INFORMATION SYSTEMS INVESTMENT APPRAISAL IN COMMERCIAL BANKS IN KENYA

Theory and Practice

By

ELSIE KHAKASA ONSONGO

Strathmore University Library

A thesis submitted in fulfillment of the requirements of the degree of Master of Commerce

Strathmore University Faculty of Commerce June 2009

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

SIGNED……DATE ……

Elsie Khakasa Onsongo.

This thesis proposal has been submitted for examination with my approval as the University Supervisors.

SIGNED _____ _____ DATE _____

Dr. Ismael Ateya

STRATHMORE UNIVERSITY

ABSTRACT

A review of literature on the practise of Information Systems investment appraisal in firms suggests a gap between theory and practice. In an attempt to explore the extent of this gap, this research reviews the theory of fixed asset investment when applied to the current state of practice of IS investment evaluation among Kenyan banking institutions. Results of the survey show that the level of usage of discounted cashflow (DCF) techniques and sophisticated analytical and integrated techniques is low compared to the usage of simple financial and strategic techniques. To illustrate, simple. ratio-based techniques were found to be very popular, with Cost Benefit analysis being used by 92% of responding banks, Payback Period (60%) and Return on Investment (60%). Appraisal techniques that consider strategic arguments were also found to be very popular, i.e. technical considerations (92%), competitive advantage (64%) and Critical Success Factors and SWOT analysis (56% each). On the other hand, DCF techniques were unpopular i.e. Net Present Value (8%) and Internal Rate of Return (0%). Further, analytical and integrated appraisal techniques were also found to be relatively unpopular: value analysis (28%), scoring models (16%), computer based techniques (4%), the Balanced Scorecard (56%) and Information Economics (40%). In addition, a partial relationship was found between the adoption of a type of investment appraisal technique and the size of a firm. As the size of the firm, determined by the book value of total assets increases, the usage of strategic and analytical techniques increases, while at the same time, the use of ratio-based techniques reduces. Based on these findings, this study highlights the shortcomings of normative fixed asset investment theory when applied to IS investment appraisal.

ACKNOWLEDGEMENT

I would like to express my gratitude to everyone who supported me while writing this thesis.

First, I wish to thank my sponsoring institution, Strathmore University, for giving me an opportunity to study a Master of Commerce degree. My experiences during the duration of this degree have ignited and shaped my interest in pursuing a career in scholarship and teaching.

I am deeply indebted to my supervisor Dr Ismael Ateya whose help, suggestions and encouragement motivated me through this research process. Dr Ateya was always available to discuss my projects, and was very prompt in reviewing each section of my work. His feedback has gone a long way to improve this thesis.

Special thanks go to Ms Lillian Ollows, with whom I explored the theoretical angles of this research. Ms Ollows help.ed me to clarify the objectives of this research, and their relationship to the findings and conclusions. In addition, I would like to thank Dr James McFie, for guiding me during the initial stages of this research, Mr David Wangombe, for reading my work at short notice and suggesting ideas that have greatly improved the quality of this thesis, Dr Ruth Kiraka for exposing me to academic research and for her encouragement, and Ms Racheal Mbogo who helped me to understand how to use regression analysis to establish relationships between variables. I also appreciate Ms Margaret Roche for her constant encouragement, and for believing in me.

I also extend my gratitude to my colleagues in the Master of Commerce 2006 intake class for their motivation and suggestions. Especially I am obliged to Terry Kimundi and Kenneth Muchiri.

Last, but not least, I thank my mother, Ms Agnes Sachida, for giving me life, educating me and for encouraging me to pursue my interests. Without her, I would not be here.

I am eternally grateful to God for making me who I am today.

TABLE OF CONTENTS

DECLARATION I

ABSTRACT II

ACKNOWLEDGEMENT III

LIST OF TABLES VI

LIST OF FIGURES VII

CHAPTER 1 : INTRODUCTION 1

1.1 INTRODUCTION 1
1.2 PROBLEM STATEMENT 4
1.3 RESEARCH OBJECTIVES 5
1.4 THE SCOPE AND JUSTIFICATION FOR THE STUDY 6
1.5 DEFINITION OF TERMS 6

CHAPTER 2 : LITERATURE REVIEW 7

2.1 ANALYSIS OF IS INVESTMENTS 7
2.2 FIXED ASSET INVESTMENT THEORY 10
2.2.1 DEFICIENCIES OF NORMATIVE FIXED ASSET INVESTMENT THEORY 12
2.2.2 ARGUMENTS AGAINST USING CAPITAL BUDGETING METHODS TO APPRAISE IS/IT INVESTMENTS 15
2.3 REVIEW OF EXISTING METHODOLOGIES OF IS INVESTMENT APPRAISAL 17
ADAPTED FROM IRANI ET AL. (1997) 18
2.3.1 ECONOMIC APPROACH 19
2.3.2 STRATEGIC APPROACH 20
2.3.3 ANALYTIC APPROACH 22
2.3.4 INTEGRATED APPROACH 24
2.4 ACT OF FAITH 26
2.5 PREVIOUS STUDIES ON THE USE OF INVESTMENT APPRAISAL TECHNIQUES 26
2.6 LIMITATIONS AND GAPS IN EXTANT LITERATURE 33
2.7 RESEARCH HYPOTHESIS AND THE CONCEPTUAL FRAMEWORK 34

CHAPTER 3 : RESEARCH METHODOLOGY 37

3.1 THE RESEARCH DESIGN 37
3.2 POPULATION AND SAMPLING 37
3.3 DATA COLLECTION 38
3.4 DATA ANALYSIS 39
3.4.1 APPRAISAL APPROACHES 39
3.4.2 APPRAISAL APPROACH AND FIRM SIZE 39

CHAPTER 4 : RESEARCH FINDINGS 43

4.1 DESCRIPTIVE STATISTICS 43
4.2 APPRAISAL APPROACHES 44
4.3 DETERMINING THE RELATIONSHIP BETWEEN APPRAISAL APPROACH AND FIRM SIZE 48
4.3.1 USING CHI-SQUARE CROSS TABULATION ANALYSIS 49
4.3.2 USING SIMPLE LINEAR REGRESSION ANALYSIS 55

CHAPTER 5 : DISCUSSION AND CONCLUSIONS 59

5.1 DISCUSSION 59
5.1.1 THE USAGE OF IS INVESTMENT APPRAISAL TECHNIQUES 59
5.1.2 ANALYSIS OF THEORY AND PRACTICE 64
5.1.3 PROPOSED IMPROVEMENTS ON INVESTMENT THEORY 67
5.2 CONCLUSION 69
5.3 LIMITATIONS AND FURTHER RESEARCH 71

6. REFERENCES 72

APPENDICES 80

APPENDIX A 80
SAMPLE INVITATION LETTER TO THE STUDY 80
APPENDIX B 81
SAMPLE SURVEY QUESTIONNAIRE 81
APPENDIX C 85
CHI SQUARE ANALYSIS 85
APPENDIX D 89
SIMPLE REGRESSION ANALYSIS 89

LIST OF TABLES

Table 2.1 Taxonomy ofIS Investment Appraisal Approaches 18
Table 3.1 Survey Responses Be Total Assets 42
Table 4~1 Survey Responses by Job Title 44
Table 4.2 Usage and Application of a Given 1ST Investment (Project Selection) Criterion 46
Table 4.3 Cross tabulation statistics for Economic Appraisal Techniques and Firm Size 50
Table 4.4 Cross tabulation statistics for Strategic Appraisal Techniques and Firm Size 52
Table 4.5 Cross tabulation statistics for Analytical Appraisal Techniques and Firm Size 53
Table 4.6 Cross tabulation statistics for Integrated Appraisal Techniques and Firm Size 54
Table 4.7 The Effect of Firm Size on the Usage of Economic Appraisal Techniques 56
Table 4.8 The Effect of Firm Size on the Usage of Strategic Appraisal Techniques 56
Table 4.9 The Effect of Firm Size on the Usage of Analytical Appraisal Techniques 57
Table 4.10 The Effect of Firm Size on the Usage of Integrated Appraisal Techniques 58

LIST OF FIGURES

Figure 2.1 A conceptual model illustrating the association between the size of a firm and the use ofIS Investment appraisal techniques 36

Figure 4.1 Descriptive Statistics by Total Assets 44

Figure 5.1 A revised conceptual model illustrating how firms select ISIIT Investment appraisal techniques based on firm size 63

Chapter 1 . INTRODUCTION

1.1 Introduction

Information Systems (IS) investments have had a tremendous impact on firms by reducing costs, improving product quality and increasing value to customers, thus enabling the firms to gain competitive advantage (Francalanci and Maggiolini, 1994). Griffiths and Remenyi (2003) found that among firms in fmancial services, information technology expenditure consumes an ever increasing portion of operating costs. Yet with regard to planning for the implementation of these technologies, IS executives struggle with the challenging issue of how to justify investment in information technology (Fasheng and Teck, 2000).

IS investments carry significant long term business implications. Assessing IS investments is thus difficult; both before the investment is undertaken, and after the new (or enhanced) systems have been acquired and implemented. Renkema (2000) highlights four important reasons why such assessments are so complex:

- IS investments are not initiated to merely reduce costs but rather to achieve more intangible, sometimes long-term benefits and calculating the return on investment of such benefits has proven to be very difficult.
- The direct costs of IS investments can be very difficult to predict since they typically are high and the systems have long life-cycles.
- As a consequence, IS investment appraisals are accompanied with substantial uncertainties, as benefits and costs are likely to range between wide margins, which in tum translate into large risks.
- There is typically a large, heterogeneous group of stakeholders involved in the IS investment appraisal process, which easily leads to communication problems and political conflicts among the stakeholders.

