertation seeks to explore the statistical relationship between three key dimensions (identified from the literature review) with Organisational Performance and consequently the following key propositions were tested:

P1: *System quality is positively related to organisational performance*

P2: *Information quality is positively related to organisational performance*

P3: *Service provider quality is positively related to organisational performance*

The proposed model incorporates the main concepts in the IS effectiveness concept which are linked with Organisational Performance by drawing mainly on the conceptualisation of the Delone and Maclean (1992; 2002) framework. The research model that was developed following a detailed literature review was tested in May 2010 on 700 IT managers in Greek companies of different sizes operating in various industries. Using web-survey, 168 usable responses were collected from different industries and company sizes. Using SPSS software, the statistical analysis of the model involved three steps: Descriptive statistics, Exploratory Factor Analysis (EFA) and, finally, Multiple Regression to test the hypothesised associative relationships. The methodology, empirical part and findings are extensively discussed in chapters 4-7. The following paragraph provides a brief description of the main research constructs putting the study in context, helping thus the reader comprehend the framework and research questions that motivated this dissertation.

1.3.1 Brief discussion on the main constructs

The most popular definition for IS effectiveness is "the extent to which a specific information system actually contributes to achieving organisational goals, i.e. its effect on organisational performance" (Hamilton & Chervany, 1981*)* which is the basic research objective of this thesis.

The definition of organisational performance, on the other hand, is a continuous open research question with limited studies using consistent definitions and measures (see Kirby, 2005). Perhaps an easy definition is given by Yamin, Gunasekaran & Mavondo (1999) according to which "Organisational Performance refers to how well an organisation accomplishes its market-oriented goals as well as its financial goals".

There are some important reviews on performance (e.g., Chakravarthy, 1986; Venkatraman & Ramanujam, 1986), because the domain attracts researchers due to its vital link with management practices (Boyd, Gove & Hitt, 2005).

At this point it should be mentioned that there has been some debate as to whether the terms performance and effectiveness are the same and researchers consider effectiveness "*a broader construct that captures organisational performance, but with grounding in organisational theory that entertains alternate performance goals"* (Cameron & Whetten, 1983). Richard et al. (2009) view organisational performance "as a term that encompasses three specific areas of firm outcomes: (a) financial performance (profits, return on assets, etc.); (b) product market performance (sales, market share, etc.); and (c) shareholder return (total shareholder return, etc.)". Effectiveness, however, contains the performance measures plus some other internal or external indicators.

In their attempt to understand and study organisational effectiveness, scholars have utilised a variety of indicators reflecting their research backgrounds. Thus, business policy and strategic management scholars rely "almost solely on financial measures of effectiveness (Hitt, 1988, p.29)", whereas; other researchers have employed a variety of diverse measures such as minimisation of regret, morale, absenteeism, anxiety (e.g. Allen et al., 1979). In addition, marketing scholars have utilised both economic and non economic as well as generic measures to assess effectiveness (e.g. Katsikeas et al., 2000).

Modern theories and concepts as well as the implementation of balanced scorecards have also intensified the attention given to organisational effectiveness. Non financial measures had been primarily used for internal benchmarking and control, (Kaplan & Norton, 1996a). These measures were meaningful for each individual firm, but the research results across companies showed that the BSC measures were difficult for a single firm (Argyropoulou et al., 2010), let alone for comparisons amongst companies (Schneiderman, 1999; Neely & Bourne, 2000). For this reason, the narrower domain of performance with the use of mainly financial measures prevailed over the wider term of effectiveness.

A detailed discussion on our constructs is provided in chapter 2. What is important to be considered at this point of the dissertation, is that the definition of *organisational performance* is still an open question with few studies using consistent definitions and measures (see Kirby, 2005). Based on the recent review by Richard et al. (2009), in this work the term organisational performance is adopted for our dependent construct which was conceptualised with a selection of variables that were appropriate for the purposes of the research.

The next section explains the motivation of the dissertation, the literature gaps and the importance of this research to academics as well as practitioners.

1.4 Motivation and identification of literature gaps

The literature review on the area of IS evaluation reveals that the findings remain inconclusive and that the sole investment in technology without the consideration of the soft variables is not necessarily improving performance as the investment might be wasted (Mooney, Gurbaxani & Kraemer, 1996). The basic concept behind those findings is that IT is not an isolated island (Strassmann, 1997) within the organization and that only those who can successfully integrate the IT into their business processes will be able to reap benefits. This approach coincided with the Hirschheim and Smithson (1988) arguments that "treating IT as a technical problem leads to meaningless conclusions which fail to see their social context" (Symons, 1991; Walsham, 1993; 1995). This notion prompted a broader definition of IS as complex social systems (Burns, 2006) because their evaluation should comprise the "*context, history, infrastructure, stakeholder perspectives, informal procedures, and information flows*" (Brown, 1992, p.p. 137-139). Further, the evaluation process moved from the traditional investment approach to include some other qualitative and often intangible benefits (Symons, 1991, p. 211).

Findings about the relationship between IT and firm performance have been reported by many research studies in Information Technology (IT) and Information Systems (IS), but the results remain inconclusive (Li & Ye, 1999; Ray et al., 2005; Wang et al., 2006). Recent studies continue to find weak relationships (Ravichandran et al., 2009). This phenomenon is called "Productivity paradox" because it highlights the rather surprising negative or weak relationships between IT adoption implementation and organisational performance (Brynjolfsson, 1993).

However, another stream of research documents that IT investments result in significant effects on both productivity and profitability of the firm (Brynjolfsson & Hitt, 1996). For some researchers IT is important for the enhancement of business value and competitive advantage (e.g. Melville et al., 2004) whereas for some others (eg Shin, 2006) "IT contributes to financial performance significantly when it is measured by gross margin". Liang et al. (2010) showed that both financial performance and organisational efficiency benefit from IT through the improvement of organisational capabilities.

However, the description of the dependent variable (IT impact) as well as the variables measuring it, still attract research attention. Melville et al. (2004, p. 285) note that "*IT business value scholars are motivated by a desire to understand how and to what extent the application of IT within firms leads to improved organisational performance.*" Sharing the shame concerns, other researchers like Tallon and Kraemer (2007), argue "*on the lack of robust, firm-level measures of IT impact*". Motivated by the need for a profound understanding of the firm-level impacts of IT and their measurement, the following research questions have been formulated and guided the analysis of this dissertation.

- How do we measure Information Effectiveness and Organisational Performance?
- Is there a positive relationship between Information System Effectiveness and Organisational Performance?
- Which IS implementation factors are leading indicators of Organisational Performance?

1.5 The literature gaps - Importance of the study

The topic of IS/IT evaluation has been explored by many authors. The literature in this area is broad but heterogeneous as it comprises various models and approaches (Delone & Maclean, 2002; Symons, 1991). Various organisational performance measures (as dependent variables) have been chosen by field and case studies for the exploration of the information systems evaluation (e.g. DeLone & Mclean, 1992; 2002; Rai, Lang & Welker, 2002; Chang & King, 2005). Most of these studies consider that IS are effective only if they contribute to organisational effectiveness (Thong & Yap, 1996). The attempts, however, were not frequent due to the inherent difficulty in separating the contribution of the information systems from other contributors to organisational performance (DeLone & Mclean, 1992; 2002). The technology advances have made this relationship an important issue for academics, IS practitioners and top managers.

The few studies that measured the impact of IS on business performance produced inconclusive findings varying from a positive relationship between IS and financial performance (e.g. Banker, Kauffman & Morey, 1990; Barua, Kriebel & Mukhopadhyay, 1995) to negative relationship between IT implementation and productivity and profitability in many companies in different sectors (e.g. Ezingeard, Irani & Race, 1999; Irani & Love, 2001). Another stream of research found no relationship between IT investment and organisational performance (e.g. Floyd & Woolridge, 1990; Dos Santos, Peffers & Mauer; 1993; Kettinger, Grover, Guha & Segars, 1994).

As a result, the research interest in the field is still high and deserves further development and testing (Irani & Love 2002; Chang & King, 2005; Wang & Liao, 2008). This dissertation aims at filling certain gaps in previous research by exploring further the impact of IS on firm performance. Therefore, it offers several contributions to the academic community (see chapter 8 for details) the most important being the following:

- It proposes and tests a research framework which draws from the pertinent literature on IS and organisational Performance.
- It provides empirical evidence concerning the statistically significant positive relationship between the IS effectiveness and financial as well as non-financial measures of organisational performance.

- It produces results from a rigorous methodology that shed light into the IS evaluation field of research
- It documents a number of IS implementation issues and provides useful advice for the choices/practices that are necessary for the achievement of benefits when adopting IS.

1.6 Outline of the study

Chapter One provides an introduction to the thesis, sets the context of the study, presents its focus and research objectives and discusses the potential significance of the research effort.

Following this introductory chapter, Chapter Two reviews the pertinent literature. Initially the chapter provides a detailed discussion on the IS discipline and it continues with a detailed examination of the main constructs and sub-constructs of the research. Finally, the main research frameworks are presented in an attempt to explore the key contributions and to identify the gaps that motivated the thesis.

Chapter Three introduces the research framework and the research propositions. An analysis of the literature findings is undertaken for the theoretical foundation of the model and conceptualisation of its constructs. A series of propositions is formulated.

Chapter Four is devoted to the research methodology. The chapter provides a most detailed discussion on the research setting and decisions taken, : the research design; the process of data collection; the development of the questionnaire instrument; the sampling frame; the survey implementation; the response rate attained; the sample characteristics; the reliability and validity evaluation of the measures utilised; and, the statistical techniques employed to test the research hypotheses.

Chapter Five presents the main descriptive statistics. In this regard, it discusses the sample demographics, and the perception of the IT managers regarding the use of the IS from the entire company.

Chapter Six analyses all the steps and results of the Exploratory Factor Analysis which produced 15 factors which satisfied the statistical and conceptual criteria for acceptance and inclusion in the multiple regression analyses that followed.

Chapter Seven explores and discusses in detail the multiple regression analyses that were performed for the testing of the various hypotheses that were produced following the formation of the 15 factors attributed to our main constructs: Information Effectiveness and organisationqal performance.

Finally, Chapter 8 summarises this research, reviews the research questions, hypotheses and objectives as well as the methods used. Significance of this research is underlined and limitations are discussed. Finally relevant future research directions are provided.

1.7 Summary

This chapter introduces the basic concepts and discusses the context of the thesis, clarifies its research focus, presents the research framework and the objectives of this research endeavour. It emphasises the importance of such an empirical study along with its potential contribution, and finishes with an outline of the present work.

CHAPTER 2

Literature Review

2.1 Introduction

The first part of the literature review chapter presents the definition and analysis of the Information Systems domain, placing an emphasis on system theory and how this applies to the IS discipline. The second and longer part focuses on the specific literature on the research constructs. Two main sets of constructs were operationalised in this study - the Information Effectiveness and Organisational Performance. The second part, therefore, discusses the pertinent literature on these constructs and their sub constructs, setting thus the theoretical platform for the execution of the study. The chapter finishes with a synthesis of the literature findings and the identification of the literature gap that motivated this research.

2.2 System theory and system thinking

According to Fuenmayor ‘‘system refers to a ‘‘*complex whole of related parts*’’- whether it is biological (e.g. human or an ecosystem), structural (e.g. a railway system), organised ideas (e.g. the democratic system), or any other assemblage of components comprising a whole” (Fuenmayor, 1991). Systems thinking is a more complex concept and “*balances the focus between the whole and its parts, and takes multiple perspectives into account”* (Cabrera, Colosi & Lobdell, 2008, p.301). Senge (1990), argued that “*Systems thinking is a discipline for seeing wholes…a framework for seeing interrelationships rather than things, for seeing patterns of change rather than snapshots”* (Senge, 1990, p.68). There have been many definitions regarding the concept of system thinking, but they all include the “*ability to see the whole and its interconnections to its environment*” (Wolstenholme, 2003, p. 20)

The primary concepts on systems thinking were introduced in disciplines like biology, physics, psychology and they include sub-concepts such as: parts/wholes, environment, structure/process, positive and negative feedback, information and control, open systems, holism, and the observer (Mingers & White, 2010).

It was in 1950 when a biologist Ludwig von Bertalanffy noted that all systems studied by physicists are close systems, meaning that there is no interaction between them and their environment. Von Bertalanffy (1950) also examined the nature of open systems i.e. systems that receive information from the environment and interact with it.

This is the main idea of general systems theory (GST) which was later taken up in Operations Research and in Management Science. These developments include management cybernetics (Beer, 1967), system dynamics (Forrester, 1968), systems engineering (Hall, 1962) and what we know as systems approach (Churchman, 1979; Weinberg, 1975). These are briefly discussed below:

Cybernetics: Cybernetics investigates the flow of information through a system and how the system uses that information as a means of controlling itself (Ashby, 1956). Stafford Beer applied the principles of cybernetics to management science (Beer, 1959). The terms used today are '*biocybernetics', 'biomedical systems', 'artificial intelligence', 'robotics' a*nd '*adaptive systems'*.

System dynamics: The introduction of fundamental ideas of system dynamics is attributed to Jay Forrester at MIT in the 1960s who tried to model "the dynamic behaviour of systems such as populations in cities and industrial supply chains" (Forrester, 1961). Forrester's explanation of the argued behaviour of such systems was based on their multi-echelon structures of flows, delays, information and feedback relations.

Soft systems and problem structuring methods (PSMs): Problem structuring methods (PSM) include several modelling approaches whose aim is "*to assist groups of diverse composition to alleviate a complex, problematic situation of common interest"* (Mingers and White, 2010 p.1151). According to the authors, the concept of system thinking triggered several studies in management and operations science cybernetics and evolved to what is generally considered as 'system approach in management' (Mingers and White, 2010). This topic is briefly discussed in the next paragraphs.

2.2.1 Application of the system approach in management science

The importance of systems thinking for management science was emphasised early in the 60s from Ackoff (1962), Churchman (1963) and Hall (1962). However, the use of system approach has received a lot of attention in more recent studies with application in several disciplines (Mingers and White, 2010) The authors provide some indicative studies such as a book from Haines (2000) which deals with the impact of system thinking on strategy, the system bible from Gall (2002) and a textbook from Daellenbach and McNickle (2004).

The common perceptions in all works based on system approach are the following: viewing the whole instead of its parts and the interaction between the elements might be more important than the elements themselves (Lane, and Oliva, 1998; Mingers and White, 2010). Perhaps the disciplines that have been mostly discussed by system approach philosophers are strategy, operations management and information systems. This is briefly explained based on the recent publication from Mingers and White (2010).

***System approach in* strategy:** It is surprising to see that several of the early texts regarding strategic planning were written by systems experts (eg Ackoff, 1970). Ackoff was primarily the first researcher to propose a system's approach to strategic planning, arguing that strategic decisions are "messes, often characterised as interactive systems of related issues" (Ackoff, 1970, as cited in Mingers and White, 2010) and he suggested a "recipe for a rational approach required to develop strategy". In more recent publications, system thinking has embraced ideas from complexity theory, which explains that strategic decision making is complex at it involves various issues and a number of interacting factors and stakeholders (e.g. Houchin & MacLean, 2005; Mason, 2007).

System approach in operations management: Generally, applying systems thinking within the field of operations management is based on viewing the organisation as a system that aims at improving efficiency and quality (e.g. Mashayekhi, 2000). Many other researchers have shown how systems dynamics thinking can be the basis for analysing complex organisational operations, like supply chain management (e.g. Beth et al., 2003; Moon & Kim, 2005), or project management (e.g. Lyneis & Ford, 2007).

System approach in Information Systems: The systems approach is evident in the IS/IT literature. Terms such as system, sub-system, control, are commonly used in the specific field (Avgerou, 2000). The discipline is called information *systems*, after all, and few academics would disagree with the argument that system theory is the most influential platform in the IS theory besides *organisational rationalism (*Alter 2004). Organisational rationalism refers to a series of principles of deploying the resources of organisations in order to survive in the market but it does not really belong to a school of thought; With its origins in the work of Max Weber, it is based mainly on the "*shared ideological fundamentals of the prevailing `orthodoxy' of theories and practical rule on how to run organisatios"* (Avgerou, 2000). According to Avgerou (2000), the systems perception has provided a useful abstraction, which continues to provide theoretical thinking tools for the theoretical foundations of IS (Checkland, 1981) which is analysed in the subsequent paragraphs as it provides the theoretical foundation of this study.

2.2.2 Information System Theory –the input/output model

As discussed in chapter 1, "*Information Systems (IS*) are *systems that provide information service"* (Langefors, 1977, p.207). The approach taken by Langefors (1977) emphasises on both the "*systems aspect and the information aspect (or infological aspect*)". The information aspect suggests that the sole purpose of the data stored is *to convey information to people (and to processes*). The systems aspect, on the other hand, "*brings to attention the importance of the integration to be realised by the relationships between the parts, the data, the processes, the users"* (Langefors, 1977, p.207).

Considering the system aspect, it is concluded that the term integration is associated with this approach with strong implications, since data, people, processes and environment are entities of the system (Symons, 1991). People may have access to some data from any part of the system regardless of who did the data entry and under the same thinking processes may use data and programs from whichever part of the system. However, the term IS system suggests the concept of "*whole"* (Wolstenholme, 2003) with an internal coherence and with the understanding that the "*whole is greater than the sum of its parts*" (Symons, 1991).

The fundamental building block of the Information Systems approach represents data flow and data processing activities in an as demonstrated in Figure 2.1

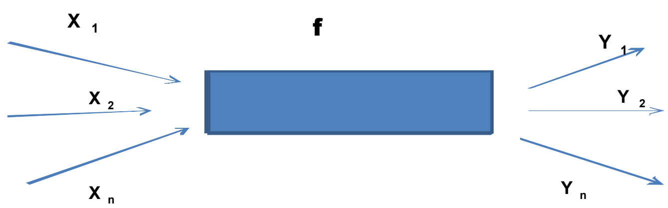


Figure 2.1 The input –output model.

Source: Ballou, and Pazer, 1985

According to the model multiple inputs (represented by X_1…..X_n values) are processed by a function F and then are transformed to yield multiple outputs (represented by

Y_1.....Yn values. The processing block in IS represents the handling of data by analytic models (Cushing, 1974; Ballou, and Pazer, 1985; Ballou, 2004).

Based on the systems' approach (Symons, 1991) and on a theoretical input–output model Chang and King (2005) argued that an IS system is open system which has inputs and outputs (Fig 2.2). According to the model, IS inputs can be the IS resources and the IS capabilities. The literature has identified three main categories of IS as resource: *human, technological,* and *relationships* (Bharadwaj, 2000). The human resources (IS skills) constitute the human capital (Lee, Trauth & Farewell, 1995). Technological resources stem from the network platform (Armstrong & Sambamurthy, 1999) and data sophistication (Duncan, 1995). Relationships can be internal (Nelson & Cooprider, 1996; Ravichandran & Rai, 2000) or they can refer to external partnerships (Grover, Chen & Teng, 1996). As far as Capabilities are concerned, the literature posits that IS capabilities are "*socially complex routines*" for the determination of the efficiency with which firms transform inputs into outputs (Collis, 1994).

In a more focused approach where Grant claimed that "*Capabilities can be identified and appraised using a standard functional classification of the firm's activities*" (Grant, 1991, p.120) whereas (Tavakolian, 1989) focused on *planning, systems development, IS support, and IS operations* which were further explored by Ravinchandran and Lertwongsatien (2005) who argued that these constitute the functional capabilities of a firm. The same authors found a direct positive relationship between resources and capabilities which extended the previously causal relationship in the definition of capabilities as an organisation's ability to deploy resources (Amit & Schoemaker, 1993).

According to Saunders and Jones (1992) the IS function includes all IS groups and departments within the organisation. Based on the system's approach, we can say that "IS resources and capabilities are the inputs used by the IS function to produce system outputs, information outputs, and IS service provider outputs" (Segars & Hendrickson, 2000) which, in turn, are viewed as the drivers of organisational performance (Chang & King, 2005, Figure 2.2). This provided the theoretical justification of this research and became the research framework that was introduced in chapter 1.

Having established the fundamental theory on IS and our theoretical framework, it was considered necessary to examine the IS discipline in more detail. This is discussed in the next section.

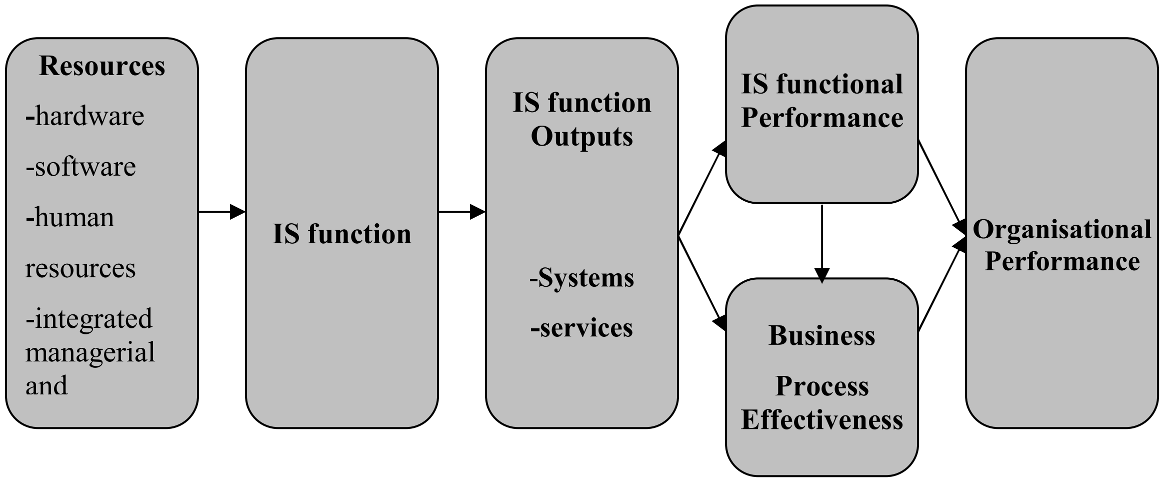


Figure 2.2 Input – Output Performance Model

Source: Chang and King 2005

2.3 The Information System Discipline

There has been much debate as to the nature of the IS discipline. Researchers have doubted the ability of IS to be a discipline on its own (Banville & Landry 1989; Landry & Banville 1992), mentioning that IS have been based on "other reference disciplines" (Keen, 1980).

This previously held conviction seems, however, to be fading as more recent publications argue that "the time has come for IS to become a *reference discipline for others"* (Baskerville & Myers, 2002, p.3). Based on an extensive review of publications in major journals like MIS Quarterly by the authors, "*the field has a distinct subject matter, a distinct research perspective, and a well-developed communication system that includes respected journals"* The authors highlight the increasing use of ICT applications on several other disciplines including accounting or marketing, and they conclude that "*no other single discipline is able to completely address today's multi-faceted research issues so well as IS"* (Baskerville & Myers, 2002). In addition, they claim that IS research itself has motivated many other entirely new disciplines such as "*bio-informatics*, *biotechnolog*y, *and geographical information system"* (Baskerville & Myers, 2002, p.7).

2.3.1 Basic categories in IS business research

According to Table 2.1, there are nine basic research categories in the field. The developments in ICT have been fundamentally changing the way organisations conduct business and this has resulted in many research opportunities and significant contributions to knowledge while at the same time helping mangers to run their businesses better. Avgerou (2000, p 567-579) tried to categorise IS focusing on five thematic areas, these being: "*applications of information technology to support the functioning of an organisation; the process of systems development; information systems management; the organisational value of information systems and the societal impact of information systems*". In a more recent publication, Banker and Kauffman (2004) reviewed the last 50 years of IS research and they identified five research streams that relate to IS: "*decision support and design science, human-computer systems interaction, value of information, IS organization and strategy, and economics of IS and IT".*

Table 2.1 Major categories in IS research.
Source: Barki, Rivard and Talbot, (1993)

1	Reference disciplines: Behavioral science, computer science, decision theory, information theory, organisational theory, social science, management science, economic theory, ergonomics, political science and psychology
2	External environment: economic, legal, political and social
3	Information Technology: computer systems and software
4	Organisational environment: characteristics, functions and tasks
5	IS management: hardware, software, personnel, projects, planning, evaluation, security and other management issues
6	IS design and development
7	IS usage, by organisations and users, and their support, access and processing
8	IS types, application areas, components and characteristics
9	IS education

Despite the different approaches to categorising IS research, it is obvious that there is potential in future IS studies, which will provide insight on how academics and managers understand and implement older and emerging technologies. There are many research opportunities as the domain defined by the development, use and application of information systems by individuals and organisations is far too large for IS research (Baskerville & Myers, 2002). The next section discusses in detail the literature on IS evaluation examining the major contributions to this basic category of IS research.

2.4 Classification of the literature on IS evaluation

According to a rather recent review by Gunasekaran, Ngai and McGaughey (2006), the literature on IT/IS justification / evaluation has been divided into four categories (see Table 2.2). These are briefly discussed:

2.4.1 General IT/IS evaluation and justification concepts

This stream of research explores the evaluation of IT/IS investments and places an emphasis on looking at it from a holistic organisational perspective (Grover et al., 1998). This means that the evaluation process should include a well justified investment in IT/IS (Willcocks, 1992), the recognition of the IT value (Ballantine & Stray, 1999) the relationship between IT value and productivity (Hitt & Brynjolfsson, 1996) or between IT value and market factors (Chircu & Kauffman, 2000). This stream incorporated the need to examine how different stakeholders perceive the benefits of IT investment (Massey et al, 2001). Another important factor for the evaluation of IS has been the consideration of the total costs involved when implementing IS (Larsen & Bloniarz, 2000) or the relationship between firm performance and both IT and corporate investments (Sircar, Turnbow & Bordoloi, 2000; Massey et al., 2001; Alshawi, Irani & Baldwin, 2003) Finally, the performance measures and metrics should be such to include organisational goals (Sethi, Hwang & Pegels, 1993). The resource-based view of the firm attributes provided new approaches for the IS evaluation. Bharadwaj (2000) developed the concept of IT as an organisational capability and examined the relationship between IT capability and firm performance. The empirical findings supported his hypothesis that firms having a high IT capability tended to outperform others without it on a variety of profit and cost-based performance measures.

2.4.2 Evaluation criteria

Another stream of research focused on the type of performance measures that should be considered in an attempt to evaluate the IS projects. The review identified the impact of IT/IS on strategy, on tactical/operational considerations, the use of financial or non-financial measures and the tangibles/intangible benefits reaped.

The strategic importance of IT/IS has been emphasized by many researchers (e.g. Powell, 1993; Sarkis & Sundarraj, 2000) who argued that the strategic goals should determine why and which IS should be implemented. Croteau and Bergeron (2001) added that strategic IS can support business strategy; this concept was further explored by Benaroch (2002) who presented an approach for managing IT investment risk.

Table 2.2 References for the literature on IT/IS justification
Source: Gunasekaran, Ngai & McGaughey, (2006)

Major classification	Sub-classification	References
General IT/IS evaluation and justification concepts	Justification of investment in IT/IS projects	Willcocks, 1992; Hitt & Brynjolfsson, 1996; Lubbe & Remenyi, 1999; Serafeimidis & Smithson, 1999; Southon, 1999; Massey etal, 2001.
	Costs and benefits of IT/IS implementation	Devaraj & Kohli, 2000; Larsen & Bloniarz, 2000; Sircar et al., 2000; Massey et al., 2001; Alshawi et al., 2003.
	Implications of IT/IS evaluation	Sethi et al., 1993; Ballantine & Stray, 1999; Bharadwaj, 2000; Chircu & Kauffman, 2000.
Evaluation criteria emphasized for justifying IT/IS projects	Strategic impact	Powell, 1993; Sarkis & Sundarraj, 2000; Croteau & Bergeron, 2001; Benaroch, 2002; Wagner, 2004.
	Tactical considerations	Belcher & Watson, 1993; Kassicieh et al., 1993; Apostolopoulos & Pramataris, 1997; Cronk & Fitzgerald, 1999; Drury & Farhoomand, 1999; Ezingeard et al., 1999; Lubbe & Remenyi, 1999; Bharadwaj, 2000; Larsen & Bloniarz, 2000; Gunasekaran et al., 2001; Irani & Love, 2001; Hitt, Wu & Zhou , 2002; Alshawi et al., 2003.
	Operational performance	Clemons, 1991; Willcocks, 1992; Sethi et al., 1993; Farbey et al., 1994; Small & Chen, 1995; Grover et al., 1998; Anandarajan and Wen, 1999; Ezingeard et al., 1999; Tallon et al., 2000; Gunasekaran et al., 2001; Hitt, Wu & Zhou, 2002; Love & Irani, 2001; Irani & Love, 2001; Thatcher and Oliver, 2001; Irani et al., 2002.
	Financial measures	Ballantine and Stray, 1999; Love & Irani, 2001; Hitt, Wu & Zhou, 2002; Cavusoglu et al., 2004; Milis & Mercken, 2004.

	Non-financial indicators	Chokhani, 1992; Davis et al., 1992; Belcher & Watson, 1993; Ballantine and Stray, 1999; Ryan & Harrison, 2000; Ryan et al., 2002.
Evaluation criteria emphasized for justifying IT/IS projects	Tangibles	Clemons, 1991; Willcocks, 1992; Sethi et al., 1993; Farbey et al., 1994; Small & Chen, 1995; Anandarajan & Wen, 1999; Ezingeard et al., 1999; Grover et al., 1998; Irani & Love, 2001; Love & Irani, 2001; Thatcher & Oliver, 2001; Chatterjee et al., 2002; Hitt, Wu & Zhou, 2002.
	Intangibles	Clemons, 1991; Willcocks, 1992; Sethi et al., 1993; Farbey et al., 1994; Small & Chen, 1995; Grover et al., 1998; Anandarajan & Wen, 1999; Ezingeard et al., 1999; Irani & Love, 2001; Hitt, Wu & Zhou, 2002; Kushniruk & Patel, 1998; Kushniruk et al., 2001; Love & Irani, 2001; Palvia et al., 2001; Thatcher & Oliver, 2001; Ammenwerth et al., 2003.
Techniques and tools used for evaluating and justifying IT/IS projects	Economic approaches	Kauffman & Wang, 1994; Willcocks, 1995; Irani et al., 1997; Irani et al., 2002; Small & Chen, 1997; Love et al., 2004; Hamill et al., 2005.
	Strategic approaches	Powell, 1993; Lefley & Sarkis, 1997; Irani et al., 2002; Sarkis & Sundarraj, 2000; Fink & Shoeib, 2003; Suwardy et al., 2003.
	Analytic approaches	Kassicieh et al., 1993; Lichtenstein, 1996; Thatcher & Oliver, 2001; Phillips-Wren et al., 2004.
Evaluation of the implementation of IT/IS projects	Financial	Apostolopoulos & Pramataris, 1997; Ballantine & Stray, 1999; Gottschalk, 1999; Hitt, Wu & Zhou, 2002; Love & Irani, 2001; Lin & Pervan, 2003; Milis & Mercken, 2004; Wagner, 2004 .
	Non-financial	Watson et al., 1991; Belcher & Watson, 1993; Powell, 1993; Apostolopoulos & Pramataris, 1997; Hitt & Brynjolfsson, 1997; Huerta & Sanchez, 1999; Gunasekaran et al., 2001; Irani et al., 2002.

Together with the reengineering of major business processes this issue received a lot of attention, since IT/IS directly or indirectly influence all processes that are automated. Many publications explored the criteria which could be useful in evaluating IT/IS contributions at the tactical level (Belcher & Watson, 1993; Kassicieh, Ravinder & Yourstone, 1993; Cronk & Fitzgerald, 1999; Ezingeard et al., 1999; Bharadwaj, 2000; Gunasekaran et al., 2001; Irani & Love, 2001; Hitt, Wu & Zhou, 2002; Alshawi, Irani & Baldwin, 2003). Nonetheless, researchers are still arguing on the relationship between tactical objectives and IS implementation (Gunasekaran, Ngai & McGaughey, 2006).

2.4.3 IS and operational performance

Operational performance from the IT/IS perspective focused on several areas including sales, production lead-time, inventory turnover and cost, utilisation of the available capacity, employee turnover, etc. (Clemons, 1991; Sethi, Hwang & Pegels, 1993; Farbey, Targett & Land, 1994; Anandarajan & Wen, 1999; Ezingeard et al., 1999; Grover et al., 1998; Hitt, Love & Irani, 2001; Irani & Love; 2001; Wu & Zhou, 2002).

Performance measures are usually divided into two main groups. These are: financial measures and non-financial (or operational) measures (Ittner & Larker, 2002; 2003). Financial measures, based on the economic state of a company, incorporate traditional measures (like profits, revenues, costs, financial margins, cash flow) and other more recent measures such as Economic Value Added (EVA), Cash Flow Return on Investment (CFROI) etc. Non-financial measures, on the other hand, aim at quantifying the organisational performance in relation with: customers (e.g. customer satisfaction-retention-acquisition), employees (e.g. employee satisfaction), innovation, quality, culture, etc, (Kaplan, & Norton 1992; 1996a; 1996b). The above measures have been further broken down into hard measures that are easily quantifiable (such as customer acquisition, number of complaints, etc.) and soft measures which are difficult to quantify, (e.g. satisfaction).

Nevertheless, having in mind that the two most desired characteristics of performance measures are (i) completeness, (i.e. the measure captures the ‘whole truth’ about performance) and (ii) controllability (the measure is only influenced by elements under the unit’s control) (Heneman, Ledford & Gresham, 2000), it can be clearly deduced that non-financial performance measures present many difficulties. The difficulty and the subjectivity inherent in measuring non-financial performance, along with the necessity to focus all efforts on the ultimate goal, which is to satisfy shareholders, have made some researchers suggest that performance measures should be purely financial (Kurtzman, 1997; Newman, 1998).

Many researchers in the field of IS evaluation used financial measures (e.g. Ballantine & Stray, 1999; Milis & Mercken, 2004) such as payback period (PP) and Accounting Rate of Return/Return on Investment (ROI). Techniques such as Internal rate of return (IRR) and Net Present Value (NPV)—have been used to a lesser extent.

However, traditional financial performance measures have been widely criticised (Brown & Laverick, 1994; Banker, Potter, & Srinivasan, 2000; Bourne, Mills, Wilcox, Neely & Platts, 2000) for: focusing mainly on past transactions (Kaplan & Norton, 1992), being centred on short-term improvement (Banks & Wheelwright, 1979; Hayes & Garvin, 1982), not being in alignment with strategic / long term goals (Skinner, 1971; Kaplan, 1983; Kaplan & Norton, 1996b; Johnson & Kaplan, 1987; Eccles, 1991; Gregory, 1993; Ittner & Larker, 2003) concentrating on local/internal optimisation (Eccles, 1991), not focusing on the external environment (Kaplan & Norton, 1992), arriving too late for any action (Johnson & Kaplan, 1987), not aligning staff decisions and actions (Parker, 1979; Banker et al., 2000) and being too aggregated (Johnson & Kaplan, 1987). In addition, according to Dearden (1969) financial measures can be manipulated in order to achieve better short-term performance in the expense of the long-term goals. The research in IS evaluation has many publications (Chokhani, 1992; Davis et al., 1992; Belcher & Watson, 1993). The above mentioned criticism interwined with the socio-technical systems approach (discussed earlier in chapter 1) promoted research on the use of non-financial measures (Ryan & Harrison, 2000).

The benefits reaped from IS implementation vary in the literature as it has been difficult to evaluate investments in IT/IS from both a conceptual and functional perspective (Gunasekaran et al., 2001). This being the case, some authors focused on the importance of tangibles (Clemons, 1991; Willcocks, 1992b; Sethi, Hwang & Pegels, 1993; Farbey, Targett & Land, 1994) whereas many others highlighted the importance of intangibles (e.g. Anandarajan & Wen, 1999).

2.5 The construct of organisational performance

Whether we refer to the narrow term of performance or to the broader domain of organisational effectiveness (see chapter 1) it is *"the ultimate dependent variable in organisational research*" (Cameron & Wheeten, 1983, p.200). Even when examining the narrower domain, i.e. organisational performance, we are not thinking of one-dimensional theoretical construct (Richard, Devinney, Yip & Johnson, 2009) but of a multidimensional construct (Venkatraman & Ramanujam, 1986).

These dimensions are:

- *The Stakeholders*, which implies that all potential stakeholders have a stake stemming from the activities of the firm (Freeman, 1984). These stakeholders use various different measures to evaluate performance according to their personal claims to organsational rents (Hillman & Keim, 2001; Fitzgerald & Storbeck, 2003), which affects the acceptability of the measures (Mitchell, Agle & Wood, 1997; Blattberg, 2000).
- *Heterogeneity*, which means that since organisations are not the same in many ways, the way they measure performance, differs. Size is key factor of heterogeneity: For example larger organisations use both financial and nonfinancial performance measures (Malina & Selto, 2004) whereas smaller companies focus on non-financial measures (Laitinen & Chong, 2006). Different in size companies are also likely different in the way they deploy their resources (Barney, 1991). Another factor of heterogeneity is the industry and environment in which companies operate and for this reason this factor frames strategies and performance indicators (Hawawini, Subramanian, & Verdin, 2003; 2005).
- *The Timeframe* is the last but perhaps the most important source of multidimensionality as performance outcomes can be attributed to lack or random events (Denrell, 2004; Powell, 2003).

Lewin and Minton (1986) have proposed that: "the research on organisational effectiveness can be captured by a number of questions:

> "What is effectiveness? What are its indicators? What are its predictors? Can it be specified or measured? Can it be related to particular perspectives, environments, behaviours or structures? Is it a constant or an idea? Can it be sought, gained enhanced or lost? Why is one effective at one time and not at another, or why is one effective and another not*?"*

Lewin and Minton (1986, p.515)

In the same direction and in an attempt to address these concerns, Cameron (1986) suggested that researchers should be clear about what they measure or not in terms of effectiveness, and he proposed seven guidelines which can help to "limit the scope of the assessment and provide boundaries to the definition". These guidelines were:

- "From whose perspective is effectiveness being judged"?
- "On what domains of activity is the judgement focused"?
- "What level of analysis is used"?
- "What is the purpose of the assessment"?
- "What time frame is employed"?
- "What types of data are sought"?
- "What is the referent against which effectiveness is judged"?

Cameron (1986, p.93)

2.5.1 Measuring organisational performance

Researchers have defined performance measurement from various perspectives. Neely, Gregory and Platts (1995, p.80) define it as the "*Process of quantifying the efficiency and effectiveness of action ... where effectiveness refers to the extent to which customer requirements are met, while efficiency is a measure of how economically the firm's resources are utilised when providing a given level of customer satisfaction".* Cook, Vansant, Stewart, and Adrian, (1995) explained that measurement is "*the process of evaluating performance in terms of the explicit short-medium-, and long-term objectives achieved and reporting the results to management".* Rose (1995) added that the "process of evaluating performance is relative to a defined goal" which means that "*performance measurement is not just a means of observing the past data but also a tool for leading the company into a better future*" (Chan, Chan & Qi, 2006).

Summarising the above, in the business context, performance measurement refers to the "*process of quantifying the efficiency and effectiveness of certain business actions"* (Neely et al., 1995), which are considered to contribute to the achievement of business goals. In this regard, performance measurement is conducted through different performance measures and constitutes the enabler for firms to plan, track/monitor the implementation of their plans so that they can determine whether any corrective actions are necessary (Simons, 1995; Atkinson, Waterhouse & Wells, 1997b).

Thus, with the use of performance measurement, companies can identify problems in the processes (e.g. bottlenecks or any non-value adding activities), in their action plans (e.g. penetration in a new market segment) and in their strategy (Simons, 1995) and they can perform corrective actions (Parker, 2000). Moreover, performance measurement can be helpful in understanding '*how the business works'* (Argyris, 1977) and consequently enhances decision making both at the top management and at the operating level. Finally, performance measurement can be used to '*motivate employees, increase accountability and reward certain behaviours and results*' (Neely et al., 1996).

2.5.2 Objective measures

The most frequent objective measures used for measuring organisational performance are accounting and/or financial. Some indicative accounting measures are described in Table 2.3.

Table 2.3 Accounting measures

Source: Richard et al., 2009

Earnings before interest and taxes (EBIT).	This is the firm's profit, which is defined as revenues minus costs of goods sold and administrative and selling costs associated with the firm's operations
Net operating profits	This is equal to the firm's revenue minus the cost of goods sold and selling, general and administrative expenses. Taxes and interest are removed to reach this net figure.
Profit margin	This is the ratio of net operating profit to sales.
Return on assets (ROA)	This is a very popular accounting measure of performance. It is defined as the ratio of net operating profit to the firm's start-of-year assets recorded on its balance sheet

These measures are frequent as they are easy to find (Danielson & Press, 2003) but have received much criticism regarding their reliability because they use historic data (Keats, 1988) and can be wrong in revealing expectations about future performance as in the case of Enron (Richard et al.,2009). In addition, their applicability in non-Western operations is limited because of different regulatory and institutional environments (Jusoh & Parnell, 2008).

The financial measures are used for instruments that measure organisational performance because they incorporate some intangible assets (Lev, 2001) and they concern more stakeholders (see Table 2.4). Financial measures are based on the economic state of a company and incorporate traditional measures such as costs, revenues, profits, financial margins, cash flow and other more recent measures such as Economic Value Added (EVA), Cash Flow Return on Investment (CFROI), etc. A major limitation of the use of financial data in management research is that these measures cannot provide specific information regarding operations (Ittner & Larker, 2002) and different business units (Jacobson, 1987).

The next paragraph discusses the use of financial versus non-financial data.

Table 2.4: Indicative Financial measures

Source: Richard et al., 2009

Beta coefficient The b-coefficient from the capital asset pricing model (CAPM)	The level of systematic risk associated with the individual firm relative to the market portfolio
Earnings-per-share (EPS)	It is equal to net operating profit minus dividends paid to preference shares divided by the number of common stocks issued..
Price-to-earnings ratio (P/E ratio)	Price-to-earnings ratio (P/E ratio)
Total shareholder return (TSR)	TSR is the sum of the change in stock price during the year plus any dividends paid out, expressed as a percentage of the opening value of the stock performance.

2.5.3 Financial vs Non-financial performance measures

Financial measures first became popular during the industrial-age competition (19th and most of the 20th century) in a time where the economy depended mainly on tangible assets (Chandler, 1990). In 1978, the average U.S. Company had a book-value-to market-value-ratio of 95% (Brewer, 2002), thus financial measures could evaluate the company and the investment it had made.

During the second half of the 20th century intangible assets showed up and begun dominating the source of competitive advantage (Nanni, Miller & Vollmann, 1988; Rappaport, 1999). By the end of the 20th century, the book-value-to market-value-ratio had plummeted to 20%, thus the value of tangible assets represented only a small part of market values (Brewer, 2002). Companies were obliged to turn to non-financial measures in an effort to quantify the organisational performance related to: customers (e.g. customer satisfaction-retention-acquisition), employees (e.g. employee satisfaction), innovation, quality, culture, etc. (Argyropoulou et al., 2010, p.701). According to the authors, these measures were further broken down into (i) easily quantifiable hard measures (e.g. customer acquisition, number of complaints, etc.) and soft measures which present difficulty in quantifying, such as satisfaction.

Nonetheless, as discussed in previous sections, having in mind that completeness, (i.e. the measure captures the ‘whole truth’ about performance) and controllability (meaning that the measure is only influenced by elements under the unit’s control) are the two most desired characteristics of performance measures (Heneman, Ledford &

Gresham, 2000), it can be clearly concluded that non-financial performance measures present a series of difficulties.

Realising the value of both financial and nor-financial performance, many authors supported the view of complementarily, whereby financial performance needs to be complemented by non-financial performance so that valuable conclusions can be derived for the company and the employees (Amir & Lev, 1996). Additionally, it has been suggested and demonstrated that the use of multiple performance measures and the importance placed upon is higher in companies having increased competition.

2.5.4 Subjective Measures of Organisational Performance

Subjective measures evaluate the opinion regarding organisational performance. These can be further divided into fully subjective and *quasi-objective* i.e. those that replicate objective measures (Richard et al., 2009). *Quasi-objective measures* seek for the opinion of key informants on objective measures, e.g. asking a CEO to estimate the market share of the firm.

Fully subjective measures became very popular after increased interest in the triple bottom line of *economic*, *social*, and *environmental performance* and the adoption of a balance approach (Kaplan & Norton, 1996a). In addition, these measures allow researchers to assess the underlying performance construct in a flexible manner as they are not anchored to any definite object, and are inherently relative (March & Sutton, 1997).

The above mentioned analysis regarding the dimensionality and the use of multiple performance measures revealed that there can be many different approaches and frameworks each one having specific advantages and disadvantages. The following paragraph reviews some of the most important frameworks found in the organisational performance literature.

2.5.4.1 Performance Measurement (Models) Frameworks

Significant efforts have been expended in developing different frameworks for performance measurement. According to De Toni and Tonchia (2001, pp. 50-51) the main performance measurement models can be split into five typologies:

(a) *Internal and External* models which measure internal and external performance. Internal performance models seek to measure quality processes, etc, whereas external performance relates to the "*performance perceived by customers, shareholders*";

(b) *Value chain* measures explore the internal relationship of customer/supplier;

(c) *Strictly hierarchical (or strictly vertical*) models contain cost and non-cost performance measures for different levels of aggregation, until they ultimately become economic-financial

(d) "*Frustrum"* models transfrom low-level measures into more aggregated indicators

(e) *Balanced* models like balanced scorecard or the tableau de bord, where several separate performances are considered independently.

Various performance measurement frameworks are proposed in the literature and the most widely used include:

The performance Pyramid or the Strategic Measurement and Reporting Technique

McNair, Kynch and Cross (1990) presented a model which they called the performance pyramid, also known as the Strategic Measurement and Reporting Technique (SMART) (Lynch & Cross, 1991). It is a customer oriented model, based on the principles of Total Quality Management (TQM), linked to company strategy, which accounts for financial and non-financial performance (Olve, Roy & Wetter, 1999) aiming at aiding in translating financial measures into non-financial ones. The Performance Pyramid categorises performance in four different interlinked levels. Level 1 represents the corporate vision, level 2 encompasses the market and financial performance. Level 3 examines customer satisfaction, flexibility and productivity and level 4 is concerned with operations. The Performance Pyramid stresses that goals must be mutually consistent, strategy and operational goals are to be formulated by top management and the development and communication of non-financial measures should be performed by lower levels in the company (Kald & Nilson, 2000).

The Performance Measurement Matrix

Keegan, Eiler and Joemes (1989) have proposed a performance measurement framework, which they call the performance measurement matrix. This model accounts for the different dimensions of performance and distinguishes between '*internal', 'external'*, '*financial'* and '*non-financial'* performance measures (Neely, Gregory & Platts, 1995; Bourne et al., 2000). Whilst the performance measurement matrix is based on valid principals it is not .used since it does not account for the cause and effect links between different dimensions of business performance (Neely, Bourne & Kennerley, 2000).

The results and determinants matrix

The results and determinants framework categorises the performance measures in lead (determinants) and lag (results) (Fitzgerald, Johnston, Brignal, Silvestr & Voss, 1991). The results incorporate measures of financial performance and competitiveness, while the determinants have to do with measurers of quality, flexibility, resource utilisation, and innovation. This way, Fitzgerald et al. (1991) make the distinction that there are certain determinants that influence future business performance (Neely, Bourne & Kennerley, 2000)

The macro process model

The macro process model (Brown, 1996) is a process-focused framework, aimed at controlling repeat business. In order to achieve this, this framework distinguishes between the inputs, the processes, the outputs and the outcomes. The inputs involve the requirements of the customers, the raw materials, the capital and the employees, the processes include the design of the products/services and the financial results, and the outcomes involve meeting customer needs and delighting the customers.

The Business Excellence Model

The Business Excellence Model is a measurement framework from the European Foundation of Quality Management (1993) (similar to the Malcolm Baldridge Quality award). This model is characterised as a self-assessment model (Pun & White, 2005) which distinguishes two different sets of performance excellence: the enablers and the results. The enablers are leadership, people, policy & strategy, partnerships & resources and processes, and the results involve the people, customer, society and the key performance results. One of the weaknesses of this framework is that it is difficult to operationalise (Neely, Bourne & Kennerley, 2000) since it is difficult to establish the particular measures that one should measure.

The performance Prism

The performance Prism (Neely & Adams, 2001) addresses the organisation's relationship with its key stakeholders and links this to the strategy, the processes, and the capabilities. It is a three dimensional framework, with five perspectives: stakeholder satisfaction, stakeholder contribution, strategy, processes and capabilities (Neely & Adams, 2001).

The 'Tableau de bord'

The Tableau de bord (literally meaning 'dashboard' or 'instrument panel') emerged in France well before the Balanced Scorecard (BSC) as a solution to engineers' need for information related to the production and the management of the business (Lebas, 1994). It was focused on monitoring three levels of management (strategy, management, operations) and was based on the same principles as the BSC, namely the translation of the mission and vision of a company into objectives, which are then translated into Key Performance Measures. Thus, when the BSC emerged, it received global recognition and use by enterprises worldwide, with the exception of France.

2.5.4.2 Conclusion on the organisational performance measures

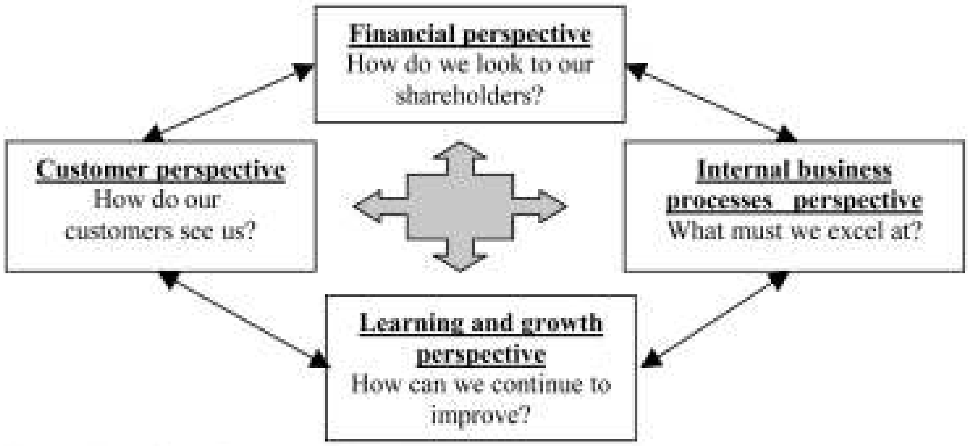
There are many performance measurement frameworks. Apart from the aforementioned models, other researchers have proposed more specific measurement models and developed approaches, procedures and guidelines for developing and designing effective performance measurement systems (Doumeingsts, Clave and Ducq, 1995; Krause, 1999). Little agreement exists between researchers on an accepted definition of performance or on the "*appropriate structural form of the relationships between measures*" (Richard et al., 2009). Perhaps the most widely accepted and most frequently cited framework is the Balanced Scorecard (BSC) (Marr & Schiuma, 2003). This framework was awarded a prize in 1997 by the American Accounting Association and has been adopted worldwide (Rigby, 2001). The framework is discussed in detail as it has been partly adopted for the operationalisation of organisational performance construct in this thesis.

The balanced Scorecard (BSC)

The BSC can be described as a management tool that claims to incorporate all quantitative and abstract measures of true importance to the enterprise (Kaplan & Norton 1996b). According to Kaplan and Norton (1996a) "*The Balanced Scorecard provides managers with the instrumentation they need to navigate to future competitive success*". They continue that "*...it addresses a serious deficiency in traditional* *management systems: their inability to link a company's long-term strategy with short-term action*". The authors also opine that the BSC provides two basic enhancement and improvements compared with the traditional frameworks. The BSC incorporates four areas stemming from the strategy and evaluate the competitive position of all firms (see fig 2.3). According to Kaplan and Norton, (1992; 2004a; 2004b) these are:

- The financial perspective: It represents the long-term financial objectives for growth and productivity and embodies the tactile outcomes of the strategy in traditional financial terms (EVA, profit margins etc); this perspective appeals mostly to shareholders (Kaplan & Norton, 2004a).
- The customer perspective: It defines the value proposition that will be applied for the satisfaction of customers and is representative of the way in which intangible assets create value (Kaplan & Norton, 2004a). Thus, the selected measures should measure the value that is derived for the customer (time, quality, cost) and the resulting outcomes as well (customer satisfaction, retention, market share) (Kaplan & Norton, 1992).
- The internal business process perspective: It is concerned with the processes required to provide the value expected by the customers and the relevant measures are defects, new products, time-to market, etc. (Kaplan & Norton 2004b).
- The learning & growth perspective: It focuses on the intangible assets and mainly on the internal skills and capabilities required to support the internal processes (Kaplan & Norton 2004a). It refers to the training, skills, and cultural attitudes of the company employees and the relevant measures are employee retention, training efficiency, etc.

It is obvious that every single of these four perspectives must be in accordance with the business strategy of the entire organisation (Papalexandris, Ioannou & Prastacos, 2004). The authors claim that "by maintaining equilibrium between all perspectives and through monitoring metrics, management is able to control the strategy implementation process, not only to realise short-term financial outcomes, but also to develop long-term competitive capabilities" (Papalexandris, Ioannou & Prastacos, 2004). The equilibrium in these four different areas/perspectives can be managed by measuring the internal (learning and growth) and the external (financial and customer) perspectives as well as the short term (revenue) and long term (customer satisfaction) objectives and the tangible (financial) as well as intangible (employee morale) objectives (Kaplan & Norton, 1996a, p. 150). These multiple objectives are, in turn, broken down into a system of measures that can translate strategy and can facilitate its communication to all stakeholders (Kaplan & Norton, 1992). Since the initial introduction of the BSC in 1992 as a performance measurement framework, there have been plenty of studies that promoted its role as a strategic management tool (Muralidharan, 1997) and as a communication tool (Niven, 2002). It has also received a lot of criticism, which is discussed in the following paragraph.



Source: Kaplan and Norton (1996a)

Figure 2.3 The Balance scorecard

Criticism of the BSC

Some academics and researchers have found disadvantages concerning the implementation of the BSC (e.g. Argyropoulou et al., 2010): It is rather simplistic an approach and the limited number of performance measures cannot provide a holistic representation of all stakeholders' needs (Hoque & James, 2000). According to Kanji & Sa, (2002) some measures are overlooked. Examples include suppliers, partners, and competitors. The selected measures are chosen so that they can be aligned with the strategy of a company at any given time; hence, frequent validation of the measures used is a necessity (Papalexandris, Ioannou & Prastacos, 2004). Jensen (2001) points out that it will be difficult to assess overall performance based on multiple criteria unless all measures improve simultaneously, but this is rarely the case. In an attempt to improve performance on so many different business operations, trade-offs cannot be easily decided (Papalexandris, Ioannou & Prastacos, 2004; Argyropoulou et al, 2010).

Nonetheless, there are many supporters of the BSC model due to its salient benefits: It can foster better performance measurement and enhance decision-making (Lipe & Salterio, 2002) by linking financial and non-financial measures in a single document (Kanji & Sa, 2002). It provides better performance management (Epstein & Mnzoni, 1998) by helping set targets in alignment with the company's strategy (Braam & Nijssen, 2004). Finally, it is a concept that is easily understood and used (Ahn, 2001) which means that it can be communicated to all departments (Niven, 2002; Argyropoulou et al., 2010)

Many researchers propose the use of additional perspectives to incorporate more information on the human resource area (Maisel, 1992), on the environment in which a company operates (Olve et al., 2003) or on its stakeholders (Bontis et al, 1999). Nonetheless, behind the adoption of a balanced approach there is the establishment of a model that combines accounting, financial market, and other measures of performance, between objective and subjective measures of performance, and between performance measures and measures of organisational effectiveness.