Technical arguments have often been used to justify IS investments, where assessment methods that measure the functionality and the non-functional qualities of IT-systems such as data quality, security and maintainability have been used (Ward, Hertogh and Viaene, 2007). However, today, having good technical properties is rarely enough to motivate a costly ITinvestment. Decision makers now look for business driven rationale for IS investments (Sherer, 2004).

Some managers focus on measuring expected economic return on IS investments using financial metrics such as Return on Investment, Payback Period, Internal Rate of Return and other discounted cash flow methods. However, the predictive ability of appraisal processes mainly dependent on economic appraisal techniques has been questioned. This is because while economic implications, i.e. costs (hardware, software, planning, training, operations, etc.) and many of the operational benefits are generally easily quantifiable, some of the major strategic benefits are very difficult to estimate using these techniques (Locher, Mehlau and Wild, 2004). Thus, researchers criticized these appraisal techniques as myopic for the appraisal of complex technology investments (Clemons and Weber, 1990; Bacon, 1992; Alshawi, Irani and Baldwin, 2003; Lee, 2004; Bardhan, Bagchi and Sougstad, 2004; Silvius, 2006; Ward et aI., 2007).

To overcome the limitations of fmancial techniques, the IS academic community has promoted the use of strategic justification approaches that consider criteria such as comparison with competitors, the retention, attainment or perception of industry leadership, and expected future developments in the industry (Small, 2006). In the case of banks, the Basel Committee (2006) has indicated that with regard to regulatory capital requirements, it is no longer sufficient to apply methods of investment analysis without taking into account the effects of operational risk, a major strategic business consideration. Thus, when evaluating IS investments, banks have to calculate these investments' expected effects on capital for operational risk. As a consequence, more comprehensive appraisal techniques that incorporate a risk assessment component have been recommended (Locher et aI., 2004).

However, there is some concern that reliance on strategic justification alone may be as problematic as full reliance on traditional financial justification approaches. There is a growing consensus that hybrid investment approaches which include both strategic and economic justification criteria are needed to evaluate complex systems (Stewart and Mohamed, 2002a).

As a result of these varied perspectives to IS investment appraisal, numerous methodologies for predicting the potential return on IS investments have been advanced, focusing on financial (quantitative) or non-financial (qualitative) aspects of investment appraisal, or integrating both aspects. Irani et aI. (1997) grouped these methodologies into four classifications according to the approach adopted: i) the economic approach, ii) the strategic approach, iii) the analytical approach and iv) the integrated approach. Ballantine and Stray (1998) maintain that these methodologies vary in degree of usefulness, and claim that no methodology can evaluate IS investments adequately.

Bacon (1992) emphasizes the importance of selecting appropriate criteria for IS investment decision making, as they significantly impact the effectiveness of decision making. In addition, Bacon (1992) submits that the criteria used indicate whether there is an appropriate balance in utilizing both quantitative and qualitative forms of appraisal in selecting IS investments. Chen (2008) found that quantitative and qualitative forms of appraisal play different roles when considering potential investments. Financial analysis will lead to optimal investment decisions as long as a firm is able to estimate the parameters accurately. On the other hand, non-fmancial analyses supplement financial analyses by enabling the firm to consider intangible factors.

There are elements that may affect or influence the selection of particular techniques, such as type of investment (Farbey, 1992; Irani et aI., 1997; Small, 2006), how companies allocate the IS investment decision making responsibility (Paul and Tate, 2002) and the size of a firm (Pike, 1996; Arnold and Hatzopoulos, 2000). However, no consensus has been reached as to whether there is a relationship between firm size and the techniques a firm uses.

Nevertheless, it is crucial to select and use appropriate justification techniques to ensure that IS projects are evaluated for all the strategic, operational and economic benefits they can provide, and for all the costs that are associated with their acquisition and operation.

1.2 Problem Statement

As organisations continue to increase their investment in IS, the process of evaluating potential IS investments is also becoming one of theinost important activities for an organisation's management (Doherty and King, 2005). However, one of the biggest problems IS managers have when making effective IS investments is their inability to predict and measure the benefits that result (Irani, Love and Li, 1997).

Researchers have characterized IS investments as uncertain, interdependent and irreversible (Bardhan, et aI., 2004; Xiao-lin, 2006), resembling capital investments in research and development (R&D) which have corporate-wide, intangible and long lasting effects (Bharadwaj et aI., 1999). Therefore, the process of evaluating potential IS investments is important, as there is a need to seek concrete evidence of the expected contribution each IS investment will make to the firm (Barua et aI., 1995).

Are investments in IS any different from other capital investments in the firm?
Ashford, et aI. (1988) assert that there is no difference, as standard investment appraisal techniques i.e. capital budgeting techniques, are as applicable to IS projects as to any other type of project.

Normative fixed asset investment theory requires that all projects be subjected to formal analysis. The theory submits that the effective assessment of potential capital investments should incorporate the estimation of parameters such as: (1) a project's future cash

flow; (2) the risk-adjusted discount rate; (3) the project's impact on cash flows generated from other assets; and (4) the project's impact on future investment opportunities (Myers, 1984). However, studies by Gitman & Forrester (1977) and Pike (1982) suggest that during investment appraisal, these procedures may be violated in practice. Extant IS literature also suggests that financial techniques (predominately referred to as "economic approaches") are considered "traditional", and are not widely used to evaluate potential IS investments. (Alshawi et aI., 2003; Lee, 2004; Bardhan et aI., 2004; Ward et aI., 2007). This suggests a gap between what scholars and practitioners consider as acceptable and realistic IS investment appraisal practice.

This study attempts to examine this gap between theory and practice of investment appraisal for potential IS projects. The study attempts to establish the extent of this gap by analysing the level of usage of fmancial appraisal techniques by banking institutions in Kenya.

As extant literature suggests that financial techniques developed under the fixed asset investment theory are not being applied in practice as required by the theory, IS executives may be using other non-financial techniques to appraise their potential investments. The study further seeks to establish whether non-financial techniques are being used during IS investment appraisal, and the extent to which they are used.

Finally, the study attempts to determine whether the size of a firm is associated with the appraisal technique used, thereby establishing whether the size of a firm has an effect on the extent of the gap between the theory discussed for investment appraisal, and practice.

1.3 Research Objectives

(i) To determine which formal appraisal approaches banking institutions have adopted to assess and justify potential IS investments.

(ii) To find out if there is any relationship between the size of a firm and the appraisal approach and techniques used.

1.4 Research Questions

(iii) Which formal appraisal approaches have banking institutions adopted to assess and justify potential IS investments?

(iv) Is there any relationship between the size of a firm and the appraisal approach and techniques used?

1.5 The Scope and Justification for the study

Globally, the banking sector has been found to be the most IS intensive industry (Berger, 2003). Similarly, it can be reasonably concluded that the banking sector in Kenya is an information technology leader among Kenyan industries.

This research has been inspired by the general lack of empirical information on contemporary project appraisal practices for IS investment decision making, especially on the use of non-financial appraisal techniques. If improvements are to be made on the practice of investment appraisal, a closer look needs to be taken on how IS investments are currently appraised. Thus, this research aims to provide such empirical information, which may form a basis of an effort to improve the way IS executives appraise their investments.

Results will help to establish banking industry-wide benchmarks and best practices in IS investment appraisal that can be applied across other service industries, thereby assisting firms to make more informed decisions for future investments.

1.6 Definition of Terms

Information System Investment: Any acquisition of computer hardware, network facilities, or pre-developed software, or any "in-house" systems development project, that is

expected to add to or enhance an organization's information systems capabilities and produce benefits beyond the short term (Bacon, 1992) (pp. 335).

IS investment appraisal: The weighing up process to rationally assess the value of any acquisition of software or hardware which is expected to improve the business value of an organisation's information systems (Grembergen, 2001 (pp. 3).

Chapter 2 . LITERATURE REVIEW

2.1 Analysis ofIS investments

The adoption of **IS** in the banking sector has been seen to have a tremendous impact on the industry by increasing efficiency, reducing operating costs, improving product quality and increasing value to customers (Ferguson, 2000). Managers have often justified **IS** spending by exemplifying past achievements. Anecdotal evidence suggests that since organizations have reported better returns as a result of adopting certain technologies, it is expected that if larger investments are made in technology, the finn would report even more outstanding results and achieve superior competencies in the industry. Thus, dramatic improvements in **IS** capabilities have usually been accompanied by increased IS investments (Stewart and Mohamed, 2002a).

However, researchers who have attempted to establish a relationship between the level of investment in IS and profitability in the finn have found low or zero correlation, thus concluding that increased investment in IS does not necessarily lead to increased productivity, or value in the finn (Harris and Katz 1991, Strassmann 1990). The inability to demonstrate strong linkages between the investment in IS and a wide variety of performance measures (a phenomenon commonly referred to as the "productivity paradox") leaves the central problem of whether IS really does make a difference in the finn unanswered (Brynjolfsson and Hitt, 1993).