The BSC has been widely adopted in research for the above mentioned reasons whereas other studies (e.g. Bryant, Jones & Widener, 2004) found that "*measures within a balanced scorecard are strongly interrelated, with learning having direct and indirect effects on process and customer outcomes, which in turn predict financial performance*".

2.6. The construct of IS effectiveness in the literature

Before analysing the IS effectiveness as our independent construct, it was considered necessary to provide a brief discussion on the concepts of success and effectiveness and how these were defined in the pertinent literature. The attempt to evaluate the implementation of Information Systems started in 1949 (e.g. Shannon & Weaver, 1949) *"when researchers were still trying to understand when one considers that 'information' as the output of an information system or the message in a communication system which could be measured at a technical, semantic level, and effectiveness level"* (DeLone and McLean, 1992, p 61). Following the advances on IT, several rather older studies used the term effectiveness in an attempt to explore the impact of IS on organisations (Hamilton and Chervany, 1981; Thong and Yap, 1996).

There are two main views that attempt to define system effectiveness and suggest ways that it can be measured: *the goal-centered view* and the *systems-resource view* (Campbell, 1977; Molnar & Rogers, 1976). The goal-centred view evaluates system effectiveness in terms of the achievement of pre-determined objectives (Molnar & Rogers, 1976). On the other hand, the system-resource view conceptualises system effectiveness in terms of resource viability rather than in terms of specific task objectives. For example, considering technological resources, system effectiveness can be evaluated by the quality of the system or service levels (Hamilton & Chervany, 1981). For some researchers, the evaluation should consider both views (Chang & King, 2005; Hamilton & Chervany, 1981).

It was in 1992 when DeLone and McLean (1992) identified more than 100 criteria/ measures that had been used in some 180 studies at the time. The authors presented the interrelationships between six IS implementation variables that could be used as 'success measures'. Ever since the appearance of these measures, most authors used the term success for the evaluation of information systems (DeLone and McLean 1992; 2003, Gable, Sedera and Chan, 2008; Markus and Tanis, 2000; DeLone and McLean; 2008). The model and the six implementation variables are discussed extensively in the following sections. In this section it is used to provide an explanation on the term IS success which gradually became a synonym of IS effectiveness (Peter, DeLone and McLean, 2012) as most recent researchers used the DeLone and McLean model as their theoretical background for IS evaluation (Chang and King, 2005; Gable, Sedera, and Chan, 2008; Wang and Liao 2008).

For the purposes of this research we used the term effectiveness of IS as our research objective is in alignment with the broad IS effectiveness definition i.e. "the extent to which an information system actually contributes to achieving organisational goals" (Grover, Jeonga and Segars, 1996; Hamilton and Chervany, 1981). The following paragraphs discuss in detail the construct of IS effectiveness and the frameworks that were used to capture it.

2.6.1 IS effectiveness frameworks

As discussed in Chapter 1, the main approaches addressing the IS evaluation were dealing with: Return on Investment (ROI), (Brealey & Myers, 1991), the impact of IS on economic performance (King & Rodriguez, 1978), cost-and-benefit analysis (King & Schrems, 1978) or information economics (Maish, 1979; Parker et al., 1988). While still keeping the economic objectives in mind, many researchers got influenced by the Resource based View (RBV) or the balanced approach and they shifted to other measures focusing either on system usage or user perceived effectiveness.

The origin of these approaches is found in the Ein-Dor and Segev (1978) research and received a lot of criticism in favor and against. For example Ginzberg (1978) disapproved of system usage approach but supported the user perceived effectiveness approach; Ives, Olson and Baroudi (1983), on the other hand, opined that both approaches (system usage and user perceived effectiveness) should be present when evaluating IS effectiveness. Whilst the system usage was easy to measure especially with objective metrics, it was the user perceived effectiveness of the system that attracted the research interest and a number of approaches appeared in the field. The literature review on this specific topic revealed that Jenkins and Ricketts (1979) framework was the best at the time as it actually measured user satisfaction with the system and it comprised five key underlying dimensions (see Table 2.5).

The Jenkins and Ricketts (1979) construct of perceived effectiveness motivated some new studies (e.g. Srinivasan, 1985; Davis, 1989; 1993; DeLone & McLean 1992) which tried to measure the impact of IS implementation. The two most widely used frameworks are discussed in the subsequent paragraphs.

Table 2.5 Dimensions of Perceived Effectiveness-

Source: Jenkins and Ricketts, 1979

Report Content	**Report Form**	**Problem Solving**	**Input Procedures**	**Systems stability**
Accuracy of report contents	Quality of format	Usefulness for identifying and defining problems	Ease of understanding input procedures	Response time
Relevance of report contents	Timeliness of report	Usefulness for selecting among alternatives	Comprehensiveness of documentation	Error proneness
Adequacy of report contents	Mode of presentation	Power of the modelling language employed	Interfacing languages	Reliability of the system
Understandability of report contents	Sequencing of information	Flexibility of the modelling language involved	Editor characteristics	Accessibility /availability of the system

2.6.2 The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was developed by Davis (1989; 1993) and Davis et al., (1989) who used the Theory of Reasoned Action (fig 2.4) (Fishbein & Ajzen, 1975) to explain why some IS are more readily accepted by users than others.

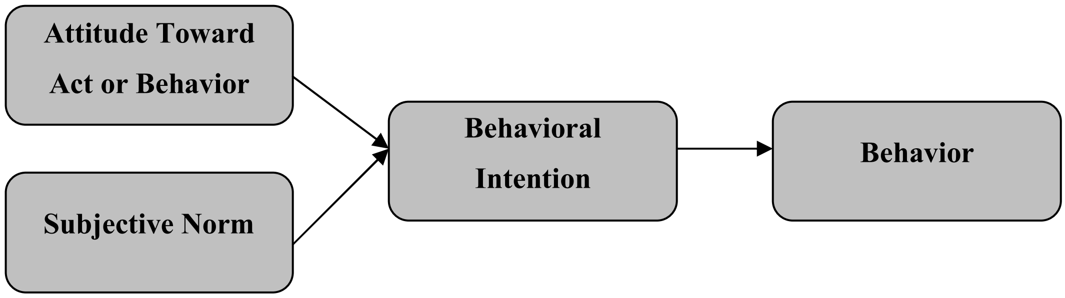


Figure 2.4 Theory of Reasoned Action
Source: Fishbein & Ajzen, 1975

According to a critical review of TAM (Legris, Ingham & Collerette, 2003), the researchers focused on computer user satisfaction to evaluate the system use and for this reason they used psychology to find the factors that can influence user satisfaction. They came up with the Technology Acceptance Model (TAM) (fig 2.5). The authors opined that the objective of the original model was to provide a basis for evaluating the impact of external variables on internal beliefs, attitudes, and intentions.

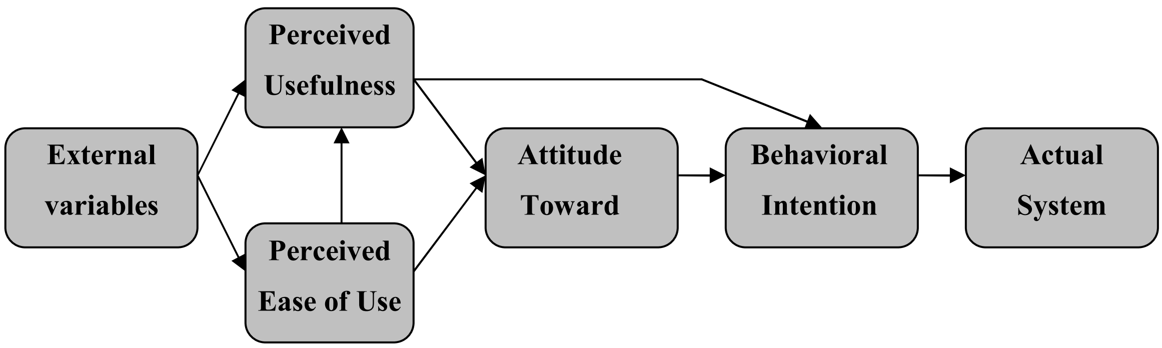


Figure 2.5 The Original Technology Acceptance Model
Davis (1989; 1993)

According to the model, the two most important factors in explaining system use are the perceived ease of use and perceived usefulness. Some years later, a detailed literature review conducted by Legris, Ingham and Collerette (2003) revealed how the items measuring the perceived ease of use and the perceived usefulness had been used by other studies and they concluded with two tables that summarize the results in which the items show to have the greatest internal consistency. Tables 2.6, 2.7, 2.8 and 2.9

depict these results. The other constructs of TAM are not discussed as they do not relate to the research objectives of the thesis

2.6.2.1 Research based on TAM

A review from Legris, Ingham and Collerette (2003) revealed that the TAM model had been used by many researchers and provided a useful theoretical framework for researchers seeking to measure and or explain user behavior in companies adopting IS. Tables 2.4-2.7 present in detail the TAM variables that have been used in research studies. The model itself was tested and justified by other authors (e.g. Roberts & Henderson, 2000; Straub, Keil & Brenner, 1997). Other researches, however, extended the original model as they found other variables that enhanced its predictive ability. Some indicative extensions include: self-efficacy (Chen, 2010; Moran et al., 2010; Terzis & Economides, 2011), perceived enjoyment (Teo & Noyes, 2011), facilitating conditions (Terzis & Economides, 2011) and self-efficacy (Venkatesh and Morris, 2000). Other extensions include the TAM-TPB by Taylor and Todd (1995), the TAM2 form Venkatesh et al. (2003), the TRAM from Lin et al. (2007) and the Task-technology fit and Technology Acceptance Model from Chang (2008).

Following the advances in IT many authors used, tested or extended the original TAM as this was found the best model to explain user’s behaviour in a fast changing technological environment (Chen, Li and Li, 2011). For example Moon and Kin (2001) used TAM to measure users’ acceptance of World-Wide-Web. Stern et al. (2008) tested a revised Technology Acceptance Model for the explanation of consumers’ acceptance of online auctions.

Table 2.6 Measures of perceived usefulness (Legris, Ingham and Collerette 2003:198)

Measuring perceived usefulness	Davis, 1989;1993	Davis et al., 1989	Mathieson, 1991	Subramanian, 1994	Taylor and Todd, 1995	Keil et al. 1995	Szajna, 1996	Chau, 1996	Jackson et al., 1997	Igbaria et al., 1997
Using (application) improves the quality of the work I do	x					x				
Using (application) gives me greater control over my work	x									
Application enables me to accomplish tasks more quickly	x					x	x	X		
Application supports critical aspects of my job	x									
Using (application) increases my productivity	x	x	x	x		x	x	X	x	x
Using (application) increases my job performance	x	x	x		x	x	x	X	x	x
Using (application) allows me to accomplish more work than would otherwise be possible	x									
Using (application) enhances my effectiveness on the job	x	x	x	x					x	x
Using (application) makes it easier to do my job	x			x		x	x	X		
Overall, I find the (application) useful in my job	x	x	x		x	x	x	X	x	x

Table 2.7 Measures of perceived usefulness (Legris, Ingham and Collerette 2003:198)

Measuring perceived usefulness	Bajaj and Nidumolu, 1998	Gefen and Keil 1998	Agarwal and Prasad, 1997;1999	Lucas and Spitler, 1999	Karahanna et al. 1999	Hu et al. 1999	Dishaw and Strong, 1999	Venkatesh and Davis, 1996;2000	Venkatesh and Morris, 2000
Using (application) improves the quality of the work I do		x	x		x				
Using (application) gives me greater control over my work			x						
Application enables me to accomplish tasks more quickly		x	x		x	x	x		
Application supports critical aspects of my job									
Using (application) increases my productivity	x	x	x	x		x	x	X	x
Using (application) increases my job performance	x	x						X	x
Using (application) allows me to accomplish more work than would otherwise be possible									
Using (application) enhances my effectiveness on the job	x		x	x	x	x	x	X	x
Using (application) makes it easier to do my job			x	x	x	x	x	X	x
Overall, I find the (application) useful in my job	x	x	x	x				X	

Table 2.8 Measures of Perceived Ease of Use (Legris, Ingham and Collerette 2003:199)

Measures of Perceived Ease of Use	Davis, 1989;1993	Davis et al., 1989	Mathieson, 1991	Subramanian, 1994	Taylor and Todd, 1995	Keil et al. 1995	Szajna, 1996	Chau, 1996	Jackson et al., 1997	Igbaria et al., 1997
I find (application) cumbersome to use	X					x		X		
Learning to operate (application) is easy for me	X	x	x	x	x	x	x	X	x	
Interacting with the (application) is often frustrating	X					x				
I find it easy to get the (application) to do what I want to do	X	x	x	x	x	x	x		x	x
The (application) is rigid and inflexible to interact with	X						x	X		x
It is easy for me to remember how to perform tasks using the (application)	X									
Interacting with the (application) requires a lot of mental effort	X					x				
My interaction with the (application) is clear	X					x				
I find it takes a lot of effort to become skilful at using the (application)	X	x	x	x	x		x	X		
Overall, I find the (application) easy to use	X	x	x	x	x	x	x		x	x

Table 2.9 Measures of perceived ease of use (Legris, Ingham and Collerette 2003:199)

Measus of Perceived Ease of Use	Bajaj and Nidumolu, 1998	Gefen and Keil 1998	Agarwal and Prasad, 1997;1999	Lucas and Spitler, 1999	Karahanna et al. 1999	Hu et al. 1999	Dishaw and Strong, 1999	Venkatesh and Davis, 1996;2000	Venkatesh and Morris, 2000
I find (application) cumbersome to use		x							
Learning to operate (application) is easy for me					x				
Interacting with the (application) is often frustrating									
I find it easy to get the (application) to do what I want to do	X		x	x		x	x	X	x
The (application) is rigid and inflexible to interact with			x			x	x	X	
It is easy for me to remember how to perform tasks using the (application)			x			x			
Interacting with the (application) requires a lot of mental effort	X								
My interaction with the (application) is clear and understandable								X	x
I find it takes a lot of effort to become skilful at using the (application)									
Overall, I find the (application) easy to use	X	x	x	x	x	x	x	X	x

2.6.3 The DeLone and McLean Models

DeLone and McLean (1992) identified more than 100 measures that had been used in some 180 studies at the time. They found that attempts to measure IS success had started in 1949 (e.g. Shannon & Weaver, 1949) *"when researchers were still trying to understand when one considers that 'information' as the output of an information system or the message in a communication system which could be measured at a technical, semantic level, and effectiveness level"* (DeLone and McLean, 1992, p 61).

Using the Shannon and Weaver (1949) definitions, Mason (1978) improved their levels based on the communication theory under which the nature of information is serial. According to Mason (1978, p.227) the information system produces information that is, afterwards, communicated to the recipient who is subsequently influenced (or not!) by the information (see Table 2.1). Using the two most important theories by then and the numerous studies dealing with each level or stage of the information transfer DeLone and McLean (1992) concluded that this huge research can be gathered in six distinct categories or aspects of information systems: (1) system quality, (2) information quality, (3) IS use, (4) user satisfaction, (5) individual impact, and (6) organisational impact (see Table 2.10). The authors did not provide empirical validation of the model; they concluded their study mentioning the need for empirical testing and validation of their taxonomy (DeLone & McLean, 1992). Nonetheless, the model had been widely adopted by researchers in the IS discipline during the following years, received a lot of criticism and provided the background for almost all studies that aimed at IS evaluation. For this reason the original taxonomy is briefly discussed in the next paragraphs.

Table 2.10 Categories of I/S Success**.**

Source: DeLone and Mclean (1992)

Shannon & Weaver, 1949	***Technical level***	***Semantic level***	***Effectiveness /Influence level***			
Mason, 1978	***Production***	***Product***	***Receipt***		***Influence on receipt***	***Influence on system***
Categories of IS success	System quality	Information quality	Use	User satisfaction	Individual impact	Organisation impact

The original DeLone and McLean (1992) model (see Fig. 2.6) presented the interrelationships between six IS success variables. These categories contained the most frequently used measures that had been identified by the year 1992 and provided the theoretical background for the subsequent streams of research.

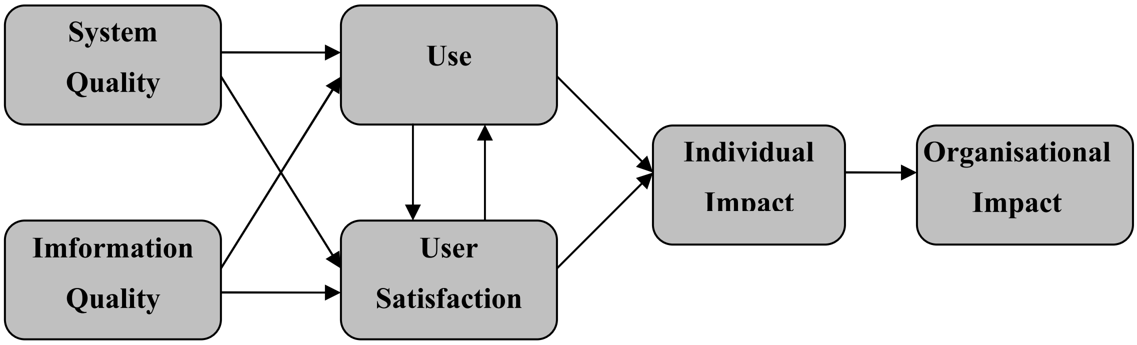


Figure 2.6 The DeLone and McLean Model (1992)

The concept of system quality

This concept is basically dealing with the processing system itself (DeLone & McLean, 1992) or the system's performance. There have been many studies dealing with different measures of system's quality. Kriebel (1979) and Raviv (1980) tested a productivity model for computer systems measuring utilisation and investment utilisation which had been previously adopted by Alloway's (1980) system success criteria. Some other researchers focused on other technical issues such as the reliability of the computer system, the response time and the ease of use (Swanson, 1974; Belardo, Kanvan & Wallace, 1982; Srinivasan, 1985). Emery (1971) also suggested measuring system characteristics, such as the content of the database, response time, and system accuracy, which were further tested by Hamilton and Chervany (1981) who added system flexibility and ease of use among others as part of a "*formative evaluation*" scheme that can possibly evaluate the system quality.

The concept of information quality

Many researchers focused on measuring the quality of the basic system output, mainly the reports. In an early study Gallagher's (1974) instrument included measures of relevance, informativeness, usefulness, and importance which were later used by Munro and Davis (1977), who used Gallagher's instrument to measure a decision maker's perceived value of information. Swanson (1974) contributed with additional information characteristics such as uniqueness, conciseness, clarity, and readability, whereas Olson and Ives (1982) added appearance and accuracy as measures of information quality. In another study, Ahituv (1980) found five more information characteristics: timeliness, accuracy, relevance, aggregation and formatting, whereas King and Epstein (1983) proposed sufficiency, understandability, freedom from bias, reliability, comparability, decision relevance and quantitativeness

Exploring through a different perception, Larcker and Lessig (1980) formulated six questionnaire items for measuring the perceived importance and usability of information. Bailey and Pearson (1983) proposed many previously used variables for measuring user satisfaction such as output timeliness, accuracy, reliability, completeness, relevance, precision and currency. This triggered a number of studies which focused on the broad area of "User Information Satisfaction" (e.g. Kettinger and Lee, 1994) which is discussed later in the chapter.

The concept of information use

The use of information system reports is one of the oldest reported measures of the success of an information system (e.g. Lucas, 1973; Schultz & Slevin, 1975; Ein-Dor & Segev, 1978; Zmud, 1978). Many studies in the past focused on the difference between voluntary or discretionary users (Ein-Dor, Segev & Steinfeld, 1981; Hogue, 1987), or others (e.g. Maish, 1979; Kim & Lee, 1986) measured only voluntary use as measures of IS success.

Some objective measures of success became the number of computer inquiries (King & Rodriguez, 1978; 1981; Swanson, 1974), or the user time in the computer (Ginzberg, 1981; Snitkin & King, 1986; Trice & Treacy, 1986), the number of computer functions utilised (Ginzberg, 1981), the number of client records processed (Robey, 1979), or the actual charges for computer use (Gremillion, 1984), or even the impact of IS on functions such as production (Baroudi, Olson & Ives, 1986) or the impact of IS Cost reduction, Management, Strategy planning, Competitive thrust (Zmud, Boynton & Jacobs, 1987).

It was in 1970 when Huysmans (1970) questioned the issue of who is using the system and this triggered another kind of study (Culnan, 1983) which considered both direct use and chauffeured use (i.e. use through others). Finally other studies (e.g. Bean et al., 1975; King & Rodriguez, 1978; King & Rodriguez, 1981; Fuerst & Cheney, 1982; DeBrabander & Thiers, 1984) adopted the classification of general use and specific use in their study of decision support.

The concept - Measures of use

There were many studies that tried to empirically test measures of IS use which comprised many different items such as intention to use and frequency of use, which brought out the issue of heavy users who tend to underestimate use, and light users tended to overestimate use. Finally others explained that this construct should be seen from a multilevel perspective across the individual and organisational levels to allow for a comprehensive measurement and grasp of the construct (Burton-Jones & Gallivan, 2007). A detailed list is depicted in Table 2.11.

Table 2.11 Information use measures

Source: DeLone and McLean, 1992; Petter et al., 2008

Information use measures	Literature
Use or nonuse of computer aids	Alavi & Henderson, 1981; DeBrabander & Thiers, 1984;
Use of I/S to support production	Baroudi, Olson, & Ives, 1986
Use of I/S to support production, Cost reduction, Management, Strategy planning, Competitive thrust	Zmud, Boynton & Jacobs, 1987
Percentage of time DSS is used in decision making	Barti & Huff ,1985
Use of numerical vs. nonnumeric info	Bell, 1984
Frequency of requests for specific reports	Benbasat, Dexter, & Masulis, 1981
Number of computer inquiries	King & Rodriguez, 1978; 1981; Swanson, 1974.
Use of chargeback information	Bergeron, 1986
Acceptance of report	Chandrasekaran & Kirs, 1986.
Direct use of I/S vs. chaufieured use	Culnan, 1983.
Frequency of use	Culnan, 1983; Ein-Dor, Segev & Steinfeld, 1981; Fuerst & Cheney, 1982; Raymond, 1985.
Frequency of intended use	Ein-Dor, Segev & Steinfeld, 198l; Hogue, 1987.
Motivation to use	DeSanctis, 1986.
Expenditures/charges for use	Gremillion, 1984.
Time of use	Ginzberg, 1981;.
The number of client records processed	Robey, 1979.
Managerial use	Maish, 1979; Fuerst & Cheney 1982; Raymond, 1985.

The concept- Measures of satisfaction

As discussed in the previous section, the concept of satisfaction with IS became one of the most important determinants of success and for this reason many researchers questioned whose satisfaction should be measured: i.e., the users' or managers' (DeSanctis, 1986) which is actually in accordance with Cameron and Whetton's (1983) guidelines on"*whose perspective is being assessed*".

Powers and Dickson (1973) asked the managers how well their information needs were being satisfied, whereas ten years later King and Epstein (1983) considered IS value based on managerial satisfaction ratings. Nonetheless, the majority of studies focused on user satisfaction (e.g. Bailey & Pearson, 1983; Doll et al., 1994; Nelson & Cheney, 1987; Raymond, 1985; Rushinek & Rushinek, 1985). User satisfaction or user information satisfaction became the most widely used determinant of IS success not only due to the logical explanation, but also because it constituted a comprehensive construct compared to other concepts that were too difficult to conceptually develop and test (Delone & McLean, 1992). The detailed list is depicted in Table 2.12.

Table 2.12 Satisfaction with IS measures.

Source: DeLone and McLean, 1992

Satisfaction with IS measures	Literature
Overall satisfaction with DSS	Alavi & Henderson, 1981; Bailey & Pearson, 1983; Cats-Baril and Huber, 1987; Ginzberg, 1981; Mahmood, 1987.
User satisfaction	Bailey & Pearson, 1983; Baroudi, Olson & Ives, 1986; Barti & Huff, 1985; Ives, Olson & Baroudi, 1983; Bruwer, 1984; Doll & Ahmed, 1985; Edmundson & Jeffery, 1984; Hogue, 1987; Jenkins, Naumann & Wetherbe, 1984; Langle, Leitheiser & Naumann, 1984; Nelson & Cheney, 1987; Raymond, 1987; Rushinek & Rushinek, 1985.
Top management satisfaction	DeSanctis, 1986.
Software satisfaction Hardware satisfaction	Lehman, Van Wetering & Vogel, 1986.
Satisfaction with the development project	McKeen, 1983.
Difference between information needed and amount of information received	Olson & Ives, 1981.
Decision-making satisfaction	Sanders & Courtney, 1985; Sanders, Courtney & Loy, 1984.

The impact of information on individuals

It was very early for this field of research when Emery (1971) opined that "*Information has no intrinsic value*"*… its value is related only with the influence it may have on physical events"* (Emery, 1971, p.1). This triggered research by Lucas and Nielsen (1980) who used learning, (in terms of performance improvement), as a dependent variable and the understanding of the inventory as a measure of IS success.

The impact on the individual received a lot of attention in the following years and the pertinent literature involved, at the time, examined measures such as user confidence (Aldag & Power, 1986; Goslar, Green & Hughes, 1986), quality of decisions (e.g. DeSanctis & Jarvenpaa 1985; Sanders & Courtney, 1985; Aldag & Power, 1986) time to complete tasks (DeBrabander & Thiers, l984; Benbasat & Dexter, 1985; 1986), improved personal productivity (Crawford, 1982) and personal effectiveness (Snitkin & King, 1986; Millman & Hanwick, 1987). The related measures are depicted in Table 2.13.

The impact of Information on Organisational Performance

There are several past and recent field studies that have explored the influence of information systems and used organisational performance measures for their dependent Variable (Chervany & Dickson, 1974; Chang & King, 2005; Bernroider, 2008). It was in 1971 that Emery stated that a specific benefit reaped from an information system is the "*reduction in operating costs of activities external to the information processing system*." (Emery, 1971, p.6). This motivated Chervany and Dickson (1974) who also chose cost reductions as their dependent variable. In another survey of large companies, Rivard and Huff (1984) asked managers to evaluate the cost reductions and company profits realised from specific user-developed application programs. Hamilton and Chervany (1981) found that company income could also be improved by computer-based information systems whereas Bender (1986) investigated the financial impact of information processing.

Table 2.13 Measures for "Impact on individual"

Source: DeLone and McLean, 1992

Impact on individual measures	**Literature**
User confidence	Aldag & Power, 1986; Goslar, Green & Hughes, 1986.
Quality of decision analysis	Aldag & Power, 1986; DeSanctis & Jarvenpaa, 1985; Dickson, DeSanctis & McBride, 1986; King & Rodriguez, 1978; Sanders & Courtney, 1985.
Efficient decisions	Belardo, Kanvan & Wallace, 1982; Zmud, Blocher & Moffie, 1983.
Time to arrive at a decision	Belardo, Kanvan & Wallace, 1982; Goslar, Green & Hughes, 1986; Green & Hughes, 1986; Hughes, 1987.
Time taken to complete a task	Benbasat & Dexter, 1985; 1986; DeBrabander & Thiers, 1984.
Quality of career plans	Cats-Baril & Huber, 1987.
Improved personal productivity	Crawford, 1982.
Computer awareness	Drury, 1982.
Change in decision behavior	Ein-Dor, Segev & Steinfeld, 1981.
Number of **altematives** considered	Goslar, Green & Hughes, 1986; Green & Hughes, 1986; Hughes, 1987.
Ability to identify solutions	Goslar, Green & Hughes, 1986.
Ability to identify strategic opportunities or problems	Goul, Shane & Tonge, 1986.
Precision of decision maker's forecast	Grudnitski, 1981; Kaspar, 1985.
Confidence in performance	Gueutal, Surprenant & Bubeck, 1984.
Worth of information system	King & Rodriguez, 1981.
Accuracy of information interpretation	Lee, MacLachlan & Wallace, 1986.
Time to solve problems	Lee, MacLachlan & Wallace, 1986; Luzi & Mackenzie, 1982.
Accuracy of problem solution	Luzi & Mackenzie, 1982.
Efficiency of effort	Luzi & Mackenzie, 1982.
Effectiveness in supporting decisions	Meador, Guyote & Keen, 1984.
Personal effectiveness	Millman & Hartwick, 1987; Snitkin & King, 1986.
User productivity	Rivard & Huff, 1984.
Problem identification	Srinivasan, 1985.
Change in commitment of time and money	Vogel, Lehman & Dickson, 1986.
Recall of information	Watson & Driver, 1983.
Recognition and use of modern software practices	Zmud, 1983.
Learning	Mock, 1971.

Having the financial performance in mind, many other studies explored IS effectiveness looking at its contribution to company profit (Benbasat & Dexter 1985; Hamilton & Chervany 1981), return on investment (Vasarhelyi, 1981), return on assets

(Cron & Sobol, 1983), stock price (Kaspar & Cerveny, 1985), overall cost reduction (Rivard & Huff, 1984) or profit per net assets (Yap & Walsham, 1986).

Following the trend for the use of non-financial measures Jenster (1987) incorporated several nonfinancial measures (e.g. productivity, innovation, product quality) to explore the impact on IS on these variables. Table 2.14 summarises the measures for the impact on organisation.

Table 2.14 Measures for Impact on Organization

Source: DeLone and McLean, (1992)

Impact on organization measures	**Literature**
Profitability	Benbasat & Dexter, 1985; Ein-Dor. Segev & Steinfeld, 1981.
Ratio of total general expense to total premium income	Bender, 1986.
Pretax return on assets Return on net worth, Pretax profits (% of sales) Average 5-year sales growth	Cron & Sobol, 1983.
Overall manager productivity (cost of information per employee)	Edelman, 1981.
Economic performance, Marketing achievements Productivity in production, Innovations, Product and management quality	Jenster, 1987.
Return on assets, Market share Stock price	Kaspar & Cerveny, 1985.
Internal rate of return Cost-benefit ratio	Lincoln, 1986.
Inventory ordering costs	Lucas, 1981.
Overall cost-effectiveness of I/S	Miller & Doyle, 1987.
I/S contribution to meeting goals	Perry, 1983.
Production scheduling costs	Remus, 1984.
Cost reductions	Rivard & Huff, 1984.
Net income relative to total operating expenses	Turner, 1982.
Return on investment of stock portfolio	Vasarhelyi, 1981.
Profits per net assets	Yap & Walsham, 1986.

2.6.4 Criticism on the original D&M model

The model was widely adopted by researchers in the IS discipline during the period 1993-2003 and received a lot of criticism. First of all, the framework had not been empirically tested; it was just a good taxonomy. Many researchers started testing elements from the six categories (e.g. Goodhue & Thompson, 1995; Hunton and Flowers 1997; Seddon & Kiew 1996). The most important contribution probably came from Seddon and Kiew (1996) who tested part of the DeLone and McLean model (system quality, information quality, use, and user satisfaction) by using a structural equation mode and replacing “use” with “usefulness” which was motivated by the idea of perceived usefulness from TAM by Davis (1989).

One year later, Seddon (1997) argued that the model was confusing as it was mixing process and causal explanations of IS success and for this reason he introduced a causal model for the six categories. The author also claimed that IS use is not a measure of success and replaced DeLone and McLean's IS “use” with “perceived usefulness” to capture a concept that serves as an antecedent of net benefits. Some years later Rai, Lang and Welker (2002) tested both models (i.e. DeLone and McLean, 1992; and Seddon, 1997) in a quasi-voluntary IS use context, and they claimed that both frameworks had shown reasonable fit with their collected data taken from 274 system users of an integrated student information system at a University.

Other researchers on the other hand accepted fully all six categories and suggested that service quality should be an integral construct in the D&M model. These researchers had been motivated by another framework from the marketing disciple the SERVQUAL (Parasuraman, Zeithaml & Berry, 1985; 1988). The SERVQUAL model had been used widely as a measuring instrument of service quality, and as an indicator of possible discrepancies between customer expectations and perceptions (Fig. 2.7) In their original study Parasuraman, Zeithaml and Berry (1985) found ten determinants of service quality: communication, access, competence, credibility, reliability, responsiveness, courtesy, security, understanding/knowing the customer and tangibles. Following many pilot studies and in-depth interviews they concluded with five dimensions to be used as general framework for measurement of quality service across all industries:

1. reliability (the ability to perform the promised service)
2. responsiveness (the ability and will to serve customers)
3. assurance (the ability to inspire trust and confidence)
4. empathy (the ability to care for the customer needs)
5. tangibles (e.g. the physical facilities, equipment and aesthetics)

Source: Parasuraman et al., (1985, 1988)

Considering service quality as a major construct Pitt et al. (1995) evaluated another instrument in which the service quality construct represented the quality of the services rendered by the IT department and their idea was followed by others contemporary researchers (e.g. Jiang, Klein & Carr, 2002). There were many other attempts to test or criticise the D&M model. For example, there was a stream of research arguing that the

IS implementation has an impact on various levels and not only on users or on organisation as there are many other stakeholders involved occasionally such as workgroups (Myers, Kappelman & Prybutok, 1998), customers (Brynjolfsson, 1996), and society (Seddon, 1997).

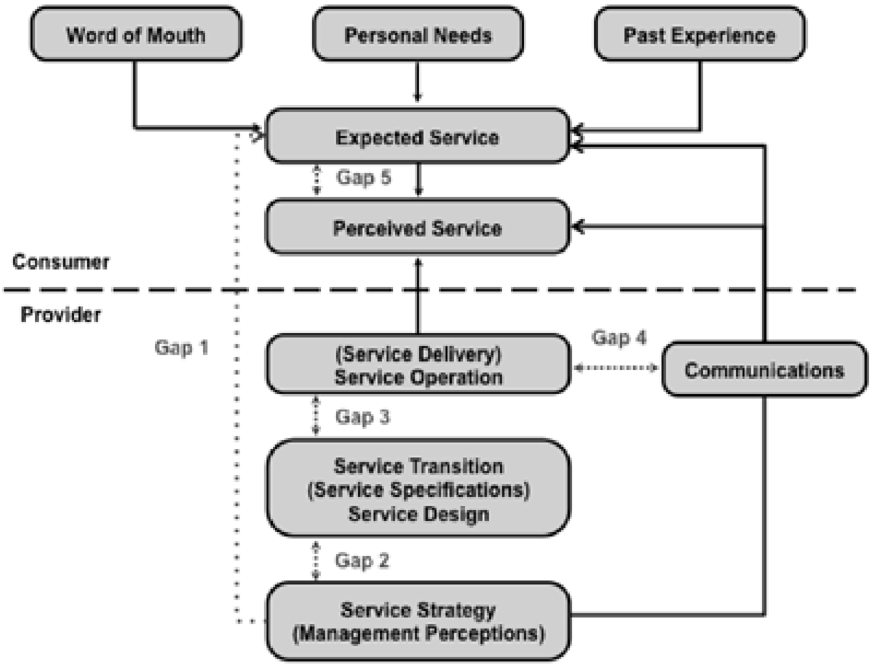


Figure 2.7 The SERVQUAL

Source: Parasuraman et al., (1985; 1988)

2.7 The new D&M model of IS success

The wide adoption of the original IS success model, the even wider criticism and the increased interest in the construct of IS effectiveness motivated DeLone and Mclean (2002; 2003) to extend the original framework addressing the main topics of the debates. The revised model (Fig. 2.8) comprised a new construct the 'service quality' and the 'net benefits' which captured the broader impact of IS. Finally, for the construct "use" the authors explained that it …"preceeded user satisfaction'' in a process sense. However, they went on to say that the positive experience with 'use' will lead to greater ''user satisfaction" 'in a causal sense' (DeLone & McLean, 2003).

This concept of System Quality covers technical aspects and includes measures such as data quality, flexibility, ease of use, functionality, reliability, and integration with other systems (DeLone & McLean, 2003).

Information quality refers to the quality of the reports that the system produces (DeLone & McLean, 1992; 2003), and relevant measures are accuracy, completeness, consistency, and currency.

Service quality refers to the quality of the services rendered by the IT support department and includes the following measures like responsiveness reliability, technical competence, and empathy of the IT people (DeLone & McLean, 1992; 2003; Pitt et al., 1995)

System use refers to the way the people capitalise on the capabilities of the system, i.e. frequency of use, purpose of use, level of use etc (DeLone & McLean, 1992; 2003).

User satisfaction covers all the measures relevant to the user's satisfaction with the system as presented in table 2.7 and discussed in the previous paragraph (DeLone & McLean, 1992; 2003)

The '*net benefits'* was the new term comprising the measures that contribute to the success of various groups involved when we talk about IS success: individuals, groups, organisations, and industries. These can be productivity, sales, cost reduction and any other suitable benefits for the different stakeholders (DeLone & McLean, 1992; 2003).

The next section is devoted to a detailed review of the pair relationships between the D&M model constructs.

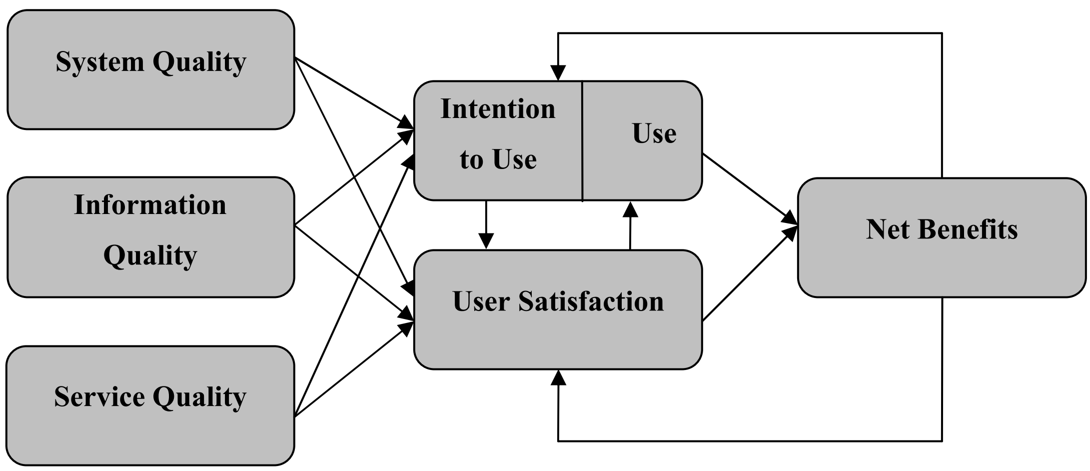


Figure 2.8 The New D&M Model
Source: DeLone & McLean, (2002)

2.7.1 The causal relationships between the constructs of IS

The new version of the D&M model attracted more interest in the IS research and triggered further empirical testing and modifications. Another group of researchers (e.g. Au et al., 2002) focused on detailed reviews which either focused on the classification of IS effectiveness measures or collected the results of empirical studies regarding the suggested pair wise relationships of the new model (see Table 2.15). Some relationships were found constantly significant while others have received only mixed support (i.e., some studies find significant results while others are non significant). To address these inconsistencies some academics resorted to research technique of meta-analysis synthesising the literature by using quantitative data reported across research studies (Hwang et al., 2000; Mahmood, Hall and Swanberg, 2001; Sabherwal, Jeyaraj & Chowa, 2006). As a matter of fact, the meta-analysis conducted by Sabherwal, Jeyaraj and Chowa (2006) has validated a great portion of the D&M model's suggested relationships.

These various studies contributed substantially as they offered the platform for IS measurement frameworks and a clearer segregation of the constructs to consider when trying to test IS success empirically. Petter et al. (2008) collected the results of all these studies that tested part the models relationships or all of them and provided a detailed review of the findings regarding the significance of the links between the constructs. Their detailed review covered the empirical papers which tested part, or, all of the D&M model focusing on *utilitarian* IS ie all the systems that are used for individual or organisational performance and not for entertainment. The review from Petter at al. (2008) provided the best knowledge so far on the validated causal relationships between the IS constructs and the findings are depicted in Tables 2.16– 2.44.

180 articles had been reviewed for the period of 1992–2007. The authors finally came to the conclusion that the most important comments from their qualitative research was that there is difficulty in interpreting the relationship among several of the success constructs and net benefits related to IS implementation.

Table 2.15 Tested pair wise relationships Petter et al. (2008)

System quality	➡	System use
System quality	➡	User satisfaction
System quality	➡	Net benefits
Information quality	➡	System use
Information quality	➡	User satisfaction
Information quality	➡	Net benefits
Service quality	➡	System use
Service quality	➡	User satisfaction
Service quality	➡	Net benefits
System use	➡	User satisfaction
System use	➡	Net benefits
User satisfaction	➡	System use
User satisfaction	➡	Net benefits
Net benefits	➡	System use
Net benefits	➡	User satisfaction

Table 2.16 The Relationship between system quality and use

Source: Petter et al. (2008)

System quality and use	
Empirical studies	**Study result**
Halawi et al., 2007	positively significant
Hsieh & Wang, 2007	positively significant
Iivari, 2005	positively significant
Rai et al., 2002	positively significant
Hong et al., 2001/ 2002	positively significant
Venkatesh & Davis, 2000	positively significant
Venkatesh & Morris, 2000	positively significant
Igbaria et al., 1997	positively significant
Suh et al., 1994	positively significant
Kositanurit et al., 2006	Mixed
Venkatesh et al., 2003	Mixed
Agarwal & Prasad, 1997	Mixed
Goodhue & Thompson, 1995	Mixed
Adams et al., 1992	Mixed
Klein, 2007	not significant
McGill et al., 2003	not significant
Lucas & Spitler, 1999	not significant
Gefen & Keil, 1998	not significant
Straub et al., 1995	not significant
Markus & Keil, 1994	not significant
Subramanian, 1994	not significant

Table 2.17 The Relationship Between System Quality And User Satisfaction

Source: Peter et al. (2008)

System quality and user satisfaction	
Empirical studies	Study result
Chiu et al., 2007	positively significant
Halawi et al., 2007	positively significant
Hsieh & Wang, 2007	positively significant
Leclercq, 2007	positively significant
Kulkarni et al., 2006	positively significant
Wu & Wang, 2006	positively significant
Almutairi & Subramanian, 2005	positively significant
Iivari, 2005	positively significant
McGill & Klobas, 2005	positively significant
Wixom & Todd, 2005	positively significant
McGill et al., 2003	positively significant
Bharati, 2002	positively significant
Devaraj et al., 2002	positively significant
Gelderman, 2002	positively significant
Kim et al., 2002	positively significant
Palmer, 2002	positively significant
Rai et al., 2002	positively significant
Guimaraes et al., 1996	positively significant
Seddon & Kiew, 1996	positively significant
Yoon et al., 1995	positively significant
Seddon & Yip, 1992	positively significant

Table 2.18 The Relationship Between System Quality and Net Benefits

Source: Petter et al. (2008)

System quality and net benefits	
Empirical studies	**Study result**
Hsieh & Wang, 2007	positively significant
Klein, 2007	positively significant
Bharati & Chaudhury, 2006	positively significant
Wixom & Todd, 2005	positively significant
Shih, 2004	positively significant
Yang & Yoo, 2004	positively significant
Rai et al., 2002	positively significant
Devaraj et al., 2002	positively significant
Hong et al., 2001/ 2002	positively significant
Venkatesh & Davis, 2000	positively significant
Venkatesh & Morris, 2000	positively significant
Agarwal & Prasad, 1999	positively significant
Lucas & Spitler, 1999	positively significant
Gefen & Keil, 1998	positively significant
Seddon & Kiew, 1996	positively significant
Kositanurit et al., 2006	mixed
Kulkarni et al., 2006	not significant
Wu & Wang, 2006	not significant
McGill & Klobas, 2005	not significant
Chau & Hu, 2002	not significant
Goodhue & Thompson, 1995	not significant
Subramanian, 1994	not significant

Table 2.19 The Relationship Between Information Quality and Use

Source**:** Peter et al. (2008)

Information quality and use	
Empirical studies	**Study result**
Halawi et al., 2007	positively significant
Kositanurit et al., 2006	positively significant
Rai et al., 2002	positively significant
Goodhue & Thompson, 1995	Mixed
McGill et al., 2003	not significant
Iivari, 2005	not significant

Table 2.20 The Relationship Between Information Quality and User Satisfaction

Source: Peter et al. (2008)

Information quality and user satisfaction	
Empirical studies	**Study result**
Chiu et al., 2007	positively significant
Halawi et al., 2007	positively significant
Leclercq, 2007	positively significant
Kulkarni et al., 2006	positively significant
Wu & Wang, 2006	positively significant
Almutairi & Subramanian, 2005	positively significant
Iivari, 2005	positively significant
Wixom & Todd, 2005	positively significant
McGill et al., 2003	positively significant
Bharati, 2002	positively significant
Kim et al., 2002	positively significant
Palmer, 2002	positively significant
Rai et al., 2002	positively significant
Seddon & Kiew, 1996	positively significant
Seddon & Yip, 1992	positively significant
Marble, 2003	not significant

Table 2.21 The Relationship Between Information Quality and Net Benefits

Source: Peter et al. (2008)

Information quality and net benefits	
Empirical studies	**Study result**
Bharati & Chaudhury, 2006	positively significant
Kositanurit et al., 2006	positively significant
Wu & Wang, 2006	positively significant
Shih, 2004	positively significant
Rai et al., 2002	positively significant
D'Ambra & Rice, 2001	positively significant
Seddon & Kiew, 1996	positively significant
Gatian, 1994	positively significant
Kraemer et al., 1993	positively significant
Hong et al., 2001/ 2002	Mixed
Kulkarni et al., 2006	not significant

Table 2.22 The Relationship Between Service Quality and Use

Source: Peter et al. (2008)

Service quality-use	
Empirical studies	**Study result**
Choe, 1996	Mixed
Halawi et al., 2007	not significant
Kositanurit et al., 2006	not significant

Table 2.23 The Relationship Between Service Quality and User Satisfaction

Source: Peter et al. (2008)

Service quality-user satisfaction	
Empirical studies	**Study results**
Halawi et al., 2007	positively significant
Leclercq, 2007	positively significant
Shaw et al., 2002	positively significant
Yoon et al., 1995	positively significant
Kettinger & Lee, 1994	positively significant
Leonard-Barton & Sinha, 1993	positively significant
Devaraj et al., 2002	Mixed
Chiu et al., 2007	not significant
Marble, 2003	not significant
Aladwani, 2002	not significant
Palmer, 2002	not significant
Choe, 1996	not significant

Table 2.24 The Relationship Between Service Quality and Net Benefits

Source: Peter et al. (2008)

Service quality-net benefits	
Empirical studies	**Study result**
Agarwal & Prasad, 1999	positively significant
Gefen & Keil, 1998	positively significant
Leonard-Barton & Sinha, 1993	positively significant
Blanton et al., 1992	positively significant
Igbaria et al., 1997	mixed
Kositanurit et al., 2006	not significant
Yoon & Guimaraes, 1995	not significant

Table 2.25 The Relationship Between Use and User Satisfaction

Source: Peter et al. (2008)

Use -user satisfaction	
Empirical studies	**Study result**
Chiu et al., 2007	positively significant
Halawi et al., 2007	positively significant
Iivari, 2005	positively significant
Guimaraes et al., 1996	positively significant
Seddon & Kiew, 1996	not significant

Table 2.26 The Relationship Between Use and Net Benefits

Source: Peter et al. (2008)

Use-net benefits	
Empirical studies	**Study result**
Halawi et al., 2007	positively significant
Burton-Jones & Straub, 2006	positively significant
Kositanurit et al., 2006	positively significant
Almutairi & Subramanian, 2005	positively significant
Vlahos et al., 2004	positively significant
Rai et al., 2002	positively significant
D'Ambra & Rice, 2001	positively significant
Torkzadeh & Doll, 1999	positively significant
Weill & Vitale, 1999	positively significant
Yuthas & Young, 1998	positively significant
Abdul-Gader, 1997	positively significant
Guimaraes & Igbaria, 1997	positively significant
Igbaria & Tan, 1997	positively significant
Seddon & Kiew, 1996	positively significant
Goodhue & Thompson, 1995	positively significant
Yoon & Guimaraes, 1995	positively significant
Wu & Wang, 2006	not significant
Iivari, 2005	not significant
McGill et al., 2003	not significant
Lucas & Spitler, 1999	not significant
Ang & Soh; 1997	not significant
Vlahos & Ferratt; 1995	not significant

Table 2.27 The Relationship Between Use and Net Benefits
Source: Peter et al. (2008)

User satisfaction-use	
Empirical studies	**Study result**
Chiu et al., 2007	positively significant
Halawi et al., 2007	positively significant
Bharati & Chaudhury, 2006	positively significant
Kulkarni et al., 2006	positively significant
Wu & Wang, 2006	positively significant
Iivari, 2005	positively significant
Wixom & Todd, 2005	positively significant
McGill et al., 2003	positively significant
Kim et al., 2002	positively significant
Rai et al., 2002	positively significant
Torkzadeh & Doll, 1999	positively significant
Khalil & Elkordy, 1999	positively significant
Winter et al., 1998	positively significant
Yuthas & Young, 1998	positively significant
Abdul-Gader, 1997	positively significant
Guimaraes & Igbaria, 1997	positively significant
Igbaria & Tan, 1997	positively significant
Collopy, 1996	mixed
Vlahos et al., 2004	not significant
Ang & Soh, 1997	not significant
Vlahos & Ferratt, 1995	not significant

Table 2.28 The Relationship Between User Satisfaction and Net Benefits

Source**:** Peter et al. (2008)

User satisfaction-net benefits	
Empirical studies	**Study result**
Halawi et al., 2007	positively significant
Iivari, 2005	positively significant
McGill & Klobas, 2005	positively significant
Vlahos et al., 2004	positively significant
McGill et al., 2003	positively significant
Morris et al., 2002	positively significant
Rai et al., 2002	positively significant
Torkzadeh & Doll, 1999	positively significant
Yuthas & Young, 1998	positively significant
Ang & Soh, 1997	positively significant
Guimaraes & Igbaria. 1997	positively significant
Igbaria & Tan, 1997	positively significant
Vlahos & Ferratt, 1995	positively significant
Yoon & Guimaraes, 1995	positively significant

Table 2.29 The Relationship Between Net Benefits and Use

Source**:** Peter et al. (2008)

Net benefits –use	
Empirical studies	**Study result**
Hsieh & Wang, 2007	positively significant
Klein, 2007	positively significant
Wu & Wang, 2006	positively significant
Malhotra & Galletta, 2005	positively significant
Wixom & Todd, 2005	positively significant
Yang & Yoo, 2004	positively significant
Venkatesh et al., 2003	positively significant
Chau & Hu, 2002	positively significant

Rai et al., 2002	positively significant
Hong et al., 2001/ 2002	positively significant
Venkatesh & Morris, 2000	positively significant
Agarwal & Prasad, 1999	positively significant
Gefen & Keil, 1998	positively significant
Igbaria et al., 1997	positively significant
Subramanian, 1994	positively significant
Compeau et al., 1999	Mixed
Agarwal & Prasad, 1997	Mixed
Straub et al., 1995	Mixed
Adams et al., 1992	Mixed
Kulkarni et al., 2006	not significant
Lucas & Spitler, 1999	not significant

Table 2.30 The Relationship Between Net Benefits and User Satisfaction

Source: Peter et al. (2008)

net benefits - user satisfaction	
Empirical studies	**Study result**
Hsieh & Wang, 2007	positively significant
Leclercq, 2007	positively significant
Bharati & Chaudhury, 2006	positively significant
Kulkarni et al., 2006	positively significant
Wu & Wang, 2006	positively significant
Devaraj et al., 2002	positively significant
Rai et al., 2002	positively significant
Abdul-Gader, 1997	positively significant
Guimaraes et al., 1996	positively significant
Seddon & Kiew, 1996	positively significant
Yoon et al., 1995	positively significant

Table 2.31 The Relationship Between System Quality and Use

Source: Peter et al. (2008)

System quality-use	
Empirical studies	**Study result**
Fitzgerald & Russo, 2005	positively significant
Caldeira & Ward, 2002	positively significant
Premkumar et al., 1994	Mixed
Gefen, 2000	not significant
Gill, 1995	not significant

Table 2.32 The Relationship Between System Quality and User Satisfaction

Source**:** Peter et al. (2008)

System quality-user satisfaction	
Empirical studies	**Study result**
Scheepers et al., 2006	positively significant
Benard & Satir, 1993	positively significant
Premkumar et al., 1994	not significant

Table 2.33 The Relationship Between System Quality and Net Benefits

Source: Peter et al. (2008)

System quality-net benefits	
Empirical studies	**Study result**
Wixom & Watson, 2001	positively significant
Gefen, 2000	positively significant
Weill & Vitale, 1999	positively significant
Farhoomand & Drury, 1996	positively significant
Bradley et al., 2006	mixed

Table 2.34 The Relationship Between Information Quality and Use

Source: Peter et al. (2008)

Information quality-use	
Empirical studies	**Study result**
Fitzgerald & Russo, 2005	positively significant

Table 2.35 The Relationship Between Information Quality and User Satisfaction

Source**:** Peter et al. (2008)

Information quality-user satisfaction	
Empirical studies	**Study result**
Scheepers et al., 2006	positively significant
Coombs et al., 2001	positively significant
Teo & Wong, 1998	positively significant

Table 2.36 The Relationship Between Information Quality and Net Benefits

Source**:** Peter et al. (2008)

Information quality-net benefits	
Empirical studies	**Study result**
Wixom & Watson, 2001	positively significant
Teo & Wong, 1998	positively significant
Farhoomand & Drury, 1996	positively significant
Bradley et al., 2006	Mixed

Table 2.37 The Relationship Between Service Quality and Use

Source: Peter et al. (2008)

Service quality –use **Empirical studies**	**Study result**
Fitzgerald & Russo, 2005	positively significant
Caldeira & Ward, 2002	positively significant
Gill, 1995	positively significant

Table 2.38 The Relationship Between Service Quality and User Satisfaction

Source**:** Peter et al. (2008)

Service quality –user satisfaction **Empirical studies**	**Study result**
Coombs et al., 2001	positively significant
Thong & Yap, 1996	positively significant
Thong et al., 1994	positively significant
Benard & Satir, 1993	not significant

Table 2.39 The Relationship Between Service Quality and Net Benefits

Source**:** Peter et al. (2008)

Service quality –net benefits **Empirical studies**	**Study result**
Gefen, 2000	positively significant
Thong & Yap, 1996	positively significant
Thong et al., 1994	positively significant

Table 2.40 The Relationship Between Use and User Satisfaction

Source: Peter et al. (2008)

Use-user satisfaction **Empirical studies**	**Study result**
Gelderman, 1998	Mixed

Table 2.41 The Relationship Between Use and Net Benefits

Source**:** Peter et al. (2008)

Use-net benefits	
Empirical studies	**Study result**
Leclercq, 2007	positively significant
Zhu & Kraemer, 2005	positively significant
Devaraj & Kohli, 2003	positively significant
Teng & Calhoun, 1996	positively significant
Belcher & Watson, 1993	positively significant
Gelderman, 1998	not significant

Table 2.42 The Relationship Between User Satisfaction and Net Benefits

Source: Peter et al. (2008)

User satisfaction-net benefits	
Empirical studies	**Study result**
Gelderman, 1998	positively significant
Law & Ngai, 2007	positively significant

Table 2.43 The Relationship Between Net Benefits and Use

Source: Peter et al. (2008)

Net benefits –use	
Empirical studies	**Study result**
Gefen, 2000	positively significant
Gill, 1996	positively significant
Belcher & Watson, 1993	positively significant
Premkumar et al., 1994	mixed

Table 2.44 The Relationship Between Net Benefits and User Satisfaction

Source: Peter et al. (2008)

Net benefits –user satisfaction Empirical studies	Study result
Jones & Beatty, 2001	mixed
Teo & Wong, 1998	mixed
Premkumar et al., 1994	mixed

2.8 The IS success model in the literature

Sedera and Gable (2004) tested a number of published success models, the D&M and Seddon models included, against empirical data and concluded that the DeLone McLean Model was the most suitable for measuring enterprise systems success especially when considering the organisational perspective.

The D&M dimensions provided the platform for almost all subsequent IS success frameworks that attempted to measure the impact of IS on organisational performance. The six dimensions kept motivating researchers partly (e.g. Bernroider, 2008; Gorla, Somers & Wong, 2010) or as a whole (Wang & Liao, 2008) or became subject to further modifications (Chang & King, 2005).

Bernroider (2008) tested the D&M dimensions (see Fig 2.9.) and concluded that the model with the general success dimensions were consistent and, when combined they could yield a single valid measure of ERP success.

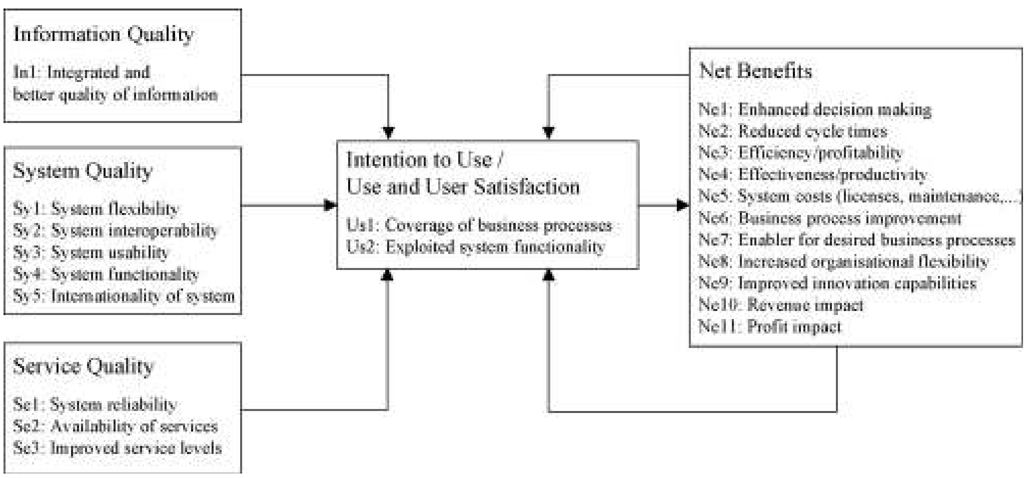


Figure 2.9 The Bernroider (2008) framework

Wang and Liao (2008) provided a new empirical test of an adaptation of the DeLone and McLean's model in the context of G2C eGovernment (see Fig 2.10). As depicted in figure 2.10, the hypothesised relationships among the six success variables were supported by their data with the exception of the link from system quality to use (with $p<0.1$)

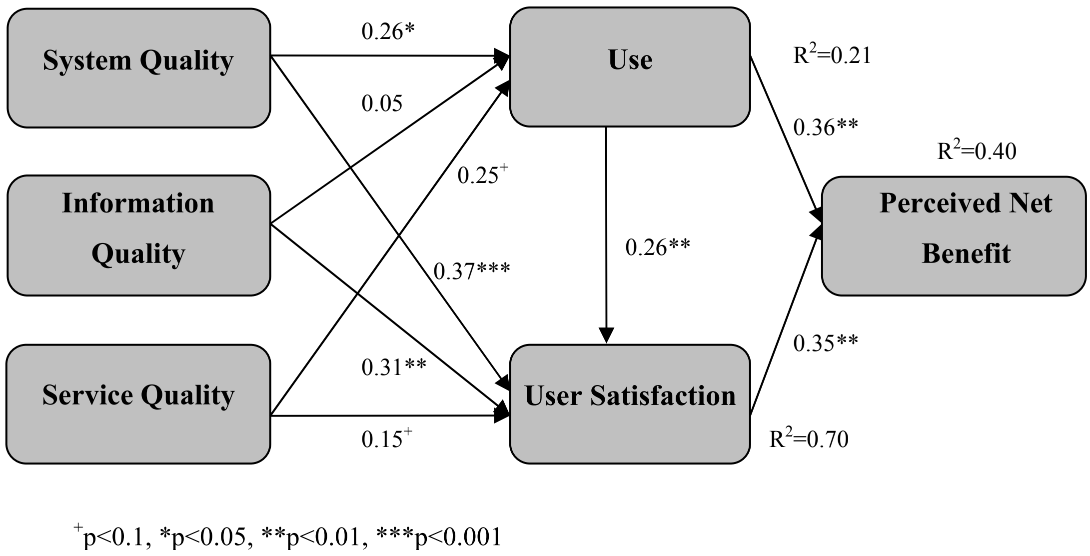


Figure 2.10 The Research Model from Wang, and Liao (2008)

Gorla, Somers and Wong (2010) used the four dimensions of the D&M model to determine the IS system quality, information quality, and service quality effects on organisational impact (see Fig. 2.11). Their model included "four constructs motivated by the D&M model. Specifically, system quality and service quality were the independent variables, information quality was both an independent and a dependent variable, and organisational impact became their dependent variable" Gorla, Somers and Wong (2010). This particular research showed that there are indeed "links between system quality, information quality, service quality and organisational impact on the understanding that variance in organisational impacts can be addressed through variance in IS quality" (see Fig. 2.11) which implies that information quality is the key mediator between system quality and organisational impact (Gorla et al., 2010, p.13). The key finding here is, that there is a significant direct or indirect organisational impact from system quality, information quality, and service quality (see Fig. 2.12). The major contribution, however, was the comprehensive analysis at the organisational level.

Based on the systems' approach and on the theoretical input–output model (see fig. 2.1/section 2.1) Chang and King (2005) argued that an IS system is an open system which has inputs and outputs (fig. 2.13.)

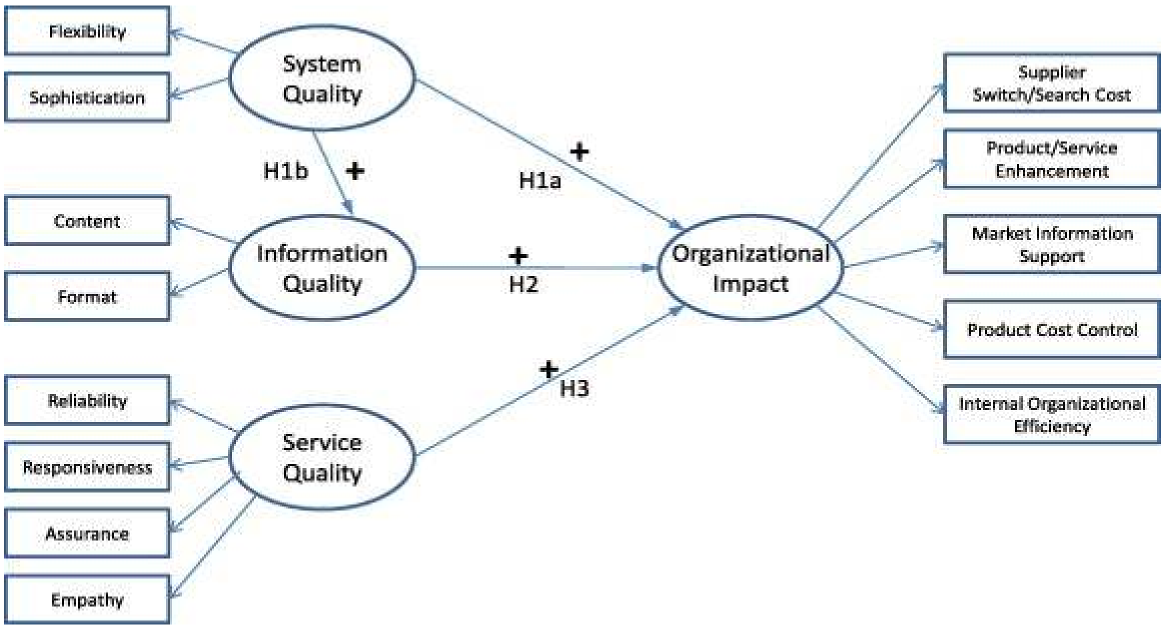


Figure 2.11 The Research Model on IS success from Gorla, Somers and Wong (2010)

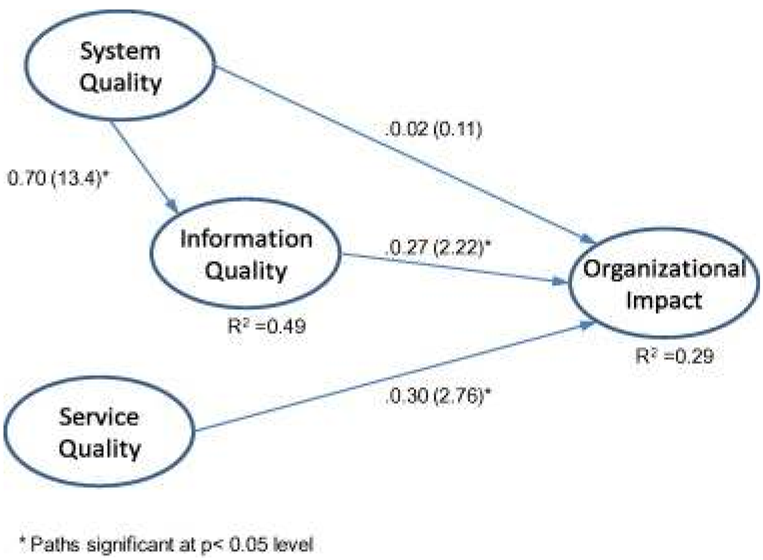


Figure 2.12 Structural PLS Model from Gorla, Somers and Wong (2010)

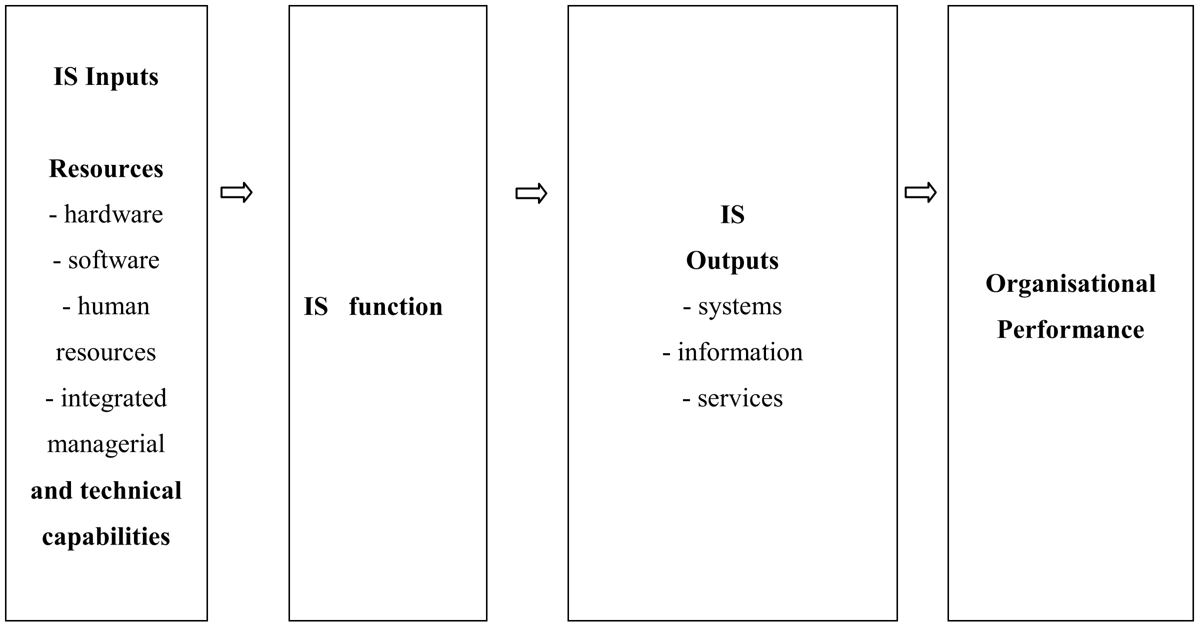


Figure 2.13 The Theoretical Model from Chang and King (2005**)**

According to the model, IS inputs can be the IS resources and the IS capabilities. The literature has identified three main categories of IS as resource: *human, technological,* and *relationships* (Bharadwaj, 2000). The human resources (IS skills) constitute the human capital (Lee, Trauth & Farewell, 1995). Technological resources stem from the network platform (Armstrong & Sambamurthy, 1999) and data sophistication (Duncan, 1995). Relationships can be internal (Nelson & Cooprider, 1996; Ravichandran & Rai, 2000) or they can refer to external partnerships (Grover, Chen & Teng, 1996).

As far as Capabilities are concerned, Collins claimed that these are the '*socially complex routines'* that determine how well inputs are transformed into outputs within an organization (Collis, 1994). In a more focused approach, Grant claimed that "*Capabilities can be identified and appraised using a standard functional classification of the firm's activities*" (Grant, 1991, p.120) whereas Tavakolian (1989) focused on *planning, systems development, IS support, and IS operations.* These were further explored by Ravinchandran and Lertwongsatien (2005) who found a direct positive relationship between resources and capabilities which extended the previously causal relationship in the definition of capabilities as an organisation's ability to deploy resources (Amit & Schoemaker, 1993).

The information system function and the IS Function outputs

According to Saunders and Jones (1992) the IS function includes all IS groups and departments within the organisation. Based on the system's approach (details in paragraph 2.2.2) we can say that IS resources and capabilities are the inputs used by the IS function to produce outputs measured by three constructs: system, information and service provider (Segars, & Hendrickson, 2000) which in turn are viewed as the drivers of organisational performance (Chang & King, 2005).

System, information and service provider measures are based on the D&M model relevant categories. Cha-Jan Chang & King (2005), suggested the *ISFS (Information Systems Functional Scorecard)* and developed an instrument comprising the following three major dimensions: systems performance, information effectiveness and service performance (see Table 2.45), which formed the basic constructs for their field research.

Systems performance: Measures of this dimension evaluate the quality aspects of the system (reliability, response time, ease of use, and so on) and the various impacts of the systems on the user's work.

Information effectiveness: Measures of this dimension evaluate the quality of information (in terms of the design, operation, use, and value) provided by information and the effects of the information on the user's job as well.

Service performance: Measures of this dimension evaluate each user's experience with the services provided by the IS function in terms of quality and flexibility.

Table 2.45 Sub-ISFS Constructs

Adopted by Cha -Jan Chang and King, (2005)

Systems performance	**Information effectiveness**	**Service performance**
Impact on job	Intrinsic quality of information	Responsiveness
Impact on external constituencies	Contextual quality of information	Reliability
Impact on internal processes	Presentation quality of information	Service provider quality
Effect on knowledge and learning	Accessibility of information	Empathy
Systems features	Reliability of information	Training
Ease of use	Flexibility of information	Flexibility of services
	Usefulness of information	Cost/benefit of services

2.9 Summary on the most important frameworks used in the IS literature

The construct of effectiveness is always present in the literature of Information Systems and researchers have tried to conceptualise and operationalise it using different frameworks (e.g. DeLone & McLean, 1992; Ballantine et al., 1996; Goodhue, 1995; Chang & King, 2005; Gorla, Somers & Wong, 2010). Many research papers were reviewed for the identification of the most important frameworks in the IS evaluation field. It became apparent that the way to evaluate the success or effectiveness of IS changed over time as the purpose, use and impact of IT evolved over time. The key finding of this detailed review was that almost all authors tested or expanded either the Technology Acceptance model (see Table 2.46) or the IS success model proposed by DeLone and McLean (see table 2.47).

The Technology Acceptance Model has been widely used (in its original or revised form) from all researchers aiming at "predicting the acceptance, adoption, and use of information technologies" (Chen, Li and Li 2011). However, acceptance, was not supposed to be equivalent to success, although acceptance of an information system is a prerequisite for success (DeLone & McLean, 1992; 2003) and for this reason another stream of research focused on the six IS dimensions that could measure success of IS.

Several authors and researchers agreed on the existence of IS benefits at different levels, as many other stakeholders were identified (DeLone and McLean, 2003; Peter, DeLone and McLean, 2012). For this reason the DeLone and McLean model was revised in 2003 to include a comprehensive dimension under the term 'net benefits'.

Table 2.46 Frameworks based on TAM

Source Chen, Li and Li (2011)

Frameworks	**Introducing authors**
Original TAM	Davis, F.D. (1989), Davis, F.D., Bagozzi, R.P., Warshaw, P.R. (1989),
TAM-TPB	Taylor and Todd (1995),
TAM2	Venkatesh et al. (2003)
TRAM	Lin et al. (2007
Task-technology fit and	Chang (2008).

Table 2.47 Frameworks based on the IS success model

Frameworks	**Introducing authors**
Original IS success model	Bernroider, 2008; Gorla, Somers & Wong, 2010; Sedera and Gable (2004); Wang & Liao, 2008
Extended IS model	Cha -Jan Chang and King, (2005)

The DeLone and McLean model motivated this thesis. Apart from its word-wide acceptance this framework was considered as the most appropriate because it included both: the ever going elements of success such as information quality and system quality and the net benefits i.e. the impact of IS implementation on the entire organisation. The next paragraph discusses the training programs as another important construct identified in the literature that has been related to the effectiveness of Information Systems.

2.10 Training programs

Training the users of any Information System implementation has been reported as a key success factor in several studies (erg Al-Mashari et al., 2003; Nelson and Cheney 1987; Santhanam, M.K. Sein, 1994; Somers and Nelson, 2004). Companies spend a lot of money investing in latest technologies in their attempt to remain competitive. However, this investment can be successful only when the IS function responds to the computing demands of the users (Rondeau, Ragu-Natha. and Vonderembse 2010). The question, however, is how effectively the training programs are to enable users familiarize themselves with these technologies, develop their computing skills, and finally use the new skills to improve their productivity (Rondeau, Ragu-Natha. and Vonderembse 2003; 2010).

The ultimate goal of any training program is skill development which, in turn, improves organisational outcomes (Eldridge & Nisar, 2006). Prior research indicated that effective training programs are those that meet the ever-changing user needs and are oriented towards organisational objectives (Huang, 2002). This definition of training program effectiveness refers to management's perception if IS training (Rondeau, Ragu-Natha. and Vonderembse 2010) and is based on the classic analysis recommended in 1998 by Donald Kirkpatrick. The second question, therefore, is how top managers can evaluate a training program and how the effect of the training is transferred to workplace (Mahapatra and Lai, 2005). Research so far has shown that there is not much information about how managers measure training effectiveness (Mahapatra and Lai, 2005; Rondeau, Ragu-Natha. and Vonderembse 2010). This question became another focal point for the ensuing research on IS effectiveness which seeks to explore senior managements' perception of the IS training received by end-users (Rondeau, Ragu-Natha. and Vonderembse 2010)

2.11 The literature gap

The comprehensive literature review revealed that limited research has attempted to measure IS effectiveness at an organisational level (Gable, Sedera and Chan, 2012; Gorla, Somers & Wong, 2010; Petter et al., 2008). This particular stream of research has been criticised for its '*inability to create a common theoretical base*' and '*incompatibly across the IS studies'* (Petter et al., 2008; Thong & Yap, 1996). In simple words, there are few research studies and frameworks that measured the impact of IS on firm performance and those attempting to measure it produced conflicting findings (Brynjolfsson & Hitt 1996; Sircar, Tumbow & Borodoli, 2000; Peter, DeLone and McLean 2012). The next section discusses the papers and findings that were used for the identification of the literature gap that motivated the thesis and the ensuing research.

2.11.1 The research on IS effectiveness at an organisational level

The limited research on IS effectiveness at the organisational level has produced contradicting results. Some researchers found a significantly positive impact from IT implementation on performance (e.g. Banker, Kauffman & Morey, 1990; Barua, Kriebel & Mukhopadhyay, 1995). This relationship was further supported by Brynjolfsson and Hitt (1996) who studied 367 large firms and found that the investment in IS had made a statistically significant contribution to firm performance. In a more recent research Kudyba and Diwan (2002) argued that investment in IT enhanced returns over time.

Other researchers, however, produced different results. For example, the advances in technology had occasionally coincided with lower productivity and profitability in many companies in different sectors (e.g. Ezingeard, Irani & Race, 1999; Irani & Love, 2001). Another stream of research found no relationship between IT investment and organisational performance (e.g. Floyd, & Woolridge, 1990; Dos Santos, Peffers & Mauer; 1993; Kettinger, Grover, Guha & Segars, 1994).

Weill (1992) categorised IT investment on behalf of management objective (i.e., strategic, informational and transactional) and tested it against the following four measures of performance: two measures of labour productivity, sales growth and return on assets. His results were different for each objective because the transactional IT investment was found to be significantly associated with strong firm performance whereas, use of strategic IT was found to have no connection in the long term and was associated only with relatively poorly performing firms in the short term.

Kivijarvi and Saarinen (1995) found that investment in IT is not always related to superior financial performance, especially in the short term, and benefits can be reaped in the long run. This became known as the productivity paradox (Brynjolfsson, 1993) which means that IT does not actually offer the promised benefits. This was further explored by Schrage (1997) who talked about the "big lie of the Information Age." According to Schrage (1997) the spending on IT was unable to solve fundamental business problems. In a more recent study Stratopoulos and Dehning (2000) supported the Schrage (1997) findings arguing that the productivity paradox holds true and is partly attributed to mismanagement.

These contradicting findings triggered a need for researchers to reconsider the operationalisation of firm performance variables (Segars & Grover, 1998). Some empirical studies used intermediary performance measures and found some more consistent findings. Mukhopadhyay, Rajivand and Srinivasan (1997) focused on process efficiency and quality and the reported impact of IT. Thatcher and Oliver (2001) examined the contribution of IT to productivity and found that IT investments which can reduce the firm's fixed overhead costs, whilst not affecting the firm's product quality, do increase profits and improve productivity.

2.11.2 Synthesis of the reading

The detailed review on the methods and tools on IS evaluation identified its inherent problems: it seems that there is still limited knowledge on the time, methods and tools to evaluate IS systems as well as no consensus amongst the academic community, as discussed by Irani and Love (2002) and by Wang and Liao (2008). In another paper, Irani (2008, p.88) argues that "*the questions and problems that had been identified 15 years ago are still unsanswered because of the complexity associated with linking intra- and inter-organisational IS*".

The same problem exixsts in the practiotioners' world as managers do not really have an awareness of the impact of IS on organisational performance translated in costs, benefits and risks associated with financial and social capital investments when implementing IT (Stockdale & Standing, 2006). It is still very common in the literature to read that IS projects fail which raises the question of what actually constitutes IS success/effectiveness (Smith & Keil, 2003).

Concluding this section it should be mentioned that the evaluation of information systems (IS) success or effectiveness (both terms are used interchangeably) has attracted the academic interest/research but researchers are still trying to identify the constructs which can measure IS success in a comprehensive manner (Rai, Lang & Welker, 2002). The research in the Information Systems (IS) field has often been and is still being characterised as fragmented (Larsen, 2003; Chang & King, 2005; Wang & Liao, 2008) due to the multiplicity of the relevant constructs (DeLone & McLean 1992; Rai, Lang & Welker, 2002) and the ambiguity of the concepts (Wang & Liao, 2008).

Even the most recent reviews on IS success/effectiveness make it clear that the relationship of IS effectiveness constructs with organisational performance remains inconclusive and researchers must ensure that the person evaluating the impact on organisational performance must be in a position to assess and to answer the related questions (Peter, DeLone and McLean 2008; Peter, DeLone and McLean, 2012).

The two main questions which still remain vague are: How can we measure IS effectiveness in a holistic manner and how, in turn, this construct is associated with organisational performance when using financial and non financial measures? These questions motivated this thesis. The strength of the approach followed lies in the fact that the methodology used is robust and in that it integrates major aspects of various philosophical approaches, including the systems approach that has been discussed in section 2.1. The theoretical model is presented in Fig 2.14. The next chapter discusses in detail the conceptualisation of the dimensions and the construction of our research framework along with the ensuing propositions and hypotheses.

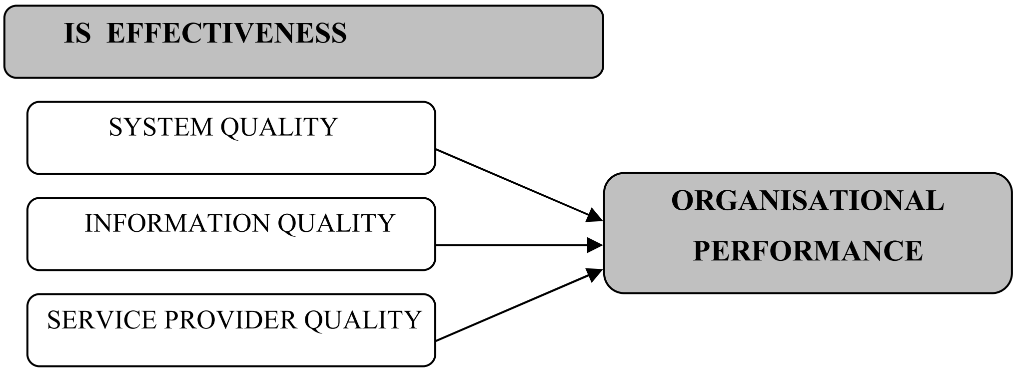


Figure 2.14 The Theoretical Framework

Based on the DeLone & McLean (1992) and Chang & King, (2005) frameworks

CHAPTER 3

3.1 Introduction

Chapter 2 provided a detailed description of the measures of the ***IS effectiveness*** sub-constructs and how these have been selected in different frameworks in the literature promoting thus the understanding of IS effectiveness in a more unified approach. A detailed discussion on ***Organisational Performance*** was also incorporated as this constituted the dependable construct of the study. This chapter aims at providing the conceptualisation of our two basic constructs and a detailed analysis of propositions and hypotheses stemming from the association of the dimensions and factors of our research model.

3.2 The research model and the conceptualisation of the two main constructs

The research model is depicted in Figure 3.1. The theoretical framework was introduced early in the study (chapter 1) to guide the reader towards the research objectives. The IS effectiveness construct used in this study reflects mainly the model adopted by Chang and King, (2005) and Delone and McLean (2003) which in turn was based on the model of Pitt et al. (1995). The review of the literature on the concepts around IS effectiveness revealed that it is not easy to measure it from a single dimension and that the most widely used constructs have been provided by the D&M (2002; 2003). The research framework contains, however, another dimension: training quality. This was treated as a discrete dimension to capture the key informants' perception on IS effectiveness without associating it to the service provider's quality. This could produce important findings in case the training was provided by a different entity.

The conceptualisation of organisational performance was based on several studies form the pertinent literature which used perceptual indicators and not objective measures. This decision was based on a thorough review of related studies that focused on the Organisational Performance measures (e.g. Chakravarthy, 1986; Venkatraman & Ramanujam, 1986; Kaplan and Norton, 1992), as well as on the impact of Information Systems on Organisational Performance (e.g.Melville, Kraemer and Gurbaxani, 2004; Irani et al., 2006).

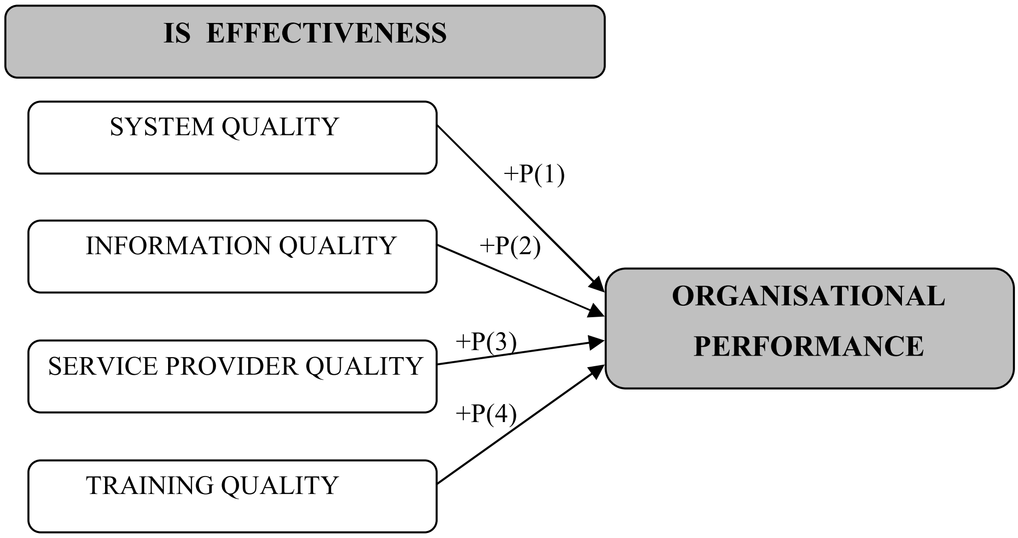


Figure 3.1 The research model

The items selected for the constructs were mainly adapted from prior studies to ensure content validity of the scales used in the study. The remaining of the chapter discusses in detail the conceptualisation of the two main constructs as well as the construction of propositions and hypotheses.

3.3 Conceptualising IS effectiveness

As extensively discussed in chapter 2 the construct has been frequently used in the pertinent literature. The common finding from the literature review was that it is not easy to measure IS effectiveness from a single dimension and that most of the researchers used the following sub-constructs; *system quality, information quality and service quality* to measure it (Rai et al., 2002; Chang & King, 2005; Bernoider, 2008; Gorla, Somers & Wong, 2010). These are discussed in detail in the following sections.

3.3.1 Dimension 1- System quality in the literature

A well designed, developed and implemented system ensures effective IS implementation (DeLone and MacLean, 2002; 2003). Perceived ease of use is the measure frequently used (Davis, 1989) for this dimension but it does not capture the entire construct as depicted in Table 3.1 where it can be seen that many researchers tested a number of measures (eg Rai, Lang and Welker, 2002; Bernoider, 2008; Gorla, Somers and Wong 2010).

Table 3.1 System quality measures

Source: DeLone and McLean, (1992); (Gorla, Somers and Wong (2010)

System quality measures	Literature
Convenience of access	Bailey & Pearson, 1983.
Flexibility	Bailey & Pearson, 1983; Gorla et al., 2010; Wang & Strong, 1996; Nelson et al., 2005.
Integration of systems	Bailey & Pearson, 1983; Nelson et al., 2005.
Realisation of user expectations	Barti & Huff, 1985.
Reliability	Belardo, Kanvan & Wallace, 1982; Srinivasan, 1985; Swanson, 1974.
Accessibility	Srinivasan, 1985
Ease of use	Davis, 1989; Doll & Torkzadeh, 1988;; Srinivasan, 1985.
Ease of learning	Miller & Doyle, 1987; Sedera & Gable, 2004; Srinivasan, 1985.
Response time	Gorla et al., 2010; Hamilton & Chervany, 1981; Swanson, 1974; Srinivasan, 1985.
Perceived usefulness of I/S	Franz & Robey, 1986.
Usefulness of DSS features	Goslar, Green and Hughes, 1986.
Usefulness of specific functions	Hiltz & Turoff, 1981.
Maintainability	Rivard et al., 1997
Resource utilization	Alloway, 1980; Kriebel, 1979; Raviv, 1980.
Investment utilization	Alloway, 1980 Kriebel, 1979; Raviv, 1980.
I/S sophistication (use of new technology)	Gorla et al., 2010; Lehman, 1986.
User friendly	Doll & Torkzadeh, 1988; Gorla et al., 2010; Miller & Doyle, 1987;
Flexibility of system	Gorla et al., 2010; Mahmood, 1987.
Stored record error rate	Emery, 1971; Morey, 1982.

3.3.1.1 Operationalisation of system quality for this research

This study used the measures as they were developed by Chang and King (2005) adding, however, some items from more recent literature. It was in 2005 that Chang and King introduced a more improved construct under the name of system's performance which aimed at measuring the impact of the system on the users and on orgainsational processes. The Chang and King (2005) model used variables from DeLone and McLean (2002) and from other models such as Baroudi and Orlikowski (1988), Doll and Torkzadeh (1988), Davis (1989), Kraemer et al., (1993) Mirani and King (1994), Goodhue and Thompson (1995), Ryker and Nath (1995).

Drawing from the detailed literature review, we collected all items used by Chang and King (2005) adding attributes for system quality that were found in other studies as shown in Table 3.2. The related questions used in this research instrument constitute our Part II of the research questionnaire (Appendix 3.1)

Table 3.2 Conceptualisation of System quality–35 Items employed in this research

Measures of system's performance	Literature
1. Makes it easy for the user to do the job	Davis, 1989; Chang & King, 2005.
2. Helps user decision making	Davis, 1989; Chang & King, 2005; Belardo, Kanvan, and Wallace, 1982; Zmud, Blocher and Moffie, 1983.
3. Gives user confidence to accomplish their job	Davis, 1989; Chang & King, 2005; Aldag and Power, 1986; Goslar, Green, and Hughes, 1986; Gueutal, Surprenant & Bubeck, 1984.
4. Increases user participation in decision making	Chang & King, 2005.
5. Improves the quality of the work product	Baroudi & Orlikowski, 1988; Chang & King, 2005.
6. Enhances problem-solving ability	Chang & King, 2005.
7. Facilitates collective group decision making	Chang & King, 2005.
8. Facilitates personal learning	Chang & King, 2005.
9. Facilitates knowledge transfer	Chang & King, 2005.
10. Improves modernisation of working methods	Gorla et al., 2010;
11. Reduces process costs	Chang & King, 2005.
12. Reduces process time	Chang & King, 2005.
13. Facilitates internal relationships	Chang & King, 2005.
14. Facilitates relationships with external business partners	Chang & King, 2005.
15. Enhances information sharing with your suppliers	Chang & King, 2005.
16. Helps to retain valued customers	Chang & King, 2005.
17. Helps to select and qualify desired suppliers	Chang & King, 2005.
18. Improves supply's control	Chang & King, 2005.
19. Speeds product delivery	Chang & King, 2005.
20. Speeds service delivery	Chang & King, 2005.
21. System is reliable	Belardo, Kanvan & Wallace, 1982; Chang & King, 2005; Rivard et al., 1997; Srinivasan, 1985; Swanson, 1974.
22. System is flexible	Bailey & Pearson, 1983; Chang & King, 2005; Gorla et al., 2010; Nelson et al. 2005; Wang & Strong, 1996.
23. System is easy to use	Chang & King, 2005; Davis, 1989; Doll & Torkzadeh, 1988; Gorla et al., 2010; Srinivasan, 1985; Miller & Doyle, 1987.
24. System is easy to learn	Chang & King, 2005; Davis, 1989;

	Doll & Torkzadeh, 1988; Gorla et al., 2010; Srinivasan, 1985 Miller & Doyle, 1987.
25. System is cost effective	Chang & King, 2005.
26. System is well integrated	Bailey & Pearson, 1983; Nelson et al., 2005; Chang & King, 2005.
27. System can be easily maintained	Rivard et al., 1997
28. System is easy to customise	Chang & King, 2005; Wang & Strong, 1996; Nelson et al., 2005.
29. System can been easily upgraded	Chang & King, 2005.
30. System has fast response time	Gorla et al., 2010; Hamilton & Chervany, 1981; Swanson, 1974 Chang & King, 2005; Bailey & Pearson, 1983.
31. System downtime is minimal	Chang & King, 2005.
32. System is responsive to meet your changing needs	Chang & King, 2005.
33. System meets expectations	Barti & Huff, 1985; Chang & King, 2005;
34. System provides benefits for the entire organisation	Chang & King, 2005; Mirani & Lederer, 1998.
35. Facilitates information exchange with suppliers	Chang & King, 2005.
36. System is used for multiple purposes	Chang &King 2005
37. System meets changing needs	Chang &King 2005
38. System meets requirements	Chang & King 2005

3.3.2 Dimension 2 - Information quality in the literature

Information quality has been used widely either as a construct or as a dimension of user satisfaction measuring instruments (Baroudi & Orlikowski, 1988; Doll et al., 1994). Some researchers like Fraser & Salter (1995) developed a generic scale of information quality, others used the information quality measures from the original D&M model (e.g. Wang & Strong, 1996), whereas another stream modified the D&M (2003) construct adding items from other relevant frameworks (Coombs et al., 2001; Wixom & Watson, 2001; Gorla, Somers & Wong, 2010). A detailed presentation of the items in the pertinent literature is depicted in table 3.3.

Table 3.3 Information quality measures

Source: DeLone and McLean, 1992; Gorla, Somers and Wong, 2010

Information quality measures	Literature
Accuracy	Ahituv, 1980; Bailey & Pearson, 1983; Wang & Strong, 1996; Srinivasan, 1985.
Precision	Ahituv, 1980; Bailey & Pearson, 1983.
Currency	Bailey & Pearson, 1983; Wang & Strong, 1996.
Reliability	Bailey & Pearson, 1983; Wang & Strong, 1996.
Completeness	Bailey & Pearson, 1983; Nelson et al., 2005; Gorla et al., 2010; Wang & Strong, 1996.
Conciseness	Bailey & Pearson, 1983; Kahn et al., 2002; Swanson, 1974; Wang & Strong, 1996.
Format	Bailey & Pearson, 1983; Wang & Strong, 1996
Relevance	Ahituv, 1980; Bailey & Pearson, 1983; King & Epstein, 1983; Wang & Strong, 1996.
Clarity	Swanson, 1974; Olson & Lucas, 1982.
Perceived usefulness of reports	Gallagher, 1974; Munro & Davis, 1977; Larcker & Lessig, 1980; King & Epstein, 1983; Kahn et al., 2002.
Perceived importance	Jones & McLeod, 1986; Gallagher, 1974; Munro & Davis, 1977; Larcker & Lessig, 1980.
Consistent	Gorla et al., 2010; Huh et al., 1990.
Currency	King & Epstein, 1983; Wang & Strong, 1996.
Sufficiency	King & Epstein, 1983; Wang & Strong, 1996.
Understandability	King & Epstein, 1983; Wang & Strong, 1996.
Freedom from bias	King & Epstein, 1983; Wang & Strong, 1996.
Timeliness	King & Epstein, 1983 Srinivasan, 1985; Wang & Strong, 1996.
Reliability	King & Epstein, 1983; Wang & Strong, 1996.
Relevance to decisions	King & Epstein, 1983; Wang & Strong, 1996.
Comparability	King & Epstein, 1983; Wang & Strong, 1996.
Quantitativeness	King & Epstein, 1983; Wang & Strong, 1996.

3.3.2.1 Operationalisation of Information quality for this research

Information quality is conceptualised as the quality of outputs produced by the information system (DeLone and McLean, 1992), which means the reports but it can refer to how users value the overall information that is available to them. Our dimension mirrors the different sub-dimensions and uses the Chang and King (2005) items for information effectiveness along with several new items found in older and more recent research (table 3.4).

The related questions formed our Part III of the research questionnaire (Appendix 3.1).

3.3.3 Dimension 3 Service quality in the literature

This construct measures the quality of the services rendered by the IT department as depicted in table 3.5. As understood, this construct in the literature suggests knowledgeable IT people with good communication skills and the ability to provide reliable and timely support to IT users. It also suggests that a suitable vendor with responsiveness and ability to cooperate is necessary for IS effective implementation (Gefen, 2000; Argyropoulou et al, 2007).

Table 3.4 Conceptualisation of Information quality –31 Items used in this research

Measures of Information Quality		Literature
1.	Interpretable	Chang & King, 2005; Wang & Strong, 1996.
2.	Understandable:	King & Epstein, 1983; Wang & Strong, 1996.
3.	Complete	Chang & King, 2005; Gorla et al., 2010; Wang & Strong, 1996.
4.	Clear	Swanson, 1974;
5.	Concise	Ahituv, 1980; Bailey & Pearson, 1983; Wang & Strong, 1996.
6.	Accurate	Bailey & Pearson, 1983; Wang & Strong, 1996.
7.	Important	Chang & King, 2005.
8.	Relevant	King & Epstein, 1983; Wang & Strong, 1996.
9.	Usable	Wang & Strong, 1996.
10.	Well organised	Chang & King, 2005; Wang & Strong, 1996.
11.	Well defined	Chang & King, 2005; Wang & Strong, 1996.
12.	Available	Chang & King, 2005; Wang & Strong, 1996.
13.	Accessible	Doll et al., 1994; Wang & Strong, 1996.
14.	Up-to-date	Chang & King, 2005.
15.	Received in a timely manner:	Srinivasan, 1985; Wang & Strong, 1996.
16.	Reliable	Chang & King, 2005; Wang & Strong, 1996.
17.	Verifiable	Chang & King, 2005; Wang & Strong, 1996,
18.	Believable:	Chang & King, 2005; Wang & Strong, 1996.
19.	Unbiased	King & Epstein, 1983; Wang & Strong, 1996.
20.	Easily compared to past information	Gorla et al., 2010.
21.	Used for multiple purposes	Chang & King, 2005.
22.	Meets requirements	Chang & King, 2005.
23.	Is useful for making decisions	Kahn et al., 2002.
24.	Improves decision effectiveness	Kahn et al., 2002.
25.	Is useful for problem identification	Chang & King, 2005
26.	Is useful for problem definition	Chang & King, 2005.
27.	Is easily integrated	Chang & King, 2005
28.	Is easily updated	Chang & King, 2005.
29.	Is easily changed	Chang & King, 2005
30.	Improves decision effectiveness	Chang & King, 2005
31.	Improves functional productivity	Chang & King, 2005

Table 3.5 Service Quality measures in the literature

Source: DeLone and McLean (2002) and Gorla, Somers and Wong (2010)

Service Quality measures	Literature
Reliable people	Parasuraman et al., 1988; Gorla et al., 2010.
Responsive people	Kettinger & Lee, 2005; Parasuraman et al., 1988; Gorla et al., 2010.
Dependable	Pitt et al., 1995; Parasuraman et al., 1988; Gorla et al., 2010.
Are there when needed	Carr, 2002; Parasuraman et al., 1988; Gorla et al., 2010.
Know their job	Carr, 2002; Parasuraman et al., 1988; Gorla et al., 2010.
Responsive people	Kettinger & Lee, 2005; Parasuraman et al., 1988; Gorla et al., 2010.
Give users individual attention	Kettinger & Lee, 2005 Parasuraman et al., 1988; Gorla et al., 2010.
Have the users' best interests at heart	Carr, 2002; Parasuraman et al., 1988; Gorla et al., 2010.

3.3.3.1 Operationalisation of Service quality for this research

The literature review showed that this construct had been used in a number of ways. Some researchers measured the quality of services provided placing an emphasis on the reliability and skills of the provider (see Table 3.5), whereas most recent research incorporated measures of the provider's empathy (e.g. Parasuraman et al., 1988; Kettinger & Lee, 2005; Gorla, Somers & Wong, 2010). Some case studies also indicated the ability to honour the contractual agreement (Argyropoulou et al., 2007) as key success factor of IS success.

We used the 16-item construct by Chang and King (2005) adding, however, some older and recent items we located in recent studies as depicted in Table 3.6 (part IV of questionnaire – see Appendix 3.1)

Table 3.6 Conceptualisation of “Service Provider” (SP) *27 items used in this research*

Service Provider Quality measures	**Literature**
1. SP provides valuable services	Chang & King, 2005.
2. SP responds in a timely manner	Chang & King, 2005.
3. SP completes services in an effective manner	Chang & King, 2005. Chang & King, 2005.
4. Provides variety of services	Parasuraman et al., 1988; Chang & King, 2005; Gorla et al., 2010;
5. SP provides reliable services	Parasuraman et al., 1988; Chang
6. SP provides cost effective services	& King, 2005; Gorla et al., 2010;
7. SP has sufficient people to provide services	Chang & King, 2005.
	Chang & King, 2005.
8. SP people are effective in performing their services	Chang & King, 2005.
9. SP people have the knowledge and skill to do their job	Chang & King, 2005.
10. SP people are dependable	Chang & King, 2005.
11. SP people are polite	Chang & King, 2005.
12. SP people are sincere	Chang & King, 2005.
13. SP people show respect to you	Chang & King, 2005.
14. SP people are pleasant to work with	Chang & King, 2005.
15. SP people Know the business processes	Argyropoulou et al., 2007.
16. SP people honour the contractual agreement	Argyropoulou et al., 2007.
17. SP people care for a long lasting relationship	Argyropoulou et al., 2007.
18. SP people are willing to help you	Chang & King, 2005.
19. SP people help employees become skilful users	Chang & King, 2005.
20. SP people are dependable	Pitt et al., 1995; Chang & King, 2005; Parasuraman et al., 1988; Gorla et al., 2010.
21. SP people instill confidence in you	Pitt et al., 1995; Chang & King, 2005; Parasuraman et al., 1988; Gorla et al., 2010
22. SP people Know the industry	Argyropoulou et al., 2007
23. SP people are there when needed/in emergency	Carr, 2002; Chang & King, 2005; Parasuraman et al., 1988; Gorla et al., 2010.
24. SP people understand your specific needs	Carr, 2002; Parasuraman et al., 1988; Gorla et al., 2010.
25. SP people solve your problems as if they were their own	Kettinger & Lee, 2005; Parasuraman et al., 1988; Gorla et al., 2010.
26. Give users individual attention	Kettinger & Lee, 2005; Chang & King, 2005; Parasuraman et al., 1988; Gorla et al., 2010.
27. Have the users’ best interests at heart	Carr, 2002; Chang & King, 2005; Parasuraman et al., 1988; Gorla et al., 2010.

Table 3.7 Training quality measures - 7 items used in this research

Training programs are useful	Chang & King, 2005.
Training programs cover user needs	Chang & King, 2005.
Training programs are frequent	Chang & King, 2005.
Training programs are instructive	Chang & King, 2005.
Training programs cover specific needs	Chang & King, 2005.
Training programs are cost effective	Chang & King, 2005.
Training programs help users learn the various system's uses	Chang & King, 2005.

3.5 Organisational Performance Measures

As discussed briefly in chapter 1, the definition of organisational performance is a continuous open question with limited studies using consistent definitions and measures (see Kirby, 2005). There are some important reviews on performance (e.g. Chakravarthy, 1986; Venkatraman & Ramanujam, 1986), because the domain attracts researchers due to its vital link with management practices. Furthermore, there are different performance measures that serve the purposes of various strategies Hyvonen (2007).

The operationalisation of this construct depends mainly on its association with other constructs. All studies used either subjective or objective measures. Both approaches have their advantages and disadvantages. This research, however, is based on subjective measures which are considered to be coherent with objective measures, thus improving the reliability and validity of construct measurement (Venkatraman and Ramanujam 1986)

On that, Dess and Robinson (1984, p.271) supported that "*subjective perceptions of relative improvement were strongly correlated with objective measures of the absolute changes in return on assets and sales over the same period*".

With regard to its association to IS, it should be mentioned that there are several past and recent field studies that have explored the influence of information systems and used organisational performance measures for their dependent variable (Bernroider, 2008; Chervany and Dickson, 1974; Chang and King, 2005). Some of them include financial measures such as profitability (Hamilton & Chervany, 1981 Benbasat & Dexter, 1985), return on investment (Vasarhelyi, 1981), return on assets (Cron & Sobol, 1983), stock price (Kaspar & Cerveny, 1985), overall cost reduction (Rivard & Huff, 1984) or profit per net assets (Yap & Walsham, 1986). Other researchers used non-financial measures. For example Jenster (1987) incorporated several nonfinancial measures (e.g. productivity, innovation, product quality) to explore the impact on IS on these variables.

Other studies have used the Kaplan and Norton (1992; 2004a; 2004b; 2005) to evaluate some IT tools on performance (e.g. Wu & Hung, 2007). In this study we used the balanced score card approach (see details in chapter 2) to conceptualise organisational performance using financial and non-financial variables. Summarising the main reasons it should be mentioned that the choice was based on the BSC benefits such as: the comprehensiveness of measures that include all departments (Martin, 1997; Argyropoulou et al., 2010), the customers' and stockholders' opinion, (MacStravic, 1999), and the strategic concerns (Frigo & Krumwiede, 2000).

26 items were used in the research (PART V- Appendix 3.1) representing the four BSC perspectives as well several net benefits from the DeLone and McLean Model (2002). The financial measures that were used captured the way the key informants see the impact of IS on the financial performance of a firm, (Brynjolfsson & Hitt, 1995; Davenport, 1998; Narver, & Slater, 1995; Nicolaou 2004; Law & Ngai, 2007; Sweat, 1998; Stratopoulos & Dehming, 2000). The non-financial measures included the impact of IS on customers (Grover & Davenport, 2001) market position and strategic objectives (Broadbent & Weill, 1999; Law & Ngai, 2007; Yen, & Sheu, 2004) and several items found in the recent literature capturing internal capabilities (Mirani & Lederer, 1998; Wu & Hung, 2007). Table 3.8 presents the selected along with the pertinent literature.

Table 3.8 Conceptualisation of "Organisational Performance" *26 items used in this research*

Organisational Performance Measures	**Literature**
Company's productivity	Hitt and Brynjolfsson 1996; Ezingeard, Irani & Race, 1999 Jenster 1987; Thatcher and Oliver 2001
Company's income	Bernroider, 2008; Brynjolfsson & Hitt, 1995; Davenport, 1998; Narver, & Slater, 1995; Nicolaou 2004; Law & Ngai, 2007; Sweat, 1998; Stratopoulos & Dehming, 2000
Company's production cost	Rivard & Huff, 1984 Ballantine & Stray, 1999; Milis & Mercken, 2004
Company's inventory levels	Cardinaels &Van Veen-Dirks 2010 Lucas, 1981; Martin & Patterson, 2009;
Company's logistics costs	Benbasat & Dexter 1985; Rivard & Huff, 1984
Company's gross profit	Benbasat & Dexter, 1985; Brynjolfsson & Hitt, 1995; Davenport, 1998; Hamilton & Chervany, 1981; Narver, & Slater, 1995; Nicolaou 2004; Law & Ngai, 2007; Stratopoulos & Dehming, 2000
Delivery of goods that meet customer needs	Appleton, 1998; Martin & Patterson, 2009
Delivery of services that meet customer needs	Martin & Patterson, (2009); Sethi and King (1994)
Delivery of goods according to specifications	Appleton, 1998; Tallon et al. 2000
Customer complaints	Grover & Davenport, 2001
Customer retention	Grover & Davenport, 2001
Customer satisfaction	Cardinaels &Van Veen-Dirks 2010
Supplier's defect free deliveries	Cardinaels &Van Veen-Dirks 2010
Replenishment time	Cardinaels &Van Veen-Dirks 2010
New product /service development	Mahmood &Soon, 1991; Tallon et al. 2000; Gorla et al., 2010
Range of products and services	Mahmood &Soon, 1991; Tallon et al. 2000; Gorla et al., 2010
Innovation capability	Bernroider, 2008; Chan & Qi, 2003; Jenster 1987; Mansury & Love, 2008
Forecasting capability	Tallon et al. (2000; Golra et al., 2010
Information sharing through the Supply Chain	Rai et al. 2006
Timely decision making	Sethi and King 1994; Gorla et al., 2010
Organisational flexibility	Bernroider, 2008; Chan & Qi, 2003
Information flow between departments	Bradley et al. 2006
Cooperation between departments	Bradley et al. 2006
Achievement of strategic goals	Broadbent & Weill, 1999; Frigo & Krumwiede, 2000
Increase of market share	Broadbent & Weill, 1999; Frigo & Krumwiede, 2000; Gupta and Govindarajan Profit, 1984
Competitive position	Broadbent & Weill, 1999; Law & Ngai, 2007; Yen, & Sheu, 2004

3.6 Research propositions

3.6.1 System quality and organisational performance

The information system that is well implemented and accepted by the users is a very important condition for a company to reap benefits of financial and non-financial nature. A system that helps people perform better is expected to be positively associated with net benefits (Bernroider, 2008; Wang & Liao, 2008). A system that is well designed from a technical point of view has a positive impact on organisational efficiency as found by Bradley et al. (2006) in a research involving entrepreneurial firms and a positive impact on organization in general as found by Gorla, Somers and Wong (2010). Furthermore, a system that improves business processes due to integration of software such as ERP and SCM is expected to lead to increased profitability, (Hendricks et al. 2007) and can help a firm gain competitive advantage (Slaughter, Harter & Krishnan, 1998).

In light of the above analysis we propose that:

P1*: *System quality is positively related to organisational performance

3.6.2 Information quality and organisational performance

Treating reports as the main product of any Information System, (Gorla et al., 2010) it is easy to understand that these products should have the basic characteristics of timeliness and reliability that affect performance. Poor data and reporting quality will affect negatively the customers, the decision making process and strategic objectives will be difficult to archive (Law & Ngai, 2007). In addition, the information should have the attributes of usefulness to the users (Calisir & Calisir, 2004) as the IS success is based on the needs of current and future users (Wu & Wang, 2007). Thus, we propose that:

P2*: *Information quality is positively related to organisational performance

3.6.3 Service provider quality and organisational performance

The literature provided us with some studies that considered the impact of service provider quality on organisational performance (Bernroider, 2008; Gorla et al., 2010). The features of a good IS provider have been extensively discussed as a prerequisite for IS success (Bernroider, 2008; Gorla et al., 2010). Quality services rendered by the appropriate provider are necessary for organisational success, since they are positively related to customer loyalty, higher profitability, higher revenues (Reicheld & Sasser, 1990) and competitive advantage (Bharadwaj, 2000). Other researchers found attributes of empathy (Chang & King, 2005) that are of importance for IS implementation as such features of the provider constitute the "feeling good" prerequisite that establishes a trustful relationship (Argyropoulou et al., 2007). For this reason we propose that:

P3*: *Service provider quality is positively related to organisational performance

3.6.4 Training quality and organisational performance

Training end users has been discussed extensively in the literature (e.g. Kraut, Dumais & Susan, 1989; Lee et al., 1995; Al-Mashari et al., 2003). In a study related to ERP systems implementation Irani (2002) claimed that lack of training leads to poor support of the system amongst its stakeholders, whereas Amoako-Gyampah and Salam (2004; 2007) argued that training removes all obstacles for success that derive from technological complexity. Considering the above we propose that:

P4*: *Training quality is positively related to organisational performance

3.6.5 Summary

Following a comprehensive literature review this chapter focused on the operationalisation of the main constructs of this research: Information Effectiveness and Organisational Performance. Four research questions were framed to guide the researcher. The following chapter discusses in detail the methodology that was followed to test the propositions as well as the ensuing hypotheses, answering thus to the main research questions.

CHAPTER 4

Methods and Methodology

4.1 Introduction

In the previous chapter, the research model with its associated constructs, dimensions and variables, as well as a number of propositions and hypotheses were discussed. This chapter deals with some important philosophical and methodological issues. The following section constitutes an analysis of topics pertaining to philosophy of science in general, and social sciences in particular placing an emphasis on Information Systems Research Theory and Development. The chapter continues with a review on research design approaches, data sources and scales, and the relevant considerations for this study's objectives. A detailed discussion of the survey techniques follows and the ensuing methodological steps and decisions are thoroughly discussed.

4.2 Philosophical Underpinnings Information System Research

Although it is not the aim of this dissertation to discuss in depth what *Philosophy* is, this section presents some of the philosophical issues that should be considered when a research project either of academic or of commercial nature is designed in the social science domain, and more particularly in the business and management field. As a result, an account would be given of issues relating to epistemology, scientific theories and how these are associated with Information Systems research.