While some scholars submit that these outcomes in research may have been compromised by methodological factors like sample characteristics, measurement errors and failure to control for other firm-specific factors that influence firm performance (Dos Santos, Peffers and Mauers. 1993, Brynjolfsson and Hitt 1996, Weill 1992), it is imperative that firms re-examine their information technology strategies to identify the reasons why IS investments may not be returning the expected results.

Grembergen (2001) defines IS investment appraisal as "the weighing up process to rationally assess the value of any acquisition of software or hardware which is expected to improve the business value of an organisation's information systems" (pp. 3). Although there is potential for appraisal of an IS investment to be carried out at five different stages of the project, namely feasibility, development, implementation, post implementation and in routine operations, in practice, the most critical appraisal takes place prior to development when the costs, benefits, risks and value of the proposed investment are assessed (Simmons, 1994).

Researchers have characterized IS investments as uncertain, interdependent and irreversible (Bardhan, et aI., 2004; Xiao-lin, 2006), resembling capital investments in research and development (R&D) which have corporate-wide, intangible and long lasting effects (Bharadwaj et aI., 1999). There is no uniform definition or understanding of what constitutes an IS investment, and not all investments are of a capital nature. Bacon (1992) defines an IS capital investment as "any acquisition of computer hardware, network facilities, or predeveloped software, or any "in-house" systems development project, that is expected to add to or enhance an organization's information systems capabilities and produce benefits beyond the short term" (pp. 335).

The process of evaluating potential IS investments is important, as there is a need to seek concrete evidence of the expected contribution each IS investment will make to the firm

(Barua et al., 1995). Investing in IS represents a significant drain on the firm's financial resources. Consequently, investing in the wrong IS project may hasten the decline of the organisation. In addition, formal evaluation is significant as it enables the firm to ascertain the quality of an investment. Prior to implementation, the value of an IS investment is difficult to ascertain (Bacon, 1992; Lynn et al., 2001). As the nature of IS investments evolves with environmental changes, continuous evaluation may reduce the risk of failure. IS investment appraisal has also been emphasised due to the significance of IS in the firm, and tight budgetary constraints (Bacon, 1992).

Farbey et al. (1992) suggest that IS/IT appraisal serves various objectives. These are:

(i) to justify investments;

(ii) to enable organizations to decide between competing projects, especially if capital rationing is an issue;

(iii) to act as a control mechanism over expenditure, benefits and the development and implementation of projects;

(iv) to act as a learning device enabling improved appraisal and systems development to take place in the future.

Are capital investments in IS any different from other capital investments in the firm? Some researchers assert that there is no difference, as standard investment appraisal techniques i.e. capital budgeting techniques, are as applicable to IS projects as to any other type of project (Ashford, et al., 1988). Other scholars contend that many benefits resulting from IS investments are intangible, and therefore difficult to quantify (Parker et aI., 1988; Farbey et aI., 1993; Renkema, 2000; Berger, 2003). Renkema and Berghout (1997) found that as a result of this difference of opinion, many studies about IS investment appraisal carried out over the past four decades sought to establish the principles and criteria relevant and necessary for developing appraisal methodologies that address both the tangible and intangible aspects of IS investments.

2.2 Fixed Asset Investment Theory

Modem theoretical ideas about the appraisal of capital investment can be traced back to ideas developed by Irving Fisher and Maynard Keynes. In *The Rate of Interest,* Fisher (1907) explained that investment is a response to the choice between consumption today and consumption in the future. A rational investor will only postpone consumption of their savings if they will be rewarded with extra consumption in the future to compensate the postponement. This reward is determined by the rate of interest, which is established when the forces of demand and supply of savings balance. In a subsequent paper, *The Theory of Interest,* Fisher (1930) emphasised that investment is determined at the point where the rate of return on an investment is equal to the prevailing interest rate. Thus, an investment is economically viable only when the rate of return over costs is equal to or greater than the prevailing interest rate. Fisher's rate of return over costs is the rate that equates the present value of future cash inflows from the investment and the initial cost of the investment.

Keynes (1936), in The General Theory of Employment, Interest and Money, held similar ideas to Fisher's on investment and investor behaviour. Keynes' measure of expected profitability, the marginal efficiency of capital (MEK), is the discount rate that makes the present value of an investment's prospective yield, i.e. expected cash inflows, equal to its current supply price, or replacement cost, i.e. initial investment. However, Keynes argues further that an investor's subjective influences have a major impact of their expectations under uncertainty, thus affecting the MEK. Consequently, given limited information, precise mathematical instruments cannot be relied upon when making decisions to invest in a fixed asset, as subjective expectations will playa key role.

The Keynesian approach to investment was further developed by incorporating the accelerator theory, originally developed by Maurice Clark. Clark (1917) argues that businesses invest in response to growing demand. Therefore, investment is the process of capital stock adjustment, determined by expected demand for a firm's products. The accelerator theory

paved way for the development of models in which quantity factors determine investment decisions, such as Jorgenson's model.

Besides allowing for quantity factors, Jorgenson (1963) introduces the relative cost of capital. Like Fisher (1930), Jorgenson (1963) argues that rational, profit-maximizing investors calculate the present value of net cash flows from investment decisions. However, he further contends that rational investors balance the present value of marginal benefits of an investment (i.e. the marginal productivity of capital), and the marginal costs of that investment (i.e. the costs involved in using the capital such as capital goods prices, depreciation, interest and capital gains or losses from changes in the price of the capital). In simple terms, firms will purchase a machine if the extra revenue the machine generates is a smidgen more than its cost (Hassett, 2008). Jorgenson's model forms the basis of modern neoclassical theories of investment. A major analytical shortcoming of Jorgenson's theory arises from his assumption that capital stock adjustment occurs instantaneously. Haavelmo (1960) found that Jorgenson failed to defme the rate of investment over time, should capital stock adjustment be lagged over time.

A comprehensive response to the shortcomings of Jorgenson's model came from Brainard and Tobin (1968) and Tobin (1969), who submitted that expectations are crucial to an understanding of investment under uncertainty. Tobin (1969) incorporated rational expectations of future profits into a model to measure incentive to invest in capital - the ratio of the market value of a firm to the replacement cost of its capital stock - a ratio that he called "Q". Tobin's Q, as it has become known, is the empirical implementation of Keynes's (1936) notion that capital investment becomes more attractive as the value of capital increases relative to the cost of acquiring the capital.

Based on further criticism of Jorgenson's assumption that investment decisions are reversible, real options theories of investment under uncertainty were introduced. Credit is given to Dixit and Pindyck (1994) for developing the 'real options' approach to investment, which is used in judging investment opportunities that are likely to involve large sunk costs.

They compare investment decisions to financial call options, where investors will exercise an option to invest today against the benefits of delaying investments.

Concepts discussed in theoretical literature mentioned above such as interest, present value, capital stock adjustment, user cost of capital and marginal benefits, expectations and uncertainty form the basis of the capital budgeting techniques being used by business managers, such as Net Present Value (NPV), Internal Rate of Return (IRR), Cost Benefit Analysis (CBA), Real Options Analysis (ROA) and Payback period.

2.2.1 Deficiencies of Normative Fixed Asset Investment Theory

Normative fixed asset investment theory requires that all projects be subjected to formal analysis. Myers (1984) submits that the usefulness of capital budgeting methods depends on a firm's ability to estimate parameters such as: (1) a project's future cash flow; (2) the risk-adjusted discount rate; (3) the project's impact on cash flows generated from other assets; and (4) the project's impact on future investment opportunities. However, studies by Gitman & Forrester (1977) and Pike (1982) suggest that this might be violated in practice. These studies suggest that projects may not be subjected to analysis due to their nature, size, or whether the project is mandated by regulatory agencies. Some firms indicate that there are some units or departments within the firm whose proposed projects are exempt from formal financial analysis. Murkhejee and Henderson (1987) in their extensive review of literature found further contradictions in the theory and practice of capital budgeting procedures, as follows:

(i) The use of discounted cash flow techniques is now the rule rather than the exception, but it is internal rate of return, not the theoretically preferable net present value technique, that business has chosen as its method.

(ii) Despite many years of disparagement, payback period is still widely used.

(iii) Capital rationing is commonplace. Such a condition is at odds with the financial market equilibrium theories. The theoretical prescription for optimisation under capital constraints, linear programming, is infrequently used.

(iv) Firms use the cost of capital. However, a significant minority do not use it exactly as it is suggested by theory.

(v) Risk analysis models are yet to be accepted universally. Many firms simply change the required payback period to adjust for risk.

ill addition, Kaplan (1984) discovered that during ex-post audits, firms tend to use Return on Investment type of measures as the basis of performance measurement for projects where discounted techniques were used for selection, causing managers to settle for short-term profitability at the expense of long-term goals. This procedure is inconsistent with investment theory.

Extant literature indicates that such criteria as payback, average rate of return, internal rate of return and present value may all be used with differing importance and frequency of occurrence attached to each from time to time (Klammer, 1972; Gitman and Forrester, 1978; Pike, 1982) . Why do differences between theory and practice persist? After reviewing the related literature, Murkhejee and Henderson (1987) concluded that much of the gap can be attributed to deficiencies in the capital budgeting models, which they found to have the following limitations:

(i) An inability to capture the role of organizational structure and behaviour in corporate decision making

(ii) A failure to incorporate management behaviour toward risk

(iii) Difficulties in application due especially to unrealistic assumptions about data availability, and

(iv) Inability to incorporate strategic considerations in decisions made by the firm. (pp

86)

Normative theory does not prescribe any qualitative factors that should be used in conjunction with capital investment decisions. Lumby (1981) recognises that there are other factors which are considered when making investment decisions. He states: 'no method of investment appraisal can give a definitive decision. They cannot tell a company's financial decision maker to "invest" or "not invest", but can only act as a decision guide .... All they will do is help to communicate information to the decision maker; but when the decision is finally made, it is based on a whole range of very diverse considerations which are beyond our present capabilities to encompass in "overall" decision making formulae' (p. 11).