4.2.1 Issues on Epistemology and social science

One of the basic branches of *Philosophy* is *Epistemology,* which is the theory of knowledge (Marsh and Stoker, 2002). Epistemology is based on two pillars: *positivism* and *interpretivism* whose basic difference lies in the way they approach knowledge. For positivists, scientific knowledge is established through the accumulation of verified facts (Schrag, 1992). In such cases there is an observable social reality and the researcher is independent of the research subject (Giddens, 1979; Marsh and Stoker, 2002). The positivist researchers develop a hypothesis from a theory about the phenomenon under research and then test the theory through their empirical approach. If the findings are in accordance with the theory, the theory is true and if not, the theory is false. The main research methods followed by the positivist researchers are laboratories, surveys and quasi-experiments.

The proponents of *Interpretivism,* on the other hand, claim that reality is subjective and the meaning of a phenomenon is a function of the circumstances and the individuals involved. For this reason in social sciences positivism degrades the complex human behavior to *simplistic patterns* (Schrag, 1992). Nonetheless, despite its criticism, positivist paradigm is very popular in social sciences and *hard to avoid* (Schrag, 1992).

At this point it should be mentioned that one important development of positivism or logical positivism is the *falsification* doctrine, introduced by Popper (1963; 1980), according to which scientists should better attempt to "*falsify*, rather than *verify*, scientific hypotheses" (Popper, 1980). This doctrine has been the objective of many research papers, the most important being the publication from Hansson (2006). Based on 70 previously published papers in Nature in 2000, the author found only one article conforming to Popper's doctrine and he concluded that "*.......falsificationism relies on an incorrect view of the nature of scientific inquiry and that it is, therefore, not a tenable research methodology"* (Hansson, 2006 p. 275).

This discussion, however, raises the importance of theory definition and development, which is the theme of the subsequent section.

4.2.2 Theory definition

Researchers have paid significant attention to what constitutes a theory and what does not (e.g. DiMaggio, 1995; Bacharach, 1989; Colquitt & Zapata-Phelan, 2007). There are many views of "*what is theory*", each one depending on different philosophical and disciplinary orientations (Gregor, 2006). For example, there are philosophers of science who see theory as "providing explanations and predictions and as being testable". (Bacharach, 1989 p.498) viewed theory as "*...a system of constructs and variables in which the constructs are related to each other by propositions and the variables are related to each other by hypotheses. The whole system is bounded by the theorist's assumptions".*

Other philosophers like Popper defined theory as follows:

> "Scientific theories are universal statements. Like all linguistic representations they are systems of signs or symbols. Theories are nets cast to catch what we call "the world"; to rationalise, to explain and to master it. We endeavor to make the mesh even finer and finer".
>
> Popper (1980, p.59)

Although there are many different orientations (natural studies, social studies etc) philosophers agree that when conceptualising theory there are four common problems that constitute the core of the theory concept: *causality, explanation, prediction, and generality.*

Causality involves the explanation of an event by asking/exploring its cause, having its origin in the 18th century (Kant, 1781) and is based on the characteristic of the human mind to understand in terms of cause and effect.

Although the literature on *explanation* in the philosophy of science has changed the last 50 years, there are two broad approaches shedding light on this issue: The first approach points out the scientific law that governs the occurrence of an event (Hempel and Oppenheim, 1948). The second approach is more flexible, and contains the notion that explanation is a "*communicative process"* (Achinstein, 1983). This notion extends Nagel's (1979) argument that a theory is a system of interrelated statements that sometimes cannot be translated into empirical measures (Nagel, 1979).

Prediction as a characteristic of theory refers to its ability to be tested and entails the concept of *generality*. It is understood that generalisation is possible when talking about the theory in nature (Audi, 1999, p.705) but in social science this is unlikely and we only expect specific levels of generalisation. It should be noted here that according to Popper (1979, p.349) "the task of science is partly theoretical-explanation and partly practical-prediction and technical application".

Moreover, he supported that:

> "The conjecture that it is the aim of science to find satisfactory explanations leads us further to the idea of improving the degree of satisfactoriness of the explanation by improving the degree of testability, this is to say, by proceeding to better testable theories; which means proceeding to theories of ever richer content, of higher degrees of universality, and of higher degrees of precision".

Popper (1979, p.193)"

As such, an issue pertaining to theory is, the constructs of the research phenomenon, the relationships amongst constructs and the methodology for observing them. This attracted the attention of scinentists and scholars and became important for the development of the scientific method and the research process itself. Despite, however, the various views on theory definition, it seems that, in general, theory aims to "*describe, explain, and enhance understanding of the world and, occasionally, to provide predictions of what will happen in the future giving a basis for intervention and action"* (Bacharach, 1989; Gregor, 2006).

Another issue of high importance is how theories and models are assessed. The struggle for theories which are better and richer in content prompts the difficult question of truth, and the criteria for evaluation of theories.

> "Although we have no criterion of truth, and no means of being even quite sure of the falsity of a theory, it is easier to find out that a theory is false than to find out it is true. We have even good reasons to think that most of our theories -even our best theories- are, strictly speaking, false; for they oversimplify or idealise"

(Popper, 1979, p.318).

Patterson (1983) identified eight criteria for the evaluation of a theory. These are briefly described:

- *Importance* - the applicability to many situations and its durability over time.
- *Preciseness and Clarity* - the theory is first of an understandable nature and free from ambiguities.
- *Parsimony* - the theory is as simple as possible and contains a limited number of assumptions.
- *Comprehensiveness* - the theory covers all data in the field to which it applies.
- *Operationality* - the concepts must be measurable.
- *Empirical Validity/Verifiability* - the theory can be tested for its validity
- *Fruitfulness* –the ability of a theory to produce hypotheses or predictions that can be tested.
- *Practicality* - the theory has some use for researchers to organise their thoughts in the model that is suggested.

4.2.3 Theory building

Having analysed the various concepts on what constitutes theory, it is deemed necessary to discuss the ensuing tenet, the theory development. There are different procedures for theory-building but they all "*suggest how to operationalise specific types of research projects"* (Wacker, 1998). For the purpose of this research, we believe that the most important approaches to be brought for discussion are rationalist research and case study research (Meredith, 1998). According to the author, "*Rationalism* is an epistemological paradigm that is based on positivism and uses quantitative research methods and models as well as laboratory experiments". *Case study,* on the other hand, "is based on interpretivism and uses both quantitative and qualitative methodologies" (Eisenhardt, 1989). As such, we can summarise "*that rationalist methods test existing theory*", whereas interpretive methods are used for *generating* (McCutcheon & Meredith, 1993) or *extending theory"* (Richardt & Cook, 1979, p.17).

Whetten (1989, p.49) opined that regardless of the case study or rationalism approach, the building blocks for theory development are:

- **Who-What**: This concerns the definition of variables, constructs and concepts (Wacker, 1998).
- **When-Where:** This concerns the limitation of the domain and observes and limits the conditions when the antecedent event and where the subsequent event are expected to occur (Wacker, 1998).
- **Why-How**: This concerns the Relationship model and the reasoning for each relationship

(Wacker, 1998, p.49).

Theory, therefore, is about answering or attempting to explain "*how and why specific relationships lead to particular events"*` (Poole & Van de Ven, 1989).

Another important issue that characterises this research is the approach of theory building in reation to Information Systems and this is discussed in the subsequent paragraph.

4.2.3.1 The nature of theory building in Information Systems

Lynham and Torraco (2001) claimed that theory building is the process of modeling real-world phenomena. Gregor (2006) views IS as having many commonalities with some design disciplines like engineering or architecture, since they all concern people and artifacts. Therefore, understanding IS theory has links to the natural and social world which has become the body of knowledge termed *design science* (Hevner et al., 2004). Whatever the definition, the main thinking in theory development is to establish a process which is valid and reliable, issues extensively discussed in the following paragraphs

Positivism is very popular in Information Systems research literature (Orlikowski & Baroudi, 1991; Trauth & Jessup, 2000; Weber, 2004). As a matter of fact, Orlikowski and Baroudi (1991) argue, that the most dominant epistemology espoused in IS research is positivism, as in their review of the relevant literature (IS publications from 1983-1988) they found that 96.8% of publications were using the positivism approach. As such it includes "*independent and dependent variables, mathematical propositions, quantitative data, inferential statistics, and experimental controls"* (Lee & Hubona, 2009).

Nonetheless, many younger researchers regard qualitative research to be as valid as quantitative research (e.g. Dubé and Paré, 2003; Lee and Hubona, 2009) and they use the Interpretive approach which states that social world can be studied in a different way than the physical world (Lee, 1991) as social processes cannot be subject to hypothesis testing.

In this thesis, however, considering the research framework presented in Chapter 3, we argue that the theory building lies in the positivism paradigm since it seeks to test a number of relationships between the principal constructs, to identify causal relationships between them, and hopefully, based on the findings, to generalise and as such to predict and prescribe effective behaviours. For this reason, it is necessary to provide a discussion on the relevant concepts of constructs and variables, thus putting the study in its positivist context.

4.2.4 Contracts and variables

As discussed in the previous sections there are many definitions of theory and theory development. For this thesis we chose the definition of Kerlinger (1986) who described theory a "*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"'* Kerlinger (1986, p.9)

Kaplan (1964, p.55) defined constructs as "*terms which, though not observational either directly or indirectly, may be applied or even defined on the basis of the observable*" whereas according to Cronbach (1951) constructs "*correspond to dimensions of empirical variation within a defined population"*. In other words, constructs are abstractions that express similar characteristics (Bagozzi, Yi & Phillips, 1991) and theory aims at explaining observed phenomena by systematically exploring interrelationships between constructs (Malhotra & Grover, 1998).

Similarly, the notion of variable, although heavily used in other disciplines such as mathematics, statistics and symbolic logic, is a relatively simple idea and in this context we can say variables constitute the way of describing phenomena (constructs) objectively and quantitatively (Lazarsfeld & Rosenberg, 1955) and as such any concept under research may correspond to either a construct or a variable depending on the research model and the relevant theory (Markus, 2008). This can be easily understood looking at Figure 4.1 which depicts their relationship. As it can be seen, propositions are statements that associate two or more constructs, whereas hypothesis are statements related to two or more variables (Bacharach, 1989, p499).

Having conceptualised the meanings of constructs, operationalism follows to identify the items to be grouped together presuming to be measuring the same underlying construct (Kerlinger, 1986). This process, in turn, creates the basic problems of **validity** and ***internal consistency*** as shown in Table 4.1.

BOUNDARY= ASSUMPTIONS ABOUT VALUES, TIME, AND SPACE

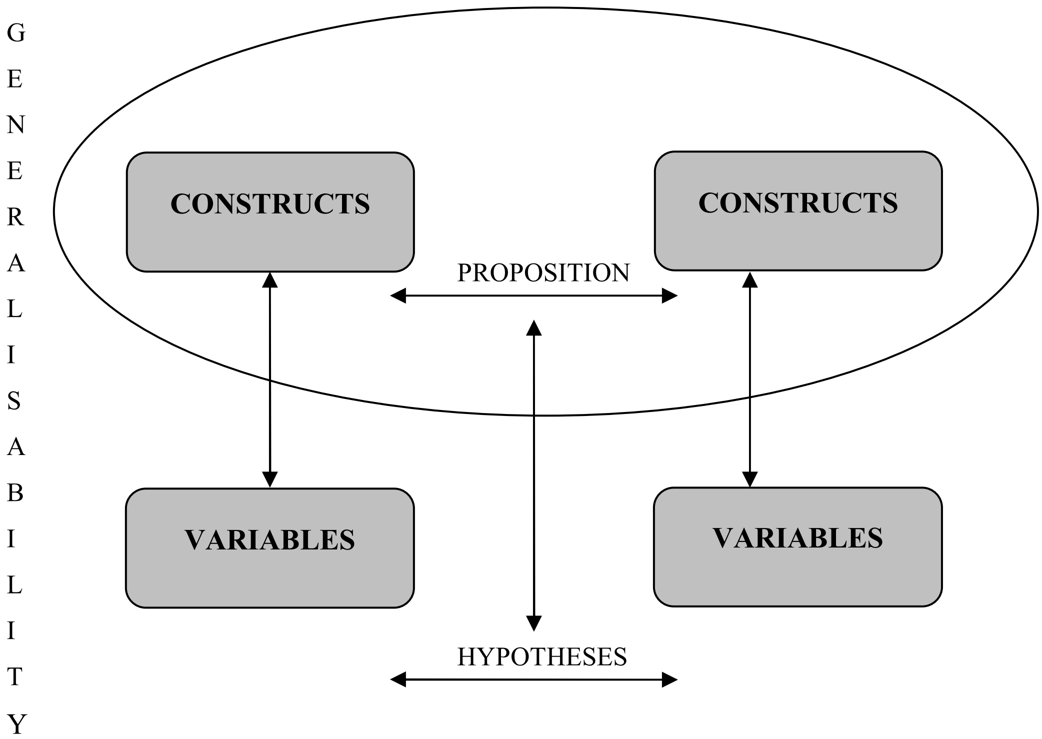


Figure 4.1 Components of a Theory

Source: Bacharach (1989:499)

Table 4.1 Key Components of Construct Validity

Source: Venkatraman & Grant (1986:79)

Component	"Working Definition"	Relevant techniques /analytical framework
A Content or Face Validity	Extent to which empirical measurement reflects a specific domain of content	Review by "experts" and analyses of the extent of consistency among them
B Internal Consistency		
Unidimensionality	Extent to which the items reflect one underlying construct	Exploratory factor analysis; Confirmatory factor analysis.
Reliability	Absence of measurement error in cluster score	Cronbach alpha; Reliability coefficient of structural equation models
C Convergent Validity	Degree to which multiple attempts to measure the same concept with different methods are in agreement	Correlation analysis; MTMM matrix; Structural equation methodology - confirmatory factor analysis
D Discriminant	Extent to which a concept differs from other concepts	Correlation analysis; MTMM matrix; Structural equation methodology.
E Nomological (Predictive Validity)	Degree to which predictions from a theoretical network are confirmed	Correlation; Regressions; Causal modeling

Content or face validity "refers to the extent to which empirical measurement reflects a specific construct" (Venkatraman and Grant, 1986). In our study, we have dealt with this kind of validity by presenting-throughout the pre-testing phase-the various proposed items to experts who have commented on them.

Internal consistency has two major components; the *unidimensionality* and the *reliability*. The former concerns the extent to which the various items reflect one underlying construct (Kerlinger, 1986). We have taken into account this validity check by carrying out exploratory factor analysis, which is presented in detail in Chapter 6.

Regarding the second component of *internal consistency,* which is the *reliability assessment,* it should be noted that although it has been seen as a distinct issue by many researchers, Bagozzi et al. (1991) proposed that it could be taken as part of the validity component. *Reliability* is a "matter of whether a particular technique, applied repeatedly to the same object, would yield the same results each time" (Saunders, Lewis & Thornhill, 2007, p.366) and helps in assessing whether the used measures are actually measuring what they claim to measure and not something else.

Reliability in all studies and consequently in this one, is assessed through the use of the coefficient (Cronbach) alpha (Cortina, 1993) and the composite reliability index which measures the degree to which construct items indicate the common latent construct (White, Varadarajan & Dacin, 2003). Several methods with which reliability can be assessed have been proposed, as depicted in Table 4.2. The Cronbach's alpha coefficient has been criticised for being based in the assumption of the equal importance of all indicators, (Green, Lissitz & Mulaik, 1977). Nonetheless, it has been widely used in organisational research literature (Churchill &Peter, 1984; Venkatraman and Grant, 1986) as well as in operations management literature (Malhotra & Grover, 1998).

On these grounds, and for the purposes of this study, we have adopted the guidelines by Nunnally and Bernstein (1994) accepting the reliability over 0.4. As such, items that did not belong to the content domain of the constructs or dimensions under investigation –exhibited item-to-total correlation below 0.50- were dropped from further analysis.

Convergent validity refers to what degree multiple attempts measuring the same concept with different methods are in agreement (Bollen, 1989; Venkatraman and Grant, 1986). This is examined though the inter-item correlations (items under the same construct) Fornell and Larker, (1981) recommend a minimum composite reliability of .60. It is also examined using the Average variance Extracted (AVE) measure (Fornell & Larker, 1981)

Discriminant validity refers to the extent to which a concept is different from other concepts (Campbell and Fiske, 1959; Venkatraman and Grant, 1986) and in this research we accepted it when the result was less than .70 (Hair et al., 2010; Kline, 1998).

Finally, *nomological* (predictive, criterion, concurrent or pragmatic) refers to the degree to which predictions from a theoretical network are confirmed. The term "nomology" derives from the Greek, meaning "lawful" representing the degree to which a construct belongs to the measuring instrument and represents its relations with the other constructs (Cronbach & Meehl, 1955).

Table 4.2 Techniques for Assessing Reliability

Methods	Characteristics	Problems
Test/Retest	The same test or measure is being examined repeatedly.	Duplicate the research effort. Time consuming Changes the phenomenon under observation between the two periods
Multiple or Alternate forms	Two tests (two questionnaires using different items to measure the same concept) are tested among the same subjects	Difficulty to create different forms of a test, measuring the same construct
Split-Half Method	The same measuring instrument containing twice as many items as it needs, with half of the items repeated or measuring the same thing	Different methods of splitting the items may produce different results
Internal consistency	The mean correlation coefficient for all the possible ways of splitting the items in any measure into halves	The Cronbach a coefficient is the most common approach. Another view is that reliability represents the proposition of measure variance attributable to the underlying trait (Werts et al, 1974)

4.3 Research Design

Research design can be viewed as a holistic plan which not only provides the framework of the investigation approach and the data collection but also determines to a significant extent other important research issues (Churchill, 1997; Kumar, Aaker and Day, 2002). In the view of Ghauri et al. (1995), the appropriate research design needs to be carefully conceived because it affects all the subsequent activities on data collection, research strategy and approaches which are discussed in the following paragraphs together with our decisions that guided this thesis.

4.3.1 Data sources

Two main sources of data can be identified: primary and secondary. *Primary sources* refer to data which are collected from the researcher for the needs of the research project in question. *Secondary sources* refer to data collected in the past, for purposes that are probably different from the purposes of any given study. Secondary data are data that have been collected from respondents (individuals or organisations)

(Houston, 2004) for scopes other than the research situation in discussion (Lehmann, 1989; Parasuraman, 1986). According to Churchill (1997) secondary data can be collected from government reports, reports of companies, institutions and departments, sites and any kind of published material.

4.3.1.1 Criticism on secondary data

"Secondary data, generally, represent 'real' decisions that have been made by 'real' decision-makers in 'real' environments" (Winer, 1999) and "they are collected in less obtrusive manners; they are less probable to have been influenced by self-report biases" (Tomarken, 1995). In addition, such data are free of biases introduced by the key informant sampling approach (Houston, 2004). Last but not least they are easy to collect as there is no need for instrument creation and primary data collection techniques (Houston, 2004).

Despite the obvious advantages (saving time and money) there are several drawbacks of the latter approach: Some secondary data which seem proxy constructs of interest may not be in alignment with the domain of the research construct (Titman and Wessels, 1988). It might also be difficult to match secondary data to other types or to complement other findings since secondary data often lag the events they report (Houston, 2004). However, researchers use secondary data for reasons of multi-method triangulation (Campbell and Fiske, 1959) to the primary findings.

4.3.2 Data collection approaches

When doing business research, it is of major importance to decide between quantitative and qualitative data collection. Quantitative approach produces numerical data whereas the qualitative one collects and produces non-numerical data (Saunders et al., 2007). The quantitative research is based on numerical data and tests relationships between variables, (White, 2000, p.46). Quantitative research methods are mainly "used to incorporate the use of systematic and sophisticated procedures to test, prove and verify hypotheses" (Albright et al, 2006, p. 423) enabling statistical techniques to be applied. "A hypothesis, called alternative hypothesis or research hypothesis (or theory), is formulated and then tested to infer conclusions. Testing a hypothesis means checking whether and how the collected data can support it" (Albright et al., 2006, p. 423). "The qualitative research is based on descriptive non-mathematical procedures" (White, 2000, p.25) and "is conducted via interviews, observation, case studies or action research, although the last two are not discrete qualitative techniques" (White, 2000, p.28).

Many researchers combine the two approaches using a multi-method (Bryman, 2008; Tashakkori and Teddlie, 2003) allowing, thus, for triangulation. However, more recent research has identified a number of barriers to the integration of quantitative and qualitative research (Bryman, 2006; 2007). Bryman considers it very difficult to "bring such findings together because in most cases the overall research design is not conceptualised in a sufficiently integrated way" (Bryman, 2007). Having considered the challenges of such an approach and the nature of IS Research (see paragraph 4.2.3.1), it was decided to focus on the sole use of primary quantitative data, which is versed in systematic scientific research, and then continue with an analysis in order to prove hypotheses and to formulate conclusions.

4.3.2.1 Subjective or objective data collection

Another important issue relating to data collection approach was the kind of data we were seeking to collect. Researchers have adopted two approaches for data collection: the subjective and objective (Sathe, 1978; Angel and Gronfein, 1988). Angel and Gronfein (1988) view subjective as data relevant to well-being or pain, i.e. data that have no "*objective external referent'*. Under the same thinking objective data include reports that do refer to some *objective external reality* (Angel and Gronfein, 1988).

This thesis has been based on the collection of subjective data which triggered further consideration on the use of scales which are discussed here below.

4.3.2.2 Scales

Four types of scales have been identified in the literature; the *nominal, ordinal, interval* and the *ratio*. Each one represents a higher form of measurement precision. Thus, the ordinal scale provides the least precise measurement whereas ratio the highest one. The sophistication increases with the progression from nominal to ratio and thus the flexibility in using more powerful tests (Forza, 2002).

One of the most commonly-used scales was developed by Rensis Likert (1932), who developed a technique that increases the variation in the possible scores from which a respondent can choose. It has become very popular in social science research but with some controversy. Much debate has been around the subject of this scale being ordinal or interval. Some academics assume that Likert scale is more ordinal in nature than interval but researchers always used it as an interval approximation (eg Allen & Seamn, 2007).

Osgood *et al.* (1957) developed a similar method, named *Semantic Differential,* which uses seven point scale, ranging from one extreme to the other, with the middle category representing neutral. However, the two opposites are not strongly agree - strongly disagree (as in the Likert scale); but sets of adjectives pairs which describe different situations.

Likert scales are frequent in quantitative research because of their "ease, adaptability and reliability" (Hodge & Gillespie, 2003). Likert scales have been studied with regard to the effect of the number of scale points on the reliability and on the Type I/Type II error rates of statistical tests (e.g. Cicchetti, Showalter & Tyrer, 1985; Cox, 1980). Churchill and Peter (1984) reported that better reliability and validity could be obtained by increasing the number of rating points. Cicchetti et al. (1985) studied the effects of the number of scale points from 2 to 100 and they concluded that reliability increased steadily from a 2-point scale to a 7-point scale but there was not any significant effect after the 7-point scale.

Concerning the number of points (five versus seven), it should be noted that Lissitz and Green (1975), argued for the use of five or seven point scales with inconclusive results. Gregoire and Driver (1987), on the other hand, reported serious effects on the Type I and Type II error rates when using a 5-point scale. However, other studies (e.g. Rasmussen, 1989) indicate that the accuracy of statistics calculated on these scales is not affected provided that the scales have points about 5 or more and that the Type I and Type II error rates are not seriously compromised by the use of ordinal-scale data (Rasmussen, 1989). Bandalos and Enders (1996) in their research also found that after the 5 or 7 scale points, reliability values are levelled off.

Concluding this section it should be mentioned that we considered the Churchill and Peter (1984) findings in favour of increased number of scales. Having in mind the above analysis, as well as the findings from the pre-testing phase, we adopted the seven point scales throughout the questionnaire.

4.4 Research Design Approaches

There are two research approaches: the *deductive* and the *inductive*. Ghauri et al. (1995) opine that induction might lead to theories and hypotheses, whilst when employing deduction, the hypotheses are either accepted or rejected. In other words deduction is "about testing theory, whereas induction is concerned with the nature of a problem and the formulation of a theory" (D'Cruz, and Noronha, 2000). These approaches are discussed in the following sections.

4.4.1 Aims and Objectives of a Research Design Approach

Three main approaches relating to research design have been proposed (e.g. Ghauri et al., 1995; Robson, 2002 p.59) in the social research context: *exploratory*, *descriptive* and *explanatory* (causal). Each one has its specific characteristics and its optimal use for the purposes of research:

An *exploratory* study is a valuable means of finding out "what is happening; to seek new insights; to ask questions and to assess phenomena in a new light*"* (Robson, 2002, p. 59). Exploratory research is followed during the preliminary stages of research when the problem is not well understood and structured (Ghauri et al., 1995; Webb, 1992) and the whole process is characterised therefore by high levels of flexibility (Webb, 1992). There are three principal ways of conducting exploratory research: (i) search of the literature, (ii) interviewing 'experts' and (iii) conducting focus group interviews (Kumar, Aaker & Day, 2002). The exploratory approach is primarily adopted where the phenomena under investigation are inadequately understood. Moreover, this research is advisable when the researcher needs to identify main variables, to test the feasibility of undertaking a more detailed study, and to generate hypotheses for further research. In short, the main purpose of the exploratory approach is to grasp an overall understanding of the variables relevant the research problem.

A *descriptive* study "aims at portraying an accurate profile of persons, events, or situations" (Robson, 2002, p.59). In this case, the research problem is clearly defined and the main purpose is to describe the research phenomenon. Through descriptive research the research objectives provide evidence ir verify the phenomena of interest and "it is more appropriate when hypotheses are to be tested. In other words the purpose of description is to answer to the question of "what" (Bacharach, 1989; Dubin, 1978; Whetten, 1989).

An *explanatory* study explores and tests causal relationships between variables. The key task is to isolate causes and to find out to what extent such causes relate to effects. "This design process requires that the researcher manipulates one or more independent variables in order to observe the effects on the dependent variables" (Kerlinger, 1986). To simplify the concept of causality, it should be mentioned that "two variables are considered to be causally related if the cause precedes the effect in time, an empirical correlation between them is evident, and their relationship is not due to the effects of a third variable" (Babbie, 1992).

4.4.2 Time frame employed in Research Design Approach

The second way of categorising research designs is according to the time frame employed. There are two major approaches; *cross-sectional* and *longitudinal* studies. In the first, the researcher explores its sample at one point in time while in the latter approach observations are made at many time intervals (Saunders et al., 2007, p.148). However, time and budget constraints as well as career pressures have lead the vast majority of researchers and the author of this dissertation to adopt a cross-sectional approach (Parasuraman et al, 1991; Rindfleisch, Malter, Ganesan and Moorman, 2008).

4.5 Research strategy

As discussed, there are several different research strategies that can be used for exploratory, descriptive and explanatory research (Yin, 2003). Some of them clearly belong to the deductive approach, others to the inductive approach. The most important are discussed:

- An *Experiment* is the form of research that is used mainly in natural sciences (Hakim, 2000).
- A *case study* is a "strategy for doing research which by using multiple sources of evidence, a researcher investigates empirically a particular contemporary phenomenon within its real life context"(Yin, 2003). This strategy can provide insight and understanding of the problem being explored (Morris and Wood, 1991).
- The '*action research'* strategy proposed by Lewin (1946) has the following characteristics: a) research on action rather than about action (Coghlan & Brannick, 2005; Marsick & Watkins, 1997); b) "involvement of academics/consultants with a genuine concern for the expected findings" (Eden and Huxham, 1996, p.75) and c) iterative

nature of the process of diagnosing, planning, taking action, and evaluating.

- The *Grounded theory* (Glaser & Strauss, 1967) or 'theory building' is considered an inductive approach that is used by researchers in their attempt to predict and explain behaviour (Goulding 2002).
- A *Survey* is usually associated with the deductive approach. It is, therefore, used mainly for exploratory and descriptive research. Surveys are popular because, in a cost effective way, they allow the collection of a large amount of data from a sizable population. Finally, surveys "allow the collection of quantitative data which can be analysed using descriptive and inferential statistics" (Saunders, 2007, p. 138). A survey research involves asking people using mail questionnaires, phone interviews, or face to face interviews depending on the budget and time constraints of the research (Rossi *et al*., 1983). Surveys usually collect quantitative data and sampling techniques are applied to target at a representative fraction of the studied population (Malhotra & Grover, 1998; Rea and Parker, 1992).

Concluding the section of research design, it is noted that given the nature of the research problem and the fact that sufficient evidence- from the literature-is available to formulate propositions for testing, it is deemed that a survey adopting an explanatory approach, being cross sectional in character, would be the most suitable for the study. The following paragraphs review the literature on survey research placing an emphasis on the research considerations and challenges associated with this thesis.

4.5.1 Survey considerations

Theory testing survey research is a long process which presupposes a number of processes (Forza, 2002), which we can say constitute three main research stages:

a) The construction of a theoretical model / conceptual framework to guide the research by depicting the propositions/hypotheses which, in turn, translate "*the theoretical domain into the empirical domain*" (Sekaran, 1992; Wacker, 1998).

b) The empirical stage which, usually, includes many sub-processes: the definition of the unit of analysis; the selection of the surveying technique, the survey design; the pilot testing processes and the process of collecting data for theory testing.

c) The data analysis and the ensuing interpretation of results.

The first stage has been fully analysed in Chapter three where all constructs are explained together with the important linkages between them. The processes and consideration of the empirical part are discussed in the remainder of this chapter, while the stage of data analysis will be covered in chapters five, six and seven.

4.6 The considerations and challenges of the empirical part

As already discussed in chapters 1 and 3 this research has been conducted on Greek enterprises that have adopted IS, focusing on the latter's impact on organisational performance. Choosing Greece was a decision that was based on some reasons of academic and practical nature: While adding to existing knowledge in the field of IS, the research so far in Greece was limited to case studies (Longinidis and Gotzamani, 2009; Myrtidis and Vishanth 2008) or to surveys on ERP system implementation success factors (Spathis and Constantinides, 2003; Stefanou 2001). The use of IS and the evaluation of the outcome in Greece are seen as a trivial procedure in many companies and the reading revealed the need for a holistic approach that would involve the entire country and all kinds of systems implemented. Furthermore, for reasons of feasibility, it was deemed more sensible as well as convenient to conduct the research in the author's home country. The IT managers were considered as the target respondents as they would have an interest to provide meaningful responses regarding the use of Information Systems. Furthermore, this being a research that focused on organisational and not on individual performance, these people were targeted as the most knowledgeable informants.

Data for this study were collected by means of a questionnaire and a sample of 700 companies of different sizes operating in various industries. 168 usable responses were collected from different industries and company sizes. The choice of the sample instigated some methodological dilemmas and challenges that had to be handled with special care: The one key informant or the multiple respondent approach, the steps to avoid common method variance as well as the survey translation to Greek and back translation to achieve equivalency (Hambleton, 1994). These are discussed in detail along with all the other challenges of the empirical part in the following paragraphs (4.6.1, 4.6.2 and 4.6.3).

4.6.1 Defining the unit of analysis

The unit of analysis in business studies may be divisions, companies, projects, systems, individuals, dyads, groups, plants, etc. (Flynn *et al*., 1990). In cases where the level of reference is higher or lower from the unit of analysis the researcher will face the "*cross-level inference problem"* (Babbie, 1992), i.e. collecting data at one level and interpreting the result at a different level (Dansereau & Markham, 1997). This introduces bias and it can be avoided by choosing the most knowledgeable person *about the construct of interest* (Huber and Power, 1985).

4.6.1.1 One Key Informant or multiple respondent approaches –dealing with Common Method Variance

A multiple respondent approach provides certain advantages (Reio, 2010; Venkatraman & Grant, 1986; Glick *et al.*, 1990). Researchers and theorist conclude that the most important reason for adopting this approach is avoidance of Common Method Variance (CMV) (Podsakoff & Organ, 1986; Richardson, Simmering & Sturman, 2009; Spector, 2006 as cited in Reio, 2010). This variance is caused to the measurement method (Campbell & Fiske, 1959; Podsakoff et al., 2003) and it happens when participants respond to all survey items in a single sitting (Burton-Jones, 2009), meaning that one respondent completes the questionnaire (Podsakoff et al., 2003, pp.881-885). This might affect the validity of the relationships between the measures of different constructs (Reio, 2010). However, there are researchers that have questioned the significance of CMV as time and cost considerations can severely limit the researcher's options for multiple methods of data collection (Spector, 2006).

As understood it was not easy for this research to use multiple respondents approach due to time and budget constraints. Furthermore, having considered the nature of our study (Malhorta, Kim & Patil, 2006) the constructs under examination and the kind of information we were looking for (Gupta, Shaw and Delery, 2000), it was deemed acceptable to use the one key informant approach. The literature discusses several advantages of this approach (Seidler, 1974; Glick *et al.* 1990; Podsakoff et al., 2003; Rindfleisch, Malter &Spector, 2006; Ganesan and Moorman, 2008). Some of them include:

- high probability that data is provided by the most knowledgeable informant
- low variation in informational and motivational biases
- high probability that respondents will agree to participate and
- given a fixed budget an increased number of respondents can be included in the sample

Furthermore, Gupta, et al. (2000) opine that when research is not focusing on the respondent characteristics (reporting on their own attitudes, perceptions) then key-informant methodology is best suited to provide valid findings "because of their formal positions in the organisation and their knowledge of the core issues in the study" and, as such, are called on to make generalisations "about patterns of behaviour, after summarising either observed (actual) or expected (prescribed) organisational relations" (Seidler, 1974, p.817; Gupta et al., 2000, p.323-324). Finally, according to Gupta, et al. (2000, p. 343), the key informant approach combined with "a timely research question, high-quality preparatory work, and a closely developed relationship with informants can result in very high response rates, even with prohibitively long questionnaires"

Nevertheless, many researchers argue that the key informant approach requires careful consideration of specific issues to reduce potential measurement error (Campbell & Fiske, 1959; Huber and Power, 1985; Podsakoff et al., 2003). Recent studies provide us with solutions/ways for handling the bias introduced due to CMV (Burton-Jones, 2009; Podsakoff et al., 2003; Rindfleisch, Malter, Ganesan and Moorman, 2008; Spector, 2006 as cited in Reio, 2010). These ways include "*avoidance of common source, introduce time lag between the measurement of the predictors and dependent constructs, ensure confidentiality, use scales that are clear and precise and provide clear instructions for questionnaire completion"* (Podsakoff et al., 2003; Reio, 2010). In this study, we took the following measures, suggested by the literature, to avoid Common Method Variance:

- Identification of the key informant,
- Recognition of key informant's emotional involvement with the subject,
- Steps to motivate key informant to co-operate with the study seriously,
- Minimisation of elapsed time,
- Consideration of the impact of alternate framing of questions and finally,
- Use of pre-tested and structured questions.

The decision taken for this research favoured the choice of the Information Technology Manager as the most appropriate respondent for the organisational performance construct. The approach taken followed the steps and guidelines adopted by the Chang and King (2005) study which in turn was based on the literature on organisational effectiveness (Cameron, 1986; Cameron and Whetton, 1983). Therefore, the IT manager of the firms in our sample was considered to have the knowledge and interest to provide meaningful responses regarding the use of Information Systems and was targeted as the most knowledgeable informant. These guidelines have been used by other researchers (e.g. Seddon et al., 1999; Bernroider, 2008) in their quest to explore Information System effectiveness.

In chapter 5 we discuss in detail the Job-titles of the key informants of our sample. Table 5.4, in particular, presents the translation of several titles around the IT managerial position that we collected from our answers. Apart from the initial finding on the variety of the managerial titles, it was apparent that the majority of the informants were IT Managers or Chief Information Officers, i;e. people in managerial positions. In other words, the collection and interpretation of data occurred at the same level to avoid the *cross-level inference problem"* (Babbie, 1992; Dansereau and Markham, 1997).

4.6.2 Surveying techniques

There are different surveying techniques which are categorised "according to the medium used: face-to-face, telephone, mail or electronic" (Simsek and Veiga, 2000). Whatever the medium used, these techniques are based on "questioning" people to collect primary data with the ultimate purpose of making generalisations about a population from which only some individuals are surveyed (Simsek and Veiga, 2000).

Technological developments have had a huge impact on surveying techniques which have proliferated to many different forms, each one having specific characteristics: computer-assisted personal interviewing (Couper & Burt, 1994), computer-assisted telephone interviewing (Havice, 1990), fully automated telephone interviewing (Dacko, 1995), fax surveys (Vazzana & Bachmann, 1994), and on-line surveys (Dillman, 2000; 2007; Dillman and Bowker, 2001).

4.6.2.1 On line surveys: EST or WWW?

Recent research was shown a shift from traditional paper surveys to Web-based administration procedures (Thompson, Surface, Martin & Sanders, 2003). Within the on-line context, a survey technique can be a simple e-mail or Electronic Survey Technique (EST) or a WWW based one (Simsek and Veiga, 2000). The former uses a self-administered questionnaire which is distributed (by e-mail) to potential respondents who, in turn, complete it and return it. The latter is a technique that uses a questionnaire located at a specific site of the study (Subramanian, McAfee & Getzinger, 1997). The questionnaire is filled out by clicking on small circles/boxes to respond to a specific question. "These WWW surveys can have features like images and sound graphics, and responses can be coded and processed faster" (Roberts, Konczak & Macan, 2004). On the other hand, the attached e-mail survey has several disadvantages that might cause low response rate: the fear of computer viruses and the extra burden for the potential respondent who must have the "hardware and software that will enable him/her to download, read and upload a foreign file", (Dommeyer & Moriarty, 2000).

4.6.2.2 Comparing Web and Paper-and Pencil surveys

Comparing the Web techniques with the traditional Paper-and Pencil methods (PP) it can be said that the former have several advantages over the more conventional PP method (Yun & Trumbo, 2000). Some of the expected benefits are the following: they are convenient to complete at any day/hour (Pettit, 1999; Stanton and Rogelberg, 2001), allow for considerable savings of time and cost relevant to paper, envelopes and stamps (Dillman, 2000; 2007; Stanton and Rogelberg, 2001); provide a wide variety of response formats (Simsek & Veiga, 2001) and have a wider geographical reach (Epstein, Klinkenberg, Wiley & McKinley, 2001). In addition, more recent research has found some other less apparent advantages dealing with the processing of the responses such as: faster data collection, less coding errors and less missing values (Cook, Heath, Thompson & Thompson, 2001; Roberts, Konczak & Macan, 2004)

However, this method of conducting surveys has several disadvantages that have been found by the relevant research, the most important being the higher non-response rate (Schaeffer & Dillman, 1998; Crawford, Couper and Lamias (2001), A meta – analysis by Shih and Fan (2008) showed a difference of 11% in favor of conventional mail surveys. Other researchers found that web surveys have a higher risk of getting dishonest answers (Booth-Kewley, Edwards, Rosenfeld, 1992; Lautenschlager & Flaherty, 1990) and the inclusion of multiple submissions (Reips, 2000).

Many other authors have pointed out that privacy is another primary concern with online surveys (Cho & LaRose, 1999; Thompson and Surface, 2007) as well as a feeling of being overwhelmed by 'o*versurveying*' (Tippins, 2002). Other issues with on-line surveys include potential technical difficulties with the computer or software systems employed. These may also include inability to easily complete the survey, or even computer literacy (Thompson et al., 2003).

Last but not least, there is the "*coverage problem*", as all online surveys are restricted to people with e-mail address and they cannot include the views and opinions of the general public (Paolo et al. 2000; Parker, 1992). Finally, Weible and Wallace

(1998) found a very high returned or undeliverable rate as e-addresses become outdated very fast.

4.6.2.3 Types of Bias

Burkey and Kuechler (2003) identified three basic types of bias important for web surveys, these being; coverage, sampling error and on-response error, and they are briefly analysed:

Coverage and sampling error occurs because of a mismatch between the target population and the sample population. Sampling in the web survey face unique challenges related to sampling error and coverage error (Couper, 2000). Sampling error therefore is "the result of collecting data from only a subset, rather than all, of the members of the sampling frame" (Dillman, 2007, p. 43). The coverage error "results from every unit in the survey population not having a known, nonzero chance of being included in the sample" (Dillman, 2007, p.43). This is a common and important issue with web surveys, even with finite population lists, as the web addresses become outdated very fast (Cook, Heath and Thompson, 2000; Shih and Fan, 2008).

Non-response error, according Dillman (2007, p.17), occurs when not all sampled respondents, actually respond to the survey. Bias due to non-response error is a very important consideration for any web research and special tests are conducted to make sure that this is managed in an appropriate manner.

4.6.2.4 Deciding on the Appropriate Research Design Approach

Prior to adopting one or more research design approaches, the present thesis has carefully considered two important issues; namely the conceptual model of the thesis (presented in Chapter 2), as well as the research objectives of the study (presented in Chapter 3). The approach followed in this thesis is based on deduction, as it is deemed to be the dominant research approach (Collis & Hussey, 2003) and because it has specific characteristics that apply to the present analysis: a) it explains causal relationships; b) it involves the collection of quantitative data; c) it allows the application of controls to ensure validity of data; d) it entails a highly structured approach; and e) it necessitates the selection of samples of sufficient size in order to generalise findings. As such, both a descriptive and explanatory cross-sectional research approach was adopted in order to test a number of hypotheses among the main theoretical constructs presented earlier.

Considering carefully the above mentioned pros and cons of the various surveying techniques and methods and having in mind that the targeted sample is computer literate people with internet access it was decided that the surveying technique would be conducted through the use of a web questionnaire. In addition, based on the Kiernan, et al. (2005) findings, we considered that the Web survey could be as effective as a mail survey in the completion of "*quantitative questions that measure knowledge, attitudes, behaviours, and intentions*" (Kiernan et al., 2005). The following section discusses in detail the concerns relevant to this e-survey design such as the process of web site construction, development of the research instrument for the empirical part of this thesis.

4.6.3 The four steps of the Web survey

The process followed for our web survey is based on the most recent research findings from Fan and Yan (2010). According to the authors, the process of a web survey includes four basic steps:

a) *"web survey development* during which surveyors (researchers) design the survey and upload it to the survey website which resembles the process of developing a conventional mail survey (printing out the necessary documents)".

b) *"web survey delivery* where the researchers develop a sampling method, contact potential participants, and deliver the web survey which resembles the process of mailing the questionnaires".

c) *"web survey completion* in which the web respondents complete the survey i.e: log into the survey website, complete the relevant questions on–line and then log out, as in the conventional process of completing a paper questionnaire".

d) *"web survey return* constitutes the last step in which the surveyors download the collected data from the website, which is like the process of handing in or sending back the completed survey document".

The following paragraphs analyse each of these steps, placing an emphasis on the most critical challenge identified form the extant literature: the response rate. As discussed most web surveys are subject to two main challenges: losing participants with no e-mail address and low response rates (for the reasons already discussed in paragraph 4.6.2.3) which might produce biased results (Couper, 2000; Fricker & Schonlau, 2002). The first challenge was not perceived as an issue for the specific research due to the nature of the research objectives. However, special emphasis was placed on all the factors which could affect the non response bias such as incomplete database, mistrust about survey uses, internet surveys perceived as spam survey length and privacy (Evans and Mathur, 2005).

4.6.3.1 Web survey development

This process started in October 2009 and finished in February 2010 and concerned the construction of the measuring instrument and its presentation on the web site. More than fifteen (15) versions through revisions were produced for the questionnaire to take its final form. The first ten (10) efforts concerned the content itself: the content and length of the measuring instrument, the translation, the wording and the order of paragraphs. The last five efforts concerned its digital presentation. The main activities are presented in Table 4.3 whilst the pertinent theory and challenges are discussed in detail in the following paragraphs.

Table 4.3 Web survey development activities and considerations

Source: Author

Web survey development - October 2010-February 2010 Construction of the measuring instrument
The content- Question Types
Labeling of scales and the use of midpoint
Survey translation
The length of the questionnaire
Wording and paragraph order
The interface design /display of the measuring instrument
Pilot testing and technological concerns

The content of the measuring instrument

At this point it should be mentioned that we removed several items suggested by Chang and King (2005) and we added some new items, as identified from the more recent literature findings. The questionnaire for the IT manager was divided into five sections (from I to V), each one exploring the main concepts of our model. Questions 1-9 comprised Part I, seeking to collect data on the company's / manager's background and on the kind of IS adopted. List and category questions were used for that part. Questions 10 -17 (Parts II to IV-109 items) were aiming at the perception of the IT manager regarding the use of the IS from the entire company. Questions 18-19 (Part V-27 items) were dealing with the organisational performance construct. (see Appendix 3.1).

Question Types –labelling of scales and the use of midpoint

The first part of the questionnaire comprised mainly closed-end questions, designed to give both category (yes/no) answers and ranked responses, in order to facilitate quantitative analysis. The remaining parts contained only ranking questions. Another important issue concerning the construction of scales was whether to label all scale points with words or to label with numbers. According to Krosnick and Fabrigar (1997) each decision has advantages and disadvantages. Numerical points can be more precise than verbal labels. On the other hand numbered scales have no inherent meaning other than to suggest equal divisions (Krosnick & Fabrigar, 1997). The use of the midpoint on a Likert-type scale serves two meanings (Ryan, 1980): neutral (Ayidiya & McClendon, 1990) or do not know/undecided (Schuman & Presser, 1977; Tuohy & Stradling, 1987).

Furthermore, following a pilot study of the paper and pencil questionnaire draft, we concluded that people found it more natural to express their opinion via words. Due to this important semantic ambiguity of the midpoint we included both a separate response category 'don't know' on Non Applicable and a midpoint, since both choices are of use and can be seen as "*an indication of knowledge or involvement"* (Raaijmakers, et al., 2000).

Survey translation

Survey translation was another important issue that was considered together with the length of the questionnaire. It was essential that the English and Greek versions of the survey instrument be '*equivalent*' (Brislin, 1970; Werner & Campbell, 1970). "To achieve *equivalency,* the English version was translated into Greek by the author who has bicultural experience and could therefore communicate the intended meaning" (Hambleton, 1994). The next step involved a pilot-test of the Greek version which was distributed by e-mail to 10 IT managers and consultants in Greece as we needed to make sure that we had conveyed the appropriate meanings (Beck, Bernal & Froman, 2003). The IT managers were asked to report any ambiguities on each item, together with any problematic wording in the headings and constructs. The two constructs were found vague and three items were removed as their Greek translation caused repetition of the same meaning.

The improved version was then *back-translated* into English by a bilingual academic, which was deemed necessary for the semantic equivalence in cross-cultural research (Beck, Bernal & Froman, 2003; Brislin, 1970). The final step involved the validation of the five dimensions (Flaherty et al., 1988) of cross-cultural equivalence:

the *content equivalence* as well as *the semantic equivalence* of each item ensuring that the original meaning of each item was conveyed in the adapted version (Brent Mallinckrodt and Chia-Chih Wang, 2004). Special care was given to the *criterion and conceptual equivalence* of the underlying constructs to make sure that the original concepts had been kept. Finally, the *technical equivalence* was ensured, since the data collection method was not supposed to raise any cultural concerns.

The length of the questionnaire

The length of the questionnaire was our first concern as we tried to keep it as short and possibl, since, a negative linear relation of length with response rates in mail and web surveys has been found in previous studies, (Cook et al., 2000; Edwards et al., 2002; Heberlein & Baumgartner, 1978; Walston et al., 2006; Yammarino et al., 1991). The paper and pencil version of this questionnaire produced a draft of 9 (nine) pages which was found appropriate when compared with the paper and pencil Dillmann (1978) suggestions for a maximum of "12 pages" questionnaire.

Wording and paragraph order

Special care had been taken to ensure that questions were simply worded and not leading. Wording the questions was recognised as another important factor for a successful completion and the basic principles for writing the mail survey were kept: using simple questions, avoiding biased and vague parts generalisations, ambiguous expressions etc (LaGrace & Kuhn, 1995; Dillman & Smyth, 2007; Tourangeau,Rips & Rasinski, 2000). In addition special care was given to the introductory paragraph of each of the questionnaire parts.

Finally, the questions were ordered according to their content, taking into account that the accuracy of the questions can be negatively affected by response-order effect (Krosnik and Alwin, 1987). Ordering of questions has a significant impact on the responses: Researchers have found that the preceding questions can affect how respondents evaluate the latter questions (Couper, Conrad & Tourangeau, 2007; Mason, Carlson & Tourangeau, 1994; Tourangeau, Couper & Conrad, 2004). Since the recent research on web survey has not provided us with specific insight as to the ordering of questions (Fan & Yan, 2010), we followed the same order as the original survey conducted by Chang and King (2005) as this had already been tested for its impact on respondents.

The interface design /display of the measuring instrument

Having completed the questionnaire content, the next step was to develop the web link for its communication. There are many web survey software products available for researchers such as SurveyMonkey, SmartSurveys, Web-Based Survey etc. Having carried out some literature research we found that these programs support different browsers (Couper et al., 2004; Dillman, 2000) and each one of them could display differently our survey to respondents.

We conducted a thorough literature research on the interface design, since the visual layout is important for respondents when they decide on which answer to select (Couper, Traugott and Lamias, 2001). There is a long list of technicalities for the display design, including human–computer interaction (Couper & Hansen, 2002) and web site usability (Nielsen, 2000) issues: the choice between screen-by-screen or scrolling, items per screen, how to use backgrounds, logos, graphics, progress indicators, and navigational instructions, how to choose radio buttons, check boxes, etc.

There is considerable literature on the choice between screen-by screen or scrolling questionnaires which constitute the main questionnaire layouts (Couper et al., 2001; Peytchev, Couper, McCabe & Crawford, 2006; Tourangeau et al., 2004). The scrolling design needs the respondents to scroll from the head to the bottom to view the whole questionnaire and provide responses, which according to Dillman (2007) "(a) *requires less computer time and computer resources to contact with the web server because it only requires one single submission of the final responses and (b) provides richer context for respondents to respond because all questions are on one page*".

The screen-by-screen designs put one or several questions within *one screen* and respondents press the button of ‘‘next page" in order to continue. Peytchev et al. (2006) found a major advantage of this design: respondents skip easily the questions that are not applicable to them, whilst at the same time know the exact completion time left; this makes them feel more satisfied with the survey (Schonlau, Fricker & Elliott, 2002) . We decided on the screen-by-screen design as our pilot testing results coincided with the Schonlau, et al. (2002) findings that scrolling can become boring for respondents as it gives the impression that the survey is too long to complete.

The next important issue to deal with was the "items per page". Toepoel, Das and Soest (2009) found that the optimum number of items per screen requires a trade-off: They argue that survey time shortens with more items per screen but data and respondent satisfaction may be reduced. They also found that non response increases with the number of items appearing on a single screen Following the Toep**o**el et al.

(2009) suggestion we decided on ten items per screen, thus avoiding the necessity to scroll. This resulted in a 12 screen questionnaire which was found appropriate when compared with the paper and pencil Dillmann (1978) suggestions for a "12 pages" questionnaire.

Pilot testing and technological concerns

This was the final step before the survey delivery, during which we tried to assess the virtual appeal of the survey as well as several technicalities with a few number of respondents in the real life situation (Fan and Yan, 2010). Pilot testing of paper based questionnaires normally deals with issues such as whether the questions are understandable, whether the directions are clear and the time to complete the questionnaire (Umbach, 2004). However, web based questionnaires require "*pilot testing related to hardware / software interactions, respondent interactions with the survey and data processing*" (Austin, Richter and Reinking, 2008). Pilot testing of the questionnaire was carried out with the help of a five volunteers sample selected from the target sample population. The pilot test respondents were contacted personally and asked if they would be willing to participate. Then they were provided with the web link to the survey.

Layout was considered very important as "*an attractively designed, well spaced document, with headings in different print, questions clearly numbered, insets, underlining and boxes for replies, all help to increase response rates*" (Staples, 1991). Many different versions were created to test the backgrounds, the radio buttons and the navigation instructions. A plain design with two colours was found more attractive. An introductory paragraph was also added together with a progress measurement screen. A 'thank you' screen at the end of the questionnaire was considered to be a good practice. The completion of the questionnaire varied between 8 and 12 minutes.

We tried to address the technological concerns such as *authentication* (Gilmore, Kormann & Rubin, 1999) and avoidance of *multiple responses* (Schmidt, 2000). Access control and authentication were deemed very important in the sense that unwanted research participants should be allowed to have access to web link (Stanton & Rogelberg, 2001). For this reason, access to the web site was allowed only with the use of password (Schmidt, 2000). The other aspect of avoiding multiple responses from the same individual could be solved with the filtering of IP address attached to each submission (Stanton & Rogelberg, 2001).

4.6.3.2 Web survey delivery

Having solved the website technological issues and the content development, the next step was to deliver the survey to the potential respondents. The literature discusses five important issues that had to be addressed: the sampling issues and the targeted respondents, as well the factors that might increase the response rate, such as personalisation, the use of pre-notification and reminders and last but not least the use of incentives. These are depicted in Table 4.4.

Table 4.4 web survey delivery and relevant considerations

Source:Author

Web survey delivery - February 2010-March 2010
Deciding on the sampling frame
Deciding on the sampling techniques
Finding the targeted group
Clearing up the data-Phase I of the survey Feb -8th 31st March
Using pre-notification and reminders
Using personalised messages and incentives

Deciding on the sampling frame

We decided to choose an appropriate sample that could be sufficient for us to generalise upon our findings. In our research the population was defined by the following criteria. First, the companies should operate in Greece. Secondly, the firm should employ more than 50 employees. Thirdly, an IT manager should be easily identifiable, and finally firms should operate in various industries so that the external validity of the findings could be reinforced. Having defined our objectives concerning the population of our study, a sampling frame had to be determined which successfully satisfied the above requirements. A number of prospective published materials were examined. These were: Athens Chamber of Commerce list of companies, the “Who is Who” on line list of Greek enterprises, and the ICAP list of Greek firms. It was decided that the ICAP Directory satisfied most of the Criteria listed above and a sample of 2,800 companies was drawn from this directory. In addition the ICAP directory was found to be the most updated list from the directories available at the time.

Deciding on the sampling technique

Web surveys can be categorized like mail surveys into two non-probability surveys and probability surveys (Couper, 2000). Non-probability web surveys include a chosen group of volunteer opt-in respondents which renders the findings not generalisable.

Probability web surveys are based on random selection to select a sample and are subject to greater generalisabilities.

This research *was based on probability sampling* and we used the ICAP directory of all companies in Greece which employed more than 50 people. Micro SMEs were not included as they were unlikely to have adopted an Information System appropriate for the research objectives (Argyropoulou et al., 2008). Having considered the additional challenges and errors that arise from the web survey we used the entire data base list (2,800 companies employing more than 50 people) which would reduce the sampling error to the minimum as the directory included the entire population. The non-coverage error was considered a major concern as we could face the problem of outdated or wrong e-mail address. In addition, identifying our Key informants (the IT managers) became an additional challenge as the ICAP list contained only the general company contacts, e-mail address and a phone number. It was important to find the appropriate informants for the information required as answers from not knowledgeable respondents "cannot be trusted and increase random or even bias error" (Forza, 2002). For this reason we decided to clear up the database, aiming at the collection of valid address in the first place and at the identification of IT manager names and personal addresses. This is described in the next paragraph.

Updating the ICAP directory - respondent identification

As discussed, the list provided by ICAP contained in most cases an impersonal address such as "*info@....*" However, this could not cover the requirements of our research as we needed specific information, i.e. the names and e-mail address of the Information Technology Managers or CIOs who were considered the key informants for the survey.We used all the 2,800 e-mail contacts that were provided in the database and we sent a standardised message to the contact addresses informing the potential recipients of the upcoming arrival of a University survey and asking for the name and e-mail address of the Information Technology Manager. The unknown recipient would easily respond by replying to the sender after having completed a small table with the necessary information. This would provide us with the necessary information for the construction of a revised database with the personal details of the targeted respondents.