There are a number of studies that refer to qualitative factors as significant in the decision making process. Arnold and Hatzopolos (2000) found that many firms consider strategic fit to be an important criterion for the acceptance of projects alongside quantitative hurdles. Myers (1984), in discussing the inability offmancial analysis to capture the benefits of future growth and flexibility, concludes that rational managers should simply bring these considerations into project evaluation, in addition to financial analysis, as strategic factors. Klammer (1993) suggests that strategic cost management be integrated into capital budgeting using methods such as value-chain analysis, cost-driver analysis, and competitive-advantage analysis. Pike (1996), in his trend analysis, found that traditional capital budgeting methods are most appropriate in assessing non-strategic investment alternatives where the intangible elements and risks are low, a scenario that was common in his earlier survey of capital budgeting practices between 1975 and 1992. In a subsequent survey in 1992, respondents were invited to discuss the role of non-financial criteria in investment appraisal. Emphasis was placed by many upon the impact of investment on improvements in quality, reduced cycle time, reduced waste, and improved delivery performance.

Chen (2008) while reviewing literature found case study evidence, although limited, that offers support for the use of non-financial considerations in capital budgeting. He attempts

to measure and compare the degree to which financial techniques and non-financial measures are used in capital budgeting. His study shows that both financial techniques and non-financial measures are widely used in practice and that their use appears linked, in part, to contingent-based variables. He recommends that future capital budgeting studies should examine not only traditional financial analysis but also non-financial considerations in relation to firms' operating environment.

2.2.2 Arguments against using Capital Budgeting Methods to appraise ISIIT investments

There is extensive accounting and fmance literature which argues that capital budgeting techniques are appropriate techniques for appraising capital investments. On the other hand, there is also extensive ISIIT literature which argues that capital budgeting techniques are inappropriate for appraising IS/IT investments. In IS literature, fmancial approaches towards IS investment appraisal (predominately referred to as "economic approaches") are considered "traditional" (Alshawi et aI., 2003; Lee, 2004; Bardhan et aI., 2004; Ward et aI., 2007). The main arguments stem from the assertion that IS/IT is inherently different from other types of capital investment and, as a result, financial techniques which have historically been used to appraise capital investments are inappropriate for appraising IS/IT investments (Clemons and Weber, 1990; Bacon, 1992; Hochstrasser, 1992; Silvius, 2006).

Purely quantitative justification approaches such as NPV and IRR have been found to be inappropriate for measuring expected intangible benefits of IS such as improvements in flexibility, quality and other synergistic effects. For example, Hochstrasser (1992) argues that existing appraisal techniques are fmancially oriented, with particular emphasis on profit. Such techniques, he argues, are regarded as inappropriate given the nature of IS investments. For example, 'projects aimed to 'improve customer support', or to 'offer better market information' might, in the short-term, be impossible to quantify' (p. 18). ISIIT executives know there will be

unanticipated benefits from such investments, but cannot estimate them. In addition, Alshawi et al. (2003) argues that the use of these techniques tends to cause managers to focus on direct cost of the investment, ignoring indirect costs that have far reaching consequences for companies, e.g., the loss of revenue due to insufficiently trained employees.

Silvius (2006), Bardhan et al. (2004) and Locher et al. (2004) argue that traditional calculation methods are all limited in their ability to cope with risk and flexibility inherent in most IS investment decisions. This inflexibility experienced when using financial techniques forces managers to rely on gut instinct when finalizing IS investment decisions (Bardhan, 2004). Consequently, managers resort to setting arbitrarily high hurdle rates to compensate for high perceived risk (Parker and Benson, 1987).

In addition, capital budgeting methods fail to estimate complex interactions between IS and organisational performance. Clemons (1990) adds that part of the problem of using financial appraisal techniques when justifying IS investments comes from viewing even strategic opportunities to invest in IS as projects to be judged on their expected value. Financial benefits only address one dimension of the value derived from an information system - the impact on the shareholder, but no insight is provided into the impact on other stakeholders like customers and end users (Simmons, 1994).

In a contrasting view, Ashford et al. (1988) asserts that the criticisms directed at traditional appraisal methods may to some extent be based on misconceptions of the financial models and the ways in which they are best used. The alleged inadequacy of traditional financial appraisal techniques is not inherent in the techniques, but is due to the way in which the techniques are applied. For instance, the discount rate applied in an NPV calculation determines the accuracy of the cash flows generated, and errors can be avoided by correct analysis. As for the benefits ignored, many of these can be quantified and brought formally into the analysis.

Despite recognizing the limitations of the techniques, in addition to acknowledging that such techniques can never replace managerial judgement, Lumby (1981) argues that their usage can help to make judgements more sound than would otherwise be the case. Chen (2008) submits that both financial and non-financial considerations playa different role in capital budgeting. Financial analysis will lead to optimal investment decisions as long as a firm is able to estimate the parameters accurately, and non-financial considerations are recommended as an alternative when the firm cannot adequately implement DCF analysis.

2.3 Review of Existing Methodologies of IS Investment Appraisal

Numerous methodologies for predicting the potential return on IS investments have been advanced, focusing on different aspects of investment appraisal, besides fmancial viability, such as productivity (Brynjolfsson and Hitt, 1993), competitive advantage (Parker et aI., 1988), value creation (Griffiths and Remenyi, 2003), return on management (Strassmann, 1990), strategic fit (McFarlan, 1984) and risk (Remenyi and Heafield, 1995). Formal appraisal techniques can be grouped into the following four classifications:

(i) The economic approach

(ii) The strategic approach

(iii) The analytical approach

(iv) The integrated approach

Some of the techniques detailed in Table **2.1** have been discussed substantially in existing literature. The following section reviews literature on the more commonly used and discussed techniques (see asterisk * in Table 2.1).

Table 2.1 Taxonomy of IS Investment Appraisal Approaches

Classification	Appraisal technique	Characteristics	Reference Sources
	Gut feeling*	Purely judgemental in nature	
ECONOMIC APPROACHES (ratio based)	Payback	Purely quantitative in terms of benefits and costs	Dugdale(1991)
	Return on Investment (ROI)*	Purely quantitative in terms of benefits and costs	Suresh and Meredith (1985)
	Cost Benefit Analysis (CBA)	Purely judgemental in nature	Kakati and Dhar (1991)
Economic approach (discounting techniques)	Net Present Value (NPV)*	Purely quantitative financial technique with possible modified hurdle rates to account for the qualitative or strategic aspect	Kakati and Dhar (1991)
	Internal rate of Return (IRR)*	Purely quantitative financial technique with possible modified hurdle rates to account for the qualitative or strategic aspect	Hares and Royle (1994)
Economic approach (future value technique)	Real option pricing theory*	Quantitative financial technique. More complex that traditional economic approaches by including future value	Kambil *et al.* (1993)
STRATEGIC APPROACHES	Technical importance	Strategic decision as a measure of success	Naik and Chakravarty (1992)
	Competitive advantage*	Integration of strategic, operational and financial decisions into measures of success	Parker *et al.* (1988)
	Critical success factors*	Purely judgemental in nature. Integration of strategic, operational and financial decisions into measures of success	Hochstrasser and Griffiths (1991)
	Application portfolio approach*	Purely judgemental in nature. Integration of strategic, operational and financial decisions into measures of success	Ward (1990)
ANALYTICAL APPROACHES (portfolio)	Non numeric	Scoring technique with a formal structure to a judgemental approach	Suresh and Meredith (1985)
	Scoring models*	Scoring technique with a formal structure to a judgemental approach	Nelson (1986)
	Computer based techniques	Optimised approach involving analytic formulations with numerical solutions and different programming techniques	Primrose and Leonard (1987)
	Fuzzy logic	Optimised approach involving analytic formulations with numerical solutions	Awad and Wafik (1999)
ANALYTICAL APPROACHES (other)	Risk analysis*	Purely judgemental in nature. Scoring technique with a formal structure to a judgemental approach	Remenyi and Heafield (1995)
	Value analysis	Purely judgemental in nature. Scoring technique with a formal structure to a judgemental approach	Money *et al.* (1988)
INTEGRATED APPROACHES	Multi-attribute utility theory*	Purely judgemental in nature. Possible integrated approach where strategic, operational and financial decisions are integrated into measures of success	Sloggy (1984)
	Scenario planning and screening	Purely judgemental in nature. Possible integrated approach where strategic, operational and financial decisions are integrated into measures of success	Kennedy and Sugden (1986)
	Information economics*	Evaluation where financial aspects are considered first and strategic criteria applied next	Parker *et al.* (1988)
	Balanced scorecard*	Possible integrated approach where strategic, operational and financial decisions are integrated into measures of success	Kaplan and Norton (1996)

Adapted from Irani et al. (1997)

The terms 'appraisal' and 'evaluation' are frequently used within the IS literature in a synonymous manner. Ballantine and Stray (1998) have found that the term 'evaluation' is usually used to refer to the holistic consideration of IS projects at different times, for instance, before acquisition, during implementation and during the post-implementation review. Thus, in this study, the term 'appraisal' will be used to refer to the activities carried out during the feasibility stage of systems development or acquisition.

2.3.1 Economic approach

Financial returns are the most significantly considered criteria in business project appraisal. When fmancially appraising capital expenditures, capital budgeting methods have been used popularly. Typical techniques utilize Discount Cash Flow (DCF) methods, e.g. Internal Rate of Return (IRR) and Net Present Value (NPV), and ratio based techniques e.g. Payback Period (PP), Return on Investment (RO!), Return on Assets (ROA), etc (see standard finance and accounting texts e.g. Shapiro (2004) for an exposition on capital budgeting methods). Capital budgeting methods have been adopted in financially appraising capital investments in IS (Ballantine and Stray, 1999).

A recent survey of financial institutions by Gantry Group and SourceMedia ("How to Justify IS Investments", 2006) that focused on identifying the processes for IS investments analysis indicated that 90% of respondents considered economic justification as a key component in the decision process for making IS investments. To ensure accurate analysis, 50% of respondents are willing to allocate up to 57% of their total annual IS budgets toward economic appraisals. 46% of the banks and credit unions surveyed have formal processes in place to prioritize potential IS investments against each other based on expected economic return. Bacon (1992) in his survey of 80 major companies in the USA, Britain, Australia, and New Zealand identified and ranked the important decision criteria in IS investments. He found

that DCF methods are the most widely used investment criteria for IS projects. In contrast, a more recent research (Paul and Tate, 2002) found that ratio-based techniques were more widely used in IS investment appraisal.

Regardless of the financial appraisal techniques adopted by the firm in IS investment selection, Bacon (1992) found that budgetary constraints as a financial criterion figured the most, "i.e., 'Did we budget for it?'" (pp 342). Of the companies surveyed, 68 percent use budgetary constraint as a project investment approval criterion. It is applied by those companies that use it as a criterion to 64 percent of their projects. He attributes this trend to the need for improved planning and control in the use of IS resources in some companies. He also contends that there is very little likelihood of a formalized plan for IS projects where a capital budget for IS investments does not exist.

2.3.2 Strategic approach

Reservations that have been expressed about financial appraisal techniques have led some researchers to advocate for the use of strategic arguments in the appraisal of IS investments. Strategic analysis is concerned with understanding the internal organization of the firm and external business environment i.e. opportunities and threats, and developing business strategies to counter competition. Small (2006) proposes the use of criteria such as comparison with competitors, the retention, attainment or perception of industry leadership, and expected future developments in the industry, which serve as alternative factors to purely financial criteria for decision makers to approve IS projects.

Adopting a strategic approach to managing IS investment requires that each potential project is appraised to establish its "strategic fit" in the overall business, as its usage will have an effect on the business in the long run. Beimborn, Wagner, Franke and Weitzel (2007) found that there is a connection between the usage of a particular information system and the alignment between business and IS, thus emphasizing the importance of evaluating the strategic

fit of individual projects. Studies have shown that misalignment, or the lack of alignment, between IS and business strategies is one of the main reasons why organizations fail to realize the full potential of their IS investments (Ward and Griffiths, 1996; Hu and Huang, 2005). Consequently, organizations that have accomplished a high degree of alignment between business and IS are often associated with better overall business performance, and this alignment can only be achieved if fitting information systems are acquired on the outset. It is however important to note that in order for a firm to effectively evaluate the strategic fit of potential IS projects to the business, there need to be an existing overall IS strategy in which future investments in IS have already been forecasted and planned for (Leek, 1997; Cumps, Viaene and Dedene, 2006).

Scholars have illustrated how several tools and models can be employed in evaluating the strategic fit of IS projects. Among the most widely accepted techniques are value chain analysis, competitive analysis, appraisal of critical success factors and the adoption of an applications portfolio approach to investment appraisal.

Strassmann and Bienkowski (1999) contest the claim that, from a strategic standpoint, IS appraisal is effective only when intangible criteria are incorporated into the analysis. They propose that IS investments can only be aligned to overall business strategy if emphasis is placed on determining the expected financial returns. They however disregard the measurement of non-financial measures like market share and customer satisfaction, and consider financial returns as more significant since they can be incorporated into the financial budget, and proponents can be held accountable to them. In a similar vein, the Gantry Group and SourceMedia (2006) submit that measurement of the extent of the strategic impact of an IS investment can only be achieved through economic analysis. In their survey of banking institutions, 66% of responding institutions indicated that the primary driver of economic analysis is the need to align IS expenditures with corporate business objectives.

While the adoption of a strategic approach to IS investment appraisal is beneficial for firms as illustrated in literature, there are downsides to the exclusive use of these methods. Powell (1992) argues that firms that adopt the strategic perspective to IS investments devote less effort in appraising projects due to competition or "perceived competition". In a different survey of the use of Decision Support Systems in accounting, Powell (1992) found that firms adopted the new technology for the sake of corporate image, so as not to be seen as lagging behind their competition. Thus these projects were exempted from the normal review process established in the firm.

2.3.3 Analytic Approach

The move towards merging economic and strategic approaches has seen the evolution of several weighted scoring models which allow management to assign weights to each tangible and intangible factor under consideration (Locher et aI., 2004). Analytic investment appraisal techniques collect more information and frequently consider uncertainty and multiple measures and effects. According to Meredith and Suresh (1986), the superiority of these techniques is that they are more realistic, taking more factors and subjective judgements into account, and hence better reflect reality as understood by knowledgeable managers 0. However, Chan et aI., (2001) maintain that although a computer can be used for the complex analysis, it is time consuming to collect data for analysis.

Analytical approaches IS investment evaluation are structured in design but subjective in nature, with their use often including project risk besides tangible and intangible factors(Irani et aI., 1997). Scoring models, risk analysis, simulation modelling and value analysis are among the most commonly discussed techniques in IS evaluation literature.

Scoring models possess multiple criteria capabilities, are simple to use, and can take management policies into consideration (Suresh and Meredith, 1985). These techniques represent the importance of each strategic factor by weights determined by management (Small,

2006). An example of a sophisticated scoring model is the analytic hierarchy process (Stewart and Mohammed, 2002b).

IT risk-management has been acknowledged as one of the important issues facing information systems (IS) executives today. As spending on IS rises steeply, organizations become increasingly technology-dependent and, consequently, they become highly vulnerable to the risks ofIS failure (Bandyopadhyay ,Mykytyn and Mykytyn, 1999). To reduce a project's overall risk, Clemons (1990) proposes that components of IS risk such as technical, project, financial, functionality, environmental and systemic risk should be actively managed while undertaking strategic IS programs. Not assessing the risk of an IS investment could result in failure to obtain some or all of the anticipated benefits, incurring more costs than originally anticipated (Schniederjans et aI.., 2004). Researchers have analysed several approaches to risk analysis for IS investments, such as Real Option Analysis (Xiao-lin, 2006; Schwartz and Zozaya-Gorostiza, 2003; Bardhan et aI., 2004), value-at-risk portfolio analysis techniques (Kauffman and Sougstad, 2007), most of which have been informed by literature from financial economics.

Value analysis methodology as IS investment evaluation technique is based on making value-costs assessments of proposed IS investments. Value analysis as explained by Schniederjans, Schniederjans and Hamaker (2004) involves prototyping and surveying to determine the value of benefits of an IS investment. An IS prototype is proposed, its costs determined, and potential benefits identified, valued and compared to the costs. If the benefits exceed the costs, the potential project is viable and should be implemented. If not, the project may be scaled down and the cost/benefit comparison re-examined. Several iterations of value analysis are carried out until the desired result is achieved. Value analysis is an appropriate evaluation technique for IS investments whose benefits are expected to be largely intangible, as it adopts a qualitative approach to investment analysis (Locher et aI., 2004).

Simulation modelling and analysis has been used to support the process of identifying business change opportunities and evaluating IS investments. Simulation as an appraisal technique allows organizations to experiment with various alternative decisions and assess the impact of each alternative on business performance for investments that are expected to yield intangible and/or indirect benefits as opposed to hard or strategic ones (Giaglis, Paul and O'Keefe, 1999).

Other analytic appraisal techniques include computer based techniques and fuzzy logic (see Chen, et aI., 2000 for a practical application of fuzzy logic).

2.3.4 Integrated approach

Recent studies have promoted integrated appraisal approaches to alleviate the problems inherent in using purely financial or purely strategic appraisal approaches. Integrated approaches combine somewhat subjective strategic approaches with formal structure found in economic approaches. Appraisal techniques in this approach integrate financial and non-financial dimensions together, through the acknowledgement and assignment of weighting factors to the intangible implications of the project, usually incorporating project risk (Stewart and Mohamed, 2002a).