The first contact message to the unknown recipients explained clearly the reason we were asking for the IT manager's personal details and the research topic, which was expected to increase the response rate as it was deemed high salience (i.e., of high interest to potential respondents (Dillman, 2007, p.155). (A copy of the first contact message is found in Appendix 4.1). Our first attempt produced a very high rate of delivery failures for two reasons: Most of the e-mail addresses were not correct and some others were returned as they were perceived as spam. We had a total of 450 mailer-daemons and automated system administrator replies that indicated respondents were not able to receive e-mails (i.e., their mail was “bounced”). In addition, it proved an ineffective process as it produced a mere 40 IT manager names. We separated the returned mails, found some 2,300 valid addresses, and decided to proceed with an alternative method to update our database making random phone calls in alphabetical order. The phone call was always answered by a secretary who was advised on the purpose of the call and was asked to provide us with the name and e-mail address of the IT manager if there was any.

This process started early February 2010 and finished late March as depicted in Table. 4.5 and provided us with 410 IT manager names and e-mail addresses and we decided to start the survey immediately, thus keeping our IT managers continually in touch. Before we describe the next step - the survey delivery process - it should be mentioned that all key practices for an increased response rate were followed and are analysed in the following paragraphs.

Pre-notification

Many researchers have found positive effects of pre notification and reminders on response rates (e.g. Cook et al., 2000; Crawford et al., 2001; Trouteaud, 2004). One week prior to the issue of the questionnaire (on April 12, 2010 an e-mail was sent to the targeted population with a letter attached to explain the background to the research, request help and advise recipients that a questionnaire would be issued in one week’s time. 450 personalised messages were sent to the IT managers and another 6,400 messages were sent to multiple addresses for the attention of the IT manager.

Table 4.5 Identification of IT Managers

Source: Author

Clearing up the database *IT manager’s names/addresses*	**Outcome**
By e-mail 8th February 2010	
2,800 messages asking for details	450 returns 50 refusals **2,300 valid addresses**
By phone calls: Mid Feb. –End March	
Random Calls to secretaries	410 IT names /addresses
Result	**40+410 = 450 IT names**

All participants were informed of the coming survey and notified that they would receive a web link for the on-line research. All potential participants were assured of confidentiality and voluntary participation. This proved an effective approach as we received several replies expressing an interest to participate.

Personalisation –participant information - Reminders

The research findings are inconclusive concerning the effects that personalisation has on the final response rate and the speed of completion (e.g. Houston and Jefferson, 1975; Heerwegh, 2005; Porter & Whitcomb, 2005). However, as far as web surveys are concerned, the personalisation tactics seem to affect positively the response rate (Cook et al., 2000; Joinson, Woodley & Reips, 2007). The use of personalised greetings (Heerwegh, 2005) and personalised e-mail addresses (Porter & Whitcomb, 2005) increase significantly the response rate. As already discussed it took us almost three months to collect 450 names and personal e-email addresses which would help us send personal survey invitations.

A participant information letter was sent to the targeted population on the starting date of the survey containing a link to the questionnaire and specific details on the purpose of the research (see Appendix 4.1). Based on the Kaplowitz et al. (2004) findings we tried to place an emphasis on the academic orientation of the survey. The sponsorship by the University was made clear in the main text and in the subject line. All messages sent to the targeted population were stressing the fact that the responses would remain absolutely confidential and that anonymity was guaranteed. Proper on-line signatures of the researchers were incorporated in both letters (pre-notification and participant information) together with their academic titles as this would affect positively the response rate (Manfreda et al., 2008; Walston, et al., 2006). The messages were sent from the University's account with clear subject lines to avoid its blocking as spam (Couper, 2000; Couper, Kapteyn, Schonlau & Winter, 2007). Two follow-up e-mails were also sent asking those who had not responded to contribute to the research. Table 4.6 presents the entire communication process and the related results.

Incentives

We assured the respondents that they would receive a complementary report concerning the major findings of our survey. This kind of reward seemed justifiable from the reward point of view (Porter & Whitcomb, 2003b) and was conspired important for the building of a good relationship with the respondents (Forza, 2002)

4.6.3.3 Web survey completion

This is the stage of the actual survey in which the web surveyees (IT managers) complete the survey i.e: they log into the survey website, complete the relevant questions on-line and then log out. The survey started on April 12th with a pre-notification to invite the IT managers to participate in our research and the link to the survey was sent one week later with another cover letter. All shots included 450 personalised messages and 600 messages that were to be forwarded to the IT manager. Having followed the alphabetical order we had utilized 50% of the entire database. Two reminders were sent and we managed to collect 133 responses out of which 85 constituted complete answers. All key practices (pre-notification, incentives and personalisation) had been applied and the sample of 450 IT managers had produced a very good response rate of 28%. The completion rate had been steadily around 60%.

However, the outcome of this attempt did not produce a desirable outcome as we needed a minimum of 150 questionnaires to achieve a significant statistical analysis. This being the case, we proceeded with a second identical process of clearing up the remaining part of the data base focusing mainly on a personalised continuation of the survey as our first sample had been fully exhausted.

Table 4.6 The survey delivery

Source:Author

THE SURVEY DELIVERY *12th April-10th May*	**RESPONSES**	**COMPLETED**
April 12, 2010 –**pre-notification** 450 personalised / 600 blanks		
April 19, 2010 **1st shot**	**106 (22%)**	**68(64%)**
450 personalised /600 blanks April 26, 2010 **1st reminder**	**17(4%)**	**11(60%)**
450 personalised +600 general s May 3rd, 2010 **2nd reminder**	**10(2%)**	**6(60%)**
TOTAL RESULTS	**133 (28%)**	**85 (63%)**

We started a new cycle of intensive phone calls which produced another 250 IT Managers' names and e-mail address. This means that our sample comprised 700 IT maangers. The outcome of this effort is depicted in Tables 4.7 and 4.8. This new survey started on May 3rd with a pre-notification to invite the IT managers to participate in our research and, as previously, we sent the link to the survey with another cover letter one week later. One week after the first call, two reminders were issued notifying those who had not responded of a forthcoming deadline for the closing of the questionnaire, since a dead-line also helps to increase response rate (Porter and Whitcomb, 2003a).

Table 4.7 The survey continuation

Source:Author

THE SURVEY CONTINUATION *3rd May-31 May*	**From Blanks**	**From Personalised**	**Complete**
May 3, 2010 **pre-notification** 250 personalised/800blanks			
May 10, 2010 **-1st Shot**	**22**	**50(20%)**	**43**
May 17, 2010 **1st reminder**	**18**	**12(4.8%)**	**18**
May 24, 2010 **2nd reminder** with deadline	**28**	**8(3.2%)**	**22**
TOTAL RESULTS	**68 (8.5%)**	**70 (28%)**	**83 (60%)**

Table 4.8 Summary of responses

Source: Author

Survey Duration: 19th April - 31 May 2010	**Responses**
Considering the sample of 700 IT managers	196 (28%)
Non respondents	504
Total number of fully completed questionnaires	154 (22%)
Considering the 1,400 blank messages	75 (5.3%)
Total number of fully completed questionnaires	14(1%)
Total number of complete questionnaires	**168**

4.6.3.4 Web survey return and critical reflection on the results

This constitutes the last step in which we collected all data from the website. The previous paragraph described in detail the kind of responses we received. At this stage we can summarise the results as follows:

Advantages of the web-survey

We are in agreement with the benefits reported by other researchers: The web link allowed for considerable savings of time and cost relevant to paper, envelopes and stamps (Dillman, 2000; Stanton and Rogelberg, 2001). We sent the survey to the whole sampling frame which means reaching every company in Greece (Epstein, Klinkenberg, Wiley & McKinley, 2001). The collection of data was fast as they were available in different formats and there were no missing values in the completed responses, since the survey could not continue unless all answers were provided (Cook, Heath, Thompson & Thompson, 2001; Roberts, Konczak & Macan, 2004).

Disadvantages of the web survey

As far as the disadvantages are concerned we comment as follows: The "coverage problem" was not an issue due to the nature of the targeted population who, by definition, had the technology and the skills (Thompson et al., 2003) to complete the survey representing the opinion of the population (Paolo et al., 2000; Parker, 1992). We had a high returned or undeliverable rate (17%) as e-addresses contained in the ICAP directory turned out to be outdated very fast (Weible and Wallace, 1998).

Many secretaries accepted forwarding the link to the IT manager but were reserved as to its completion, mentioning that the company was overwhelmed by 'oversurveying' (Tippins, 2002). We do believe that online surveys intrude on the privacy of companies as pointed out by many other researchers (e.g. Cho & LaRose, 1999; Thompson & Surface, 2007).

Another disadvantage of this technique is inclusion of multiple submissions (Reips, 2000) but this was checked when we browsed the answers looking for identical IP addresses and there was no such issue in our completed responses.

Response - Completion rate

Our response rate compared with conventional surveys is satisfactory as regards the personalised messages. We had an average of 28% response rate which contradicts the findings from the meta –analysis conducted by Shih and Fan (2008) who argued in favor of conventional mail surveys. At this point it should be mentioned that the nature of the research and the educational background of the respondents favored the use of technology. When browsing the responses we found that some respondents started the survey completing PART I (the general information on company's background and the IS used) but they abandoned when reaching PART II which contained the Likert scale questions. Some others started the survey but abandoned it when they reached the IS consequences and the organisational performance construct. Our personal explanation is that respondents were unwilling to spend more time to complete this part. In any case these responses were removed from our analysis.

Some companies wrote back explaining the reason that they could not participate in our survey. The main reasons prevailing in their explanations were:

1. Company policy regarding surveys
2. Outsourcing of IT
3. Too busy
4. Not interested

Some others added that they had had a bad experience in the past as they never received the promised summary of the findings. Our personal feeling regarding non – respondents basically during the first cycle of shots was the adverse financial situation in Greece and the anguish regarding the support from Europe. This was slightly alleviated after the first weeks of May following the decision on financial support, and we felt some relief especially when talking with some IT managers on the phone.

Nonetheless, our general inference for researchers on non-response rate is that personalisation plays the most important role. Another thing that could be discussed is the time elapsed between the phone discussion with a secretary and the survey delivery.

4.6.3.5 Non –response bias analysis

Armstrong and Overton (1977) summarised the literature for estimating nonresponse bias. Three methods were found to be in use: comparison with known values of the population, subjective estimates and extrapolation methods. In our study the extrapolation approach was used which is based on the assumption that the "less readily" (Lambert & Harrington, 1990) respondents are very similar to non-respondents.

Thus, each questionnaire was categorised by the date it was received and subsequently was split in four equal percentiles. The first one characterised as early respondents and the last one as late. The Mann–Whitney test was run between these two groups (group 4 for late respondents and group 1 for early respondents) to examine the null hypothesis that there is similarity in all the variables across the early and late respondents.

Appendix 4.2 illustrates that no significant differences were found among the variables used. As a result, we can support that a non-response biased was not an important issue and the data were unlikely to be biased of non-response errors. The probability value (p) in both tests is not less or equal to .05 which means there are no statistically significant differences in the two scores of the two variables used from late and early respondents.

4.7 Methodology Adopted for Data Analysis

The on-line survey provided us with an immediate spreadsheet with the answers which, as discussed, were examined for multiple responses and completion. The final spreadsheet was copied to a file in the SPSS software for further statistical analysis which was used for the purposes of statistical analysis. At this point it is deemed necessary to comment briefly on the statistical manipulation of variables included in the statistical analyses and the statistical techniques followed in this thesis.

4.7.1 Statistical manipulation of variables included in the analyses

Our *basic assumption* for the subsequent statistical analysis is that the study is based on manipulation of variables with interval techniques (for more details see paragraph 4.3.2.2). As discussed there has been much debate on Type I/Type II error rates of statistical techniques when using Likert scale questions (e.g. Cicchetti, Showalter and Tyrer, 1985; Cox, 1980) but in this thesis we used the Likert scale with interval techniques. Jaccard and Wan (1996, p.4) argued that, "*for a lot of statistical tests, rather severe departures (from intervalness) do not affect Type I and Type II errors dramatically*."

Having in mind the above, and more specifically the available statistical techniques, the most appropriate techniques were selected to be used for the data analysis as the Table 4.9 Illustrates.

Table 4.9 Statistical Techniques deployed for Data Analysis

Source Author

Descriptive statistics for all the questions involved in the **(Chapter Five**)
Examination of data prior to analysis (Missing data and normality tests) **(Chapter Six)**
Data Correlation Analysis performed to detect for any potential underlying relationships within the model's constructs **(Chapter Six)**
Principal Components Analysis on selected variables within each construct and **Exploratory Factor Aanalysis (Chapter Six)**
Correlation analysis (hypothesis testing) and multiple regression analysis executed between the dependent and independent variables **(Chapter Seven)**
Regression model evaluation and assessments of multicollinearity, linearity, homoscedasticity and normality **(Chapter Seven)**

4.8 Overview of chapter 4

This Chapter has presented various issues relating to the empirical approach of this study. As such, an account was given on a number of epistemological themes underlying the empirical study, the adopted research design approach, sampling procedures, as well as issues relating to web survey implementation. In the following chapter, the descriptive findings are presented and discussed.

CHAPTER 5

Descriptive Statistics

5.1 Introduction

This chapter presents the descriptive findings from the 168 usable responses collected from this research. As discussed in Chapter 4, the questionnaire was divided into five sections. Questions 1-9 comprised Part I, seeking to collect sample data on the company's / manager's background and on the kind of IS adopted. Questions 10-17 (Parts II to IV) were aiming at the perception of the IT manager regarding the use of the IS from the entire company. Questions 18-19 (Part V) were dealing with the organisational performance construct. The following sections discuss the descriptive statistics produced from all five parts.

5.2 PART I – Demographics and other sample characteristics

The following sections discuss the sample characteristics and present the findings from the 168 complete questionnaires.

5.2.1 The industry and the size of the companies

Table 5.1 shows that the participating companies represent many different industries with nearly 60% of the companies in manufacturing, pharmaceuticals and diary firms followed by commercial firms /retailers (25%) and services like banking, hospitals and consulting companies (15%). As it is seen in Table 5.2 our sample comprised mainly companies employing more than 50 people which was expected as this had been determined for our targeted group as micro SMEs were unlikely to have implemented IS for our research.

5.2.1.1 IS users

Table 5.3 shows the frequency and the percentage of employees actually using the IS in their company and it is clear that in our research we had 70% of companies with an IS literate workforce.

Table 5.1 Industry classification

Type of industry	Number of responses	Percentages
Manufacturing and construction	99	60%
Commercial	42	25%
Services	27	15%

Table 5.2 Number of employees

No of employees	Frequency	Percent	Valid Percent	Cumulative Percent
<50	17	10.1	10.1	10.1
50 -100	53	31.5	31.5	41.7
100-250	46	27.4	27.4	69.0
250-500	27	16.1	16.1	85.1
>500	25	14.9	14.9	100.0
	168	100.0	100.0	

Table 5.3 Employees using the IS

% of employees using IS	Frequency	Percent	Valid Percent	Cumulative Percent
<10	4	2.4	2.4	2.4
10-20	46	27.4	27.4	29.8
30-50	37	22.0	22.0	51.8
>50	81	48.2	48.2	100.0

5.2.2 Demographics of respondents

The following paragraphs discuss the statistics on the demographics of the respondents which are depicted in Tables (5.4, 5.5, 5.6 and 5.7). The key characteristic of the subsequent analysis is that the predefined criteria for the sample demographics are met which, in turn, enhances the reliability of the findings.

5.2.2.1 Job titles

All the respondents have titles that are at the upper-management level, indicating that the survey had been completed by the targeted type of respondents. Table 5.4 depicts in more detail the job titles (as translated from the Greek responses). The majority of our respondents (86%) were IT people with clear IT titles- depending on the nature of the industry. 145 respondents, meaning 86% of replies are managers with IT titles or IT related titles (Business Processes & Technology Manager, Business Development Director, Technical Support Manager etc).

We also found another 7 responses by CEOs and 16 responses from Financial Manager and Marketing Managers, as in certain companies these people were more informant about the impact of IT on organisational performance.

Table 5.4 Job titles of respondents

Title	Respondents	Percentages
IT manager	105	62.50%
Chief Information Officer	15	8.93%
IT director	10	5.95%
IT related managerial positions	15	8.93%
Chief executive officer	7	4.17%
Other managerial positions	16	9.52%

5.2.2.2 Terms of employment - Tenure and Work Experience

The majority of our respondents are full time IT Managers (96%) and they are working for the company under exploration for more than 3 years (76% of responses)). According to Table 5.6 only 12 people (7% of the respondents) have been with their company for less than a year. Last but not least, 85% of the respondents have adequate work experience (Table 5.7).

Table 5.5 Full time IT managers

	Frequency	Percent	Valid Percent	Cumulative Percent
Full time	162	96.4	96.4	96.4
Part time	6	3.6	3.6	100.0
Total	168	100.0	100.0	

Table 5.6 Years in the company

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
<1	12	7.1	7.1	7.1
1-3	28	16.7	16.7	23.8
>3	128	76.2	76.2	100.0
	168	100.0	100.0	

Table 5.7 Years of experience

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
>1	15	8.9	8.9	8.9
1-3	29	**17.3**	17.3	26.2
>3	124	**73.8**	73.8	100.0
	168	100.0	100.0	

5.2.2 Characteristics of the Information Systems in use.

A number of question were seeking to collect data on the IS system in use and on the software being employed. We asked the respondents about the years that the system was in full use. We provided the option in months to allow for implementations of less than one year. The information derived from Table 5.8 shows a range of months from 2 to 480 months with a mean of 163 (13.5 years) and a standard deviation of 95.2 (8 years). Based on the evidence from the literature, this finding ensured that IS installation in our sample was in the post-implementation phase. Markus & Tanis, (2000) claimed that the appropriate length of the post implementation period over which a study should measure the impact of IS should be 21 months. These findings were further approved by other researchers (e.g. O'Leary, 2000 and McAfee 2002).

Consequently it was safe to assume that our sample had reached the point of assimilation of the automated operations to provide meaningful answers. When the SPSS removed the top and bottom 5 values, the recalculated mean (i.e. the 5% Trimmed Mean) became 159. 79 months meaning 13.25 years.

The two mean values were not very different which verified that the extreme scores were not having a strong influence on the mean (Pallant, 2007; Tabachnick and Fidell, 2007).

Table 5.8 Time of IS implementation

		Statistic	Std. Error
Mean		163,04	7,346
95% Confidence Interval for Mean	Lower Bound	148,54	
	Upper Bound	177,54	
5% Trimmed Mean		159,79	
Median		150,00	
Variance		9,065E3	
Std. Deviation		95,209	
Minimum		2	
Maximum		480	
Range		478	
Interquartile Range		144	
Skewness		,513	,187
Kurtosis		,219	,373

5.2.3 Software being used

Table 5.9 presents the kind of software implemented in our sample. The majority of the companies are using mainly Enterprise Resource Planning Systems (ERP) either single or accompanied with one of the other enterprise systems. Customer Relationship Management and Order Management are also very popular, whereas the Project Management is the less frequent software used specifically by the construction firms of our sample.

Table 5.9 Enterprise Systems

Kind of software used	frequency	%
Enterprise Resource Planning (ERP)	150	89.3
Supply Chain Management (SCM)	41	24.4
Customer Relationship Management (CRM)	72	42.9
Project Management (PM)	31	18.5
E-commerce	44	26.2
Order management	73	43.5

Almost half of the companies (43.5%) are not using one of the big names for data bases such as Oracle and SAP but they have implemented customised packaged software sold by local resellers (see Table 5.10). This finding reinforced previous research in Greece (Argyropoulou et al., 2007) in which the authors argued that resellers are preferred as they are specialised in a given sector and can provide cost effective solutions.

Table 5.10 The system used

Which data base	Frequency	%
SAP	33	19.6
ORACLE	40	23.8
NAVISION	22	13.1
OTHER FROM RESELLERS	73	43.5

5.3 Parts II –IV

The following section presents and discusses the findings from 8 questions (7-point Likert scale) seeking to measure the IS effectiveness and the perception of the IT manager regarding the use of the IS from the entire company.

5.3.1 The Impact of IS on work

The items in Table 5.11 were seeking to measure the impact of the IS on the job and work of the employees. Most of the IT managers in our sample considered that IS in their company affected positively the work of the employees. It is worth noticing that most of the respondents reported that the IS "facilitates the work of employees" to a great extent which resulted in a mean of 6.5 and a standard deviation (sd) of 0.8. The item that had the lowest mean was the "facilitates learning" with a mean 4.8 and sd 1.8

Table 5.11 The impact on the job (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	**Mean**	**SD**
Makes it easier to do their job	0	0.0	0	0.0	0	0.0	2	1.2	23	13.7	34	20.2	109	64.9	0	0.0	**6.5**	**0.8**
Helps their decision making	0	0.0	2	1.2	13	7.7	11	6.5	24	14.3	45	26.8	73	43.5	0	0.0	**5.9**	**1.3**
Gives them confidence to accomplish their job	0	0.0	1	0.6	16	9.5	26	15.5	39	23.2	52	31.0	30	17.9	4	2.4	**5.2**	**1.5**
Increases participation in decision making	0	0.0	0	0.0	4	2.4	11	6.5	25	14.9	54	32.1	74	44.0	0	0.0	**6.1**	**1.0**
Improves the quality of the work product	0	0.0	1	0.6	3	1.8	10	6.0	31	18.5	55	32.7	68	40.5	0	0.0	**6.0**	**1.0**
Enhances problem-solving ability	2	1.2	5	3.0	11	6.5	18	10.7	30	17.9	53	31.5	46	27.4	3	1.8	**5.4**	**1.6**
Facilitates collaborative problem solving	0	0.0	3	1.8	10	6.0	19	11.3	30	17.9	57	33.9	44	26.2	5	3.0	**5.4**	**1.6**
Facilitates collective group decision making	2	1.2	3	1.8	14	8.3	18	10.7	29	17.3	57	33.9	41	24.4	4	2.4	**5.3**	**1.6**
Facilitates learning	3	1.8	5	3.0	20	11.9	22	13.1	37	22.0	46	27.4	27	16.1	8	4.8	**4.8**	**1.8**
Facilitates knowledge transfer	3	1.8	7	4.2	7	4.2	17	10.1	36	21.4	50	29.8	40	23.8	8	4.8	**5.2**	**1.8**
Improves modernization of working methods	1	0.6	4	2.4	5	3.0	15	8.9	30	17.9	44	26.2	65	38.7	4	2.4	**5.7**	**1.6**
Reduces process costs	0	0.0	0	0.0	11	6.5	14	8.3	33	19.6	41	24.4	66	39.3	3	1.8	**5.7**	**1.4**
Reduces process times	0	0.0	0	0.0	4	2.4	14	8.3	22	13.1	58	34.5	68	40.5	2	1.2	**6.0**	**1.2**

5.3.2 The Impact of IS on Supply Chain management and logistics

The items in Table 5.12 were seeking to measure the impact of IS on the supply chain operations and relationships. The facilitation of internal relationships was considered the less important outcome as far as logistics are concerned (with a mean 4.7 and sd 1.7) whereas the delivery of services seemed to rank first with a mean 5.9 and sd 1.4

Table 5.12 The impact on supply chain and logistics (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
Facilates internal relationships	2	1.2	4	2.4	29	17.3	17	10.1	48	28.6	41	24.4	19	11.3	8	4.8	**4.7**	**1.7**
Facilitates relationships with external business partners	1	0.6	1	0.6	14	8.3	15	8.9	41	24.4	48	28.6	38	22.6	10	6.0	**5.1**	**1.8**
Enhances information sharing with your suppliers	0	0.0	0	0.0	4	2.4	15	8.9	35	20.8	52	31.0	57	33.9	5	3.0	**5.7**	**1.5**
Helps retain valued customers	0	0.0	2	1.2	6	3.6	11	6.5	27	16.1	58	34.5	58	34.5	6	3.6	**5.7**	**1.6**
Helps you select and qualify desired suppliers	4	2.4	3	1.8	19	11.3	19	11.3	28	16.7	45	26.8	41	24.4	9	5.4	**5.0**	**1.9**
Improves supply's control	1	0.6	3	1.8	10	6.0	11	6.5	26	15.5	50	29.8	58	34.5	9	5.4	**5.5**	**1.8**
Helps you manage product flow	1	0.6	4	2.4	3	1.8	11	6.5	22	13.1	52	31.0	68	40.5	7	4.2	**5.7**	**1.7**
Speeds product delivery	3	1.8	2	1.2	6	3.6	13	7.7	28	16.7	49	29.2	60	35.7	7	4.2	**5.5**	**1.8**
Speeds service delivery	1	0.6	0	0.0	2	1.2	13	7.7	26	15.5	48	28.6	74	44.0	4	2.4	**5.9**	**1.4**

5.3.3 The technical performance of the IS and usage characteristics

The items in Table 5.13 were seeking to measure the technical characteristics as well as the system's integration with other information technologies in the company. The results of this analysis demonstrate that the systems in this research performed excellent in technical and usage terms. This could be attributed partly to the maturity of the systems in the research. As discussed, this research involved systems in their maturity phase which entails the restoration of any possible technical weaknesses. As far as the usage items are concerned, it seems that the IT managers considered the system to be friendly and easy. This finding contains an amount of common source bias as these questions should have been answered by the end users. This issue has been however, discussed, in chapter 4.

Table 5.13 The technical performance of the IS (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
1. System can be used for multiple purposes	12	7.1	3	1.8	5	3.0	12	7.1	13	7.7	47	28.0	69	41.1	7	4.2	**5.4**	**2.1**
2. System is reliable	0	0.0	0	0.0	3	1.8	11	6.5	22	13.1	54	32.1	78	46.4	0	0.0	**6.1**	**1.0**
3. System is flexible	1	0.6	2	1.2	10	6.0	16	9.5	34	20.2	53	31.5	52	31.0	0	0.0	**5.7**	**1.3**
4. System is easy to maintain	1	0.6	1	0.6	3	1.8	11	6.5	23	13.7	63	37.5	66	39.3	0	0.0	**6.0**	**1.1**
5. System is easy to use	0	0.0	3	1.8	4	2.4	17	10.1	38	22.6	64	38.1	42	25.0	0	0.0	**5.7**	**1.1**
6. System is easy to learn	0	0.0	4	2.4	10	6.0	20	11.9	45	26.8	54	32.1	35	20.8	0	0.0	**5.4**	**1.2**
7. System is cost effective	0	0.0	3	1.8	7	4.2	15	8.9	38	22.6	47	28.0	56	33.3	2	1.2	**5.7**	**1.4**
8. System is well integrated	2	1.2	4	2.4	16	9.5	13	7.7	30	17.9	51	30.4	51	30.4	1	0.6	**5.5**	**1.5**
9. System is responsive to meet specific needs	1	0.6	2	1.2	7	4.2	13	7.7	32	19.0	49	29.2	63	37.5	1	0.6	**5.8**	**1.3**
10. System is easy to customize	0	0.0	5	3.0	6	3.6	23	13.7	35	20.8	40	23.8	58	34.5	1	0.6	**5.6**	**1.4**
11. System can been easily upgraded	2	1.2	5	3.0	12	7.1	29	17.3	25	14.9	43	25.6	51	30.4	1	0.6	**5.4**	**1.6**
12. System is responsive to meet your changing needs	0	0.0	4	2.4	12	7.1	19	11.3	30	17.9	48	28.6	55	32.7	0	0.0	**5.6**	**1.4**
13. System meets expectations	1	0.6	4	2.4	4	2.4	21	12.5	31	18.5	51	30.4	56	33.3	0	0.0	**5.7**	**1.3**
14. System provides benefits for the entire organization	1	0.6	1	0.6	3	1.8	13	7.7	23	13.7	65	38.7	60	35.7	2	1.2	**5.9**	**1.3**
15. Facilates information exchange with suppliers	1	0.6	3	1.8	10	6.0	22	13.1	27	16.1	62	36.9	34	20.2	9	5.4	**5.2**	**1.8**
16. Facilates information exchange with customers	0	0.0	2	1.2	9	5.4	21	12.5	29	17.3	57	33.9	45	26.8	5	3.0	**5.5**	**1.6**

5.3.4 The effectiveness of the Information produced

The items in Table 5.14 were seeking to find out whether the System could produce the required information when needed, and to what extent control over both the information and the information systems was maintained. All initial 19 items have almost the same high means and, consequently, they produce skewed distributions which is explained by the reasons discussed in the previous section.

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Table 5.14 Information effectiveness (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
InterpreTable	0	0.0	1	0.6	4	2.4	13	7.7	39	23.2	64	38.1	47	28.0	0	0.0	**5.8**	**1.0**
Understandable	0	0.0	0	0.0	3	1.8	9	5.4	38	22.6	70	41.7	48	28.6	0	0.0	**5.9**	**0.9**
Complete	0	0.0	0	0.0	10	6.0	13	7.7	39	23.2	62	36.9	44	26.2	0	0.0	**5.7**	**1.1**
Clear	0	0.0	0	0.0	7	4.2	8	4.8	44	26.2	63	37.5	45	26.8	1	0.6	**5.8**	**1.1**
Concise	0	0.0	1	0.6	7	4.2	16	9.5	39	23.2	65	38.7	39	23.2	1	0.6	**5.6**	**1.2**
Accurate	0	0.0	0	0.0	5	3.0	11	6.5	24	14.3	65	38.7	63	37.5	0	0.0	**6.0**	**1.0**
Important	0	0.0	0	0.0	0	0.0	10	6.0	25	14.9	63	37.5	70	41.7	0	0.0	**6.1**	**0.9**
Relevant	1	0.6	1	0.6	5	3.0	9	5.4	36	21.4	66	39.3	36	21.4	14	8.3	**5.3**	**1.9**
Usable	0	0.0	3	1.8	8	4.8	14	8.3	33	19.6	63	37.5	45	26.8	2	1.2	**5.6**	**1.3**
Well organized	0	0.0	2	1.2	8	4.8	17	10.1	35	20.8	65	38.7	40	23.8	1	0.6	**5.6**	**1.2**
Well defined	1	0.6	2	1.2	6	3.6	11	6.5	41	24.4	69	41.1	35	20.8	3	1.8	**5.5**	**1.3**
Available	0	0.0	0	0.0	3	1.8	9	5.4	22	13.1	64	38.1	68	40.5	2	1.2	**6.0**	**1.2**
Accessible	0	0.0	0	0.0	1	0.6	8	4.8	27	16.1	60	35.7	71	42.3	1	0.6	**6.1**	**1.0**
Up-to-date	0	0.0	0	0.0	2	1.2	12	7.1	25	14.9	52	31.0	75	44.6	2	1.2	**6.0**	**1.2**
Received in a timely manner	0	0.0	0	0.0	3	1.8	9	5.4	32	19.0	60	35.7	62	36.9	2	1.2	**5.9**	**1.2**
Reliable	0	0.0	0	0.0	3	1.8	9	5.4	20	11.9	56	33.3	80	47.6	0	0.0	**6.2**	**1.0**
Verifiable	0	0.0	1	0.6	5	3.0	11	6.5	18	10.7	58	34.5	74	44.0	1	0.6	**6.1**	**1.2**
Believable	0	0.0	0	0.0	4	2.4	6	3.6	29	17.3	56	33.3	67	39.9	6	3.6	**5.9**	**1.5**
Unbiased	0	0.0	0	0.0	4	2.4	6	3.6	25	14.9	55	32.7	70	41.7	8	4.8	**5.8**	**1.6**

5.3.5 The administrative and managerial effectiveness of the reporting system

The items in Table 5.15 were seeking to measure the various aspects of the reporting system. The findings highlight the effectiveness of the reporting system produced by the IS. The first 5 items were asking respondents on the administrative characteristics of the system and it was found that most of the systems were rather not easy to change (mean 5.3, sd 1.5) to include different information requirements but they could be easily updated to a newer version of the existing software.

The remaining 7 items were seeking to explore the usage of the Management Information System. As it can be seen the striking gain reaped from the IS implementation is the improvement of overall functional productivity (highest mean 5.9) whilst for most of the respondents problem definition and solution are the less benefited items form IS adoption.

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Table 5.15 The administrative and managerial effectiveness of the reporting system (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
Can be easily compared to past information	1	0.6	2	1.2	13	7.7	18	10.7	30	17.9	43	25.6	61	36.3	0	0.0	**5.7**	**1.4**
Can be easily changed	0	0.0	4	2.4	19	11.3	17	10.1	31	18.5	56	33.3	39	23.2	2	1.2	**5.3**	**1.5**
Can be easily integrated	1	0.6	3	1.8	10	6.0	17	10.1	35	20.8	52	31.0	48	28.6	2	1.2	**5.5**	**1.4**
Can be easily updated	1	0.6	1	0.6	4	2.4	20	11.9	35	20.8	58	34.5	47	28.0	2	1.2	**5.6**	**1.3**
Can be used for multiple purposes	0	0.0	2	1.2	5	3.0	14	8.3	39	23.2	64	38.1	42	25.0	2	1.2	**5.6**	**1.3**
Meets your requirements	1	0.6	1	0.6	4	2.4	12	7.1	36	21.4	64	38.1	50	29.8	0	0.0	**5.8**	**1.1**
It is useful for problem identification	0	0.0	4	2.4	5	3.0	12	7.1	33	19.6	65	38.7	49	29.2	0	0.0	**5.8**	**1.2**
It is useful for defining problems	1	0.6	3	1.8	8	4.8	19	11.3	39	23.2	59	35.1	38	22.6	1	0.6	**5.5**	**1.3**
It is useful for solving problems	1	0.6	2	1.2	11	6.5	18	10.7	36	21.4	57	33.9	42	25.0	1	0.6	**5.5**	**1.3**
It is useful for making decisions	0	0.0	4	2.4	6	3.6	14	8.3	24	14.3	71	42.3	48	28.6	1	0.6	**5.7**	**1.3**
Improves functional productivity	0	0.0	2	1.2	3	1.8	13	7.7	26	15.5	77	45.8	47	28.0	0	0.0	**5.9**	**1.0**
Improves decision effectiveness	1	0.6	2	1.2	9	5.4	13	7.7	26	15.5	68	40.5	49	29.2	0	0.0	**5.7**	**1.2**

5.3.6 Sufficiency of Training

As depicted in Table 5.16 there were 7 items seeking to measure the quality and adequacy of the training programs. The results demonstrated that training programs, albeit useful (mean 5. 2) should be more frequent and instructive as both items had the lowest means: 4.1 and 4.8 respectively.

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Table 5.16 Sufficiency of Training (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
Training programs are useful	2	1.2	1	0.6	13	7.7	13	7.7	29	17.3	53	31.5	46	27.4	11	6.5	**5.2**	**1.9**
Training programs cover your needs	1	0.6	4	2.4	16	9.5	14	8.3	40	23.8	49	29.2	33	19.6	11	6.5	**5.0**	**1.9**
Training programs are frequent	8	4.8	10	6.0	27	16.1	32	19.0	30	17.9	36	21.4	13	7.7	12	7.1	**4.1**	**1.9**
Training programs are instuctive	1	0.6	3	1.8	15	8.9	23	13.7	37	22.0	55	32.7	22	13.1	12	7.1	**4.8**	**1.8**
Cover specific needs	1	0.6	7	4.2	10	6.0	19	11.3	35	20.8	48	28.6	36	21.4	12	7.1	**5.0**	**1.9**
Training programs are cost effective	0	0.0	6	3.6	4	2.4	16	9.5	34	20.2	59	35.1	35	20.8	14	8.3	**5.1**	**1.9**
Training programs help users learn the various system's uses	2	1.2	4	2.4	9	5.4	14	8.3	36	21.4	55	32.7	37	22.0	11	6.5	**5.1**	**1.9**

5.3.7 The characteristics of a suitable IS service provider

The items in Table 5.17 were dealing with the features of a suitable IS service provider which could play a vital role for the maintenance and performance of the entire system. As it can be seen from Table 5.17 most items received answers with very high means implying high quality of such services rendered with no striking differences. Worth withstanding is the highest mean of 6.1 for the effective services that are rendered even in an emergency. The item with the lowest mean (5.1) is the number of the people available by the IS provider.

Table 5.17 The features of a suiTable IS provider (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
IS services are valuable	0	0.0	0	0.0	6	3.6	15	8.9	33	19.6	50	29.8	64	38.1	0	0.0	**5.9**	**1.1**
Responds to your service requests in a timely manner	0	0.0	0	0.0	9	5.4	12	7.1	30	17.9	53	31.5	64	38.1	0	0.0	**5.9**	**1.2**
Complete services in an effective manner	0	0.0	0	0.0	7	4.2	14	8.3	33	19.6	40	23.8	74	44.0	0	0.0	**6.0**	**1.2**
IS services are reliable	0	0.0	0	0.0	5	3.0	10	6.0	26	15.5	48	28.6	79	47.0	0	0.0	**6.1**	**1.1**
Provides a sufficient variety of services	0	0.0	1	0.6	7	4.2	13	7.7	30	17.9	48	28.6	69	41.1	0	0.0	**5.9**	**1.2**
Provides cost effective services	0	0.0	1	0.6	7	4.2	11	6.5	32	19.0	47	28.0	70	41.7	0	0.0	**5.9**	**1.2**
Cares for the company's interest	0	0.0	0	0.0	6	3.6	8	4.8	31	18.5	38	22.6	83	49.4	2	1.2	**6.0**	**1.3**
Cares for every user	0	0.0	2	1.2	5	3.0	14	8.3	38	22.6	52	31.0	57	33.9	0	0.0	**5.8**	**1.2**
Supports you in case of emergency	0	0.0	0	0.0	5	3.0	8	4.8	19	11.3	41	24.4	92	54.8	3	1.8	**6.1**	**1.3**
Has sufficient people to provide services	2	1.2	15	8.9	9	5.4	25	14.9	35	20.8	43	25.6	38	22.6	1	0.6	**5.1**	**1.6**
Knows the business processes	0	0.0	0	0.0	6	3.6	9	5.4	36	21.4	56	33.3	61	36.3	0	0.0	**5.9**	**1.1**
Know the industry	0	0.0	2	1.2	5	3.0	14	8.3	26	15.5	54	32.1	65	38.7	2	1.2	**5.9**	**1.3**
Honours the contractual agrrement	0	0.0	0	0.0	1	0.6	7	4.2	19	11.3	47	28.0	79	47.0	15	8.9	**5.7**	**2.0**
Cares for a long lasting relationship	0	0.0	0	0.0	2	1.2	6	3.6	18	10.7	42	25.0	88	52.4	12	7.1	**5.9**	**1.9**

5.3.8 The empathy of the IS service provider

Another set of items were seeking to measure the empathy of the IS provider. According to Table 5.18 the IS provider people are very sincere, polite and helpful as these items had very high means. The item that scored lowest is the ability of the IS providers to help employees become more skillful users (mean 5.5 and sd 1.5)

Table 5.18 The empathy of the IS provider (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
Are effective in performing their services	0	0.0	0	0.0	3	3.6	11	8.9	30	19.6	65	29.8	58	38.1	1	0.0	**5.9**	**1.1**
Have the knowledge and skill to do their job well	0	0.0	0	0.0	2	5.4	7	7.1	31	17.9	57	31.5	70	38.1	1	0.0	**6.1**	**1.0**
Are dependable	0	0.0	0	0.0	2	4.2	10	8.3	25	19.6	58	23.8	72	44.0	1	0.0	**6.1**	**1.1**
Are polite	0	0.0	0	0.0	1	3.0	11	6.0	28	15.5	55	28.6	72	47.0	1	0.0	**6.1**	**1.1**
Are sincere	0	0.0	0	0.6	1	4.2	16	7.7	29	17.9	54	28.6	67	41.1	1	0.0	**6.0**	**1.1**
Show respect to you	0	0.0	0	0.6	0	4.2	12	6.5	21	19.0	56	28.0	78	41.7	1	0.0	**6.2**	**1.0**
Are pleasant to work with	0	0.0	0	0.0	2	3.6	15	4.8	24	18.5	55	22.6	71	49.4	1	1.2	**6.0**	**1.1**
Instil confidence in you	0	0.0	1	1.2	5	3.0	7	8.3	28	22.6	57	31.0	68	33.9	2	0.0	**6.0**	**1.2**
Are helpful to you	0	0.0	0	0.0	6	3.0	5	4.8	28	11.3	59	24.4	69	54.8	1	1.8	**6.0**	**1.1**
Solve your problems as if they were their own	0	1.2	2	8.9	5	5.4	17	14.9	42	20.8	42	25.6	58	22.6	2	0.6	**5.7**	**1.3**
Understand your specific needs	0	0.0	1	0.0	5	3.6	13	5.4	29	21.4	56	33.3	63	36.3	1	0.0	**5.9**	**1.2**
Are willing to help you	0	0.0	1	1.2	5	3.0	6	8.3	34	15.5	47	32.1	73	38.7	2	1.2	**6.0**	**1.3**
Help employees become skillful users	1	0.0	2	0.0	15	0.6	18	4.2	29	11.3	50	28.0	51	47.0	2	8.9	**5.5**	**1.5**

5.4 Part V

The following section presents and discusses the findings from 2 questions (7-point Likert scale) seeking to measure the impact of the IS adoption on business performance and strategy.

5.4.1The impact on business performance and strategy

21 items were used based on the four perspectives of the balanced scorecard (see Table 5.19). The first 6 items were based on the financial perspective ant it was found out that the productivity was highly improved (mean 5.9 and sd 1) whilst the IS does not really help companies reduce the logistics costs. As far as the customer perspective is concerned, it can be seen that the IS can significantly affect most of the relevant items (items 7-12).

It is worth mentioning that all items that involved the learning and growth perspective had the lowest means demonstrating the respondents' belief that Information Systems do not really make companies more innovative (items 15-17). Finally, as far as the internal processes are concerned, the IS can improve the information sharing between departments (mean 5.7) but can not do much for their forecasting ability (mean 4.8; sd 2.1).

Finally the Table 5.20 depicts the impact on strategy. It is worth noticing that according to our respondents there are no important differences in the mean and standard deviation of all three items.

Table 5.19 The impact on business performance (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
1. On the company's productivity	0	0.0	0	0.0	5	3.0	10	6.0	35	20.8	59	35.1	59	35.1	0	0.0	**5.9**	**1.0**
2. On the company's income	2	1.2	1	0.6	9	5.4	25	14.9	33	19.6	60	35.7	36	21.4	2	1.2	**5.4**	**1.4**
3. On production costs	2	1.2	2	1.2	9	5.4	25	14.9	36	21.4	53	31.5	39	23.2	2	1.2	**5.4**	**1.4**
4. On inventory levels	5	3.0	0	0.0	5	3.0	13	7.7	26	15.5	61	36.3	49	29.2	9	5.4	**5.4**	**1.8**
5. On logistics costs	5	3.0	3	1.8	10	6.0	27	16.1	41	24.4	44	26.2	26	15.5	12	7.1	**4.8**	**1.9**
6. On gross profit	1	0.6	3	1.8	8	4.8	21	12.5	40	23.8	49	29.2	36	21.4	10	6.0	**5.1**	**1.8**
7. On timely delivery of goods	1	0.6	3	1.8	4	2.4	17	10.1	25	14.9	57	33.9	48	28.6	13	7.7	**5.3**	**2.0**
8. On timely customer service	0	0.0	2	1.2	5	3.0	11	6.5	24	14.3	72	42.9	52	31.0	2	1.2	**5.8**	**1.3**
9. On delivery of goods according to specifications	1	0.6	3	1.8	4	2.4	16	9.5	30	17.9	58	34.5	46	27.4	10	6.0	**5.4**	**1.8**
10. On customer complaints	2	1.2	3	1.8	10	6.0	22	13.1	33	19.6	60	35.7	29	17.3	9	5.4	**5.1**	**1.8**
11. On customer retention	1	0.6	2	1.2	9	5.4	25	14.9	32	19.0	54	32.1	34	20.2	11	6.5	**5.1**	**1.8**
12. On customer satisfaction	0	0.0	2	1.2	5	3.0	18	10.7	32	19.0	62	36.9	40	23.8	9	5.4	**5.4**	**1.7**
13. On supplier's defect free deliveries	5	3.0	2	1.2	9	5.4	14	8.3	31	18.5	55	32.7	35	20.8	17	10.1	**4.9**	**2.1**
14. On replenishment time	3	1.8	3	1.8	8	4.8	16	9.5	34	20.2	51	30.4	40	23.8	13	7.7	**5.1**	**2.0**
15. On new product /service development	6	3.6	8	4.8	12	7.1	19	11.3	24	14.3	51	30.4	30	17.9	18	10.7	**4.6**	**2.2**
16. On the range of products and services	7	4.2	6	3.6	10	6.0	17	10.1	33	19.6	48	28.6	29	17.3	18	10.7	**4.6**	**2.2**
17. On innovation capabilities	7	4.2	8	4.8	11	6.5	18	10.7	27	16.1	50	29.8	29	17.3	18	10.7	**4.6**	**2.2**

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
18. On forecasting ability	6	3.6	5	3.0	13	7.7	16	9.5	27	16.1	53	31.5	34	20.2	14	8.3	**4.8**	**2.1**
19. On information sharing through entire Supply Chain	4	2.4	2	1.2	12	7.1	8	4.8	28	16.7	58	34.5	46	27.4	10	6.0	**5.3**	**1.9**
20. On timely decision making	3	1.8	4	2.4	4	2.4	15	8.9	38	22.6	64	38.1	38	22.6	2	1.2	**5.5**	**1.4**
21. On organisational flexibility	3	1.8	6	3.6	9	5.4	10	6.0	33	19.6	68	40.5	36	21.4	3	1.8	**5.4**	**1.6**
22. On information between departments	2	1.2	3	1.8	7	4.2	7	4.2	42	25.0	59	35.1	47	28.0	1	0.6	**5.7**	**1.3**
23. On cooperation between departments	1	0.6	3	1.8	9	5.4	8	4.8	39	23.2	62	36.9	45	26.8	1	0.6	**5.6**	**1.3**

Table 5.20 The impact on strategy (N= 168)

Responses to questions	1		2		3		4		5		6		7		NA			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Mean	SD
On the achievement of strategic goals	3	1.8	2	1.2	11	6.5	15	8.9	43	25.6	57	33.9	37	22.0	0	0.0	5.5	1.3
On the increase of market share	5	3.0	6	3.6	12	7.1	22	13.1	42	25.0	51	30.4	30	17.9	0	0.0	5.2	1.5
On the competitive position	4	2.4	3	1.8	10	6.0	15	8.9	43	25.6	54	32.1	39	23.2	0	0.0	5.4	1.4

5.5 Key findings from the descriptive analysis

Form the sample demographics it can be seen that 60% of the responding companies are manufacturing, pharmaceuticals and diary firms followed by commercial firms /retailers (25%) and services like banking, hospitals and consulting companies (15%). The 70% of companies employ IT literate workforce.

The years of IS implementation demonstrate a range of months from 2 to 480 with a mean of 163 (13.5 years) and a standard deviation of 95.2 (8 years). Hendricks et al. (2007) argued that three years is the minimum accepted time when examining the benefits from IS implementation. Consequently, it is safe to assume that the Information Systems implemented by our responding companies have reached the maturity for meaningful findings. When the SPSS removed the top and bottom 5 values, the recalculated mean (i.e. the 5% Trimmed Mean) became 159. 79 months meaning 13.25 years (table 5.9). The two mean values were not very different (difference smaller than 0.2%) which verified that the extreme scores were not having a strong influence on the mean (Pallant, 2007; Tabachnick and Fidell, 2007).

The majority of our respondents are full time IT Managers (96%) and they are working for the company under exploration for more than 3 years (68% of responses). This enhances the validity of the findings as the survey was completed by the key informants. It is worth mentioning that we found several different Greek titles indicating Managerial Position. In an attempt to translate to English we found the following titles: Business Processes & Technology Manager, Business Development Director, Technical Support Manager, IS Manager etc. 60% of the companies are SMEs which are not using big names for data bases such as Oracle and SAP but customised packaged software sold by local resellers. This finding reinforced previous research in Greece (Argyropoulou et al., 2007) and in Italy (Morabito, 2005) in which the authors argue that resellers are preferred as they are specialised in a given sector and can provide cost effective solutions

Job tenure was another important finding. The majority of our respondents were full-time managers, working for the same company for more than 3 years. This is in full agreement with previous findings where Greece was found the country with the longest tenure as the average employee stayed with the same employer for 13.2 years, followed Japan with 12.2 years and Italy with 12.1 years (Auer, Berg and Coulibaly, 2005).

The majority of the companies are using mainly Enterprise Resource Planning Systems (ERP) either single or accompanied with one of the other enterprise systems such as Customer Relationship Management and Order Management. This coincides with previous research findings in South East Europe (Ketikidis, et al., 2008). In this research most companies were using MRP / ERP, SCM and CRM software demonstrating the importance of IS in local and global supply chain management.

Finally, considering the impact of IS on firm performance (i.e the main research question) it can be said that the majority of IT managers believe that IS implementation affects positively the Organisational Performance variables (see tables 5.19 and 5.20)

5.6 Summary of Chapter 5

This chapter presented the descriptive findings from the five parts of our measuring instrument. This was a rather important part of our research and these findings will be sent to our respondents as promised in our communication with them. Some of the findings can be of great interest for practitioners but these arguments are discussed in chapter 8 as we feel that they belong to the discussion chapter (8).

CHAPTER 6

Factor Analysis

6.1 Introduction

As discussed in chapter 3, the measuring instrument contained 129 items that were used for the operationalisation of the two main constructs of this research: information system effectiveness and organisational performance. This chapter discusses in detail the steps and results of the factor analysis whereas chapter 7 presents in detail a number of multiple regressions that were followed to test the hypotheses that were formed in chapter 3.

However, there are two important steps that should precede any statistical analysis, these being: missing data and normality tests. The next section discusses the examination of our data prior to the inferential statistics undertaken for this research.

6.2 Examination of data prior to analysis

This data examination is an integral part of any inferential analysis because it directs researchers to the appropriate tests and consequently better prediction and more accurate assessment of dimensionality (Hair et al., 2010). Missing data and the assumption of normality are the starting issues being discussed in the following paragraphs.

6.2.1 Missing data

This is about values recognised as missing by SPSS as a result of error in data entry or as a result of missing response (Pallant, 2007, p.56). In our research there were no missing values as the web-link would not allow the survey to continue unless all answers were completed. Furthermore, the data collected were automatically transferred to SPSS which ensured an error free process. However, the survey allowed for a Non-Applicable answer (N/A) response represented by the zero value. These N/A answers have been treated as missing in this research (see appendix 6.1)

From the data set overall we found that for most variables we had a low N/A percentage which "*did not impose any serious problems with the subsequent analysis*" (Hair et al., 2010, p. 46). However, there was an exception for the items measuring the training effectiveness where we found 7% N/A values which indicated that the specific companies had not embraced training practices for their IS users (see Appendix 6.1).

Moreover, we found a 10% missing values in the items relevant to innovation which could also be explained as some of our respondents were not expected to have such activities (construction companies). For this reason it was decided to "*Exclude cases pairwise*" from the SPSS package to exclude the cases only if they were missing for a specific test.

6.2.2 Normality

One important step in multivariate analysis is the assessment of normality. We tested our variables for normality and we used skewness and kurtosis tests (Hair et al., 2010) to find out whether our variables were normal for the use of statistical techniques like analysis of variance, linear regression etc.

Kolmogorov-Smirno and Shapiro-Wilk tests showed violation of normality (as in all cases we had sig. value less than .05). This, however, is quite common in large samples especially in social sciences where we expect scores that are skewed either positively or negatively (Pallant, 2007 p 62). We checked all skewness and kurtocis values provided by the SPSS output. The results indicated that the respective values were satisfactory for the acceptance of normality (See Appendix 6.1.). All skewness values were much less than -2 and all kurtosis values were much less that 2, whereas the cut off points the values are for skewness $< \pm 2$ and kurtosis $< \pm 7$ to be considered acceptable (Curran et al. 1996).

The histogram shapes indicated reasonably normal distributions; the normal Q-Q plots also showed that the plotted data followed closely the diagonal of the diagonal of the normal distribution (Hair at el., 2010). Finally the Detrended Normal Q-Q plots showed no real clustering on points, with most of them collecting around the zero line (Pallant, 2007 p 62).

After the completion of the tests, we decided that there was no need to transform the data since the identified departures from normality were slight and it was safe to keep the original data and continue the statistical analyses (Tabachnick and Fidell 1996).

6.3 Exploratory Factor Analysis

The literature provides many definitions for factor analysis. A broad definition is given by Hair et al., (2010, p.93): "*Factor analysis is a generic name given to a class of multivariate statistical methods whose primary purpose is to define the underlying structure in a data matrix"*. There are two statistical analyses that can be performed to extract factors: the exploratory factor analysis (EFA) and the confirmatory factor analysis (CFA). The exploratory factor analysis (EFA) method is often used in the early stages of any data analysis when the researcher needs to explore data to determine the number or the nature of factors that account for the covariation between variables and when the researcher cannot form a hypothesis about the number of factors underlying the data (Stevens, 1996). "Confirmatory factor analysis is a technique used by researchers when they need to test hypotheses for the correlation of variables" (Dillon and Goldestein, 1984).

6.3.1 Justifying the use of Exploratory Factor Analysis (EFA) –steps and decisions

This study used the exploratory factor analysis (EFA) method as this was deemed to most appropriate for the purposes of the research. One and perhaps practical reason for the choice was to reduce a large set of variables identified in the literature (129 in this study) to a manageable number of factors whilst, however, maintaining as much as possible the original variance (Conway and Huffcutt, 2003, p. 148; Fabrigar et al. 1999). In reaching the decision that favoured EFA, another reason more theoretical than practical was carefully factored in, this being the 'structure of correlations among measured variables' which is different from data reduction. Having added new variables in existing instruments especially in our attempt to measure organizational performance the use of EFA was deemed important to find out about dimensionality and continue with our hypotheses testing. EFA is considered a "*data-driven approach as the researcher has no clear idea about how many factors exist and EFA could provide the procedures for determining an appropriate number of factors and the pattern of factor loadings to be used in the subsequent hypotheses tests*" (Fabrigar et al. 1999, p.277; Hair et al., 2010). This was considered to become our major contribution to the academic research so far. EFA could be the best choice as an initial factor analysis for our research objective, i.e to explore how information systems actually contribute to achieving organisational outcomes. Although the theoretical framework (DeLone and McLean) provided guidance as to the main dimensions and their statistical relationship, we had limited empirical basis regarding the number of the a priori factors that could exist (Fabrigar et al. 1999, p. 277). We followed the steps and advice recommended by Fabrigar et al (1999) to "arrive at parsimonious model and extraction of the common factors needed to account for the pattern of correlations among the measured variables" (p. 277). When conducting the EFA, there are three main steps to be followed: the assessment of the correlations among the items, the factor extraction; and the factor rotation (Pallant, 2007). These are discussed here below:

6.3.1.1 The correlations among the items

Correlation analysis is a technique widely used to measure the association between two variables. As such, for the hypothetical associative relationship between two or more variables to be investigated, the correlation coefficient (***r***) is widely used. The correlation coefficient can take values ranging from (−1) to (+1); whereas ***r*** =−1 indicates a perfect negative relationship; ***r*** =0 not (linear) relationship; and finally ***r*** =1, a perfect positive relationship (Baggaley, 1964; Hair *et al,* 2010).

The purpose of conducting correlation analysis was to determine whether the strength of relationships within each of the model's constructs was appropriate in order of a data reduction technique to be employed in the next step (Hair *et al,* 2010). Thus, Pearson coefficients for the variables measured by metric scales were calculated showing positive correlations amongst our variables. However, due to the presence of many variables within each construct, the correlation matrices were not easy to print and to inspect. Therefore, principle component analysis was executed to identify the composite dimensions underlying the constructs in this research.

6.3.1.2 Common factor and component analysis

Two are the most well known variants of the factor analysis techniques: common factor and component analysis (eSnook and Gorsuch, 1989; Velicer & Jackson, 1990; Hair et al., 2010). In the former the "factors are based on a reduced correlation matrix. That is, communalities are inserted in the diagonal of the correlation matrix, and the extracted factors are bases only on the common variance, with specific and error variances excluded" (Hair et al, 2010). On the other hand, in the component analysis "factors are based on the total variance… (and) unities (1s) are used in the diagonal of the correlation matrix; this procedure computationally implies that all the variance is common or shared" (Hair et al, 2010). In short, "*the decision of which type of factor* *analysis to be employed rests on the objectives of the factor analysis and a priori knowledge about the variance in the variables*" (Hair et al, 2010, p. 106).

In this thesis we decided to perform a component analysis, seeking to obtain the minimum number of factors which "*were accounted for the maximum portion of the variance represented in the original set of variables"* (Hair et al, 2010, p.106).

6.3.1.3 Unrotated Factor extraction

The next decision pertaining to factor analysis was the number of factors to be extracted. Since there is not an exact quantitative approach for deciding the number of factors to be retained in the factor solution, we adopted the latent root criterion, the scree test and the percentage of variance explained (Churchill, 1997; Hair et al, 2010, p. 108). The rationale of the latent root criterion or eigenvalue or as alternatively known Kaiser's (1958) criterion is that any "individual factor should account for the variance of at least a single variable" and as such only the "factors having eigenvalues greater that 1 are considered significant" (Hair et al, 2010). The rationale of a scree test is to identify the optimum numbers of factors that can be extracted before the amount of unique variance begins to dominate the common variance structure (Cattell, 1966).

Plotting the latent roots against the number of factors in their order of extraction, and identification of the point in which the resulting curve begins to straighten out, gives an initial solution of the maximum number of factors to be extracted. In extracting the factors the criteria were as following: a factor with an eigenvalue greater than one and factors that account for a total variance at least 50% would be selected (Hair et al., 2010). 21 factors were extracted explaining 86,525% of the variance (table 6.1).

Table 6.1: Unrotated Factor Analysis

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance
1	61,753	44,749	44,749	61,753	44,749	44,749	22,678	16,433
2	10,333	7,488	52,236	10,333	7,488	52,236	15,370	11,138
3	7,155	5,185	57,421	7,155	5,185	57,421	13,771	9,979
4	5,585	4,047	61,468	5,585	4,047	61,468	12,167	8,817
5	4,144	3,003	64,471	4,144	3,003	64,471	11,834	8,575
6	3,779	2,739	67,210	3,779	2,739	67,210	7,028	5,093
7	3,001	2,174	69,384	3,001	2,174	69,384	6,347	4,599
8	2,714	1,967	71,351	2,714	1,967	71,351	3,547	2,570
9	2,548	1,846	73,197	2,548	1,846	73,197	2,961	2,145
10	2,233	1,618	74,816	2,233	1,618	74,816	2,672	1,936
11	2,170	1,573	76,389	2,170	1,573	76,389	2,385	1,728
12	1,800	1,304	77,693	1,800	1,304	77,693	2,285	1,656
13	1,752	1,270	78,962	1,752	1,270	78,962	2,274	1,648
14	1,649	1,195	80,157	1,649	1,195	80,157	2,048	1,484
15	1,471	1,066	81,223	1,471	1,066	81,223	1,964	1,423
16	1,425	1,033	82,255	1,425	1,033	82,255	1,921	1,392

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance
17	1,370	0,993	83,248	1,370	0,993	83,248	1,918	1,390
18	1,271	0,921	84,170	1,271	0,921	84,170	1,801	1,305
19	1,154	0,837	85,006	1,154	0,837	85,006	1,730	1,253
20	1,085	0,786	85,793	1,085	0,786	85,793	1,421	1,030
21	1,011	0,733	86,525	1,011	0,733	86,525	1,283	0,930

6.3.1.4. Rotated Factor extraction

Having acquired a first impression on our factors, we continued with the next step: the rotation procedure. There are two well known rotational techniques: the orthogonal and the oblique. The former computes the extracted factors so that their axes are maintained at 90 degrees. In addition, each factor is independent and the correlation between them is determined to be 0. The latter computes factor loading, so that the extracted factors are correlated.

The orthogonally rotated factor solution was achieved by using the Varimax method, and the obliquely rotated factor solution was affected from employment of the Promax method. Varimax rotation is an orthogonal rotation technique which maximises the sum of variances of squared loadings in the columns of the factor matrix (Kaizer 1958, 1959). This produces loadings in each column that are either high or near zero, thereby facilitating interpretation (Kline, 1994). One major limitation of this rotation procedure is that it "maintains the orthogonality of the initial unrotated solution (i.e., the extracted factors are uncorrelated with each other)". This can be a concern when the latent variables mismatch between the statistical model and the true data resulting thus in distorted factor solutions (Dien, 1998).

For this reason, recent research has focused on oblique rotations which allow correlation of factors. The Promax rotation is one of the most widely used (Hendrickson & White, 1964). The procedure takes the Varimax extraction as a starting point but then, it relaxes the orthogonality restriction by performing a further rotation in which orthogonality is no longer compulsory. This additional rotation takes the form of rotating toward a target computed as the current factor loadings taken to a higher power (Hakstian, 1971). This higher power is specified by a parameter, kappa, which is typically in the range of 2 to 4 (SAS uses 3 as the default and SPSS uses 4 as the default). Higher values of kappa result in more correlated solutions, with the appropriate kappa depending on the data set (Hakstian & Abell, 1974). Mathematically speaking, the Promax solution reduces even more the smallest values from Varimax, while the reduction of larger loadings is not that much. This oblique rotation results in a new set of loadings that typically reflect simple structure better than do those from the Varimax solution, particularly in cases where the latent traits are highly correlated (McLeod et al., 2001).

129 items (103 representing the independent constructs and 26 representing the dependent) were factor analysed using the principal components method and both rotation techniques, which produced the same number of factors (Figure 6.1.).

Furthermore, Table 6.2 shows that the Kaiser-Mayer-Olkin (KMO) Measure of Sampling Adequacy was 0.833, which is comfortably higher than the recommended level of 0.6 (Hair et al., 2010) and the Barlett's Test of Sphericity value was significant (i.e. the Sig. Value p= .000). This solution gave us an indication of the patterns with loadings higher than 0.3. The results were not different but the Promax solutions illustrated simpler structures in alignment with what we expected form our literature review. For this reason, the decision favoured the Promax rotation.

Table 6.2 KMO and Bartlett's Test for the factorability of variables

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,833
Bartlett's Testof Sphericity	Approx. Chi-Square	2,321E4
	df	9453
	Sig.	0,000

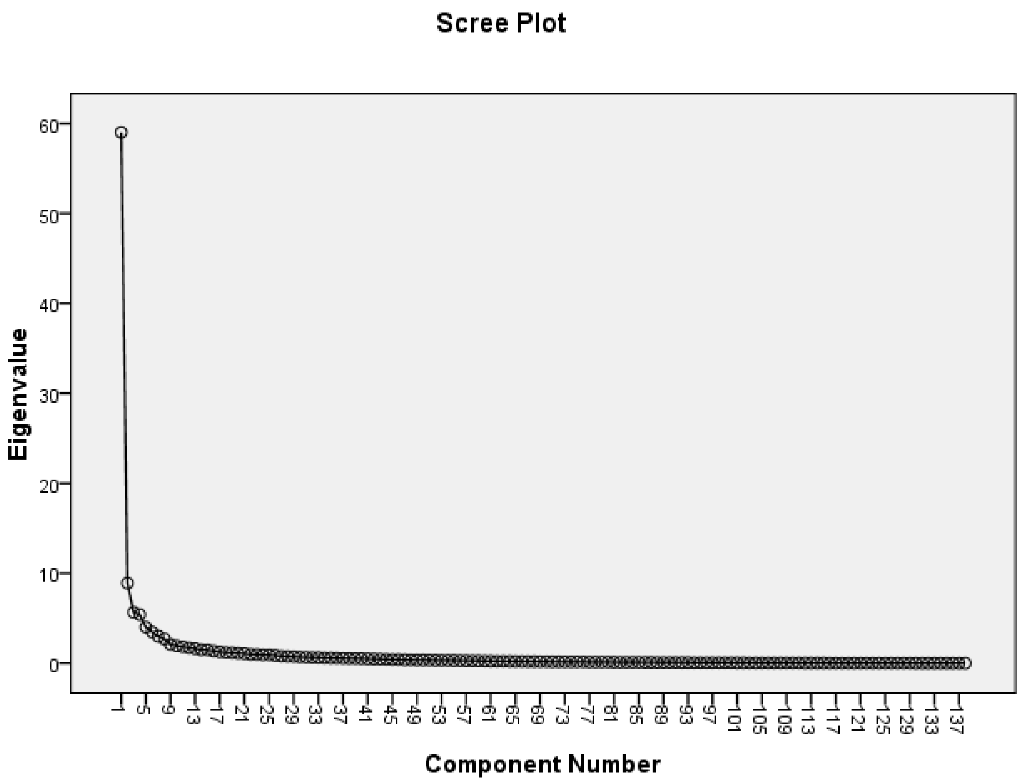

Figure 6.1 21 factors extracted from Varimax and Promax method employed with loadings higher than 0.3

6.4 Determining factors and assessing overall fit

According to Hair et al. (2010, p. 110) "*the number of factors to be interpreted largely depends on the underlying purpose of the analysis"*. However, having in mind the stricter criterion of keeping loadings higher than 0.4 we decided to conduct a more focused factor analysis to determine a set of factors that could measure the two main constructs: Information System Effectiveness and Organisational performance. We conducted a new factor analysis to examine the patterns of the independent construct (i.e. Information System Effectiveness) and the patterns of the dependent construct (i.e Organisational performance). The stricter criterion (loadings higher than 0. 4) provides us with 19 factors: 15 factors would form the independent constructs and 4 the dependent ones; the analysis is provided in detail in the following paragraphs.

6.4.1 Examining the factors attributed to Information System Effectiveness

15 factors were extracted (see figure 6.2) when we used the cut-off point of 0.4 for loadings and the basic output tables are depicted here below. We had an excellent Kaiser-Meyer-Olkin Measure of Sampling Adequacy (table 6.3.a) and the total variance explained was 88% (table 6.3.b). Finally, the pattern mix in table 6.3.c demonstrated clearly 15 factors that became subject to further evaluation.

Table 6.3.a KMO and Bartlett's Test for the factorability of independent variables

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,942
Bartlett's Test of Sphericity	Approx. Chi-Square	7,771E3
	df	1128
	Sig.	,000

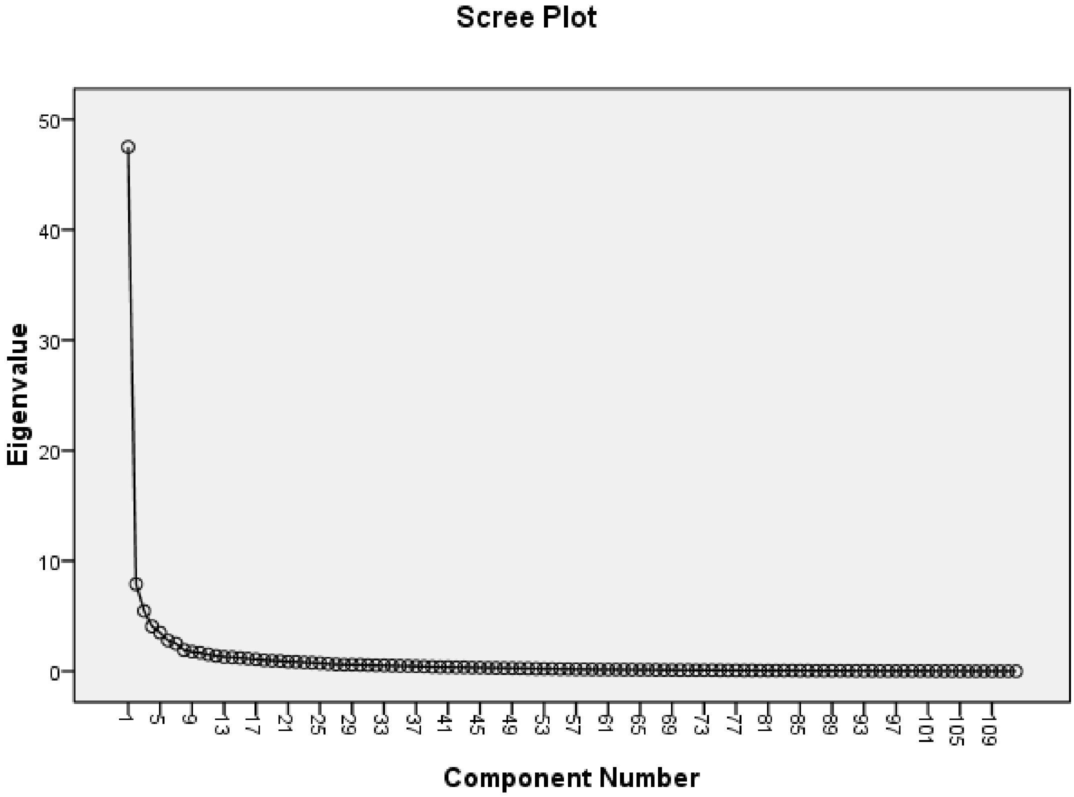

Figure 6.2 15 factors for Information Effectiveness

Table 6.3.b Total variance explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	47,504	42,414	42,414	47,504	42,414	42,414	36,069
2	7,905	7,058	49,472	7,905	7,058	49,472	27,73
3	5,471	4,884	54,356	5,471	4,884	54,356	27,073
4	4,074	3,638	57,994	4,074	3,638	57,994	26,771
5	3,505	3,129	61,123	3,505	3,129	61,123	33,566
6	2,792	2,493	63,616	2,792	2,493	63,616	19,325
7	2,52	2,25	65,866	2,52	2,25	65,866	32,686
8	1,924	1,718	67,583	1,924	1,718	67,583	7,495
9	1,763	1,574	69,158	1,763	1,574	69,158	22,091
10	1,686	1,506	70,663	1,686	1,506	70,663	15,452
11	1,531	1,367	72,03	1,531	1,367	72,03	4,354
12	1,397	1,248	73,278	1,397	1,248	73,278	3,125
13	1,297	1,158	74,436	1,297	1,158	74,436	2,42
14	1,269	1,133	75,57	1,269	1,133	75,57	13,397
15	1,21	1,081	76,65	1,21	1,081	76,65	2,422
16	1,149	1,026	77,676	1,149	1,026	77,676	2,815
17	1,087	0,971	78,647	1,087	0,971	78,647	1,654
18	1,014	0,905	79,552	1,014	0,905	79,552	1,596
19	0,967	0,863	80,416				

Table 6.3.c Pattern Matrix[a]

	Component														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sij1 Makes it easier to do their job									,988						
Sij3 Helps their decision making				,555											
Sij4 Gives them confidence to accomplish their job				,555											
Sij6 Increases participation in decision making				,821							,424				
Sij8 Improves the quality of the work product				,681											
sij9 Enhances problem-solving ability				,996											
Sik1 Facilitates collaborative problem solving				,851											
Sik2 Facilitates collective group decision making				,977											
Sik3 Facilitates learning				,827											
sik5 Facilitates knowledge transfer				,763											
SM2 Improves modernisation of working methods													,460		
Sii5 Reduces process costs													,620		
Sii6 Reduces process times													,463		
SM3 Facilitates internal relationships				,461											
Sie1 Facilitates relationships with external business partners							,550								
SM9 Enhances information sharing with your suppliers				,404											
Sie5 Helps retain valued customers															
Sie6 Helps you select and qualify desired suppliers							,729								
SM4 Improves supply's control							,855								
SM5 Helps you manage product flow							,960								
SM7 Speeds product delivery							,955								
SM8 Speeds service delivery							,478							-,509	
Ssc4 System is reliable					,496									,467	
Ssc9 System is flexible					,530										
Seu1 System is easy to use									,537						
Seu2 System is easy to learn									,498						
Ssc7 System is cost effective									,412						
SM10 System is well integrated					,642										

SM11 System is responsive to meet specific needs					1,053										
SM12 System is easy to customize					,990										
SM13 System can been easily upgraded					,921										
Ssc8 System is responsive to meet your changing needs					,931										
SM14 System meets expectations					,830										
SM15 System provides benefits for the entire organization					,648										
SM16 Facilitates information exchange with suppliers															
Iiq1 Interpretable	,831														
Iiq2 Understandable	,847														
Iiq3 Complete	,800														
Iiq4 Clear	,975														
Iiq5 Concise	,968														
Icq3 Accurate	,958														
ICq1 Important	,622														
Icq2 Relevant	,727														
Icq4 Usable	,844														
Ipq1 Well organised	,886														
Ipq2 Well defined	,881														
Iai1 Available	,761														
Iai3 Up-to-date	,746														
Iai4 Received in a timely manner	,787														
Ir1 Reliable	,438									,542					
Ir2 Verifiable	,523									,680					
Ir3 Believable	,574														
Ir4 Unbiased	,453									,492					
SM18 Can be easily maintained															
Ifi2 Can be easily changed								,589							,831
Ifi3 Can be easily integrated								,700							
Ifi4 Can be easily updated								,815							
Ifi5 Can be used for multiple purposes								,777							
Ifi7 It is useful for problem identification															
Ifi8 It is useful for defining problems								,409			,542				

Ifi9 It is useful for solving problems											,536				
SM19 Improves functional productivity											,477				
Ifi11 Improves decision effectiveness											,487				
Stg1 Training programs are useful						,767									
SM17 Facilitates information exchange with customers															
SM20 Training programs cover your needs						,785									
SM21 Training programs are frequent						,635									
SM22 Training programs are instructive						,842									
Stg3 Cover specific needs						,853									
Stg2 Training programs are cost effective						,935									
SM23 Training programs help users learn the various system's uses						,882									
Srp3 IS services are valuable			,630												
Srp1 Responds to your service requests in a timely manner			,741												
Srp2 Complete services in an effective manner			,755												
SrI6 IS services are reliable			,755												
Sfs3 Provides a sufficient variety of services			,726												
SrI4 Provides cost effective services			,897												
Sep1 Cares for the company’s interest			,980												
Sep2 cares for every user			,822												
SM24 Supports you in case of emergency			,770												
SM25 Knows the business processes			,594									,670			
SM26 Knows the industry			,553									,641			
SM27 Honours the contractual agreement			,785												
SM28 Cares for a long lasting relationship			,724												
X2 Are effective in performing their services		,727													

X5 Have the knowledge and skill to do their job well		,788													
X6 Are dependable		,864													
X1 Are polite		,883													
X7 Are sincere		,896													
X3 Show respect to you:		,917													
X4 Are pleasant to work with		,979													
X8 Instill confidence in you		,916													
X9 Are helpful to you		,912													
X10 Solve your problems as if they were their own		,825													
X11 Understand your specific needs		,788													
X12 Are willing to help you		,971													
SM29 Help employees become skilful users		,747													

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 17 iterations.

6.4.1.1 Discussion on the solution - Assigning names to the factors of the independent construct

The results of the factor analysis indicated that 15 factors were extracted that could be attributed to the 4 dimensions of the independent construct. A closer look on the pattern matrix indicated that the initial 103 variables were reduced to 92 as 11 items had loadings less than 0.4. These are the following:

1. Helps retain valued customers
2. Provides information flow
3. System is accessible
4. Facilitates information exchange with suppliers
5. Facilitates information exchange with customers
6. System has fast response time
7. System downtime is minimal
8. Systems is useful for problem identification
9. Information is safely maintained
10. Has sufficient people to provide services
11. Information produced meets your requirements

In addition, some factors looked very weak and had to be removed. We evaluated each extracted factor separately to determine its variables and therefore its presence in the subsequent analysis. Our factors were very clear as demonstrated in the pattern matrix and it became easy to isolate the weak ones:

Factor 10 comprised 3 variables (information is reliable, verifiable, unbiased) which could comfortably belong to factor 1 (due to better loadings and consistency according to our literature). Factor 12 contained only 2 variables (service provider supports you in case of emergency and service provider knows business processes). Again these variables would load better under factor 3. Factor 14 contained 2 variables: IS speeds service delivery which made sense under factor 7 and system is reliable which made sense under factor 5. Finally, factor 15 had only 1 variable which actually made more sense under factor 8. Table 6.4 summarises the number of variables and factors that remained in the analysis

Table 6.4 Factors and variables attributed to Information System Effectiveness

4 Dimensions	Factors 11	Variables 92 *(before extraction:103)*
1: **System quality**	Factor 4	11
	Factor 5	9
	Factor 7	6
	Factor 9	4
	Factor 13	3
Total number		33 *(before extraction:38)*
2: **Information quality**	Factor 1	18
	Factor 8	4
	Factor 11	4
Total number		26*(before extraction:31)*
3**: Training quality**	Factor 6	7 *(before extraction:7)*
4: **SP quality**	Factor 2	13
	Factor 3	13
Total number		26 *(before extraction:27)*

According to Hair et al. (2010) the "*number of factors to be interpreted largely depends on the underlying purpose of the analy*sis". The next step in this analysis was to explain the factors and to assign a name to the useful ones. Factor 1 was given the name "report quality" as it explicitly contained the relevant measures for the quality of the reports produced by the system (Cha-Jan Chang and King, 2005; DeLone and McLean, 1992; 2003). Factor 2 was given the name "Service Provider Empathy" as we used a previously developed construct under the name *empathy of the IT people* (Cha-Jan Chang and King, 2005; DeLone and McLean, 1992; 2003). Factor 3 was given the name "Service Provider Reliability" as the underlying measures indicated relevant features of the service provider such as knowledge of the industry, company processes etc. Factor 4 was given the name "System Use" borrowing the ideas from the concept originally developed by (DeLone and McLean, 1992; 2003) but in this case the underlying variables summarise the way IT managers perceive the impact of the system on a number of issues of common interest.

Factor 1: Report Quality

	Items	Loading
Factor-1 18 variables	Iiq1 Interpretable	,831
	Iiq2 Understandable	,847
	Iiq3 Complete	,800
	Iiq4 Clear	,975
	Iiq5 Concise	,968
	Icq3 Accurate	,958
	ICq1 Important	,622
	Icq2 Relevant	,727
	Icq4 Usable	,844
	Ipq1 Well organised	,886
	Ipq2 Well defined	,881
	Iai1 Available	,761
	Iai3 Up-to-date	,746
	Iai4 Received in a timely manner	,787
	Ir1 Reliable	,438
	Ir2 Verifiable	,523
	Ir3 Believable	,574
	Ir4 Unbiased	,453

Factor 2: Service Provider Empathy

	Items	Loading
Factor-2 13 variables	X2 Are effective in performing their services	,727
	X5 Have the knowledge and skill to do their job well	,788
	X6 Are dependable	,864
	X1 Are polite	,883
	X7 Are sincere	,896
	X3 Show respect to you	,917
	X4 Are pleasant to work with	,979
	X8 Instill confidence in you	,916
	X9 Are helpful to you	,912
	X10 Solve your problems as if they were their own	,825
	X11 Understand your specific needs	,788
	X12 Are willing to help you	,971
	SM29 Help employees become skillful users	,747

Factor 3: Service Provider (SP) Reliability

	Items	Load
	Srp3 (SP) services are valuable	,630
	Srp1 Responds to requests in a timely manner	,741
	Srp2 Complete services in an effective manner	,755
	SrI6 IS services are reliable	,755
Factor-3	Sfs3 Provides a sufficient variety of services	,726
13 variables	SrI4 Provides cost effective services	,897
	Sep1 Cares for the company's interest	,980
	Sep2 cares for every user	,822
	SM24 Supports you in case of emergency	,770
	SM25 Knows the business processes	,594
	SM26 Knows the industry	,553
	SM27 Honours the contractual agreement	,785
	SM28 Cares for a long lasting relationship	,724

Factor 4: System Use

	Items	Loading
	Sij3 Helps their decision making	,555
	Sij4 Gives them confidence to accomplish their job	,821
	Sij6 Increases participation in decision making	,681
Factor-4	Sij8 Improves the quality of the work product	,996
11 variables	sij9 Enhances individual problem-solving ability	,851
	Sik1 Facilitates collaborative problem solving	,977
	Sik2 Facilitates collective group decision making	,827
	Sik3 Facilitates learning	,763
	sik5 Facilitates knowledge transfer	,555
	SM3 Facilitates internal relationships	,461
	SM9 Enhances information sharing with suppliers	,404

Factor 5 was given the name **"**System Usefulness**"** a construct already known from the Technology Acceptance Model (Davis 1989; 1993) and included specific capabilities of the system that were of significant importance for the usefulness of the system for the entire organisation.

Factor 5: System Usefulness

	Items	**Loading**
	Ssc4 System is reliable	,496
Factor 5	Ssc9 System is flexible	,530
9 variables	SM10 System is well integrated	,642
	SM11 System is responsive to meet specific needs	1,053
	SM12 System is easy to customise	,990
	SM13 System can been easily upgraded	,921
	Ssc8 System is responsive to meet changing needs	,931
	SM14 System meets expectations	,830
	SM15 System provides benefits for the entire organisation	,648

Factor 6 was given the name "IS Training effectiveness". The concept of training has been widely used in the literature on the IS effectiveness, but it has been operationalised only by Chang and King, (2005) containing 3 measures whereas, in this study, a rather new construct has been developed comprising 7 variables as new items were incorporated to include findings from recent literature.

Factor 7 was given the name "SCM effectiveness". The relevant 6 could fully capture the way IS implementation enhances effectiveness of supply chain management

Factor 6: Training effectiveness

	Items	**Loading**
	Stg1 Training programs are useful	,767
Factor 6	SM20 Training programs cover your needs	,785
7 variables	SM21 Training programs are frequent	,635
	SM22 Training programs are instructive	,842
	Stg3 Training programs cover specific needs	,853
	Stg2 Training programs are cost effective	,935
	Stg1 Training programs help users learn system's uses	,882

.Factor 7: SCM effectiveness

	Items	Loading
	Sie1 Facilitates relationships with external partners	,550
Factor 7	Sie6 Helps you select and qualify desired suppliers	,729
6 variables	SM4 Improves supply's control	,855
	SM5 Helps you manage product flow	,960
	SM7 Speeds product delivery	,955
	SM8 Speeds service delivery	,478

Factor 8 was given the name "Information usefulness" as the 4 final underlying variables included the way IT managers perceived the usefulness of the information provided by the system. The variable "useful for problem definition" loaded better under factor 11. Another 4 items had to be excluded from the factor as they demonstrated no loading. The 4 items were the following: SM18 Can be safely maintained, Ifi7 It is useful for problem identification, SM17 Facilitates information exchange with customers, SM16 Facilitates information exchange with suppliers. This issue is being further discussed in chapter 8.

Factor 9 was given the name "System Acceptance" borrowing the concept from the Technology Acceptance Model (Davis 1989; 1993) as it included specific capabilities of the system that were of significant importance for the friendliness and acceptance of the system.

Factor 8: Information usefulness

	Items	Loading
	Ifi2 Can be easily changed	,988
Factor 8	Ifi3 Can be easily integrated	,700
4 variables	Ifi4 Can be easily updated	,815
	Ifi5 Can be used for multiple purposes	,777

Factor 9: System acceptance

	Items	Loading
	Sij1 Makes it easier to do their job	,589
Factor 9	Seu1 System is easy to use	,537
4 variables	Seu2 System is easy to learn	,498
	Ssc7 System is cost effective	,412

Factor 10 comprised three variables (Ir1 Reliable, Ir2 Verifiable, Ir4 Unbiased) which, however, demonstrated higher loading under factor 1. A review of the literature indicated that these made much better sense under factor 1 and this being the case, factor 10 was removed from the subsequent analysis. Factor 11 comprised 3 variables which stemmed from the literature construct information quality and 1 variable from the field literature (improves functional productivity). A closer look revealed that all four variables together could measure the respondents' perception on another construct which evolved around the effectiveness of the reporting system and for this reason we named it: Report effectiveness.

Factor 11: Report effectiveness

	Items	**Loading**
	Ifi8 It is useful for defining problems	,542
Factor 11	Ifi9 It is useful for solving problems	,536
4 variables	SM19 Improves functional productivity	,477
	Ifi11 Improves decision effectiveness	,487

Factor 12 contained only two variables: SM25 Knows the business processes SM26 Knows the industry. These, however, would load perfectly well under factor 3 which characterised the features of a reliable Service Provider. Factor 12 was deleted from the analysis. Factor 13 comprised 3 variables which were dealing with how IS can improve business processes. We called it business process effectiveness. Factor 14 contained only two variables: "SM8 Speeds service delivery" served better the meaning and purposes of factor 7 whereas the item "Ssc4 System is reliable" loaded higher under factor 5. Being left with no items Factor 14 was not included in the subsequent analysis.

Factor 13: Business process effectiveness

	Items	**Loading**
	SM2 Improves modernisation of working methods	,460
Factor 13	Sii5 Reduces process costs	,620
3 variables	Sii6 Reduces process times	,463

Factor 15 contained only one variable which had already been allocated under factor 8 and for this reason there was no meaning in keeping the factor for future statistics.

6.4.2 Examining the factors attributed to Organisational Performance

The pattern mix (see Table 6.7.) provided a solution of 4 factors with loadings higher than 0.4. The total variance explained was almost 83,448% (see Table 6.5). Finally, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity showed excellent factorability of the components (see Table 6.6).

Table 6.5 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	16,92	65,076	65,076	16,92	65,076	65,076	13,957
2	1,41	5,424	70,499	1,41	5,424	70,499	12,638
3	1,206	4,637	75,137	1,206	4,637	75,137	11,517
4	1,176	4,523	79,659	1,176	4,523	79,659	10,829
5	0,741	2,852	82,511				

Table 6.6 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,954
Bartlett's Test of Sphericity	Approx. Chi-Square	4623,530
	df	325
	Sig.	,000

Table 6.7 Pattern Matrix[a]

	Component			
	1	2	3	4
P1 On the company's productivity	,435		,404	
P2 On income			,709	
P3 On production cost			,819	
P4 On inventory levels			,655	
P5 On logistics costs		,528	,431	
P6 On gross profit			,702	
P7 On goods that meet customer needs				,650
P8 On services that meet customer needs				,667
P9 On delivery of goods according to specifications				,833
P10 On customer complaints				,654
P11 On customer retention		,431		,539
P12 On customer satisfaction				,770
P13 On supplier's defect free deliveries		,820		
P14 On replenishment time		,749		
P15 On new product /service development		,768		
P16 On the range of products and services		,730		
P17 On innovation capabilities		,534		
P18 On forecasting ability	,443	,513		
P19 On information sharing thought entire Supply Chain	,623			
P20 On timely decision making	,742			
P21 On al flexibility	,784			
P22 On information between departments	,886			
P23 On cooperation between departments	,859			
P24 On the achievement of strategic goals	,725		,421	
P25 On the increase of market share	,699			
P26 on competitive position	,790			

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 12 iterations.

6.4.2.1 Assigning names to the factors of Organisational Performance

All items loaded higher the 0.4 and shaped clearly our 4 factors which are demonstrated in Table 6.8

Table 6.8 Factors and variables attributed Organisational Performance

Construct	**Factors**	**Variables**
Organisational performance	Factor 1	9
	Factor 2	6
	Factor 3	5
	Factor 4	6
Total number of variables		**26**

Factor 1 contained 9 items and was given the name growth and the development as the underlying variables referred to organisational internal and external improvement and expansion. The SPSS output indicated another variable (On forecasting ability) which, however, loaded higher under factor 2.

Factor 1: Growth and Development

	Items	**Loading**
	P19 On information sharing thought entire Supply Chain	,623
Factor 1	P20 On timely decision making	,742
9 variables	P21 On organisational flexibility	,784
	P22 On information between departments	,886
	P23 On cooperation between departments	,859
	P24 On the achievement of strategic goals	,725
	P25 On the increase of market share	,699
	P26 On competitive position	,790
	P1 On the company’s productivity	,435

Factor 2 in turn, was defined dynamism and vigilance and comprised 6 variables which had a clear connection with the ability of a company to learn and respond fast. Two variables (impact on logistics cost and customer retention) seemed to load under this factor but weakly and for this reason we allocated them under factors 3 and 4 respectively where their content made more sense.

Factor 3 was easy to interpret as all underlying variables measured the financial performance of a firm. Factor 4 was named Marketing Performance as it clearly referred to a firm's ability to perform competitively.

Factor 2: Dynamism and Vigilance

	Items	**Loading**
	P13 On supplier's defect free deliveries	,820
Factor 2	P14 On replenishment time	,749
6 variables	P15 On new product /service development	,768
	P16 On the range of products and services	,730
	P17 On innovation capabilities	,534
	P18 On forecasting ability	,513

Factor 3: Financial performance

	Items	**Loading**
	P2 On income	,709
Factor 3	P3 On production cost	,819
5 variables	P4 On inventory levels	,655
	P5 On logistics costs	,431
	P6 On gross profit	,702

Factor 4: Marketing performance

	Items	**Loading**
	P7 On delivery of goods meeting customer needs	,650
Factor 4	P8 On delivery of services goods meeting customer needs	,667
6 variables	P9 On delivery of goods according to specifications	,833
	P10 On customer complaints	,654
	P11 On customer retention	,539
	P12 On customer satisfaction	,770

Having completed the interpretation of the 4 factors of our dependant construct, i.e. "Organisational Performance", it became clear that the factor analysis provided us with the measures of financial and non financial performance. The patterns clearly indicated that Kaplan and Norton (1992) approach was an appropriate choice for the impact of

Information Systems on organisational performance. This will be discussed extensively in chapter 8.

6.4.3 The final solution - Assessing the Validity and Reliability of the factors

Having completed out factor analysis it was found that 8 variables were removed and the final solution comprised 118 variables (129 were initially factorised). These variables structured 15 factors in total, as depicted in table 6.9.

Face validity was taken into account when the questionnaire was developed and the variables for inclusion had to correspond with the construct examined. The rationale for internal consistency is that the individual items of the scale should all be measuring the same construct and thus be highly inter-correlated (Churchill, 1979; Nunnally, 1994; Hair *et al*, 2010). Correlation analysis was used for assessing the discriminant validity which means that the scale sufficiently differs from other similar concepts (scales) and nomological validity was taken into account through a rigorous literature review.

In this research, reliability analysis was performed in order to assess the internal consistency of the factors. Reliability was assessed by using Cronbach's Alpha coefficient (Cronbach, 1951), which is the most common way to estimate the reliability of such scales (Nunnally, 1994). Nunnaly's (1994) threshold level of acceptable reliability being an alpha coefficient of 0.50 or greater was adopted. All scales were found to satisfy this criterion with Cronbach's a coefficient comfortably higher than the cutoff point of 0.50 (Table 6.9)

6.5 Summary on factor analysis

This chapter aimed at the extraction of factors that would be furhter used for the testing of our hypotheses. Within this principle components analysis 168 cases were used which satisfies the Rummel's (1970) criterion as the initial nymber of variables was 129. Exploratory factor analysis was performed for the purpose of the exploration of patterns of variables in order to find new concepts and a possible reduction of data (Hair et al., 2010)

The product of this analyis was the formation of 15 factors which are summarised in Table 6.9. All the factors satisfied the statistical and conceptual criteria for acceptance and we decided to include them in the subsequent analysis and proposition-hypotheses testing that are discussed in chapter 7.

Table 6.9 Reliability results for the final factors

Constructs	**Factor Name**	**Cronbach a**
Service Provider Quality	Report Quality	0.972
	Service Provider Empathy	0.974
	Service Provider (SP) Reliability	0.954
System Quality	System use	0.931
	System usefulness	0.938
	SCM effectiveness	0.894
	System acceptance	0.854
	Business process effectiveness	0.867
Information Quality	Information usefulness	0.871
	Report effectiveness	0.927
Training	Training effectiveness	0.951
Organisational performance	Growth and development	0.962
	Dynamism and Vigilance	0.955
	Financial performance	0.940
	Marketing performance	0.942

CHAPTER 7

Hypotheses Testing and Multiple Regression Analysis

7.1 Introduction

Chapter 3 provided a detailed analysis of the theory and measures that were used to conceptualise the independent and dependent constructs of our research model. Following a detailed literature review in Chapter 3, we framed 4 main propositions that expressed the relationship between our independent dimensions under the construct "*Information Effectiveness*" and our main dependent construct "*Organisational Performance*".

Following the construction of our dependent and independent factors in Chapter 6, our research model changed to include our new factors under our main constructs. Figure 7.1 depicts the research model in more detail using the main dimensions and their respective factors as well as their proposed relationship with each factor under our dependent construct. The Information Effectiveness dimensions were considered as the independent variables (IVs) and the (4) four factors that were attributed to organisational performance were the dependent variables (DVs). In order to test and quantify the possible relations between the set of IVs and the Ds, multiple regression analysis was performed.

The remaining of Chapter 7 explores these relationships and discusses in detail the multiple regression analyses that were performed for the exploration of these relationships.

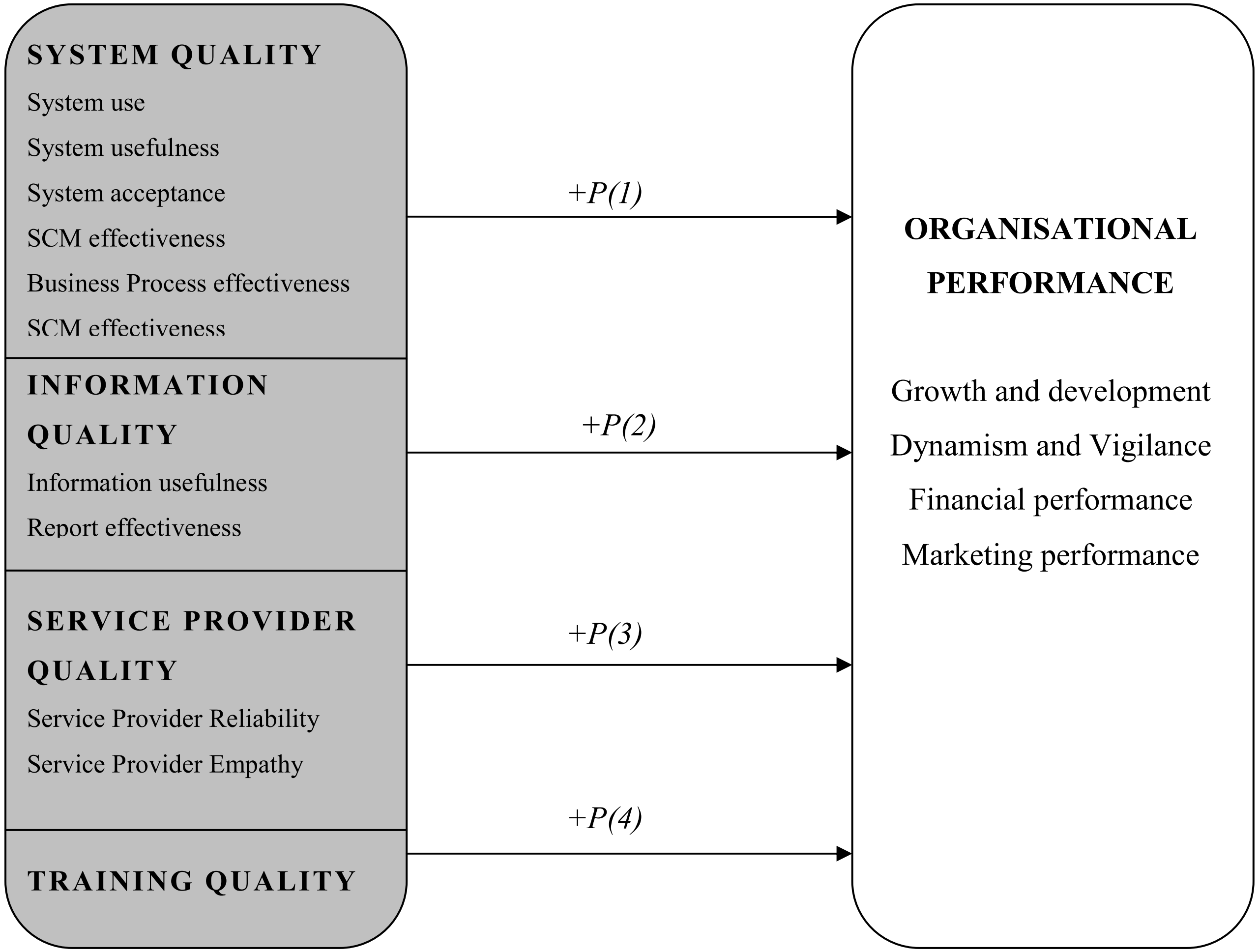

Figure 7.1 The research model

7.2 System quality and organisational performance

Chapter 2 provided the theoretical background on the relationship between system quality and organisational performance whereas Chapter 3 provided the measures that were used for the conceptualisation of these two concepts. The main arguments are summarised as follows:

The information system that is well implemented and accepted by the users is a very important condition for a company to reap benefits of financial and non-financial nature (Rai et al., 2002; Shih, 2004; Yang & Yoo, 2004; Wixom & Todd, 2005; Bharati & Chaudhury, 2006; Hsieh & Wang, 2007; Klein, 2007). A system that is well designed from a technical point of view (Bailey & Pearson, 1983; Wang & Strong, 1996; Chang & King, 2005; Nelson, Todd & Wixom, 2005; Gorla, Somers & Wong, 2010) and thus meets expectations (Barti & Huff, l985; Chang & King, 2005) has been found to have a positive impact on organisational efficiency as found by Bradley et al. (2006) in a research involving entrepreneurial firms and a positive impact on organization in general as found by Gorla, Somers & Wong (2010). Furthermore, a system that modernises business processes and optimises their time and cost is expected to result in increased organisational performance (Chang & King, 2005). Finally, yet importantly any IS should integrate the processes in a way that the whole supply chain is managed effectively (Chang & King; 2005; Argyropoulou et al., 2008) which in turn can have a positive impact on the organisational performance.

In light of the above analysis the following propositions were framed:

***P1** : System quality is positively related to organisational performance as expressed by non-financial measures of the growth and development factor*

***P2** : System quality is positively related to organisational performance as expressed by non –financial measures of the dynamic and vigilance factor*

***P3** : System quality is positively related to organisational performance as expressed by non financial measures of marketing performance factor*

***P4** : System quality is positively related to organisational performance as expressed by financial measures*

Five -5- factors were extracted (Chapter 6) that can be attributed to the dimension of system quality: ***System use, System usefulness, SCM effectiveness; System acceptance; Business process effectiveness***. The next step was to explore how each independent factor could be related to organisational performance factors and how all of them affected the dependent construct. Table 7.1 summarises the propositions and related hypotheses that were examined using multiple regression analysis.

Table 7.1 System quality and organisational performance factors

System quality factors	Growth and development related hypotheses (P1)
System use	**H1a** Growth and development increase if system use increases
System usefulness	**H1b** Growth and development increase if system usefulness increases
System acceptance	**H1c** Growth and development increase if system acceptance increases
Business process effectiveness	**H1d** Growth and development increase if business process effectiveness increases
SCM effectiveness	**H1e** Growth and development increase if SCM effectiveness increases

Table 7.1 System quality and organisational performance factors *continued*

System quality factors	Dynamism and vigilance related hypotheses (P2)
System use	**H2a** Dynamism and Vigilance increase if system use increases
System usefulness	**H2b** Dynamism and Vigilance increase if system usefulness increases
System acceptance	**H2c** Dynamism and Vigilance increase if system acceptance increases
Business process effectiveness	**H2d** Dynamism and Vigilance increase if business process effectiveness increases
SCM effectiveness	**H2e** Dynamism and Vigilance increase if SCM effectiveness increases

Table 7.1 System quality and organisational performance factors *continued*

System quality factors	**Marketing performance factor related hypotheses (P3)**
System use	**H3a** Marketing performance increases if system use increases
System usefulness	**H3b** Marketing performance increases if system usefulness increases
System acceptance	**H3c** Marketing performance increases if system acceptance increases
Business process effectiveness	**H3d** Marketing performance increases if system business process effectiveness increases
SCM effectiveness	**H3e** Marketing performance increases if SCM effectiveness increases

Table 7.1 System quality and organisational performance factors *(continued)*

System quality factors	**Financial performance factor related hypotheses (P4)**
System use	**H4a** Financial Perfromance increases if system use increases
System usefulness	**H4b** Financial Perfromance increases if system usefulness increases
System acceptance	**H4c** Financial Perfromance increases if system acceptance increases
Business process effectiveness	**H4d** Financial Perfromance increases if business process effectivenss increases
SCM effectiveness	**H4e** Financial Perfromance increases if SCM eeffectiveness increases

7.3 Information quality factors and organisational performance

Chapter 2 provided the theoretical background on the relationship between information quality and organisational performance whereas Chapter 3 provided the measures that were used for the conceptualisation of the concepts. The impact of information quality on organisational performance has been evaluated by many studies (see Chapter 2: Shih 2004; Bharati & Chaudhury, 2006; Kositanurit et al., 2006; Wu & Wang, 2006). Many researchers focused on measuring the quality of the basic system output, mainly the reports (e.g. Gallagher, 1974; Swanson, 1974; Munro & Davis, 1977; Gorla, Somers & Wong, 2010) whereas many others explored the influence of information on organisational performance (Chervan & Dickson,1974; Chang & King, 2005; Bernroider, 2008).

Reports constitute the main product of any Information System (Gorla, Somers & Wong, 2010) which implies that these products should have the basic characteristics of timeliness and reliability that affect performance. Poor data and inadequate reporting quality will affect negatively the customers, the decision making process and as a result strategic objectives will be difficult to achieve (Law & Ngai, 2007)

The reports produced by any Information System that are perceived effective are also expected to have a positive relationship with organisational performance; companies cannot operate successfully if the reports do not enhance problem solving practices and decision effectiveness (Kahn et al., 2002; Chang & King, 2005). In addition, the information should have the attributes of usefulness to the users (Calisir & Calisir, 2004; Wu & Wang, 2007).

These studies helped us frame the next block of research propositions:

P5*: Information quality is positively related to organisational performance as expressed by non-financial measures of the growth and development factor*

P6*: Information quality is positively related to organisational performance as expressed by non –financial measures of the dynamic and vigilance factor*

P7*: Information quality is positively related to organisational performance as expressed by non financial measures of marketing performance factor*

P8*: Information quality is positively related to organisational performance as expressed by financial measures*

Three factors were extracted in Chapter 6 that can be attributed to the dimension of Information quality: *Report Quality; Information usefulness; Report effectiveness*. The next step was to explore how each independent factor was related to organisational performance factors and how all of them affected the dependent construct. Table 7.2 summarises the propositions and related hypotheses that were examined using multiple regression analysis

Table 7.2 Information quality and organisational performance factors

Information quality factors	**Growth and development factor related hypotheses (P5)**
Report quality	**H5a** Growth and development increase if report quality increases
Information usefulness	**H5b** Growth and development increase if information usefulness increases
Report effectiveness	**H5c** Growth and development increase if report effectiveness increases
Information quality factors	**Dynamic and vigilance related hypotheses (P6)**
Report quality	**H6a** Dynamism and Vigilance increase if report quality increases
Information usefulness	**H6b** Dynamism and Vigilance increase if information quality increases
Report effectiveness	**H6c** Dynamism and Vigilance increase if report effectivess increases
Information quality factors	**Marketing performance factor related hypotheses (P7)**
Report quality	**H7a** Marketing performance increases if report quality increases
Information usefulness	**H7b** Marketing performance increases if information usefulness increases
Report effectiveness	**H7c** Marketing performance increases if report effectiveness increases
Information quality factors	**Financial performance factor related hypotheses (P8)**
Report quality	**H8a** Financial performance increases if report quality increases
Information usefulness	**H8b** Financial performance increases if information usefulness increases
Report effectiveness	**H8c** Financial performance increases if report effectiveness increases

7.4 Service Provider quality factors and organisational performance

Chapter 2 provided the theoretical background on the relationship between service provider quality and organisational performance whereas Chapter 3 provided the measures that were used for the conceptualisation of the concepts. There are many characteristics of the Service Provider that been extensively discussed as a prerequisite for IS success (Bernroider, 2008; Gorla 2010). Delivering quality service is a prerequisite for business success as it is positively related to customer loyalty, higher profitability, higher revenues (Reicheld & Sasser, 1990) and competitive advantage (Bharadwaj, 2000). Another stream of researchers found that features of provider empathy are of importance for IS implementation as such features of the provider constitute the “feeling good” prerequisite that establishes a trustful relationship (Argyropoulou et al., 2007).

As discussed in Chapter 2, Service Provider quality refers to the quality of the services rendered by the IT support department and includes measures like responsiveness reliability, technical competence, and empathy of the IT people (DeLone and McLean, 1992; Pit et al., 1995; DeLone and McLean, 2003). This construct has been tested in terms of its relationship with organisational performance (Thong et al. 1996; Gefen, 2000) and was found positive. Thus, we constructed another group of research propositions:

P9*: Service Provider quality is positively related to organisational performance as expressed by non-financial measures of the growth and development factor*

P10*: Service Provider quality is positively related to organisational performance as expressed by non –financial measures of the dynamic and vigilance factor*

P11*: Service Provider quality is positively related to organisational performance as expressed by non financial measures of marketing performance factor*

P12*: Service Provider quality is positively related to organisational performance as expressed by financial measures*

Two factors attributed to Service Provider Quality were extracted from our EFA in Chapter 6***: Service Provider (SP) Empathy and Service Provider (SP) Reliability.*** The next step was to explore how well each independent factor could predict the organisational performance factors and how all of them affected the dependent construct. Table 7.3 summarises the propositions and related hypotheses that were examined using multiple regression analysis

Table 7.3. Service Provider Quality and organisational performance factors

SP quality factors	**Growth and development factor related hypotheses (P9)**
SP Empathy	**H9a** Growth and development increase if Service Provider's empathy increases
SP Reliability	**H9b** Growth and development increase if Service Provider's reliability increases
SP quality factors	**Dynamic and vigilance related hypotheses (P10)**
SP Empathy	**H10a** Dynamism and vigilance increase if Service Provider's empathy increases
SP Reliability	**H10b** Dynamism and vigilance increase if Service Provider's relaibility increases
SP quality factors	**Marketing performance factor related hypotheses (P11)**
SP Empathy	**H11a** Marketing performance increases if Service Provider's empathy increases
SP Reliability	**H11b** Marketing performance increases if Service Provider's relaibility increases
SP quality factors	**Financial performance factor related hypotheses (P12)**
SP Empathy	**H12a** Financial performance increases if Service Provider's empathy increases
SP Reliability	**H12b** Financial performance increases if Service Provider's reliability increases

7.5 Training effectiveness and organisational performance

As discussed in Chapter 3 training end users has been discussed extensively in the literature (e.g. Kraut et al., 1989; Lee et al., 1995; Al-Mashari et al., 2003). In a study related to ERP systems implementation Irani (2002) claimed that lack of training leads to poor support of the system amongst its stakeholders whereas Amoako-Gyampah and Salam, (2004; 2007) argued that training removes all obstacles for success that derive from technological complexity.

Thus, we construct another group of research propositions:

P13: *Training effectiveness is positively related to organisational performance as expressed by non-financial measures of the growth and development factor*

P14*: Training effectiveness is positively related to organisational performance as expressed by non –financial measures of the dynamic and vigilance factor*

P15*: Training effectiveness is positively related to organisational performance as expressed by non financial measures of marketing performance factor*

P16*: Training effectiveness is positively related to organisational performance as expressed by financial measures*

As all variables formed one factor there were not any further hypotheses to explore.

7.6 Multiple Regression Analysis

Hair et al., (2010) describe Multiple Regression Analysis is a "multivariate statistical technique mainly used to find the relationship between dependent and independent variables by forming the variety of independent variables" Hair et al., (2010, p.158). There are two types of regression analysis; simple regression and multiple regression. The first uses only two variables, one dependent and one independent and the equation is the following:

$y = a + bx$

The latter (multiple regression) involves one dependent variable and many independent ones: Mathematically this is shown as follows:

$y = a + b1x1 + b2x2 + b3x3 + ... + bnxn+e$

where:

y = the estimated value for the dependent variable

b1, b2, b3,= partial regression coefficients,

x, x1, x2, x3,.= independent variables

a = the regression constant or intercept derived from the analysis

e= error term

In simple words, "b1 *represents the change in y corresponding to a unit change in x1 and this is used in multiple regression analysis the partial regression coefficients are used to take into account all the relationships between y and x1, x2 and so on*" (Hair et al., 2010). Using the SPSS statistical package, the partial regression coefficients are shown as Beta values. Beta values are calculated automatically by the SPSS from the partial regression coefficients using the equation that involves the standard deviation of the respective independent variables when these are expressed in a standardised form (z-score). Mathematically, the larger the B the stronger the relationship between the specific independent variable and the dependent variable (Churchill, 1997)

Using the multiple regressions for this research model we can say that the construct Organisational Performance was our dependent variable and the Information System Effectiveness dimensions and factors (extracted through factor analysis) were the independent variables.

7.6.1 Discussion on the regression statistics used in the analysis

The next step of the analysis was to discuss and investigate the related statistics of the regression models. A critical part is the measurement of goodness-of-fit of the model and the statistical significance of the estimated parameters. The common measure for the goodness-of-fit is the R^2. This actually interprets the proportion of variance of the dependent variable (about its mean) that is explained by the independent variables (Johnson and Wichern, 1982). Another form of this coefficient when many independent variables are explored in the model, is the adjusted coefficient of multiple determination or adjusted R^2. The main difference is that the R^2 might get higher with the introduction of new variables, whereas the adjusted R^2gets less when the new variables have little power in the regression model and are found to be statistically not significant. For this reason in such cases, the adjusted R^2 is a better measure as "it avoids overestimating the impact of the new variables on the explained variance" (Bowerman et al., 2005).

The statistical significance of a regression coefficient can be measured when using an *F*-test of the overall fit, followed by *t*-tests of the individual parameters. The F-test is, in simple words, the ratio of the explained to unexplained variance in the equation which means that when the F statistic is greater than the critical value of F, it can be accepted that the regression equation is statistically significant (Bowerman et al., 2005).

7.6.2 Regression model evaluation – multicollinearity

A very important assumption in a regression analysis is the independence amongst the predictor variables. Collinearity is the term used to describe the correlation between 2 independent variables whereas, multicollinearity is the term used for the correlation amongst 3 or more variables (Hair et al., 2010). Whilst multicollinearity is a problem that stems from the nature of the data, it can affect an impact on the execution of linear regression. The variance of the regression estimators will be erratically higher and incorrect signs for regression coefficients can be calcualated (Farrar and Glauber, 1967; O'Brien, 2007).

At this point is should be noted that multicollinearity is a question of degree. Indicators such as tolerance and the variance inflation factor (VIF) are typically used to judge the multicollinearity of variables: $tolerance = 1 - R^2, \quad \mathrm{VIF} = \frac{1}{tolerance}$

A tolerance of less than 0.20–0.10 or a VIF greater than 5–10 indicates a multicollinearity problem. In this study, it was decided that the variables have multicollinearity if VIF > 10 (Farrar and Glauber, 1967; O'Brien 2007).

7.6.3 Regression model evaluation – multicollinearity- homescedasticity and normality

There are three methods used in linear regression for selecting variables and these are: forward, backward and stepwise (Hair et al., 2010). The forward selection of variables begins by fitting the constant to the analysis and then all the independent variables that contribute the R square are incrementally added. Backward selection is the inverse procedure that begins with the independent variables and sequentially eliminates the variables that do not contribute significantly to the regression. Stepwise selection is a combination of both which means that the variables are included or excluded at each step according to their statistical significance for inclusion in a model.