One integrated approach to IS investment evaluation is Information Economics, developed by Parker and Benson's (1988). In this technique, value is seen as a broader concept based on the effect an IS investment has on the business performance of the firm. It seeks to identify and measure or rank the economic impact of the changes brought about by the introduction of the new system on the firm's performance. Building on traditional cost benefit analysis with four additional techniques (value linking, value acceleration, value restructuring and innovation valuation) to establish an enhanced return on investment calculation (EROI), information economics incorporates a business domain assessment (BDA) and a technical domain assessment (TDA). The BDA considers business factors such as strategic match,

competitive advantage, management information support, competitive response and project and organisational risk, while the TDA considers technical factors such as strategic IS architecture and IS infrastructure risk. The value or economic impact of IS is then determined by combining the EROI, BDA and TDA. Although this technique appears mechanical, and contains a subjective basis of many of the scores, it provides a useful checklist for assessing the wider impact of introducing systems, rather than focusing on limited financial data (Grembergen, 2001). Information Economics has been found to be useful as it utilises the concepts of value and risk, providing a framework that enables managers to consider and evaluate potential total positive and negative impacts of an IS project (Stewart and Mohamed, 2002b).

The Balanced Scorecard system for measuring finn performance was first introduced by Kaplan and Norton (1992), who argued that traditional fmancial accounting measures such as return on investment can only give limited or even misleading signals for competitive business activities. In addition to applying the Balanced Scorecard as a performance management tool for business as a whole, attempts have been made to apply this tool to narrowly defmed corporate functions, such as the IS department. Hu and Huang (2005) in a case study found that the adoption the balanced scorecard tool in IS investment evaluation contributed to the alignment of IS and business strategies in firms by acting as a platform for the communication between IS and business managers, as well as by strengthening the connections between IS and business planning processes.

Silvius (2006) proposes an 'IT Balanced Scorecard', enriched with the customer perspective showing the impact of the investment on the marketing proposition of the organisation, the impact of the investment on the business processes and possible competitive effects of the investment. Although the balanced scorecard technique relatively reduces the number of measures that managers should consider while evaluating potential investments, Schneiderman (1999) argues that this technique could fail because it incorrectly identifies nonfinancial variables as the drivers of performance, its metrics are poorly identified and high-level goals are not broken down into feasible sub-processes.

Although firms have adopted a more complex approach to evaluating IS investments, they are not utilizing these sophisticated techniques developed by academicians as a means of improving justification decisions (Small, 2006; Samakovitis and Fleck, 2006). This phenomenon may be attributed to the difficulty in understanding and applying these techniques, which continue to evolve along different paths and are extremely difficult to complement or otherwise synthesise, even where attempts are made to do so.

2.4 Act of Faith

In addition to these formal approaches, researchers have found that managers often rely on methods which do not fall within the boundaries of formal investment appraisal methodologies, thus making decisions based on their personal feelings about potential investments. Such decisions are based on 'acts of faith', 'blind faith' (Weill and Olson, 1989) or 'gut instinct' (Powell, 1992 and Bardhan et aI., 2004) or even 'strategic insight' (Bannister and Remenyi, 2000). These methods have often been "used" in very complex decisions (Remenyi, 2000), or due to the lack of adequate guidelines for evaluating investments (Weill and Olson, 1989).

2.5 Previous Studies on the Use ofInvestment Appraisal Techniques

Empirical studies reported in the accounting and finance literature provide a general picture of the extent to which capital budgeting are used to appraise capital projects, in addition to indicating how patterns of usage have changed over time. Studies have consistently shown that payback has been the most widely used technique for appraising capital investments (Klammer, 1991). The more 'sophisticated' techniques of Net Present Value (NPV) and Internal Rate of Return (IRR) have for some time been gaining in use and importance within organizations (Gitman and Forrester, 1977; Pike, 1982).

Gitman and Forrester (1977) conducted a survey to find out what capital budgeting techniques were being used by 103 major U.S. companies who replied to their 1977 survey of the 600 companies that Forbes reported as having the greatest stock price growth over the 1971-1979 period. The survey contained questions concerning capital budgeting techniques, the most important and most difficult stages of capital budgeting, the cutoff rate and the methods used to assess risk. Respondents indicated that the most difficult and most important stage of the process involves the definition and estimation of cash flows. In spite of this, sophisticated techniques for primary analysis were most popular, particularly the internal rate of return. For secondary analysis, the use of the payback period was indicated by a large number of respondents. In addition, they found that firms make capital expenditures on a competitive basis to allocate a fixed budget. The major cause of capital rationing was a debt limit which was imposed internally by management. Finally, they found that firms give explicit consideration to risk and uncertainty, and that the use of risk-adjusted discount rates and/or certainty equivalents to adjust for risk is quite popular. In summary, it is evident that the major firms in the U.S. are utilizing many of the tools of analysis presented in the fmancial theory for analyzing capital budgeting projects.

Comparison between empirical studies on the use of capital budgeting techniques to appraise general capital investments in accounting and finance literature, and the use of these techniques to appraise IS investments in IS literature reveals a difference in the level of usage of these techniques, and the type of techniques applied. While financial techniques, especially discounted techniques, are used significantly for general capital investments, IS literature reveals that simple ratio techniques such as payback period, CBA and ROJ are more commonly used, in conjunction with qualitative techniques that consider technical and strategic arguments (Bacon, 1992; Ballantine and Stray, 1998; Lin et aI., 2005; Small, 2006). Discounted techniques, which are gaining popularity in general capital investment appraisal, have been found to be unpopular in IS literature.

Bacon (1992) studies the criteria organizations use to make IS investment decisions. He used fifteen criteria, where six were financial, six management, and three development. In 1990, he surveyed 80 major companies in four countries: the United States, Britain, Australia, and New Zealand. The companies were asked to indicate which criteria they use, the percentage of projects to which each criterion is applied, and the overall ranking in terms of total project value for each criterion. His results show that discounted cash flow (in the form of Net Present Value, Internal Rate of Return, and Profitability Index Method) is used as an investment criterion for 1ST projects by about 75 percent of the Fortune 500 type of companies that participated in the survey. Overall, DCF techniques are applied to only 40 percent of all projects in the sample, although it is evident that DCF is important in the evaluation of large projects. Except for the Budgetary Constraint criterion, the Payback Method is the most widely used financial criterion. Response to Competitive Systems is used as an investment criterion by 61 percent of the companies in the sample, by whom it is ranked sixth out of 15 in importance. According to him, this reflects the increasing significance of information systems and technology in today's competitive business environment. There were two probability/risk assessment criteria included in the survey, namely Probability of Project Completion and Probability of Achieving Benefits. The completion criterion is used by one-third of the companies. The benefits criterion is used by about half of the companies. The development criterion Technical/System Requirements is used by most companies in the sample.

Ballantine and Stray (1998) consider the extent to which financial techniques are used to appraise ISIIT investments. The survey, which was carried out in 1993, examined the IS/IT appraisal practices of a sample of 98 organizations (a response rate of 55%) consisting mainly of organisations from the manufacturing, construction, electronics and engineering, and wholesale/retail sectors drawn from the Times' Top 1000 companies. They found that the majority of companies (72%) in the study used cost benefit analysis to appraise the feasibility of the most recent project, the next most popular techniques used being payback and Return on Investment (ROD/Accounting Rate of Return (ARR). Only 24% of respondent organizations

use the more sophisticated discounted cashflow techniques of NPV and IRR to appraise feasibility, a level of usage the authors consider small. The profitability index (PI) and return on management (ROM) were rarely used to appraise the most recent project. The survey also identified various problems with the ISIIT investment decision-making process within the respondent organizations, as follows: difficulties in quantification of relevant costs and benefits, unfamiliarity with project appraisal techniques, difficulty with interpretation of results, calculation of discount rate and organizational problems like lack of time, data/information and lack of interest.

Lin, et al. (2005) surveyed large Australian organisations establish current industry and government practices and norms in managing IS/IT benefits and evaluation. Following analysis of the survey, in-depth case studies were carried out to evaluate and compare results from the survey. For the survey respondents, when asked about the specific methods/technique used to decide upon ISIIT investments, the traditional financially oriented evaluation techniques such as net present value (NPV) and costlbenefit analysis (CBA) were the most commonly mentioned techniques. However, after examining measurements or evaluation instruments such as SLAs, monthly reports, standard contract management, standard project management methodology, the authors found that in reality, only informal IS/IT investment evaluation processes were used. Further, during the case studies, none of the participants mentioned any formal IS/IT investment evaluation process or methodology.

Small (2006) presents the results of an investigation on the justification of investments in advanced manufacturing technology (AMT) at manufacturing plants in the USA. He uses mail survey responses from a sample of 82 plants to examine the relationships between the type of technology portfolio being used and the justification approaches and evaluation techniques that were utilized to justify these investments. In his analysis of the usage of justification approaches, he found that almost 75 percent of their responding plants reported that they had used hybrid justification approaches. According to him, the fact that the vast majority of plants with high- and moderate-complexity portfolios had utilized hybrid justification methods might

be indicative of the difficulty of justifying the integrated information/logistic and integrated process systems on purely financial bases. On the usage of financial appraisal techniques, he found that payback and ROI had been used by 58.7 and 53.3 percent of the respondents, respectively. The third most popular technique was cost-benefit analysis which was being used by 44.0 percent of the respondents. Furthermore,over 89 percent of all the responding plants and over 80 percent of users in each portfolio classification were using at least one of the ratio techniques. The DCF techniques ofNPV and IRR were being used by 34.7 and 22.7 percent of the respondents, respectively. Of the respondents, 41 percent were using at least one of the DCF techniques. His results, which indicated that most plants are not using the more sophisticated techniques, such as DCF, Risk Analysis and weighted scoring models, led him to conclude that the major impediment to the use of many of these techniques appears to be their high level of complexity when compared to the traditional ratio appraisal techniques.