The decision to overcome the form of selection procedure is available in the SPSS when using the enter method of the model specification. This method forces each variable to be specified within the final equation, irrespective of any statistical criteria (Bryman and Cramer, 1994). This is considered the most desirable in multiple linear regression analysis as it examines all possible relationships in the model and avoids the *selection procedure that is atheoretical* (Bryman and Cramer, 1994 p. 245) and might lead to unjustified conclusions. For the purposes of this research, therefore, we used standard and hierarchical regression because of the criticism levelled at the use of the stepwise methods especially with regards to the allocation of R square (Leigh, 1988).

7.7 The results of the multiple regression analysis

For the purposes of this research, the Information Effectiveness dimensions were considered as the independent variables (IVs) and the four factors that were attributed to organisational performance were the dependent variables (DVs). In order to test and quantify the possible relations between the set of IVs and the DVs, a multiple regression analysis was performed. Multiple regression analysis is a multivariate statistical technique used to examine the relationship between a single dependent variable and a set of independent variables (Hair et al., 2010). The main objective of the multiple regression analysis, in this context, was to assess the efficacy and effectiveness of the proposed dimensions in explaining Organisational Performance. The next paragraphs discuss in detail the method and results for each of our 12 propositions together with their related hypotheses.

7.7.1 Testing proposition 1 and related hypotheses

The first proposition tested the relationship between the independent dimension / construct system quality and the dependent sub construct of organisational performance named growth and development. Multiple regression analysis was conducted using standard multiple regression. All independent factors (under system quality) were entered into the analysis simultaneously (standard regression) in order to assess the predictive strength of the proposed model.

Five -5- factors attributed to system quality entered the equation (see table 7.4)

The following paragraph interprets and discusses the main results.

Table 7.4 System quality - growth and development

Model	Variables Entered	Variables Removed	Method
1	Business process effectiveness , System acceptance , SCM effectiveness , System use , System usefulness	.	Enter

a. All requested variables entered.

b. Dependent Variable: Growth and development

Multicollinearity

The correlations between the variables are provided in table 7.5 which demonstrates that all our independent factors showed a positive relationship with the dependant factor.

Table 7.5 Correlation matrix between system quality and growth-development

Correlations

		Growth and development	System use	System usefulness	SCM effectiveness	System acceptance	Business process effectiveness
Pearson Correlation	Growth and development	1,000	,632	,636	,674	,552	,528
	System use	,632	1,000	,566	,680	,546	,695
	System usefulness	,636	,566	1,000	,604	,724	,536
	SCM effectiveness	,674	,680	,604	1,000	,468	,662
	System acceptance	,552	,546	,724	,468	1,000	,465
	Business process effectiveness	,528	,695	,536	,662	,465	1,000
Sig. (1-tailed)	Growth and development	.	,000	,000	,000	,000	,000
	System use	,000	.	,000	,000	,000	,000
	System usefulness	,000	,000	.	,000	,000	,000
	SCM effectiveness	,000	,000	,000	.	,000	,000
	System acceptance	,000	,000	,000	,000	.	,000
	Business process effectiveness	,000	,000	,000	,000	,000	.
N	Growth and development	168	168	168	168	168	168
	System use	168	168	168	168	168	168
	System usefulness	168	168	168	168	168	168
	SCM effectiveness	168	168	168	168	168	168
	System acceptance	168	168	168	168	168	168
	Business process effectiveness	168	168	168	168	168	168

The next step was to see whether the correlation was high but, as depicted in the correlations table, these were within the acceptable range of r<0.8 (Bryman and Cramer, 1994; Hasan & Ahmed, 2007). Collinearity tests were performed by SPSS. These could identify multi-collinearity problems that could not be evident in the correlation matrix. Two values were measured: Tolerance and VIF. As already discussed, tolerance is the indicator of the amount of the variability that is not explained by the other interdependent factors in our model and is calculated as 1-R squared for each factor. To avoid multicollinearity this value should be higher than 0.1 (Hair at al. 2010). The other value measure is VIF (Variance Inflator factor) which is actually the inverse of tolerance (1/tolerance) with a cut-off point of 10. In our collinearity diagnostics these values were accepted as tolerance and VIF were always within the accepted range (Table 7.10.a – 7.10.b).

Outliers, normality, linearity, homoscedasticity, independence of residuals

One of the methods that check the above assumptions is the inspection of the Normal Probability Plot (P-P) of the Regression Standardised Residual and the scatterplot (Hair et al., 2010). Looking at Figure 7.2 we found no deviation from the centralized rectangle which suggests no violation of normality assumptions whereas the presence of outliers is detected in Figure 7.3 and there is not systematic pattern triggering violations with all outliers falling between the 3 standard deviations from the center.

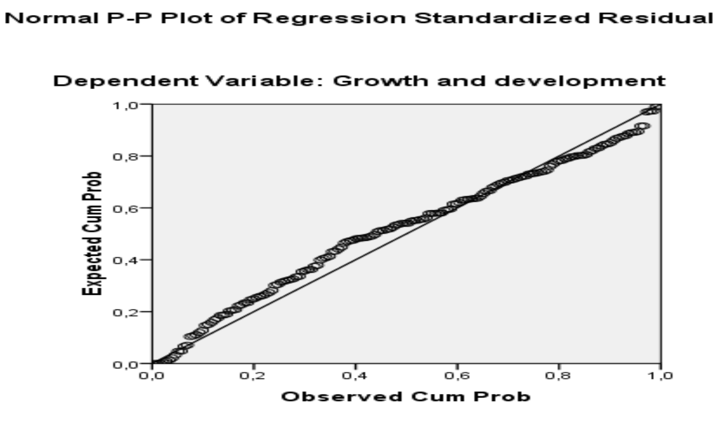

Figure 7.2: N-P plot Regression Standardised Residual for independent factor system quality

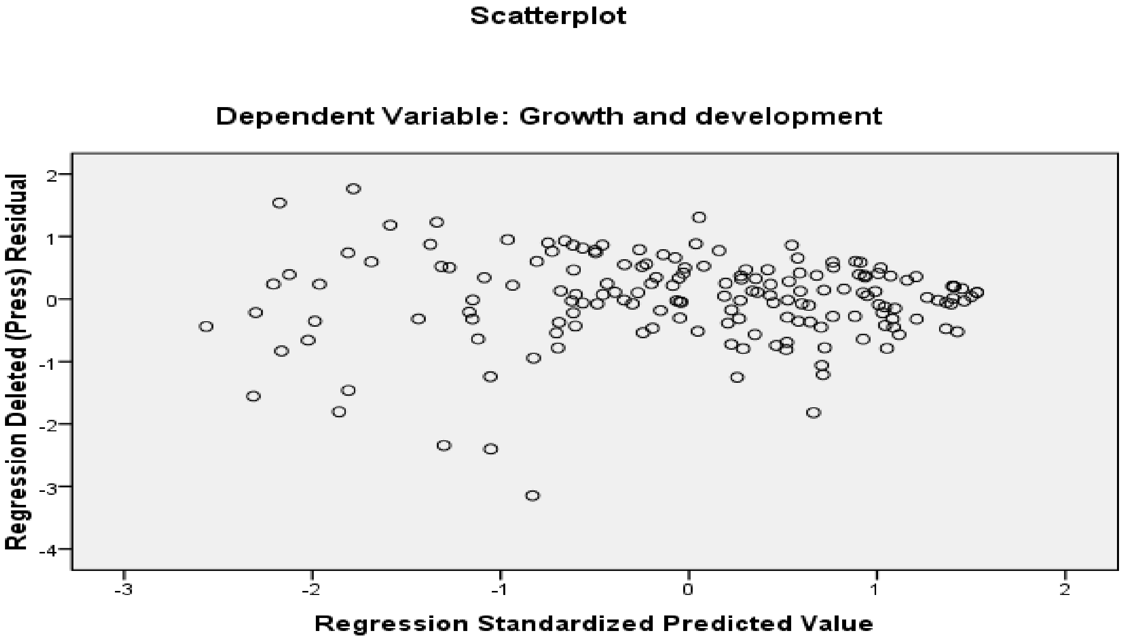

Figure 7.3. The scatter plot Regression Standardised Residual independent construct: system quality

Casewise statistics (Table 7.6) showed three cases for which our model did not predict their scores. To check whether these cases should remain in the analysis we saw that the maximum values for Cook's distance were comfortably lower than 1 (Tabachnick and Fidell, 2007, p.75) and no further steps were taken (Table 7.7)

Table 7.6 Casewise diagnostics independent factor: system quality

Casewise Diagnostics[a]

Case Nu...	Std. Residual	Growth and development	Predicted Value	Residual
95	-4,453	-3,58955	-,6276788	-2,96186744E0
126	-3,282	-3,16664	-,9833889	-2,18324650E0
149	-3,350	-3,02402	-,7957116	-2,22830708E0

a. Dependent Variable: Growth and development

Table.7.7 Residuals Statistics for system quality

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-1,9375061E0	1,1555555E0	,0000000	,75551204	168
Std. Predicted Value	-2,564	1,529	,000	1,000	168
Standard Error of Predicted Value	,061	,358	,118	,042	168
Adjusted Predicted Value	-1,8970006E0	1,1532725E0	,0059637	,74813217	168
Residual	-2,96186733E0	1,70604873E0	-4,13029399E-17	,65513476	168
Std. Residual	-4,453	2,565	,000	,985	168
Stud. Residual	-4,589	2,608	-,004	1,013	168
Deleted Residual	-3,14609790E0	1,76329279E0	-5,96366884E-3	,69436921	168
Stud. Deleted Residual	-4,905	2,656	-,008	1,031	168
Mahal. Distance	,417	47,334	4,970	5,270	168
Cook's Distance	,000	,218	,010	,031	168
Centered Leverage Value	,002	,283	,030	,032	168

a. Dependent Variable: Growth and development

Model evaluation

Looking at the model summary box, (Table 7.8) we found that the R^2 value was .571. This meant that 57.1% of the variance in our dependent factor growth and development was explained by system quality.

Table 7.8 Model Summary – independent factor system quality

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,756[a]	,571	,558	,66516804

a. Predictors: (Constant), Business process effectiveness , System acceptance , SCM effectiveness , System use , System usefulness

b. Dependent Variable: Growth and development

To assess the statistical significance of the this result we looked at the ANOVA results (Table 7.9) which tests the hypothesis that multiple R in the population equals 0.

Table 7.9 ANOVA results – independent factor: system quality

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	95,323	5	19,065	43,089	,000[a]
	Residual	71,677	162	,442		
	Total	167,000	167			

a. Predictors: (Constant), Business process effectiveness , System acceptance , SCM effectiveness , System use , System usefulness

b. Dependent Variable: Growth and development

Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 1st proposition was accepted

The next thing was to test the related hypotheses H1a-H1e. We needed to find out how each of the five independent factors, included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients for comparison purposes. The un-standardized coefficients make sense when we need to construct the regression equations. Looking at the beta values in Table 7.10a and 7.10b we found that the beta value for “SCM effectiveness’ was the highest (0.352) which explained that this factor made the strongest contribution to explaining growth and development. The next high beta value came from system usefulness.

For all the values we checked the column marked sig. which tells us if that factor is making a statistically significant unique contribution. We found that only one factor had a sig. value less than 0.05 this being SCM effectiveness whereas system usefulness and use had a sig value of .005 meaning on the cut-off point. The other factors in this model (business process effectiveness, system use and system acceptance) did not make any significant unique contribution to the prediction of growth and development.

Table 7.10.a Coefficients for each of the independent factors attributed to system quality –standard multiple regression

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	9,995E-17	,051		,000	1,000	-,101	,101					
	System use	,227	,082	,227	2,768	,006	,065	,388	,632	,213	,142	,396	2,528
	System usefulness	,238	,083	,238	2,850	,005	,073	,402	,636	,219	,147	,381	2,626
	SCM effectiveness	,353	,079	,352	4,436	,000	,196	,510	,674	,329	,228	,422	2,371
	System acceptance	,111	,077	,111	1,442	,151	-,041	,264	,552	,113	,074	,445	2,247
	Business process effectiveness	-,042	,078	-,042	-,539	,591	-,195	,111	,528	-,042	-,028	,442	2,261

a. Dependent Variable: Growth and development

Table 7.10.b Coefficients system quality and growth –development standard multiple regression

Model		Unstandardised Coefficients		Standardised Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1.	(Constant)	1,095E-17	,060		,000	1,000	-,118	,118					
	System use	,632	,060	,632	10,509	,000	,513	,751	,632	,632	,632	1,000	1,000
2	(Constant)	5,288E-17	,054		,000	1,000	-,107	,107					
	System use	,400	,066	,400	6,073	,000	,270	,530	,632	,427	,330	,679	1,472
	System usefulness	,410	,066	,410	6,226	,000	,280	,540	,636	,436	,338	,679	1,472
3	(Constant)	6,556E-17	,051		,000	1,000	-,101	,101					
	System use	,235	,073	,235	3,228	,002	,091	,379	,632	,244	,166	,499	2,004
	System usefulness	,304	,067	,304	4,534	,000	,172	,436	,636	,334	,234	,591	1,693
	SCM effectiveness	,331	,076	,330	4,376	,000	,182	,480	,674	,323	,225	,467	2,142
4	(Constant)	8,583E-17	,051		,000	1,000	-,101	,101					
	System use	,209	,075	,209	2,788	,006	,061	,357	,632	,213	,143	,469	2,132
	System usefulness	,234	,083	,234	2,819	,005	,070	,397	,636	,216	,145	,384	2,604
	SCM effectiveness	,340	,076	,339	4,492	,000	,190	,489	,674	,332	,231	,464	2,156
	System acceptance	,110	,077	,110	1,434	,154	-,042	,262	,552	,112	,074	,445	2,246

5	(Constant)	9,995E-17	,051		,000	1,000	-,101	,101					
	System use	,227	,082	,227	2,768	,006	,065	,388	,632	,213	,142	,396	2,528
	System usefulness	,238	,083	,238	2,850	,005	,073	,402	,636	,219	,147	,381	2,626
	SCM effectiveness	,353	,079	,352	4,436	,000	,196	,510	,674	,329	,228	,422	2,371
	System acceptance	,111	,077	,111	1,442	,151	-,041	,264	,552	,113	,074	,445	2,247
	Business process effectiveness	-,042	,078	-,042	-,539	,591	-,195	,111	,528	-,042	-,028	,442	2,261

We decided to double check these finding using the stepwise multiple regression method. The new model summary is depicted in Table 7.11a and the R square adjusted provided a “corrected” value to provide a better estimate of the true population value (Pallant, 2007).

Table 7.11.a The 3 models proposed by stepwise method – independent dimension system quality

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,674[a]	,454	,451	,74123923	,454	137,948	1	166	,000
2	,733[b]	,537	,531	,68459117	,083	29,609	1	165	,000
3	,751[c]	,565	,557	,66585171	,028	10,418	1	164	,002

a. Predictors: (Constant), SCM effectiveness

b. Predictors: (Constant), SCM effectiveness , System usefulness

c. Predictors: (Constant), SCM effectiveness , System usefulness, System use

d. Dependent Variable: Growth and development

Table 7.11. b Model statistical significance – dependent factor; growth and development

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	75,794	1	75,794	137,948	,000[a]
	Residual	91,206	166	,549		
	Total	167,000	167			
2	Regression	89,670	2	44,835	95,666	,000[b]
	Residual	77,330	165	,469		
	Total	167,000	167			
3	Regression	94,289	3	31,430	70,890	,000[c]
	Residual	72,711	164	,443		
	Total	167,000	167			

a. Predictors: (Constant), SCM effectiveness

b. Predictors: (Constant), SCM effectiveness , System usefulness

c. Predictors: (Constant), SCM effectiveness , System usefulness, System use

d. Dependent Variable: Growth and development

Table 7.11.c Coefficients for the 3 models proposed by stepwise method – independent dimension system quality

Excluded Variables[d]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance	VIF	Minimum Tolerance
1	Business process effectiveness	,146[a]	1,919	,057	,148	,562	1,781	,562
	System acceptance	,303[a]	5,002	,000	,363	,781	1,280	,781
	System use	,323[a]	4,349	,000	,321	,537	1,862	,537
	System usefulness	,362[a]	5,441	,000	,390	,636	1,573	,636
2	Business process effectiveness	,061[b]	,836	,404	,065	,532	1,879	,475
	System acceptance	,163[b]	2,140	,034	,165	,474	2,111	,386
	System use	,235[b]	3,228	,002	,244	,499	2,004	,467
3	Business process effectiveness	-,039[c]	-,507	,613	-,040	,443	2,260	,415
	System acceptance	,110[c]	1,434	,154	,112	,445	2,246	,384

a. Predictors in the Model: (Constant), SCM effectiveness
b. Predictors in the Model: (Constant), SCM effectiveness , System usefulness
c. Predictors in the Model: (Constant), SCM effectiveness , System usefulness, System use
d. Dependent Variable: Growth and development

The ANOVA results (table 7.11. b) showed that the statistical significance of the model and finally the beta values for SCM effectiveness, system use and usefulness had a sig value less than .005 (table 7.11.c) and we decided to accept **H1a, H1b and H1e**

7.7.2 Testing proposition 2 and related hypotheses

The second proposition tested the relationship between the independent dimension system quality and the dependent sub construct of organisational performance named dynamism and vigilance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. It was deemed unnecessary to inflate the text with the same steps and for this reason we provide the reader with the summary of the results. All assumptions of multicollinearity and all tests for outliers, normality, linearity, homoscedasticity and independence of residuals were performed which allowed us to proceed with the model evaluation.

Looking at the model summary box, Table 7.12. we found that the R square value was .442. This meant that 44.2% of the variance in our dependent factor dynamism and vigilance was explained by system quality. To assess the statistical significance of this result we looked at the ANOVA results (table 7.13) which test the hypothesis that multiple R in the population equals 0. Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 2nd proposition was accepted.

The next thing was to test the related hypotheses **H2a-H2e**. We needed to find out how each of the five independent factors included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients which these coefficients were converted to the same scale for comparison purposes. The un-standardised coefficients make sense when we need to construct the regression equations. Looking at the beta values in table 7.14a we found that the beta value for SCM effectiveness was the highest (.459) followed by system usefulness (.260). For these values we checked the column marked sig. which tells us whether that factor is making a statistically significant unique contribution. We found that only one factor had a sig. value less than 0.05 this being SCM effectiveness whereas system usefulness has a sig. value slightly above 0.05 and for this reason we decided to double check these finding using the stepwise multiple regression method**.** Table 7.14b shows clearly that the beta values for SCM effectiveness and system usefulness are statistically significant and for this reason we decided to accept **H2b and H2e**

Table 7.12 Model summary –independent factor system quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,665[a]	,442	,422	,74899174

a. Predictors: (Constant), A_A, System acceptance , Business process effectiveness , SCM effectiveness , System use , System usefulness

b. Dependent Variable: Dynamism and Vigilance

Table 7.13 Model summary –independent factor system quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	71,681	6	11,947	21,296	,000[a]
	Residual	90,319	161	,561		
	Total	162,000	167			

a. Predictors: (Constant), A_A, System acceptance , Business process effectiveness , SCM effectiveness , System use , System usefulness

Table 7.14.a Coefficients for independent factor system quality –standard method

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	,006	,119		,051	,959	-,228	,240					
	System acceptance	,012	,087	,012	,142	,888	-,159	,184	,423	,011	,008	,444	2,250
	Business process effectiveness	-,044	,088	-,044	-,497	,620	-,217	,129	,441	-,039	-,029	,440	2,271
	SCM effectiveness	,454	,091	,459	5,006	,000	,275	,633	,628	,367	,295	,411	2,433
	System use	,049	,093	,050	,532	,595	-,134	,232	,486	,042	,031	,392	2,551
	System usefulness	,256	,094	,260	2,725	,007	,070	,442	,551	,210	,160	,380	2,628
	A_A	-7,227E-5	,001	-,004	-,059	,953	-,002	,002	-,130	-,005	-,003	,944	1,060

a. Dependent Variable: Dynamism and Vigilance

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Table 7.14.b Coefficients for independent factor system quality –stepwise method

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3,778E-17	,059		,000	1,000	-,117	,117					
	SCM effectiveness	,620	,060	,628	10,393	,000	,502	,738	,628	,628	,628	1,000	1,000
2	(Constant)	4,998E-17	,057		,000	1,000	-,113	,113					
	SCM effectiveness	,458	,072	,464	6,356	,000	,316	,601	,628	,444	,370	,636	1,573
	System usefulness	,267	,072	,271	3,717	,000	,125	,409	,551	,278	,216	,636	1,573

a. Dependent Variable: Dynamism and Vigilance

7.7.3 Testing proposition 3 and related hypotheses

The third proposition tested the relationship between the independent dimension system quality and the dependent sub construct of organisational performance named marketing performance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity, independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, Table 7.15., we found that the R square value was .488. This meant that 48.8% of the variance in our dependent factor marketing performance was explained by system quality. To assess the statistical significance of this result we looked at the ANOVA results (table 7.16) which test the hypothesis that multiple R in the population equals 0. Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 3rd proposition was accepted.

The next thing was to test the related hypotheses H3a-H3e. We needed to find out how each of the five independent factors included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients for comparison purposes. The un-standardized coefficients make sense when we need to construct the regression equations.

Looking at the beta values in Table 7.17a we found that the beta value for SCM effectiveness was the highest (0.356) followed by system usefulness which explained that these 2 factors made the strongest contribution to explaining marketing performance. For all the values we checked the column marked sig. which tells us whehter that factor is making a statistically significant unique contribution. We found that these 2 factors had a sig. value less than 0.05.

We decided to double check these finding using the stepwise multiple regression method but the results were the same as far as the sig values of the betas are concerned and for this reason we accepted **only the H3b and H3e.**

Table 7.15 Model summary –independent factor system quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,699[a]	,488	,469	,72659627

a. Predictors: (Constant), A_A, System acceptance , Business process effectiveness , SCM effectiveness , System use , System usefulness

b. Dependent Variable: Marketing Performance

Table 7.16 Model summary –independent factor system quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	71,681	6	11,947	21,296	,000[a]
	Residual	90,319	161	,561		
	Total	162,000	167			

a. Predictors: (Constant), A_A, System acceptance , Business process effectiveness , SCM effectiveness , System use , System usefulness

b. Dependent Variable: Dynamism and Vigilance

Table 7.17.a Coefficients for independent factor system quality –standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	,108	,115		,941	,348	-,119	,336					
	System acceptance	,102	,084	,103	1,213	,227	-,064	,269	,512	,095	,068	,444	2,250
	Business process effectiveness	-,028	,085	-,028	-,335	,738	-,196	,139	,460	-,026	-,019	,440	2,271
	SCM effectiveness	,356	,088	,356	4,050	,000	,183	,530	,615	,304	,228	,411	2,433
	System use	,028	,090	,028	,316	,752	-,149	,206	,497	,025	,018	,392	2,551
	System usefulness	,326	,091	,327	3,572	,000	,146	,506	,624	,271	,201	,380	2,628
	A_A	-,001	,001	-,063	-1,077	,283	-,004	,001	-,181	-,085	-,061	,944	1,060

a. Dependent Variable: Marketing Performance

Table 7.17.b Coefficients for independent factor system quality –standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3,952E-17	,060		,000	1,000	-,119	,119					
	System usefulness	,623	,060	,624	10,301	,000	,503	,742	,624	,624	,624	1,000	1,000
2	(Constant)	3,206E-17	,056		,000	1,000	-,110	,110					
	System usefulness	,397	,070	,398	5,653	,000	,258	,536	,624	,403	,318	,636	1,573
	SCM effectiveness	,375	,070	,375	5,316	,000	,235	,514	,615	,382	,299	,636	1,573

a. Dependent Variable: Marketing Performance

7.7.4 Testing proposition 4 and related hypotheses

The fourth proposition tested the relationship between the independent dimension system quality and the dependent sub construct of organisational performance named financial performance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation

Looking at the model summary box, Table 7.18 we found that the R square value was .487. This meant that 48.7% of the variance in our dependent factor financial performance was explained by system quality. To assess the statistical significance of this result we looked at the ANOVA results (table 7.19) which test the hypothesis that multiple R in the population equals 0. Our model reached statistical significance (sig.=.000 meaning $p<.0005$) and the 4th proposition was accepted

The next thing was to test the related hypotheses H4a-H4e. We needed to find out was how each of the five independent factors included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients which these coefficients were converted to the same scale for comparison purposes. The un-standardised coefficients make sense when we need to construct the regression equations.

Looking at the beta values in Table 7.20a we found that the beta value for system usefulness was the highest (0.321) followed by system use and SCM effectiveness which explained that these 3 factors made the strongest contribution to explaining financial performance. For all the values we checked the column marked sig. which tells us if that factor is making a statistically significant unique contribution. We found that these 3 factors had a sig. value less than 0.05.

We decided to double check these finding using the stepwise multiple regression method but the results indicated as significant predictors only System usefulness and SCM effectiveness (see Table 7.20.b) and for this reason we accepted only **H4b and H4e**

Table 7.18 Model summary –independent factor system quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,698[a]	,487	,468	,72962934

a. Predictors: (Constant), A_A, System acceptance , Business process effectiveness , SCM effectiveness , System use , System usefulness

b. Dependent Variable: Financial Performance

Table 7.19 Model summary –independent factor system quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	81,290	6	13,548	25,450	,000[a]
	Residual	85,710	161	,532		
	Total	167,000	167			

a. Predictors: (Constant), A_A, System acceptance , Business process effectiveness , SCM effectiveness , System use , System usefulness

Table 7.20.a Coefficients for independent factor system quality –standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	,119	,116		1,025	,307	-,110	,347					
	System acceptance	,027	,085	,027	,314	,754	-,141	,194	,493	,025	,018	,444	2,250
	Business process effectiveness	,093	,085	,092	1,084	,280	-,076	,261	,538	,085	,061	,440	2,271
	SCM effectiveness	,186	,088	,185	2,102	,037	,011	,360	,591	,163	,119	,411	2,433
	System use	,183	,090	,183	2,034	,044	,005	,361	,575	,158	,115	,392	2,551
	System usefulness	,321	,092	,321	3,507	,001	,140	,502	,614	,266	,198	,380	2,628
	A_A	-,001	,001	-,068	-1,174	,242	-,004	,001	-,178	-,092	-,066	,944	1,060

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	,119	,116		1,025	,307	-,110	,347					
	System acceptance	,027	,085	,027	,314	,754	-,141	,194	,493	,025	,018	,444	2,250
	Business process effectiveness	,093	,085	,092	1,084	,280	-,076	,261	,538	,085	,061	,440	2,271
	SCM effectiveness	,186	,088	,185	2,102	,037	,011	,360	,591	,163	,119	,411	2,433
	System use	,183	,090	,183	2,034	,044	,005	,361	,575	,158	,115	,392	2,551
	System usefulness	,321	,092	,321	3,507	,001	,140	,502	,614	,266	,198	,380	2,628
	A_A	-,001	,001	-,068	-1,174	,242	-,004	,001	-,178	-,092	-,066	,944	1,060

a. Dependent Variable: Financial Performance

Table 7.20.b Coefficients for independent factor system quality –stepwise multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	6,020E-17	,061		,000	1,000	-,121	,121					
	System usefulness	,614	,061	,614	10,013	,000	,493	,735	,614	,614	,614	1,000	1,000
2	(Constant)	5,325E-17	,057		,000	1,000	-,113	,113					
	System usefulness	,404	,072	,404	5,593	,000	,261	,546	,614	,399	,322	,636	1,573
	SCM effectiveness	,349	,072	,348	4,817	,000	,206	,492	,591	,351	,277	,636	1,573
3	(Constant)	2,973E-17	,056		,000	1,000	-,111	,111					
	System usefulness	,350	,073	,350	4,763	,000	,205	,495	,614	,349	,269	,591	1,693
	SCM effectiveness	,231	,083	,230	2,786	,006	,067	,394	,591	,213	,157	,467	2,142
	System use	,221	,080	,221	2,764	,006	,063	,379	,575	,211	,156	,499	2,004

a. Dependent Variable: Financial Perfromance

7.7.5 Testing proposition 5 and related hypotheses

The fifth proposition tested the relationship between the independent dimension Information quality and the dependent sub-construct of organisational performance named growth and development. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation

Looking at the model summary box, Table 7.21 we found that the R square value was .617. This meant that 61.7 % of the variance in our dependent factor growth and development was explained by information quality. To assess the statistical significance of this result we looked at the ANOVA results (table 7.22) which test the hypothesis that multiple R in the population equals 0.

Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 5th proposition was accepted

Table 7.21 Model summary –independent factor information quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,786[a]	,617	,610	,62429334

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

b. Dependent Variable: Growth and development

Table 7.22 Model summary –independent factor information quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	103,082	3	34,361	88,163	,000[a]
	Residual	63,918	164	,390		
	Total	167,000	167			

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	103,082	3	34,361	88,163	,000[a]
	Residual	63,918	164	,390		
	Total	167,000	167			

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

b. Dependent Variable: Growth and development

The next thing was to test the related hypotheses H5a-H5c. We needed to find out how each of the three independent factors included in the model contributed to the prediction of the dependent construct. We checked beta under standardised coefficients for comparison purposes. The un-standardised coefficients make sense when we need to construct the regression equations.

Looking at the beta values in Table 7.23a we found that the beta value for report quality and report effectiveness were the highest i.e. these 2 factors made the strongest contribution to explaining growth and development. For the values we checked the column marked sig. which tells us if that factor is making a statistically significant unique contribution. We found that these 2 factors had a sig. value less than 0.05.

We decided to double check these finding using the stepwise multiple regression method and the results reinforced our decision to accept **H5a and H5c**

Table 7.23.a Coefficients for independent factor system quality –standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-8,791E-17	,048		,000	1,000	-,095	,095					
	Report Quality	,185	,072	,185	2,557	,011	,042	,328	,636	,196	,124	,446	2,240
	Information usefulness	,054	,072	,054	,753	,453	-,088	,197	,595	,059	,036	,446	2,240
	Report effectiveness	,607	,072	,607	8,392	,000	,464	,750	,770	,548	,405	,446	2,240

a. Dependent Variable: Growth and development

Table 7.23.b Coefficients for independent factor system quality –stepwise multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1,039E-16	,049		,000	1,000	-,097	,097					
	Report effectiveness	,770	,050	,770	15,553	,000	,672	,868	,770	,770	,770	1,000	1,000
2	(Constant)	-9,269E-17	,048		,000	1,000	-,095	,095					
	Report effectiveness	,629	,066	,629	9,527	,000	,499	,759	,770	,596	,460	,534	1,872
	Report Quality	,207	,066	,207	3,136	,002	,077	,337	,636	,237	,151	,534	1,872

a. Dependent Variable: Growth and development

7.7.6 Testing proposition 6and related hypotheses

The sixth proposition tested the relationship between the independent dimension Information quality and the dependent sub construct of organisational performance named dynamism and vigilance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation

Looking at the model summary box, Table 7.24 we found that the R square value was .392. This meant that 39.2 % of the variance in our dependent factor dynamism and was explained by information quality.

Table 7.24 Model summary –independent factor information quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,626[a]	,392	,381	,77510606

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

b. Dependent Variable: Dynamism and Vigilance

To assess the statistical significance of this result we looked at the ANOVA results (table 7.25) which test the hypothesis that multiple R in the population equals 0.

Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 6[th] proposition was accepted

Table 7.25 Model summary –independent factor information quality**ANOVA**[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	63,471	3	21,157	35,215	,000[a]
	Residual	98,529	164	,601		
	Total	162,000	167			

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

Table 7.25 Model summary –independent factor information quality**ANOVA**[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	63,471	3	21,157	35,215	,000[a]
	Residual	98,529	164	,601		
	Total	162,000	167			

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

b. Dependent Variable: Dynamism and Vigilance

The next thing was to test the related hypotheses H6a-H6c. We needed to find out was how each of the three independent factors included in the model contributed mostly to the dependent construct. We checked beta under standardised coefficients for comparison purposes. The un-standardised coefficients make sense when we need to construct the regression equations.

Looking at the beta values in Table 7.26a we found that the beta value report effectiveness was the highest and for this value we checked the column marked sig. which tells us if that factor is making a statistically significant unique contribution. We found that this factor had a sig. value less than 0.05.

We decided to double check these finding using the stepwise multiple regression method and the results reinforced our decision to accept **only H6c** (see Table 7.27.b)

Table 7.26.a Coefficients for independent factor information quality –standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-9,277E-17	,060		,000	1,000	-,118	,118					
	Report Quality	,076	,090	,077	,848	,397	-,101	,253	,479	,066	,052	,446	2,240
	Information usefulness	,067	,090	,068	,750	,454	-,110	,245	,476	,058	,046	,446	2,240
	Report effectiveness	,512	,090	,520	5,706	,000	,335	,689	,620	,407	,347	,446	2,240

a. Dependent Variable: Dynamism and Vigilance

Table 7.26.b Coefficients for independent factor information quality–stepwise multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1,043E-16	,060		,000	1,000	-,118	,118					
	Report effectiveness	,610	,060	,620	10,168	,000	,492	,729	,620	,620	,620	1,000	1,000

a. Dependent Variable: Dynamism and Vigilance

7.7.7 Testing proposition 7 and related hypotheses

The seventh proposition tested the relationship between the independent dimension Information quality and the dependent sub construct of organisational performance named marketing performance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation

Looking at the model summary box, Table 7.27 we found that the R square value was .478. This meant that 47.8 % of the variance in our dependent factor marketing performance was explained by information quality.

Table 7.27 Model summary –independent factor information quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,692[a]	,478	,469	,72664376

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

b. Dependent Variable: Marketing Performance

To assess the statistical significance of this result we looked at the ANOVA results (table 7.28) which test the hypothesis that multiple R in the population equals 0.

Our model reached statistical significance (sig.=.000 meaning $p<.0005$) and the 7[th] proposition was accepted

Table 7.28 Model summary –independent factor information quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	79,406	3	26,469	50,129	,000[a]
	Residual	86,594	164	,528		
	Total	166,000	167			

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

b. Dependent Variable: Marketing Performance

The next thing was to test the related hypotheses H7a-H7c. We needed to find out how each of the three independent factors included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients for comparison purposes. The un-standardised coefficients make sense when we need to construct the regression equations.

Looking at the beta values in table 7.29a we found that the beta values for report effectiveness and report quality were the highest. We checked the column marked sig. which tells us if that factor is making a statistically significant unique contribution. We found that this factor had a sig. value less than 0.05.

We decided to double check these finding using the stepwise multiple regression method and the results reinforced our decision to accept **H7a and H7c** (see table 7.30.b)

Table 7.29.a Coefficients for independent factor information quality–standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1,154E-16	,056		,000	1,000	-,111	,111					
	Report Quality	,332	,084	,333	,333	,000	,166	,498	,622	,294	,222	,446	2,240
	Information usefulness	,019	,084	,019	,019	,825	-,148	,185	,522	,017	,012	,446	2,240
	Report effectiveness	,404	,084	,405	,405	,000	,238	,570	,645	,351	,271	,446	2,240

a. Dependent Variable: Marketing Performance

Table 7.29.b Coefficients for independent factor information quality–standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1,354E-16	,059		,000	1,000	-,116	,116					
	Report effectiveness	,643	,059	,645	10,881	,000	,527	,760	,645	,645	,645	1,000	1,000
2	(Constant)	-1,170E-16	,056		,000	1,000	-,110	,110					
	Report effectiveness	,412	,077	,413	5,368	,000	,260	,563	,645	,386	,302	,534	1,872
	Report Quality	,339	,077	,340	4,423	,000	,188	,491	,622	,326	,249	,534	1,872

a. Dependent Variable: Marketing Performance

a. Dependent Variable: Marketing Performance

7.7.8 Testing proposition 8 and related hypotheses

The eighth proposition tested the relationship between the independent dimension Information quality and the dependent sub construct of organisational performance named financial performance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, Table 7.30 we found that the R square value was .451. This meant that 45.1 % of the variance in our dependent factor financial performance was explained by information quality.

Table 7.30 Model summary –independent factor information quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,671[a]	,451	,440	,74800259

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

b. Dependent Variable: Financial Performance

To assess the statistical significance of this result we looked at the ANOVA results (table 7.31) which test the hypothesis that multiple R in the population equals 0.

Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 8th proposition was accepted.

Table 7.31 Model summary –independent factor information quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	75,241	3	25,080	44,826	,000[a]
	Residual	91,759	164	,560		
	Total	167,000	167			

a. Predictors: (Constant), Report effectiveness, Information usefulness, Report Quality

b. Dependent Variable: Financial Perfromance

The next thing was to test the related hypotheses H8a-H8c. We needed to find out how each of the three independent factors included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients scale for comparison purposes. The un-standardised coefficients make sense when we need to construct the regression equations.

Looking at the beta values in Table 7.32a we found that the beta values for report effectiveness and report quality were the highest. We checked the column marked sig. which tells us if that factor is making a statistically significant unique contribution. We found that information usefulness had a sig. value higher than 0.05.

We decided to double check these finding using the stepwise multiple regression method but the results reinforced our decision to accept **H8a** and **H8c** (see table 7.32.b).

Table 7.32.a Coefficients for independent factor information quality–standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-9,382E-17	,058		,000	1,000	-,114	,114					
	Report Quality	,240	,087	,240	2,773	,006	,069	,411	,580	,212	,160	,446	2,240
	Information usefulness	,063	,087	,063	,729	,467	-,108	,234	,523	,057	,042	,446	2,240
	Report effectiveness	,434	,087	,434	5,011	,000	,263	,605	,641	,364	,290	,446	2,240

a. Dependent Variable: Financial Performance

Table 7.32.b Coefficients for independent factor information quality–standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1,137E-16	,059		,000	1,000	-,117	,117					
	Report effectiveness	,641	,060	,641	10,763	,000	,523	,759	,641	,641	,641	1,000	1,000
2	(Constant)	-9,936E-17	,058		,000	1,000	-,114	,114					
	Report effectiveness	,460	,079	,460	5,813	,000	,304	,616	,641	,412	,336	,534	1,872
	Report Quality	,266	,079	,266	3,362	,001	,110	,422	,580	,253	,194	,534	1,872

a. Dependent Variable: Financial Performance

7.7.9 Testing proposition 9 and related hypotheses

The ninth proposition tested the relationship between the independent dimension Service Provider quality and the dependent sub construct of organisational performance named growth and development. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, (Table 7.33) we found that the R square value was .344 This meant that 34.4 % of the variance in our dependent factor growth and development was explained by service provider quality.

Table 7.33 Model summary –independent factor Service Provider quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,587[a]	,344	,336	,81458224

a. Predictors: (Constant), Service Provider (SP) Reliability, Service Provider Empathy

b. Dependent Variable: Growth and development

To assess the statistical significance of this result we looked at the ANOVA results (table 7.34) which test the hypothesis that multiple R in the population equals 0.

Our model reached statistical significance (sig.=.000 meaning $p<.0005$) and the 9th proposition was accepted.

Table 7.34 Model summary –independent factor information quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	57,515	2	28,758	43,339	,000[a]
	Residual	109,485	165	,664		
	Total	167,000	167			

a. Predictors: (Constant), Service Provider (SP) Reliability, Service Provider Empathy

b. Dependent Variable: Growth and development

The next thing was to test the related hypotheses H9a-H9b. We needed to find out was how each of the two independent factors included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients for comparison purposes. The un-standardised coefficients make sense when we need to construct the regression equations.

Looking at the beta values in Table 7.35a we found that the beta values for both factors were statistically significant.

We decided to double check these finding using the stepwise multiple regression method and the results reinforced our decision to accept both **H9a and H9b** (see table 7.35.b).

Table 7.35.a Coefficients for independent factor service provider quality –standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-7,728E-18	,063		,000	1,000	-,124	,124					
	Service Provider Empathy	,339	,089	,338	3,819	,000	,164	,514	,547	,285	,241	,507	1,971
	Service Provider (SP) Reliability	,298	,088	,298	3,367	,001	,123	,473	,535	,254	,212	,507	1,971

a. Dependent Variable: Growth and development

Table 7.35.b Coefficients for independent factor SP quality –stepwise multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1,515E-17	,065		,000	1,000	-,128	,128					
	Service Provider Empathy	,549	,065	,547	8,421	,000	,420	,677	,547	,547	,547	1,000	1,000
2	(Constant)	-7,728E-18	,063		,000	1,000	-,124	,124					
	Service Provider Empathy	,339	,089	,338	3,819	,000	,164	,514	,547	,285	,241	,507	1,971
	Service Provider (SP) Reliability	,298	,088	,298	3,367	,001	,123	,473	,535	,254	,212	,507	1,971

a. Dependent Variable: Growth and development

7.7.10 Testing proposition 10 and related hypotheses

The tenth proposition tested the relationship between the independent dimension Service Provider quality and the dependent sub construct of organisational performance named dynamism and vigilance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, (Table 7.36) we found that the R square value was .220 This meant that 22 % of the variance in our dependent factor dynamism and vigilance was explained by service provider quality.

Table 7.36 Model summary –independent factor Service Provider quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,469[a]	,220	,211	,87512859

a. Predictors: (Constant), Service Provider (SP) Reliability, Service Provider Empathy

b. Dependent Variable: Dynamism and Vigilance

To assess the statistical significance of this result we looked at the ANOVA results (table 7.37) which test the hypothesis that multiple R in the population equals 0.

Our model reached statistical significance (sig.=.000 meaning $p<.0005$) and the 10th proposition was accepted.

Table 7.37 Model summary –independent factor service provider quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35,635	2	17,817	23,265	,000[a]
	Residual	126,365	165	,766		
	Total	162,000	167			

a. Predictors: (Constant), Service Provider (SP) Reliability, Service Provider Empathy

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35,635	2	17,817	23,265	,000[a]
	Residual	126,365	165	,766		
	Total	162,000	167			

a. Predictors: (Constant), Service Provider (SP) Reliability, Service Provider Empathy

b. Dependent Variable: Dynamism and Vigilance

The next thing was to test the related hypotheses H10a-H10b. We needed to find out s how each of the two independent factors included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients for comparison purposes. The un-standardized coefficients make sense when we need to construct the regression equations.

Looking at the beta values in table 7.38a we found that the beta values for both factors were statistically significant.

We decided to double check these finding using the stepwise multiple regression method and the results reinforced our decision to accept both **H10a and H10b** (see table 7.38.b)

Table 7.38.a Coefficients for independent factor service provider quality –standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-2,994E-17	,068		,000	1,000					
	Service Provider Empathy	,301	,095	,305	3,158	,002	,446	,239	,217	,507	1,971
	Service Provider (SP) Reliability	,199	,095	,202	2,091	,038	,416	,161	,144	,507	1,971

a. Dependent Variable: Dynamism and Vigilance

Table 7.38.b Coefficients for independent factor service provider quality –stepwise multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-3,489E-17	,068		,000	1,000					
	Service Provider Empathy	,441	,069	,446	6,428	,000	,446	,446	,446	1,000	1,000
2	(Constant)	-2,994E-17	,068		,000	1,000					
	Service Provider Empathy	,301	,095	,305	3,158	,002	,446	,239	,217	,507	1,971
	Service Provider (SP) Reliability	,199	,095	,202	2,091	,038	,416	,161	,144	,507	1,971

a. Dependent Variable: Dynamism and Vigilance

7.7.11 Testing proposition 11 and related hypotheses

The eleventh proposition tested the relationship between the independent dimension Service Provider quality and the dependent sub construct of organisational performance with the name marketing performance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, (Table 7.39) we found that the R square value was .314. This meant that 31.4 % of the variance in our dependent factor marketing performance was explained by service provider quality.

Table 7.39 Model summary –independent factor Service Provider quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,561[a]	,314	,306	,83050309

a. Predictors: (Constant), Service Provider (SP) Reliability, Service Provider Empathy

b. Dependent Variable: Marketing Performance

To assess the statistical significance of this result we looked at the ANOVA results (table 7.40) which test the hypothesis that multiple R in the population equals 0.

Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 11th proposition was accepted.

Table 7.40 Model summary –independent factor service provider quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	52,194	2	26,097	37,836	,000[a]
	Residual	113,806	165	,690		
	Total	166,000	167			

a. Predictors: (Constant), Service Provider (SP) Reliability, Service Provider Empathy

b. Dependent Variable: Marketing Performance

The next thing was to test the related hypotheses H11a-H11b. We needed to find out how each of the two independent factors included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients for comparison purposes. The un-standardised coefficients make sense when we need to construct the regression equations.

Looking at the beta values in Table 7.41a we found that the beta values for both factors were statistically significant.

We decided to double check these finding using the stepwise multiple regression method and the results reinforced our decision to accept both **H11a and H11b** (see table 7.41.b).

Table 7.41.a Coefficients for independent factor service provider quality –standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-5,739E-17	,064		,000	1,000					
	Service Provider Empathy	,234	,090	,234	2,587	,011	,495	,197	,167	,507	1,971
	Service Provider (SP) Reliability	,370	,090	,371	4,100	,000	,535	,304	,264	,507	1,971

a. Dependent Variable: Marketing Performance

Table 7.41.b Coefficients for independent factor service provider quality –stepwise multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-3,572E-17	,065		,000	1,000					
	Service Provider (SP) Reliability	,534	,065	,535	8,166	,000	,535	,535	,535	1,000	1,000
2	(Constant)	-5,739E-17	,064		,000	1,000					
	Service Provider (SP) Reliability	,370	,090	,371	4,100	,000	,535	,304	,264	,507	1,971
	Service Provider Empathy	,234	,090	,234	2,587	,011	,495	,197	,167	,507	1,971

a. Dependent Variable: Marketing Performance

7.7.12 Testing proposition 12 and related hypotheses

The eleventh proposition tested the relationship between the independent dimension Service Provider quality and the dependent sub construct of organisational performance with the name financial performance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, (table 7.42) we found that the R square value was .287. This meant that 28.7 % of the variance in our dependent factor financial performance was explained by service provider quality.

Table 7.42 Model summary –independent factor Service Provider quality

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,535[a]	,287	,278	,84972161

a. Predictors: (Constant), Service Provider (SP) Reliability, Service Provider Empathy

b. Dependent Variable: Financial Perfromance

To assess the statistical significance of this result we looked at the ANOVA results (table 7.43) which test the hypothesis that multiple R in the population equals 0.

Our model reached statistical significance (sig.=.000 meaning $p<.0005$) and the 12th proposition was accepted.

Table 7.43 Model summary –independent factor service provider quality

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	47,866	2	23,933	33,147	,000[a]
	Residual	119,134	165	,722		
	Total	167,000	167			

a. Predictors: (Constant), Service Provider (SP) Reliability, Service Provider Empathy

b. Dependent Variable: Financial Performance

The next thing was to test the related hypotheses H12a-H12b. We needed to find out how each of the two independent factors included in the model contributed mostly to the dependent factors. We checked beta under standardised coefficients for comparison purposes. The un-standardised coefficients make sense when we need to construct the regression equations.

Looking at the beta values in Table 7.44a we found that the beta values for both factors were statistically significant.

We decided to double check these finding using the stepwise multiple regression method and the results reinforced our decision to accept both **H12a and H12b** (see table 7.44.b).

Table 7.44.a Coefficients for independent factor service provider quality –standard multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-3,289E-17	,066		,000	1,000					
	Service Provider Empathy	,216	,093	,215	2,331	,021	,469	,179	,153	,507	1,971
	Service Provider (SP) Reliability	,362	,092	,362	3,921	,000	,513	,292	,258	,507	1,971

a. Dependent Variable: Financial Perfromance

Table 7.44.b Coefficients for independent factor service provider quality –stepwise multiple regression

Coefficients[a]

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-1,292E-17	,066		,000	1,000					
	Service Provider (SP) Reliability	,513	,067	,513	7,699	,000	,513	,513	,513	1,000	1,000
2	(Constant)	-3,289E-17	,066		,000	1,000					
	Service Provider (SP) Reliability	,362	,092	,362	3,921	,000	,513	,292	,258	,507	1,971
	Service Provider Empathy	,216	,093	,215	2,331	,021	,469	,179	,153	,507	1,971

a. Dependent Variable: Financial Perfromance

7.7.13 Testing proposition 13 and related hypotheses

The thirteenth proposition tested the relationship between the independent dimension training effectiveness and the dependent sub construct of organisational performance with the name growth and development. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, (Table 7.45) we found that the R square value was .271. This meant that 27.1 % of the variance in our dependent factor growth and development was explained by training effectiveness.

Table 7.45 Model summary –independent factor training effectiveness

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,521[a]	,271	,267	,85635945

a. Predictors: (Constant), Training effectiveness

b. Dependent Variable: Growth and development

To assess the statistical significance of this result we looked at the ANOVA results (table 7.46) which test the hypothesis that multiple R in the population equals 0.

Our model reached statistical significance (sig.=.000 meaning $p<.0005$) and the 13th proposition was accepted. The beta value and the sig value are depicted in table 7.47.

Table 7.46 Model summary –independent factor training effectiveness

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45,264	1	45,264	61,722	,000[a]
	Residual	121,736	166	,733		
	Total	167,000	167			

a. Predictors: (Constant), Training effectiveness

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45,264	1	45,264	61,722	,000[a]
	Residual	121,736	166	,733		
	Total	167,000	167			

b. Dependent Variable: Growth and development

Table 7.47 Beta coefficient – independent factor: training effectiveness

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	4,971E-17	,066		,000	1,000					
	Training effectiveness	,539	,069	,521	7,856	,000	,521	,521	,521	1,000	1,000

a. Dependent Variable: Growth and development

7.7.14 Testing proposition 14 and related hypotheses

The fourteenth proposition tested the relationship between the independent dimension training effectiveness and the dependent sub construct of organisational performance with the name dynamism and vigilance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, (Table 7.48) we found that the R square value was .128. This meant that 12.8 % of the variance in our dependent factor dynamism and vigilance was explained by training effectiveness. To assess the statistical significance of this result we looked at the ANOVA results (table 7.49) which test the hypothesis that multiple R in the population equals 0. Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 14th proposition was accepted. The beta value and the sig value are depicted in Table 7.50.

Table 7.48 Model summary –independent factor training effectiveness

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,358[a]	,128	,123	,92223162

a. Predictors: (Constant), Training effectiveness

b. Dependent Variable: Dynamism and Vigilance

Table 7.49 Model summary –independent factor training effectiveness

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20,815	1	20,815	24,474	,000[a]
	Residual	141,185	166	,851		
	Total	162,000	167			

a. Predictors: (Constant), Training effectiveness

b. Dependent Variable: Dynamism and Vigilance

Table 7.50 Beta coefficient – independent factor: training effectiveness

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1,929E-17	,071		,000	1,000					
	Training effectiveness	,365	,074	,358	4,947	,000	,358	,358	,358	1,000	1,000

a. Dependent Variable: Dynamism and Vigilance

7.7.15 Testing proposition 15 and related hypotheses

The fifth proposition tested the relationship between the independent dimension training effectiveness and the dependent sub construct of organisational performance with the name marketing performance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, (Table 7.51) we found that the R square value was .176. This meant that 17.6 % of the variance in our dependent factor marketing performance was explained by training effectiveness. To assess the statistical significance of this result we looked at the ANOVA results (Table 7.52) which test the hypothesis that multiple R in the population equals 0. Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 14th proposition was accepted The beta value and the sig value are depicted in table 7.53.

Table 7.51 Model summary –independent factor training effectiveness

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,420[a]	,176	,171	,90756385

a. Predictors: (Constant), Training effectiveness

b. Dependent Variable: Marketing Performance

Table 7.52 Model summary –independent factor training effectiveness

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29,270	1	29,270	35,536	,000[a]
	Residual	136,730	166	,824		
	Total	166,000	167			

a. Predictors: (Constant), Training effectiveness

b. Dependent Variable: Marketing Performance

Table 7.53 Beta coefficient – independent factor: training effectiveness

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-6,559E-18	,070		,000	1,000					
	Training effectiveness	,433	,073	,420	5,961	,000	,420	,420	,420	1,000	1,000

a. Dependent Variable: Marketing Performance

7.7.16 Testing proposition 16 and related hypotheses

The sixteenth proposition tested the relationship between the independent dimension training effectiveness and the dependent sub construct of organisational performance with the name financial performance. Multiple regression analysis was conducted using standard multiple regression. We followed the same steps for the analysis of the SPSS output. All assumptions of multicollinearity and all tests for Outliers, normality, linearity, homoscedasticity and independence of residuals were performed and allowed us to proceed with the model evaluation.

Looking at the model summary box, (Table 7.54) we found that the R square value was .197. This meant that 19.7 % of the variance in our dependent factor financial performance was explained by training effectiveness. To assess the statistical significance of this result we looked at the ANOVA results (table 7.55) which test the hypothesis that multiple R in the population equals 0. Our model reached statistical significance (sig.=.000 meaning p<.0005) and the 14th proposition was accepted. The beta value and the sig value are depicted in table 7.56.

Table 7.54 Model summary –independent factor training effectiveness

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,444[a]	,197	,193	,89852158

a. Predictors: (Constant), Training effectiveness

b. Dependent Variable: Financial Performance

Table 7.55 Model summary –independent factor training effectiveness

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	32,981	1	32,981	40,852	,000[a]
	Residual	134,019	166	,807		
	Total	167,000	167			

a. Predictors: (Constant), Training effectiveness

b. Dependent Variable: Financial Performance

Table 7.56 Beta coefficient – independent factor: training effectiveness

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1,378E-17	,069		,000	1,000					
	Training effectiveness	,460	,072	,444	6,392	,000	,444	,444	,444	1,000	1,000

a. Dependent Variable: Financial Perfromance

7.8 Summary of Chapter 7

This chapter presented in detail all the statistics performed to explore how well our independent factors predicted organisational performance. Multiple regressions were performed to provide the necessary SPSS outputs about the models as a whole (testing of propositions 1-16, see table 7.57) and the relative contribution of each of the factors that made up the models (see tables 7.58-7.60).

Table 7.57 Summary of propositions' test and results

		R^2	F	Sig	Result
P1	System quality is positively related to growth and development	0,571	43,086	0,000	accepted
P2	System quality is positively related to dynamism and vigilance	0,442	21,296	0,000	accepted
P3	System quality is positively related to marketing performance	0,488	21,296	0,000	accepted
P4	System quality is positively related to financial performance	0,487	25,450	0,000	accepted
P5	Information quality is positively related to growth and development	0,617	88,163	0,000	accepted
P6	Information quality is positively related to dynamism and vigilance	0,392	35,215	0,000	accepted
P7	Information quality is positively related to marketing performance	0,478	50,129	0,000	accepted
P8	Information quality is positively related to financial performance	0,451	44,826	0,000	accepted
P9	Service provider quality is positively related to growth and development	0,344	43,339	0,000	accepted
P10	Service provider quality is positively related to dynamism and vigilance	0,220	23,265	0,000	accepted
P11	Service provider quality is positively related to marketing performance	0,314	37,836	0,000	accepted
P12	Service provider quality is positively related to financial performance	0,287	33,147	0,000	accepted
P13	Training effectiveness is positively related to growth and development	0,271	61,722	0,000	accepted
P14	Training effectiveness is positively related to dynamism and vigilance	0,128	24,474	0,000	accepted
P15	Training effectiveness is positively related to marketing performance	0,176	35,536	0,000	accepted
P16	Training effectiveness is positively related to financial performance	0,197	40,852	0,000	accepted

Table 7.58 Hypotheses test results on system quality (independent factors) and organisational performance dependent factors

		Beta	t	Sig	Result
H1a	Growth and development increase if system use increases	0,227	2,768	0,006	rejected
H1b	Growth and development increase if system usefulness increases	0,238	2,85	0,000	accepted
H1c	Growth and development increase if system acceptance increases	0,111	1,442	0,151	rejected
H1d	Growth and development increase if business process effectiveness increases	-0,042	-0,539	0,591	rejected
H1e	Growth and development increase if SCM effectiveness increases	0,352	4,436	0,000	accepted

		Beta	t	Sig	Result
H2a	Dynamism and vigilance increase if system use increases	0,05	5,006	0,595	rejected
H2b	Dynamism and vigilance increase if system usefulness increases	0,26	0,532	0,007	accepted
H2c	Dynamism and vigilance increase if system acceptance increases	0,012	0,051	0,888	rejected
H2d	Dynamism and vigilance increase if business process effectiveness increases	-0,044	0,142	0,620	rejected
H2e	Dynamsim and vigilance increase if SCM effectiveness increases	0,26	0,532	0,007	accepted

		Beta	t	Sig	Result
H3a	Marketing performance increases if system use increases	0,028	0,316	0,752	rejected
H3b	Marketing performance increases if system usefulness increases	0,327	3,572	0,000	accepted
H3c	Marketing performance increases if system acceptance increases	0,103	1,213	0,227	rejected
H3d	Marketing performance increases if business process effectiveness increases	-0,028	-0,335	0,738	rejected
H3e	Marketing performance increases if SCM effectiveness increases	0,356	4,05	0,000	accepted

		Beta	t	Sig	Result
H4a	Financial performance increases if system use increases	0,183	2,034	0,044	rejected
H4b	Financial performance increases if system usefulness increases	0,321	3,507	0,001	accepted
H4c	Financial performance increases if system acceptance increases	0,027	0,314	0,754	rejected
H4d	Financial performance increases if business process effectiveness increases	0,092	1,084	0,280	rejected
H4e	Financial performance increases if SCM effectiveness increases	0,185	2,102	0,037	accepted

Table 7.59 Hypotheses test results on information quality (independent factors) and organisational performance dependent factors

		Beta	t	Sig	Result
H5a	Growth and development increase if report quality increases	0,185	2,557	0,011	accepted
H5b	Growth and development increase if information usefulness increases	0,054	0,753	0,453	rejected
H5c	Growth and development increase if report effectiveness increases	0,607	8,392	0,000	accepted

		Beta	t	Sig	Result
H6a	Dynamism and vigilance increase if report quality increases	0,077	0,848	0,397	rejected
H6b	Dynamism and vigilance increase if information usefulness increases	0,068	0,75	0,454	rejected
H6c	Dynamism and vigilance increase if report effectiveness increases	0,52	5,706	0,000	accepted

		Beta	t	Sig	Result
H7a	Marketing performance increases if report quality increases	0,333	0,333	0,000	accepted
H7b	Marketing performance increases if information usefulness increases	0,019	0,019	0,825	rejected
H7c	Marketing performance increases if report effectiveness increases	0,405	0,405	0,000	accepted

		Beta	t	Sig	Result
H8a	Financial performance increases if report quality increases	0,240	2,773	0,006	accepted
H8b	Financial performance increases if information usefulness increases	0,063	0,729	0,467	rejected
H8c	Fianancial performance increases if report effectiveness increases	0,434	5,011	0,000	accepted

Table 7.60: Hypotheses test results on Service Provider (SP) quality (independent factors) and organisational performance dependent factors

		Beta	**t**	**Sig**	**Result**
H9a	Growth and development increase if SP empathy increases	0,338	3,819	0,000	accepted
H9b	Growth and development increase if SP relaibility increases	0,298	3,367	0,001	accepted

		Beta	**t**	**Sig**	**Result**
H10a	Dynamism and vigilance increase if SP empathy increases	0,305	3,158	0,002	accepted
H10b	Dynamism and vigilance increase if SP reliability increases	0,202	2,091	0,038	accepted

		Beta	**t**	**Sig**	**Result**
H11a	Marketing performance increases if SP empathy increases	0,234	2,587	0,011	accepted
H11b	Marketing performance increases if SP reliability increases	0,371	4,100	0,000	accepted

		Beta	**t**	**Sig**	**Result**
H12a	Financial performance increases if SP empathy increases	0,215	2,587	0,021	accepted
H12b	Financancial performance increases if SP reliability increases	0,362	4,100	0,000	accepted

CHAPTER 8

8.1 Introduction

This chapter reviews and discusses the objectives, methods and results of this thesis. The first section provides a summary of the study for comprehensive understanding of the research motivation, process and findings. In continuation, the research steps and findings are reviewed critically, to present the contribution of this research to academics and practitioners, while the limitations of the research are noted. Finally, a number of ideas for future research are presented and suggested.

8.2 Overview of the thesis

The main research objective of this thesis was the exploration of the statistical relationship between two main constructs: IS effectiveness and Organisational Performance.

8.2.1 Summary of the literature review and identification of the literature gap

Following a comprehensive literature review, it was found that the construct of IS effectiveness had received a lot attention as researchers tried to conceptualise it using different frameworks (e.g. DeLone & McLean, 1992; Ballantine et al., 1996; Goodhue, 1995; Chang and King, 2005; Gorla et al., 2010). However, the same review of the IS effectiveness sub-constructs revealed the following gaps in the literature:

Most previous studies explored IS effectiveness at individual level focusing on the user and not on the company performance (Gorla et al (2010, Peter et al., 2008). The researchers trying to evaluate information systems (IS) success or effectiveness argued that this is field is fragmented (Larsen, 2003; Chang and King, 2005; Wang and Liao, 2008) because of the multiplicity of the relevant constructs (DeLone and McLean 1992; Rai, Lang, & Welker, 2002) the ambiguity of the concepts (Wang and Liao, 2008) and the production of conflicting results such as:

- a positive relationship between IS and financial performance (e.g. Banker, Kauffman, and Morey, 1990; Barua, Kriebel, and Mukhopadhyay 1995)

- a negative relationship between IT implementation and productivity and profitability in many companies in different sectors (e.g., Ezingeard, Irani and Race, 1999 Irani and Love, 2001).
- no relationship between IT investment and organisational performance (e.g. Dos Santos, Peffers and Mauer; 1993; Floyd, S., and Woolridge, 1990; Kettinger, Grover, Guha, and Segars, 1994).

Motivated by this lacuna in the literature, this thesis explored the relationship between Information Systems' Effectiveness and Organisational Performance answering to the following research questions:

RQ1: How do we measure Information Effectiveness and Organisational Performance?

RQ2: Is there a positive relationship between Information System Effectiveness and Organisational Performance?

RQ3: Which IS adoption factors are leading indicators of Organisational Performance?

To tackle the basic research questions a conceptual framework was developed in chapter 3 following a thorough review of the pertinent literature in chapter 2.

8.2.2 Summary on the empirical part and key findings from the data analysis

This paragraph summarises the findings from the data analysis to help the reader keep track of the purpose and process of this dissertation.

Data for this study were collected by means of a questionnaire and a sample of 700 companies of different sizes operating in various industries. Our measuring instrument contained 129 items that were used for the operationalisation of the two main constructs of this research: Information System Effectiveness and Organisational Performance. A web link was provided to the IT managers of the targeted companies who were considered to be the most knowledgeable respondents. These managers were the people that could evaluate the impact of IS on organisational performance and were in a position to provide valid answers to the questionnaire questions (Peter et al., 2008).

This web survey started on April 2010 with a pre-notification inviting the IT managers to participate in our research and a link to the survey was sent one week later with another e-mail. Two reminders were issued subsequently one week after the first call notifying those that had not responded of a forthcoming deadline for the closing of the questionnaire. We used the ICAP directory of all registered companies in Greece that employed more than 50 people. It was deemed unlikely for smaller companies to have adopted Information Systems suitable for our analysis. We collected 168 usable responses from different industries and company sizes.

Mann –Whitney test was run between late respondents and early respondents to examine the null hypothesis that there is similarity in all the variables across the early and late respondents. Appendix 4.2 illustrates that no significant differences were found among the variables used. As a result, we argued that our data were unlikely to be biased of non-response errors.

In our research there were no missing values as the web-link would not allow the survey to continue unless all answers were completed. Furthermore, the data collected were automatically transferred to SPSS which ensured an error free process. However, the survey allowed for a Non-Applicable answer (N/A) response represented by the zero value. These N/A answers have been treated as missing in this research (see Appendix 6.1). From the data set overall, we found that for most variables we had a low N/A percentage which "*did not impose any serious problems with the subsequent analysi*s" (Hair et al., 2010). We tested our variables for normality (see appendix 6.2) and we used skewness and kurtosis tests (Hair et al., 2010) to find out whether our variables were normal for the use of statistical techniques like analysis of variance, linear regression etc. All skewness values were much less than ± 2 and all kurtosis values were much less than ±7. The cut off points are: for skewness < ± 2 and kurtosis < ± 7 (Curran et al. 1996). Having completed the tests we decided that there was no reason to transform the data as the identified departures from normality were slight and it was safe to continue the statistical analyses keeping the original data (Tabachnick and Fidell 1996).

A principle component analysis was followed seeking to obtain the minimum number of factors. The latent root criterion, the scree test and the percentage of variance explained were used in the analysis (Hair et al, 2010). Varimax and Promax rotation techniques were employed but the final decision favoured Promax. 11 variables were removed and the final solution comprised 118 variables (129 were initially factorised). These variables formed 15 factors in total, as depicted in Table 8.1: All the factors satisfied the statistical and conceptual criteria for acceptance and were included in the proposition- hypotheses tests The detailed EFA is found in chapter 6.

Table 8.1 The final solution of the exploratory factor analysis

Constructs	**Factor Name**	**Cronbach a**	
Service Provider Quality(D1)	Service Provider Empathy	0.974	**11 Independent factors**
	Service Provider (SP) Reliability	0.954	
System Quality (D2)	System use	0.931	
	System usefulness	0.938	
	SCM effectiveness	0.894	
	System acceptance	0.854	
	Business process effectiveness	0.867	
Information Quality (D3)	Information usefulness	0.871	
	Report Quality	0.972	
	Report effectiveness	0.927	
Training quality (D4)	Training effectiveness	0.951	
Organisational performance	Growth and development	0.962	**4 Dependent Factors**
	Dynamism and Vigilance	0.955	
	Financial performance	0.940	
	Marketing performance	0.942	

All factors were entered into the analysis and multiple regression was employed to find the statistical relationship between each dependent and independent factor. Table 8.2 presents the outcome of the statistical results. The next thing was to test all related to the propositions hypotheses to find out the relative importance of each independent variable. We checked beta under standardised coefficients for comparison purposes to find out the independent factors that made a statistically significant unique contribution for each dependent factor. Table 8.3 summarises these results.

The next paragraphs discuss in detail the contribution of these findings to academia.

Table 8.2 Correlations between dependent and independent factors

	Propositions	*Relationship*
P1	System quality is positively related to growth and development	strong correlation
P2	System quality is positively related to dynamism and vigilance	strong correlation
P3	System quality is positively related to marketing performance	strong correlation
P4	System quality is positively related to financial performance	strong correlation
P5	Information quality is positively related to growth and development	strong correlation
P6	Information quality is positively related to dynamism and vigilance	moderate correlation
P7	Information quality is positively related to marketing performance	strong correlation
P8	Information quality is positively related to financial performance	strong correlation
P9	Service provider quality is positively related to growth and development	strong correlation
P10	Service provider quality is positively related to dynamism and vigilance	weak correlation
P11	Service provider quality is positively related to marketing performance	moderate correlation
P12	Service provider quality is positively related to financial performance	weak correlation
P13	Training effectiveness is positively related to growth and development	weak correlation
P14	Training effectiveness is positively related to dynamism and vigilance	weak correlation
P15	Training effectiveness is positively related to marketing performance	weak correlation
P16	Training effectiveness is positively related to financial performance	weak correlation

Table 8.3 The relative importance of the independent factors

INFORMATION EFFECTIVENESS	ORGANISATIONAL PERFORMANCE			
Independent Factors	**Growth and Development**	**Dynamism and Vigilance**	**Marketing Performance**	**Financial Performance**
System Use				+
System Usefulness	+	+	+	+
System acceptance				
Business process Effectiveness				
SCM effectiveness	+	+	+	+
Quality if reports	+		+	+
Information Usefulness				
Effectiveness of Reports	+	+	+	+
SP empathy	+	+	+	+
SP reliability	+	+	+	+

8.3 Filling the literature gaps

The thesis claims that some gaps in the literature have been filled. More particularly this research effort has contributed to the following domains.

8.3.1 Measuring IS effectiveness and Organisational Performance – Answering to Research question 1

As discussed, previous research focused on IS effectiveness measuring user's perception on IS effectiveness (Gorla et al 2010, Peter et al., 2008). This thesis explored how IT managers perceive IS effectiveness and how effectiveness IS affects Organisational Performance.

This study used the Delone and McLean's (D&M) IS success model (1992; 2003) which is widely adopted in the IS research. Following a comprehensive literature review on the older and more recent studies (e.g. Li and Ye, 1999; Rai et al., 2002; Chang & King, 2005; Bernoider, 2008; Gorla, Somers & Wong, 2010) this thesis identified all items used by researchers for the measurement of the D&M dimensions. Exploratory Factor Analysis was employed as there was no theoretical basis to specify a priori the number and patterns of common factors (Hurley et al., 1997).

In this regard, it would be logical to infer that the study contributed to the IS field as we used older and recent variables in a single coherent model. We can now argue that we have the appropriate items to measure IS and Organisational Performance concepts as the exploratory factor analysis resulted in the formation of 15 factors which satisfied the statistical and conceptual criteria for acceptance.

8.3.2 The statistical relationship between Information Effectiveness and Organisational Performance–Answering to Research question 2

The thesis supports a statistically significant relationship between all IS effectiveness dimensions and Organisational Performance:

System quality is positively linked to organisational performance

The results from the statistical tests (P1-P4) showed a strong correlation between system quality and organisational performance factors. As discussed, previous research focused on individual performance whereas at the organisational level few studies found positive relationship with decreased time and effort for decision making (Wixom & Watson, 2001). Bradley et al. (2006) compared system quality and impact of system use at operational, tactical, and strategic levels and found that this relationship "was significant at operational levels within entrepreneurial firms only" (Bradley et a., 2006 as cited in Peter et al. 2008).

Information Quality is positively linked to organisational performance

The results from the statistical tests (P5-P8) showed a statistically significant positive relationship between information quality and organisational performance factors. This can be considered a key finding as the research so far has shown contradicting and insufficient results (Peter et al., 2008). For example, Wixom & Watson (2001) argued that data quality was related to decrease in time and effort for decision making (results from). On the other hand in a research on retailers Teo & Wong, (1998) found that information quality was positively related to organisational impact as measured by productivity, competitiveness, and management improvement.

Service Provider is positively linked to Organisational Performance

The tests performed for P9-P12 show a moderate but statistically significant relationship between Services Rendered by the IS provider and Organisational Performance. This finding is in agreement with prior research ((Bernroider, 2008; Gorla et al. 2010; Thong et al. (1994; 1996). All items from SERVQUAL (Parasuraman, et al., 1985; 1988) and pertinent studies (Argyropoulou et al, 2007; Gorla 2010) were kept in our analysis indicating that a competent provider is necessary for the implementation of systems that meet and satisfy business goals.

Training is positively linked to organisational performance

The tests performed for P13-P16 showed a weak but statistically significant positive relationship. As discussed in chapter 2, this study used items from the IS literature to identify the factors that can predict organisational performance. Training has been discussed extensively in the literature (e.g. Al-Mashari et al., 2003; Kraut, Dumais & Susan, 1989; Lee et al., 1995) as a key success factor of Information Systems implementation. To our astonishment, this relationship albeit positive was found to be weakly correlated with all organisational performance factors. It seems that removing technical complexity is important when measuring IS success at the individual level but has no important impact when measuring organisational performance

8.3.3 The leading indicators of Organisational Performance - Answering to Research Question 3

The hypotheses tests (using standard and stepwise multiple regression analysis) provided us with the IS effectiveness factors which can contribute to Organisational Performance when it is measured with both financial and non-financial measures (see table 8.3). The statistical results are presented in detail in tables 7.59-7.61. To help the reader understand the relationships, we provide a brief discussion for each pair of tested relationships.

P1 *System quality is positively related to growth and development*

The acceptance of P1 is in agreement with previous research (Bernroider; 2008; Wang, & Liao 2008). Both papers argued that a well designed system is expected to be positively associated with net benefits. However, in this exploratory research, it was found that system use and acceptance from the well-known TAM model (Davis, 1989) do not seem to predict growth and development. SCM effectiveness is the strongest contributor which reinforces the findings from Hendricks et al. (2007) who argued in favor of ERP and SCM integration which can help a firm gain competitive advantage.

P2 *System quality is positively related to dynamism and vigilance*

The acceptance of P2 is also in agreement with previous research (Bernroider; 2008; Wang, & Liao 2008). Both papers argued that a well implemented system is expected to be positively associated with net benefits. Furthermore, a well designed - from a technical point of view- system has a positive impact on organisational efficiency as found also by Bradley et al. (2006) in a research involving entrepreneurial firms, and a positive impact on organization in general as found by Gorla, Somers and Wong (2010).

However, in this exploratory research, it was made clear that supply chain effectiveness is likely to be the strongest contributor for a firm that wishes to remain vigilant in terms of innovation, forecasting ability and new product development.

P3 *System quality is positively related to marketing performance*

This proposition suggested that system quality has positive impact on the company's performance when this is measured using customer oriented items such as timely delivery of goods, customer retentions, dealing with customer complaints and overall customer satisfaction. SCM effectiveness and system usefulness were kept in the model to predict marketing performance which agrees with two previous studies focusing on system quality and customer satisfaction (Benard & Satir, 1993; Scheepers et al., 2006). An older study had found a not significant relationship (Premkumar et al., 1994).

P4 *System quality is positively related to financial performance*

There has been much discussion in the pertinent literature on how system quality affects financial performance focusing, however, on single items from the net benefits dimension (DeLone and McLean 2002) and not on a distinct construct (see figures 2.8 and 2.9 in chapter 2). This study tested the relationship between system quality and financial performance measured by various items such income, production cost, inventory levels and logistics. It was found that system usefulness and SCM effectiveness contribute significantly to financial performance which coincides with previous research from Hendricks et al. (2007) who argued that ERP and SCM integration can help firms increase profitability.

P5 *Information quality is positively related to growth and development*

The impact of information quality on organisational performance has been evaluated by many studies (see Chapter 2: Bharati & Chaudhury, 2006; Kositanurit et al., 2006; Shih 2004; Wu & Wang, 2006). Relevant papers focused either on the use of the information (e.g. Bharati & Chaudhury, 2006; Kositanurit et al., 2006; Shih 2004; Wu & Wang, 2006) or on the quality of the reports produced by an Information System (Gorla et al., 2010). As discussed in this research three factors have been attributed to Information Quality: a) Report quality comprising items of timeliness, clarity and reliability, b) Report effectiveness suggesting meaningful content and c) Information usefulness evaluating the report content as a technical product of the system.

We found a statistically significant relationship between Information Quality and non-financial measures comprising the factor of growth and development. Report effectiveness is the main predictor which coincides with previous research findings in a sense that the reports produced by any IS improve flexibility and cooperation and productivity if they are perceived to enhance problem solving and decision making (Chang and King, 2005; Kahn et al., 2002)

P6 *Information quality is positively related to dynamism and vigilance*

A statistically significant relationship was found. Report effectiveness is the main predictor, again, which coincides with previous research findings in a sense that the reports produced by any IS will enhance innovation, forecasting as well as R&D if they are perceived to enhance problem solving and decision making (Chang and King, 2005; Kahn et al., 2002)

P7 *Information quality is positively related to marketing performance*

The models indicated a statistically significant relationship between Information Quality and Marketing Performance which contradicts the limited previous findings of no statistical relationship between Information Quality and competitiveness (Teo & Wong, 1998). Two predictors of almost equal contribution were found in the related model which meant that (in the mind of our respondents) accuracy, timeliness and clarity of information can contribute to better customer service, retention, less complaints and increased satisfaction.

P8 *Information quality is positively related to financial performance*

This proposition attracted our research interest as prior studies did not include financial measures when evaluating the impact of IS on organisational performance. The acceptance of P7 can be considered a key finding form this thesis. Moreover, the stepwise multiple regression indicated that there is only one predictor for financial performance this being report effectiveness. In other words the financial position of a company can be improved when the reporting system facilitates decision making and helps in problem definition / solving.

P9 *Service Provider (SP) Quality is positively related to growth and development*

Delivering quality service is a prerequisite for business success as the empathy and reliability features of the provider are equally contributing to flexibility, productivity and competitive position which reinforces the findings from Bharadwaj, (2000).

P10 *Service Provider (SP) Quality is positively related to dynamism and vigilance*

The results from P10 are almost the same with P9 which means that a reliable and long lasting relationship with a suitable provider can enhance the company's ability to adopt rigorous and dynamic practices.

P11 *Service Provider (SP) Quality is positively related to marketing performance*

This analysis strengthened older arguments that the features of a suitable IS vendor/supplier are positively related to customer loyalty and competitive advantage. (Reicheld & Sasser, 1990)

P12 *Service Provider (SP) Quality is positively related to financial performance*

We found a weak but statistically significant relationship. This was a rather reassuring finding for the Greek market as the respondents placed an emphasis on the establishment of a trustful relationship for the achievement of financial goals. These findings had been documented by Argyropoulou et al., (2007) in another research focusing on Greek ERP systems. It seems that the ability of the provider to provide professional services honouring contractual agreements remains a leading factor for IS success and financial performance of a firm.

8.4 Contribution of our exploratory factor analysis in the IS field

Exploratory Factor Analysis (EFA) is used quite often in IS research to detect multivariate data structures (Treiblmaier, and Filzmoser, 2010). This study being exploratory in nature -as it combined the use of new frameworks and items from the IS literature-provided a detailed description of all steps and concerns when conducting EFA.

Post-hoc we performed the Harman's one-factor test (Podsakoff and Organ, 1986; Podsakoff et al. 2003) to examine whether a common method variance problem existed (Rebio 2010) in our approach. We followed the process in SPSS asking for unrotated extraction of 1 factor when using all variables. Fortunately, the first factor extracted explained 40% of variance comfortably under the threshold of 50%. Apart from the recommended measures (see chapter four) to avoid CMV, the EFA in this study reinforced the Harman's single-factor test for assessing CMV. According to the test, CMV is assumed to exist if (1) “a single factor emerges from unrotated factor solutions”, or (2) “a first factor explains the majority of the variance in the variables” (Podsakoff and Organ 1986, p. 536). In this research the unrotated EFA used all the items, including those that were used to measure organisational performance. In the second EFA test we tested separately the Information Effectiveness and Organisational Performance items and the results showed the formation of many factors (21) that accounted for the variance in the measurement items which implied that there was no significant threat for common method variance for the quality of the data (Elbashir et al.,2008; Reio, 2010).

Furthermore, the EFA approach in this study reinforced previous IS research in which it was argued that CMV is less susceptible to CMV effects because "*the scales used in IS research tend to be more concrete and less ambiguous when compared with those in psychology, sociology, or education" (*Malhotra et al., 2006).

8.5 Contribution of our Exploratory Factor Analysis in the field of Organisational Performance

The operationalisation of this construct depends mainly on its association with other constructs. There are some (although not many) studies that have explored the influence of information systems and used organisational performance measures for their dependent variable (Bernroider, 2008; Chervany and Dickson, 1974 Chang and King 2005). Some researchers used financial measures such as profitability (Benbasat & Dexter, 1985; Hamilton & Chervany 1981), return on investment (Vasarhelyi, 1981), return on assets (Cron & Sobol, 1983), stock price (Kaspar & Cerveny, 1985), overall cost reduction (Rivard & Huff, 1984) or profit per net assets (Yap & Walsham, 1986). Other researchers used non-financial measures. For example Jenster (1987) incorporated several nonfinancial measures (e.g. productivity, innovation, product quality) to explore the impact on IS on these variables.

In realising the value of both financial and nor-financial performance, this study used the balanced scorecard (Kaplan and Norton 1992, 2004a, 2004b, 2005) to derive conclusions for Organisational performance. The use of a strategic tool like the BSC was deemed appropriate for the association of IS effectiveness with organisational performance since the implementation of IS has been considered in the literature as a major strategic decision (Robson, 1997) causing strategic change (Keen, 1981).

Based on the net benefits concept (DeLone and McLean, 1992; 2003) this study measured Organisational Performance using financial and non-financial measures. Motivated by the BSC approach, we conducted a comprehensive literature review to identify which items had been adopted in related studies and how they had been used. The financial measures that were used captured the way the key informants see the impact of IS on the financial performance of a firm, (Brynjolfsson & Hitt, 1995, 1996; Davenport, 1998; Law & Ngai, 2007; Narver, & Slater, 1995; Nicolaou 2004;

Stratopoulos & Dehming, 2000; Sweat, 1998). The non-financial measures included the impact of IS on customers (Grover & Davenport, 2001) market position and strategic objectives (Broadbent & Weill, 1999; Law & Ngai, 2007; Yen, & Sheu, 2004) and several items found in the recent literature capturing internal capabilities (Mirani & Lederer, 1998; Wu & Hung, 2007).

Having found many different variables in the pertinent literature, the use of EFA was deemed the “most appropriate form of analysis given the goal of this specific research” (Fabrigar, et al., 1999, p.273). One purpose of this dissertation was the development of an instrument that could measure organisational performance in a holistic manner, and “EFA served this purpose by refining the instrument’s scales” Conway and Huffcutt, 2003). 4 distinct factors were extracted from the Exploratory Factor Analysis that can be related to the four BSC perspectives. The financial performance clearly comprises items of financial nature. Marketing performance is the factor that reminds of the customer perspective as it includes customer oriented variables. The growth and development factor measures the ability of the company to develop and expand in the internal and external environment. The dynamism and vigilance factor measures the ability of a company to learn and respond fast. The names of the last two factors are new in the literature and we believe that they can be further used in future research by academics that wish to employ non-financial constructs and items.

8.6 Limitations and future research directions

As in almost every research effort, besides the accomplishments, there are still certain limitations, some of which, however, might provide opportunities for further exploration. The first limitation was the timing of the research. The empirical part started in 2010. The political turmoil had resulted in disappointment if not frustration and managers did not really have the enthusiasm or the time to complete a rather long questionnaire. Despite several steps to increase the response rate we managed to collect 168 answers from a sample of 700 IT managers.

The second limitation can be the nature of the study which is cross-sectional. This makes it difficult to infer conclusions about cause and effect relationships. A longitudinal design could examine the answers form the same sample and same model. This will introduce time lag between the measurement of the predictors and dependent constructs (Podsakoff et al., 2003; Reio 2010). In this way, future research can be directed towards a confirmatory factor analysis to establish the construct validity of the scales and to shed more light on the factors that are more instrumental to the success of Information Systems.

The third limitation stems from the single respondent per company which might lead to common source bias. We have tried to minimise this limitation by employing all possible suggestions from the literature, i.e. identification of the most informative person, motivating informants to co-operate with the study, use of pre-tested questions and a well-designed pilot study (Podsakoff et al., 2003; Reio 2010). This has been discussed in paragraph 8.4. Nonetheless, we suggest that future research can use more than one respondent per company to reduce common source bias (for example, functional managers or marketing managers can be asked for the Organisational Performance variables).

Despite the limitations, however, this study contributes to existing research in the following ways. It extends our knowledge on IS effectiveness as we adapted and modified DeLone and McLean's model (2003) of IS success to incorporate new variables from recent research. The findings contribute to the IS effectiveness research as very few studies in the past focused on the impact of IS on organisational performance as has been argued in a recent literature review (Peter, DeLone and McLean 2012). This way of looking at IS effectiveness can help companies realise how the IS contribute/affect positively several organisational variables. Our study provides statistically significant results on the IS factors that can contribute to the financial and/or non-financial performance of a firm.

Previous research focused mainly on individual impact (as discussed extensively in chapter 2). The few findings provided conflicting results on a limited number of organisational variables (Gorla et al., 2010). It was in 2010 when Gorla et al made a significant contribution to the field by using the DeLone and McLean model to evaluate IS success at the organisational level. Gorla et al (2010) published their findings when our research was in progress and produced at the time the most significant findings regarding the impact of IS on Organisational Performance.

This study provides more evidence for the statistical relationship between IS effectiveness and Organisational Performance. In particular, our findings highlight that Service Quality explains a rather low proportion of all organisational factors which is not in agreement with the findings from Gorla et al, (2010 and Thong et al (1996) who argued in favour of the ‘vendor support’. We believe that future research should focus on this specific construct when exploring its impact on organisational variables using control variables such as company size and industry.

The fact that a high proportion of the variance in organisational performance is explained by system quality is not in agreement with Gorla et al, (2010) who did not find a significant impact of system quality and organisational performance. However, we used a different instrument and a different method of analysis so the studies are not really comparable. This finding justifies future research using our instrument and CFA within PLS modeling as used by Gorla et al, (2010). To our surprise, the research showed that training programs are weakly related to Organisational Performance. Are companies spending money on inappropriate training or these programs are not that necessary as employees are becoming more sophisticated? This question deserves further exploration by future research.

Finally, yet importantly, the lack of knowledge of the a priori factors motivated the exploratory factor analysis and this work offers some answers. We provide researchers with specific factors that can influence the financial and non-financial performance of a firm. These factors can now be used in several models for confirmatory factor analysis. Future IS researchers can use our Organisational Performance factors to measure the impact of different IS keeping pace with the IT advances.

For many years researchers have been troubled with the evaluation of Information Systems concluding wth a lack of understanding as to why, how, and when to evaluate IS systems (Irani and Love 2002; Wang and Liao 2008; Gorla et al 2010). Our findings can trigger new directions to an old but enduring question. After many months of desk and empirical research we can now say that this thesis has shed some light into the IS field by focusing on how IS effectiveness may affect Organisational Performance.

8.7 Conclusion

This dissertation contributed to academia by: a) testing a research framework which draws from the pertinent literature on IS and Organisational Performance; b) providing empirical evidence for a statistically significant positive relationship between the IS effectiveness and financial, as well as non-financial, measures of organisational performance; c) producing results from a rigorous methodology that shed light on the IS evaluation field of research and d) by identifying a number of contributors to IS success.

The research design and approach undertaken can produce several papers of academic interest. The exploratory factor analysis has already been published. The paper explains the methodology followed and the exploratory factor analysis (EFA) conducted for the measurement of the construct of IS effectiveness (Argyropoulou, et al 2011). A paper examining system quality and organisational performances will be published in the proceedings of the 2013 European Conference on Operational Research. Several other academic papers can be produced:

- A theoretical paper on System theory- The strength of the particular thesis lies in the fact that the methodology used is robust and in that it integrates major aspects of various philosophical approaches, including the systems approach that has been discussed in chapter 2.
- A theoretical paper on the advantages and disadvantages of web-surveys along with all related issues of dealing with bias
- One paper with the descriptive statistics
- Other research papers each one dealing with our main propositions and ensuing hypotheses
- Group comparisons dealing with the differences between SMEs and larger firms

Managerial implications

The findings of this thesis can attract the interest of practitioners as this research documents a number of IS implementation issues in the Greek market. Using non-probability sampling and the most updated at the time Directory of Greek enterprises from the whole country, we can say with confidence that this is the first complete survey in Greece that explored the impact of IS effectiveness on firm performance. Having seen the interest of many IT managers to participate and receive the results of this research, it is important that some key findings be communicated to our respondents as promised in our web-survey messages.

For example, the reports of an Information System will enhance performance if they are perceived to enhance decision making. Top Management should be very careful with the choice of the Service Provider as these people must have the empathy skills and reliably for a long lasting relationship. Action should be taken by IT managers to enhance system quality placing an emphasis on the implementation of systems that are easy and flexible and are perceived to provide benefits to the entire firm.

Alternatively, given limited resources, IT managers should be careful with the training programs of the employees to achieve better outcomes.

Peter et al (2012, p16) argued that the “challenge for researchers is to disseminate to practice their approaches for evaluating the success of information systems”. It is our belief that research should be translated into practice. The various findings can provide guidance to managers who can use them to develop strategies on IS implementation and decide how to allocate resources effectively. Service providers can develop better practices to increase the credibility of their services. Policy makers can use many of the contributors to organisational performance as evidence-based tools to build relationships with users and managers.

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APPENDIX 3.1

The research questionnaire

This questionnaire is designed to assess the performance of the information systems (IS) function in your organization. As a key informant for the IS adopted in your organization, you have the expertise to contribute to the collection of significant data.

If you wish to receive a summary of the findings please click "YES" under the relevant question at the end of the survey.

It will take you 10 minutes to complete.

PART I

The following questions seek to collect specific data on the usage of the IS by the employees.

1. How many employees does your organization employ? (please check one)

   Less than 50
   50-100
   100-200
   250 -500
   More than 500

2. How many of the employees use the Information System? (please check one)

   Less than 10%
   10-30%
   30-50%
   More than 50%

3. How long have you been using the IS in this company?
4. Are you a full time employee in this company?

   Yes No

5. How long have you been employed in this company? (Please check one)

   Less than one year □
   1-3 years □

More than 3 years □

6. Please define your title
7. How long have you been employed as an IT manager in your career? (Please check one)

Less than one year □

1-3 years □

More than 3 years □

8. Which kind of information system / systems is the company using? (please check as appropriate)

Enterprise Resource Planning (ERP) □

Supply Chain Management (SCM) □

Customer Relationship Management (CRM) □

Project Management (PM) □

E-commerce □

Order management □

Other please specify ....

9. Which system are you using?

SAP □

ORACLE □

NAVISION □

OTHER SOFTWHARE , PLEASE SPECIFY

PART II:

The following statements ask you to assess how the IS affects the user's work. Please click the number that best represents your evaluation of each statement. If a statement is not applicable to you, please click 0.

10. The extent that the information system :

Hardly at all			To a great extend				N/A
1	2	3	4	5	6	7	0

- Makes it easier to do their job:
- Helps their decision making:
- Gives them confidence to accomplish their job
- Increases participation in decision making
- Improves the quality of the work product
- Enhances problem-solving ability
- Facilitates collaborative problem solving
- Facilitates collective group decision making
- Facilitates learning:
- Facilitates knowledge transfer
- Improves modernization of working methods
- Reduces process costs:
- Reduces process times:

The following statements ask you to assess how the IS affects inter departmental relationships as well as the organization's relationships with external business partners. Please click the number that best represents your evaluation of each statement. If a statement is not applicable to you, please click 0.

11. The extent that the information system :

Hardly at all			To a great extend				N/A
1	2	3	4	5	6	7	0

- Facilities internal relationships
- Facilitates relationships with external business partners
- Enhances information sharing with your suppliers:
- Helps retain valued customers:
- Helps you select and qualify desired suppliers
- Improves supply's control

- Helps you manage product flow
- Speeds service delivery
- Speeds product delivery

The following statements ask you to assess the technical and some general characteristics of the IS. Please click the number that best represents your evaluation of each statement. If a statement is not applicable to you, please click 0.

12. The extent that:

Hardly at all				To a great extend			N/A
1	2	3	4	5	6	7	0

- System is reliable:
- System is flexible:
- System is easy to use
- System is easy to learn
- System is well integrated:
- System is cost effective
- System is easy to customize:
- System can be easily maintained
- System can be easily upgraded
- System can be used for multiple purposes
- Systems is useful for problem identification
- System is responsive to meet your changing needs
- System meets your expectations:
- System meets your requirements
- System provides benefits for the entire organization:
- Facilities information exchange with suppliers

PART III

The following statements ask you to assess the general characteristics of the management information provided by the IS. Please click the number that best represents your evaluation of each statement. If a statement is not applicable to you, please click 0.

13. The extent that the Information is :

Hardly at all		To a great extend					N/A
1	2	3	4	5	6	7	0

- Interpretable:
- Understandable:
- Complete:
- Clear:
- Concise:
- Accurate:
- Important:
- Relevant:
- Usable:
- Well organized:
- Well defined:
- Available:
- Accessible:
- Up-to-date:
- Received in a timely manner:
- Reliable:
- Verifiable:
- Believable:
- Unbiased:

14. The extent that the Information to Top Management :

Hardly at all		To a great extend					N/A
1	2	3	4	5	6	7	0

- Can be easily compared to past information
- Can be used for multiple purposes
- Meets your requirements:
- It is useful for problem definition:
- It is useful for solving problems:
- It is useful for making decisions:
- Improves decision effectiveness
- It is useful for problem identification:
- Improves functional productivity
- Is easily changed
- Is easily integrated
- Is easily undated

PART IV

The following statements ask you to assess the training and the services provided by the service provider. Please click the number that best represents your evaluation of each statement. If a statement is not applicable to you, please click 0.

15. The extent that the Information to Top Management :

Hardly at all			To a great extend				N/A
1	2	3	4	5	6	7	0

- Training programs are useful:
- Training programs Cover specific needs
- Training programs cover your needs
- Training programs are frequent
- Training programs are instructive
- Training programs are cost effective
- Training programs help you learn the various system's uses

16. The extent that the IS provider

Hardly at all			To a great extend				N/A
1	2	3	4	5	6	7	0

- Provides valuable services:
- Responds in a timely manner
- Complete services in an effective maner
- Provides reliable services
- Provides a sufficient variety of services
- Provides cost effective services
- Cares for the company’s interest
- Cares for every user
- Supports you in case of emergency
- Have sufficient people to provide services
- Knows the business processes
- Knows the industry
- Honours the contractual agreement
- Cares for a long lasting relationship

17. The extent that the IS provider people

Hardly at all			To a great extend				N/A
1	2	3	4	5	6	7	0

- Are effective in performing their services
- Have the knowledge and skill to do their job well
- Are dependable
- Are polite:
- Are sincere:
- Show respect to you:
- Are pleasant to work with:
- Instil confidence in you:
- Are helpful to you:
- Solve your problems as if they were their own
- Understand your specific needs:
- Are willing to help you:
- Help employs become skilful users

PART V

The following statements ask you to assess organizational performance after the IS implementation. . If a statement is not applicable to you, please click 0.

18. The extent that the IS provider people

Hardly at all				To a great extend			N/A
1	2	3	4	5	6	7	0

- On the company's productivity:
- On the company's income
- On production costs
- On inventory levels
- On logistics costs
- On gross profit
- On timely delivery of goods
- On timely customer service
- On delivery of goods according to specifications
- On customer complaints
- On customer retention
- On customer satisfaction
- On supplier's defect free deliveries -
- On replenishment time
- On new product /service development
- On the range of products and services
- On innovation capabilities
- On forecasting ability
- On timely decision making
- On organizational flexibility
- On information between departments
- On cooperation between departments
- On problem solving

19. The extent that the system had a positive impact

- On the achievement of strategic goals
- On the increase of market share
- On the competitive position

APPENDIX 4.1

Participant Information Letter

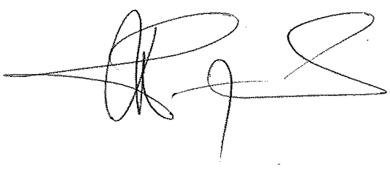
Brunel
UNIVERSITY
WEST LONDON

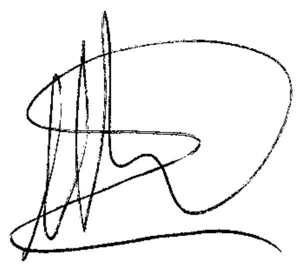
Ref: Research on Information Systems' Performance

Dear Mr

We are currently conducting a research into the Performance of Enterprise Information Systems. The research is carried out for the purposes of a PHD thesis. It would be of invaluable help if you could kindly participate providing us with your responses. The questionnaire will be administered online and will take you less than 12 minutes of your time to complete.
Furthermore, the questionnaire will be completely anonymous. Although entirely optional, your participation would be highly appreciated in order to ensure a meaningful sample.

Your reply will be used solely for the purposes of the University research.
An e-mail with details on how to complete the questionnaire and a link to the questionnaire itself will be sent to you in approximately one week's time.
Once the thesis is complete and approved by the University, we would be more than happy to share the results with you.
Kind regards,





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APPENDIX 4.2

Mann Whitney U tests for non-response bias analysis

Categorical variable (late and early respondents)

Continuous variable: years of usage

Ranks

	group	N	Mean Rank	Sum of Ranks
months of IS usage	1(early)	41	38,44	1576,00
	4(late)	41	44,56	1827,00
	Total	82		

Test Statistics[a]

	months of IS usage
Mann-Whitney U	715,000
Wilcoxon W	1576,000
Z	-1,172
Asymp. Sig. (2-tailed)	,241

a. Grouping Variable: VAR00002

Categorical variable (late and early respondents
Continuous variable: makes it easier to do their job

Ranks

	VAR00 002	N	Mean Rank	Sum of Ranks
Makes it easier to do their job	1	41	42,11	1726,50
	4	42	41,89	1759,50
	Total	83		

Test Statistics[a]

	Makes it easier to do their job
Mann-Whitney U	856,500
Wilcoxon W	1759,500
Z	-,049
Asymp. Sig. (2-tailed)	,961

APPENDIX 6.1

Missing variables and normality test

		Makes it easier to do their job	Helps their decision making	Gives them confidence	Increases productivity	Increases participation in decision making	Improves the quality of the work product	Enhances problem-solving ability	Provides information sharing	Facilitates collaborative problem solving	Facilitates collective group decision making
N	Valid	168	168	164	168	163	168	165	166	163	164
	Missing	0	0	4	0	5	0	3	2	5	4
Mean		6,49	5,88	5,31	6,09	4,83	6,02	5,5	6,09	5,6	5,46
Std. Deviation		0,774	1,312	1,251	1,031	1,623	1,044	1,43	1,164	1,27	1,398
Skewness		-1,255	-1,113	-0,418	-1,075	-0,457	-1,071	-0,989	-1,321	-0,829	-0,939
Std. Error of Skewness		0,187	0,187	0,19	0,187	0,19	0,187	0,189	0,188	0,19	0,19
Kurtosis		0,389	0,327	-0,693	0,565	-0,663	1,008	0,461	1,34	0,033	0,369
Std. Error of Kurtosis		0,373	0,373	0,377	0,373	0,378	0,373	0,376	0,375	0,378	0,377

		Facilitates learning	Facilitates knowledge transfer	Contributes to innovation	Improves modernization of woking methods:	Reduces process costs	Reduces process times:	Facilates internal relationships	Facilitates relationships with external business partners	Improves customer satisfaction	Improves customer service:
N	Valid	160	160	161	164	165	166	160	158	166	165
	Missing	8	8	7	4	3	2	8	10	2	3
Mean		5,07	5,41	5,27	5,81	5,83	6,04	4,9	5,47	5,66	6,04
Std. Deviation		1,48	1,46	1,601	1,318	1,233	1,05	1,411	1,29	1,195	0,987
Skewness		-0,627	-1,054	-0,789	-1,192	-0,818	-1,028	-0,447	-0,749	-0,993	-1,113
Std. Error of Skewness		0,192	0,192	0,191	0,19	0,189	0,188	0,192	0,193	0,188	0,189
Kurtosis		-0,238	0,758	-0,159	1,154	-0,311	0,386	-0,477	0,161	0,857	1,129
Std. Error of Kurtosis		0,381	0,381	0,38	0,377	0,376	0,375	0,381	0,384	0,375	0,376

		Enhances information sharing with your suppliers	Helps retain valued customers	Helps you select and qualify desired suppliers	Improves supply's control	Helps you manage product flow	Provides smooth information flow	Speeds product delivery:	Speeds service delivery:	System has fast response time	System downtime is minimal
N	Valid	163	162	159	159	161	166	161	164	168	161
	Missing	5	6	9	9	7	2	7	4	0	7
Mean		5,88	5,9	5,28	5,77	5,96	6,07	5,78	6,07	5,96	5,66
Std. Deviation		1,07	1,151	1,555	1,337	1,249	0,967	1,354	1,092	1,074	1,775
Skewness		-0,701	-1,154	-0,789	-1,191	-1,545	-0,907	-1,386	-1,309	-1,119	-1,52
Std. Error of Skewness		0,19	0,191	0,192	0,192	0,191	0,188	0,191	0,19	0,187	0,191
Kurtosis		-0,264	1,088	-0,103	0,971	2,494	0,269	1,984	2,157	1,07	1,357
Std. Error of Kurtosis		0,378	0,379	0,383	0,383	0,38	0,375	0,38	0,377	0,373	0,38

		System is reliable	System is flexible	System is accessible:	System is easy to use	System is easy to learn	System is cost effective	System is well integrated	System is responsive to meet specific needs	System is easy to customize	System can been easily upgraded
N	Valid	168	168	168	168	168	166	167	167	167	167
	Missing	0	0	0	0	0	2	1	1	1	1
Mean		6,15	5,66	6,02	5,68	5,43	5,73	5,53	5,83	5,63	5,41
Std. Deviation		1,001	1,289	1,097	1,134	1,246	1,238	1,46	1,256	1,337	1,498
Skewness		-1,138	-0,972	-1,496	-0,913	-0,691	-0,887	-0,983	-1,161	-0,79	-0,745
Std. Error of Skewness		0,187	0,187	0,187	0,187	0,187	0,188	0,188	0,188	0,188	0,188
Kurtosis		0,711	0,602	2,998	0,804	0,05	0,317	0,285	1,201	-0,056	-0,216
Std. Error of Kurtosis		0,373	0,373	0,373	0,373	0,373	0,375	0,374	0,374	0,374	0,374

		System is responsive to meet your changing needs	System meets expectations	System provides benefits for the entire organization	Facilates information exchange with suppliers	Facilates information exchange with customers	Interpretable	Understand able	Complete	Clear	Concise:
N	Valid	168	168	166	159	163	168	168	168	167	167
	Missing	0	0	2	9	5	0	0	0	1	1
Mean		5,61	5,7	5,96	5,47	5,63	5,8	5,9	5,7	5,78	5,66
Std. Deviation		1,358	1,297	1,108	1,301	1,238	1,047	0,939	1,12	1,03	1,102
Skewness		-0,823	-1,045	-1,403	-0,897	-0,777	-0,82	-0,718	-0,748	-0,76	-0,766
Std. Error of Skewness		0,187	0,187	0,188	0,192	0,19	0,187	0,187	0,187	0,188	0,188
Kurtosis		-0,171	0,882	2,61	0,388	-0,091	0,574	0,331	-0,006	0,363	0,269
Std. Error of Kurtosis		0,373	0,373	0,375	0,383	0,378	0,373	0,373	0,373	0,374	0,374

		Accurate	Important	Relevant	Usable	Well organized	Well defined:	Available	Accessible	Up-to-date	Received in a timely manner
N	Valid	168	168	154	166	167	165	166	167	166	166
	Missing	0	0	14	2	1	3	2	1	2	2
Mean		6,01	6,15	5,73	5,69	5,63	5,64	6,11	6,15	6,12	6,02
Std. Deviation		1,027	0,887	1,092	1,2	1,163	1,131	0,956	0,903	0,996	0,975
Skewness		-1,066	-0,819	-1,237	-0,992	-0,854	-1,178	-1,116	-0,898	-0,991	-0,87
Std. Error of Skewness		0,187	0,187	0,195	0,188	0,188	0,189	0,188	0,188	0,188	0,188
Kurtosis		0,729	-0,106	2,451	0,658	0,359	2,026	0,991	0,271	0,247	0,35
Std. Error of Kurtosis		0,373	0,373	0,389	0,375	0,374	0,376	0,375	0,374	0,375	0,375

		Reliable	Verifiable	Believable	Unbiased	Can be easily compared to past information	Can be safely maintained	Can be easily changed	Can be easily integrated	Can be easily updated	Can be used for multiple purposes
N	Valid	168	167	162	160	168	168	166	166	166	166
	Missing	0	1	6	8	0	0	2	2	2	2
Mean		6,2	6,09	6,09	6,13	5,66	6,19	5,4	5,59	5,7	5,71
Std. Deviation		0,968	1,086	0,981	0,979	1,379	0,96	1,379	1,317	1,167	1,101
Skewness		-1,246	-1,352	-1,056	-1,164	-0,894	-1,213	-0,701	-0,932	-0,935	-0,893
Std. Error of Skewness		0,187	0,188	0,191	0,192	0,187	0,187	0,188	0,188	0,188	0,188
Kurtosis		1,164	1,538	0,875	1,14	0,071	0,959	-0,455	0,491	1,027	0,771
Std. Error of Kurtosis		0,373	0,374	0,379	0,381	0,373	0,373	0,375	0,375	0,375	0,375

		Meets your requirements	It is useful for problem identification	It is useful for defining problems	It is useful for solving problems	It is useful for making decisions	Improves functional productivity	Improves decision effectivenes s	It gives your company a competitive edge	Training programs are useful	Training programs cover your needs
N	Valid	168	168	167	167	167	168	168	168	157	157
	Missing	0	0	1	1	1	0	0	0	11	11
Mean		5,82	5,77	5,52	5,54	5,77	5,87	5,74	5,65	5,61	5,34
Std. Deviation		1,109	1,173	1,251	1,279	1,196	1,041	1,233	1,411	1,353	1,371
Skewness		-1,175	-1,158	-0,918	-0,88	-1,22	-1,183	-1,225	-1,105	-1,06	-0,766
Std. Error of Skewness		0,187	0,187	0,188	0,188	0,188	0,187	0,187	0,187	0,194	0,194
Kurtosis		2,063	1,337	0,752	0,45	1,285	1,704	1,4	0,818	0,785	0,026
Std. Error of Kurtosis		0,373	0,373	0,374	0,374	0,374	0,373	0,373	0,373	0,385	0,385

		Training progrmas are frequent	Training progrmas are instuctive	Cover specific needs	Training programs are cost effective	Training programs help users learn the various system's uses	IS services are valuable	Responds to your service requests in a timely manner	Complete services in an effective maner	IS services are reliable	Provides a sufficient variety of services
N	Valid	156	156	156	154	157	168	168	168	168	168
	Missing	12	12	12	14	11	0	0	0	0	0
Mean		4,45	5,21	5,36	5,56	5,49	5,9	5,9	5,95	6,11	5,93
Std. Deviation		1,604	1,3	1,414	1,242	1,347	1,119	1,151	1,162	1,061	1,171
Skewness		-0,324	-0,668	-0,825	-1,033	-1,078	-0,809	-0,944	-0,879	-1,129	-1,014
Std. Error of Skewness		0,194	0,194	0,194	0,195	0,194	0,187	0,187	0,187	0,187	0,187
Kurtosis		-0,652	-0,035	0,123	0,923	1,024	-0,152	0,146	-0,159	0,628	0,394
Std. Error of Kurtosis		0,386	0,386	0,386	0,389	0,385	0,373	0,373	0,373	0,373	0,373

		Provides cost cost effective mservices	Cares for the comany's interest	cares for every user	Supports you in case of emergency	Has sufficient people to provide services	Knows the business processes	Know the industry	Honours the contractual agrrement	Are effective in performing their services	Have the knowledge and skill to do their job well
N	Valid	168	166	168	165	167	168	166	153	167	167
	Missing	0	2	0	3	1	0	2	15	1	1
Mean		5,95	6,11	5,81	6,25	5,14	5,93	5,93	6,28	5,98	6,11
Std. Deviation		1,159	1,096	1,153	1,04	1,59	1,056	1,163	0,899	0,979	0,934
Skewness		-1,038	-1,113	-0,902	-1,45	-0,693	-0,887	-1,122	-1,192	-0,862	-0,903
Std. Error of Skewness		0,187	0,188	0,187	0,189	0,188	0,187	0,188	0,196	0,188	0,188
Kurtosis		0,517	0,511	0,509	1,507	-0,369	0,323	0,869	0,896	0,332	0,38
Std. Error of Kurtosis		0,373	0,375	0,373	0,376	0,374	0,373	0,375	0,39	0,374	0,374

		Are dependable	Are polite	Are sincere	Show respect to you:	Are pleasant to work with	Instil confidence in you	Are helpful to you	Solve your problems as if they were their own	Understand your specific needs	Are willing to help you
N	Valid	167	167	167	167	167	166	167	166	167	166
	Missing	1	1	1	1	1	2	1	2	1	2
Mean		6,13	6,11	6,02	6,2	6,07	6,04	6,08	5,75	5,93	6,05
Std. Deviation		0,958	0,953	1,009	0,92	1,019	1,058	1,012	1,193	1,109	1,078
Skewness		-1,004	-0,864	-0,749	-0,968	-0,929	-1,235	-1,181	-0,746	-1,021	-1,155
Std. Error of Skewness		0,188	0,188	0,188	0,188	0,188	0,188	0,188	0,188	0,188	0,188
Kurtosis		0,484	-0,021	-0,391	0,045	0,047	1,495	1,229	0,042	0,638	1,171
Std. Error of Kurtosis		0,374	0,374	0,374	0,374	0,374	0,375	0,374	0,375	0,374	0,375

		Help employess become skillul users	On the company's productivity	On income	On production cost	On inventory levels	On logistics costs	On gross profit	On timely delivery of goods	On timely customer service	On delivery of goods according to specifications
N	Valid	166	168	166	166	159	156	158	155	166	158
	Missing	2	0	2	2	9	12	10	13	2	10
Mean		5,57	5,93	5,47	5,45	5,73	5,13	5,45	5,74	5,9	5,72
Std. Deviation		1,377	1,033	1,278	1,319	1,344	1,436	1,28	1,248	1,088	1,227
Skewness		-0,845	-0,857	-0,885	-0,836	-1,601	-0,838	-0,782	-1,185	-1,252	-1,159
Std. Error of Skewness		0,188	0,187	0,188	0,188	0,192	0,194	0,193	0,195	0,188	0,193
Kurtosis		-0,016	0,287	0,715	0,535	3,05	0,625	0,425	1,413	1,653	1,49
Std. Error of Kurtosis		0,375	0,373	0,375	0,375	0,383	0,386	0,384	0,387	0,375	0,384

		On customer complaints	On customer retention	On customer satisfaction	On supplier's defect free deliveries	On replenishmen t time	On new product /service development	On the range of products and services	On innovation capabilities	On forecasting ability	On information sharing thought entire Supply Chain
N	Valid	159	157	159	151	155	150	150	150	154	158
	Missing	9	11	9	17	13	18	18	18	14	10
Mean		5,37	5,44	5,68	5,44	5,5	5,13	5,15	5,11	5,26	5,61
Std. Deviation		1,32	1,278	1,138	1,445	1,383	1,645	1,604	1,659	1,592	1,431
Skewness		-0,93	-0,741	-0,856	-1,243	-1,11	-0,895	-0,995	-0,922	-1,016	-1,341
Std. Error of Skewness		0,192	0,194	0,192	0,197	0,195	0,198	0,198	0,198	0,195	0,193
Kurtosis		0,684	0,197	0,455	1,432	1,157	-0,014	0,402	0,057	0,379	1,558
Std. Error of Kurtosis		0,383	0,385	0,383	0,392	0,387	0,394	0,394	0,394	0,389	0,384

		On timely decision making	On organisation al flexibility	on information between departmetn s	On cooperation between departments	On the achievement of strategic goals	On the increase of market share	On competitive position
N	Valid	166	165	167	167	168	168	168
	Missing	2	3	1	1	0	0	0
Mean		5,56	5,5	5,69	5,68	5,45	5,16	5,43
Std. Deviation		1,3	1,395	1,256	1,233	1,33	1,49	1,395
Skewness		-1,331	-1,31	-1,331	-1,194	-1,062	-0,895	-1,109
Std. Error of Skewness		0,188	0,189	0,188	0,188	0,187	0,187	0,187
Kurtosis		2,159	1,475	2,202	1,529	1,198	0,432	1,217
Std. Error of Kurtosis		0,375	0,376	0,374	0,374	0,373	0,373	0,373