Various empirical studies have attempted to establish a relationship between the size of an organization and the use of particular techniques of appraisal (Pike, 1996; Sangster, 1993; Arnold and Hatzopoulos, 2000). Most of these survey studies conducted between 1975 and 2000 findings suggest a relationship between size and the method of capital appraisal companies select.

Pike (1996) presents a trend analysis of the change in use of capital budgeting techniques by large UK firms, over the period 1975 - 92. The survey was conducted at three points in time, and all three surveys asked respondents to report current capital budgeting practices for larger projects. In 1980, a questionnaire was sent to 208 largest quoted UK companies requesting them to indicate their capital budgeting practices in 1975 and 1980, and 150 usable responses (72% response rate) were obtained. In 1986, the same questionnaire was distributed to 140 of the companies that participated in the earlier survey, and 100 usable responses (71 %) were obtained. In 1992, Pike (1996) revisited the same 140 firms responding in 1980 and operating in 1986 in a third survey, where 99 usable responses were obtained (78.1). In his analysis, Pike (1996) observes that the requirement by larger firms to adopt a

specific search for, and screening of, project alternatives has moved from being commonplace (76%) in 1975 to being totally accepted by all firms in 1992. On the use of investment evaluation techniques, he found that steady progress in adoption has been achieved. Discounted cash flow methods, such as internal rate of return (IRR) and net present value (NPV) are well established among these large firms with 81 per cent and 74 per cent usage respectively. On the usage of multiple techniques, in 1975 most firms adopted either one or two methods (typically PB and ARR), by 1992 a combination of four methods (PB, ARR, IRR and NPV) was most common (36%), a threefold increase since 1980. In addition, Pike (1996) found that the use of IRR and NPV continue to be highly associated with firm size by demonstrating a remarkable consistency in size and investment sophistication association over the 17 years he reviewed. Further, in his 1992 survey, Pike (1996) found that investment practices where regularity of use (i.e. rarely, often, mostly, always) is associated with size of firm, a correlation he was able to establish using chi-square tests.

Sangster (1993) presents contrasting findings in his surveys of current investment appraisal practice on a sample of 491 companies from Scotland's Top 500 Companies. One survey covered 'large' companies, the other 'small', their relative size being on the basis of turnover. The survey sought to answer questions on the current usage of payback, IRR, NPV and ARR, and the difference in the usage of DCF techniques between large and small companies. A comparison of the results from the two studies revealed no significant difference in the frequency of usage of NPV between the large and small companies. Sangster (1993) argued that the Scottish studies findings show that size may no longer have the major impact upon organizational practice, as claimed by earlier researchers like Pike (1984) and Pike
(1988).

Nevertheless, Pike (1996) adds a caveat that firm size per se may not be the direct causal factor in determining use of sophisticated methods. He suggests that the size of a firm influences the use of computer-based capital budgeting packages which, in tum, influence the use of discounting methods, sensitivity analysis, and risk analysis techniques. Once size ceases

to be associated with use of computers in capital budgeting, he envisages that it will also have far less impact on capital budgeting technique usage rates.

Arnold and Hatzopoulos (2000) considered the extent to which modem investment appraisal techniques are being used among large UK corporations. Out of the 300 companies to whom questionnaires were sent, 145 responses were received, of which 96 were usable. 38 of the responding companies were large, 24 medium and 34 small. They found that all large firms were using discounted techniques, and over 90% of small and medium sized firms were using these methods. NPV was more popular than IRR among large firms in the UK. In addition, they found that two thirds of the firms surveyed were using multiple techniques, with 29% of them using NPV, IRR Payback and ARR.

Much empirical work has investigated the nature of IS appraisal in large organizations. However, little work has examined the nature of evaluation in small and medium-sized enterprises (SMEs). In an attempt to narrow this gap, Ballantine et aI., (1998) studied four SMEs to identify factors that affect their approach to ISIIT appraisal. They found that SMEs generally have limited access to capital resources, place an emphasis on. automating, are often under the influence of major customers and have limited information skills. The combination of these factors results in a lesser need to use investment appraisal techniques when selecting potential IS projects. This analysis may explain why small firms are likely not to use complex appraisal techniques.

In addition to firm size, there are other elements that may contribute to the selection of particular techniques, such as type of investment (Farbey, 1992; Irani et aI., 1997; Small, 2006) and how companies allocate the IS investment decision making responsibility (Paul and Tate, 2002). Nevertheless, this research is limited to reviewing the relationship between firm size and the techniques a firm uses.

2.6 Limitations and Gaps in Extant Literature

The review of literature presented above reveals a number of gaps and limitations in current research on investment appraisal.

Extant literature does not examine the gap between the application of fixed asset investment theory to IS investments, and practise. Scholars suggest that financial techniques (predominately referred to as "economic approaches") are considered "traditional", and are not widely used to evaluate potential IS investments. (Alshawi et aI., 2003; Lee, 2004; Bardhan et aI., 2004; Ward et aI., 2007). This suggests a gap between what scholars and practitioners consider as acceptable and realistic IS investment appraisal practice. No studies that attempt to examine this gap between theory and practice of investment appraisal for IS projects in particular have been found.

Further, researchers have not explored the use of non-fmancial and qualitative appraisal techniques that were originally not developed specifically for IS appraisal, such as information economics, the balanced scorecard, SWOT analysis, CSF, Scenario planning and screening, application portfolio and value analysis. The literature reviewed highlights the shortcomings of quantitative appraisal techniques, and researchers have suggested the inclusion of qualitative techniques (Parker and Benson, 1987; Lee, 2004; Clemons and Weber, 1990; Bacon, 1992; Hochstrasser, 1992; Simmons, 1994; Alshawi et aI., 2003; Bardhan et aI., 2004; Locher et aI., 2004; Silvius, 2006). However, they do not examine whether qualitative methods are used, and to what extent they are used.

An attempt to understand the practice of IS investment appraisal from the perspective of the fixed asset investment theory will be useful when evaluating the relevance of the theory for IS projects.

2.7 Research Hypothesis and the Conceptual Framework

In order to answer the research questions in this study, two major propositions will be examined in relation to the investment evaluation approaches used in banking institutions in Kenya. First, this study examines whether economic techniques are more prevalent in IS investment evaluation in Kenyan banks relative to the other three classifications of evaluation techniques, i.e. strategic, analytic and integrated approaches. Second, the study examines whether large firms tend to use more sophisticated appraisal techniques. Two research hypotheses have been formulated, and are discussed below.

HI. Economic approaches are more prevalent in IS investment evaluation in Kenyan banks relative to the other three evaluation approaches, i.e. strategic, analytic and integrated approaches.

Empirical studies discussed earlier show a heavy reliance on the use of financial techniques to appraise both general capital investments and IS investments (Klammer, 1972; Gitman and Forrester, 1977; Pike, 1982; Bacon, 1992; Ballantine and Stray, 1998; Lin et al., 2005; Small, 2006; Chen, 2008). Discounted cash flow techniques are used significantly for general capital investments, and simple ratio techniques such as payback period, CBA and ROI are more commonly used to appraise IS investments. Although economic techniques are used in conjunction with qualitative techniques, it seems that IS executives place more emphasis on these simple ratio techniques.

Techniques adopting a strategic approach have only recently been formalised, and applied to IS investment appraisal, to supplement the result of an economic appraisal (Chen, 2008). IS executives have been found not to be using these formal non-financial techniques much, as they are difficult to apply and understand (Small, 2006; Samakovitis and Fleck, 2006). Thus, it can be argued that in the Kenyan banking sector, IS executives would tend to focus on

simple ratio-based techniques that have been used to appraise other general capital investments by other departments in the firm.

H2. There is a relationship between the approach a firm adopts when evaluating potential IS investments and the size of the firm. In particular, firms that use more complex evaluation techniques will tend to be larger than those that use simpler techniques

Empirical studies have established a relationship between the size of an organization and the use of particular techniques of appraisal (Pike, 1996; Arnold and Hatzopoulos, 2000). These studies reveal that large firms tend to use discounted cash flow techniques. **On** the other hand, small firms have historically focused on ratio-based techniques for investment appraisal. However, Pike (1996) found that small firms have gradually begun to adopt discounted cash flow techniques in their analysis.

Therefore, it can be argued that small firms are likely to use simple appraisal techniques that adopt the economic or strategic approach, such as ROI, PP, CBA, technical arguments, SWOT analysis and CSF. On the other hand, large firms are likely to use more complex techniques like risk analysis, value analysis, information economics and the balanced scorecard.

L

Figure 2.1 provides a conceptual model of the hypothesized relationship between the use of IS investment appraisal techniques and the size of the firm in the banking industry.

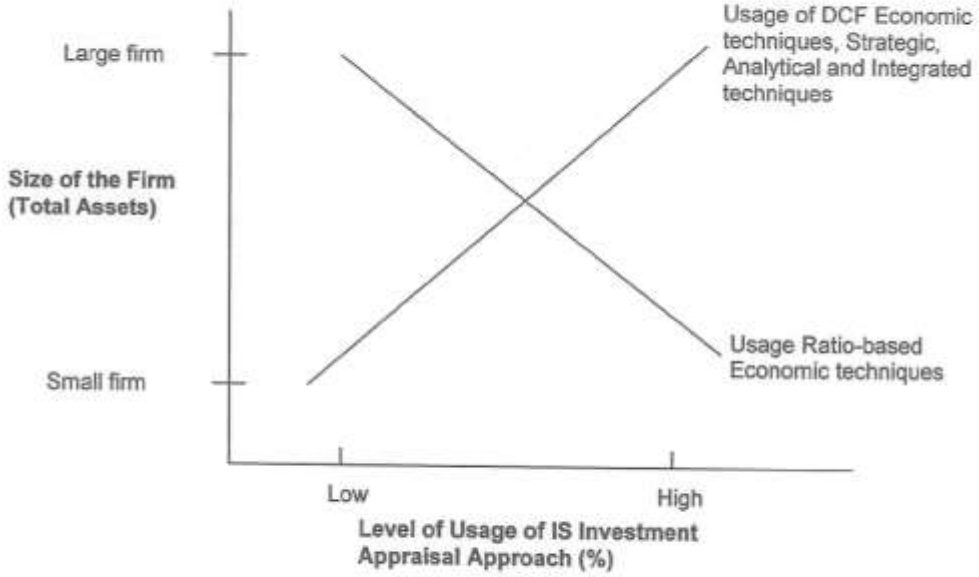

Figure 2.1 A conceptual model illustrating the association between the size of a firm and the use of IS Investment appraisal techniques

Chapter 3 . RESEARCH METHODOLOGY

3.1 The Research Design

Historically, cross-sectional survey research has been a popular research method for quantitative, empirical studies examining topics related to IS investments, such as IS investments and firm performance (Weill and Olson, 1989; Harris and Katz, 1991), evaluation of ISIIT benefits (Ward et aI., 2007) and examination of ISIIT investment appraisal techniques (Bacon, 1992; Ballantine and Stray, 1998; Lin et aI., 2005; Small,2006).

This study therefore employs a similar cross-sectional survey research design for three main reasons. First, data collected from this study will provide descriptive statistics to be compared to fmdings documented in past research. This comparison will lead to the analysis of any similarities and discrepancies between the collected and documented data in relation to IS investment appraisal practices. Second, data collected will also be statistically analysed to assess the existence of a relationship between the investment techniques a firm uses and the size of the firm. Third, survey research provided benefits such as a quick turnaround, relatively low cost, and greater privacy for respondents.

3.2 Population and Sampling

The target population of this study is banking institutions in Kenya. The Kenyan commercial banking system, which consists of 43 institutions, is dominated by several commercial banks and a small number of non-bank financial institutions which concentrate mainly on mortgage finance, insurance and other related financial services (0100, 2007). Due to the size of the banking industry, the whole population on banking institutions was included in this study. Thus, no sampling procedures were conducted. **It** has been noted that in comparison to studies on investment appraisal conducted elsewhere, the size of the population in this study is small.

3.3 Data Collection

A questionnaire was used to collect information for this study. The correspondence containing the questionnaire and a cover letter was addressed to top-level corporate managers heading the information technology function in the institution, usually referred to as the Head of Information technology, or the General Manager - Information Technology at most banks. Bacon (1992), in a study of the criteria organizations use to make IS investment decisions received 85% of his responses from IS executives (Chief Information Officer, IS Manager, IS Planning Manager and IS Controller), and 13% from the Chief Financial Officer. These response demonstrates that the decision to invest in IS is justified by IS professionals. Therefore, the head of the IS function was identified as the most suitable person to comment on the IS investment appraisal process of IS project acquisition decision making process in the bank.

The questionnaire prepared was reviewed by managers at three banking institutions to critique the content, structure and relevance of the instrument. These reviewers responded favourably to the questionnaire, recommending some minor changes such as incorporating a brief explanation of the investment appraisal techniques in the questionnaire.

The questionnaire gathered information on the IS investment approaches and the appraisal techniques that are being used during the appraisal process, and information on the level of spending on IS.

The main secondary data source for this study is the Banking Survey 2007 (0100, 2007) and the Central Bank of Kenya reports .

3.4 Data Analysis

3.4.1 Appraisal approaches

Respondents were supplied with a comprehensive list of appraisal techniques grouped according to the appraisal approach they adopted i.e. economic, strategic, analytical and integrated, and asked to indicate specific techniques they have used in their analyses. The questionnaire also asked respondents to indicate other techniques they have used that are not included in the list provided.

For each of the approaches, banks were awarded a score of 1 if they used the approach and 0 if they did not. The survey results provided the percent of companies that use a given IS investment appraisal technique.

3.4.2 Appraisal approach and firm size

To examine empirically the correlation between firm size and the IS investment appraisal approach adopted within banking institutions, two methodologies were used: chisquare cross tabulation analysis and regression analysis.

3.4.2.1 Chi-square cross tabulation analysis

To test whether there is a relationship between the appraisal approach and firm size, the chi square CX) test for independence was computed for each appraisal approach, and for the pool of all appraisal techniques. Preliminary X tests indicated that there was a significant relationship between the two classifications, with a p-value of 0.000 at the 0.05 level of confidence. To further analyse and explain this relationship, X tests were conducted for each of the appraisal approaches independently.

In addition, the appraisal techniques were cross-tabulated against the firm size.

3.4.2.2 Simple linear regression analysis

In addition to the Chi square analysis, simple linear regressions were also performed on the two variables (the usage of an IS appraisal approach and the size of the firm). The model measures the relationship between the usage of an IS appraisal approach and the size of firms. The dependent variable used in the regression analysis is the IS investment appraisal approach, i.e. the economic, strategic, analytical or integrated approach. The independent approach is the size of the firm, measured by the Total Asset value of the firm.

The basic regression model is:

$$ITA = \beta_0 + \beta_1 TA$$ where

ITA - the level of usage of an IS Appraisal Approach
TA - Total Asset value of a firm

To better understand the nature of the relationship between the appraisal approach the firms use and the firm sizes, the three classifications of firm sizes were regressed against each appraisal approach in different combinations, as follows:

- Large and medium sized banks
- Large and small banks
- Medium-sized and small banks

This approach aims at testing the existence, nature and strength of the relationship among different classifications. For example, significant results may be obtained when regressing large and medium sized banks against the economic approach, but not for the regression of medium-sized and small banks against the same approach. If the relationship between finn size and the economic approach is strong and consistent in all three cases, then

one may conclude that the relationship is persistent throughout the banking sector, regardless of firm size.

3.4.2.3 The measure of firm size

The size of a firm may be measured a number of ways: assets, sales, employees and value added are commonly used measures. Harris and Katz (1991) in their study of the relationship between firm size and IS investment intensity in the insurance industry used premium income as their measure of firm size. Turner (1982), while analysing whether large banks use IS more intensively than small banks, measured firm size using an index consisting of total bank assets, net income, and the number of full-time equivalent staff.

For the purposes of this study, however, using interest income as a measure offirm size may confound the results, due to its potential volatility over time (Chaya and Mitra, 1996). In Kenya, there has been a drastic drop in interest rates over the last ten years. 0100 (2007) in his survey of the Kenyan banking sector found that in spite of loans and advances growing by 148% between 1997 and 2006, interest income has grown by a paltry 3%. While the drop in interest rates affected large banks negatively, medium and small banks have realised robust growth in interest incomes over the ten year period. As a result, there has been a shift from reliance on interest income to non-interest income streams. Due to this inconsistency, the use of interest income as a measure of finn size may confound the results.

Technological theories of the firm, which emphasise physical capital and economies of scale and scope arising out of capital inputs, argue for using assets or sales as a measure of size (Kumar, Rajan and Zingales, 1999). Information technology expenditure, which are considered to be capital investments, have a direct impact on these economies of scale and scope, and are included in the total asset figure while preparing financial statements. Thus, when considering

the size of a firm in relation to information technology, total assets as the measure of firm size is more applicable, and has been used in this study.

The total assets measure crunches the cumulative asset portfolio owned by the banking institution. The respondents were sorted into three tiers on the volume of assets they own, as follows:

Table 3.1 Survey Responses by Total Assets

Firm size	Total Assets (millions)	Participating banks	Percentage
Large	30,001 and above	6	24%
Medium	6,001 - 30,000	9	36%
Small	6,000 and below	10	40%
		25	100%

Chapter 4 . RESEARCH FINDINGS

4.1 Descriptive Statistics

Out of the 41 questionnaires hand-delivered to the banking institutions, a total of 25 responses were obtained. During the survey, telephone calls were made to the IS executives to encourage them to complete the questionnaire. Five banking institutions opted not to participate in the survey, in most cases due to corporate policy.

The response rate was 60.97%. Analysis of non-response using ANOVA ~ests revealed that there were no statistical differences, at the 5% level of significance, between the respondents and non-respondents with respect to total asset distribution. Thus, it was concluded that the achieved sample was representative ofthe banking industry population.

Total asset values of the responding banks for 2007 ranged from Kshs 744 to Kshs 91,252 million, with a mean and a median of Kshs 16,451 million and Kshs 7,039 million respectively. The large variance of total assets and difference' between the mean and the median illustrate the structure of the banking sector in Kenya. The sector is dominated by 10 banks that control more than 75% of the market, with the remaining 32 banks sharing the balance. This scenario is also reflected in other measures such as customer deposits, loans and advances to customers and earnings (0100, 2007).

The average IS budget allocation within the banks ranged from Kshs 1.167 million to Kshs 528 million, with a mean allocation of 61 million, and a median of Kshs 26.5 million. This scenario also reflects the disparity in bank sizes, and consequently, IS spending.

1.

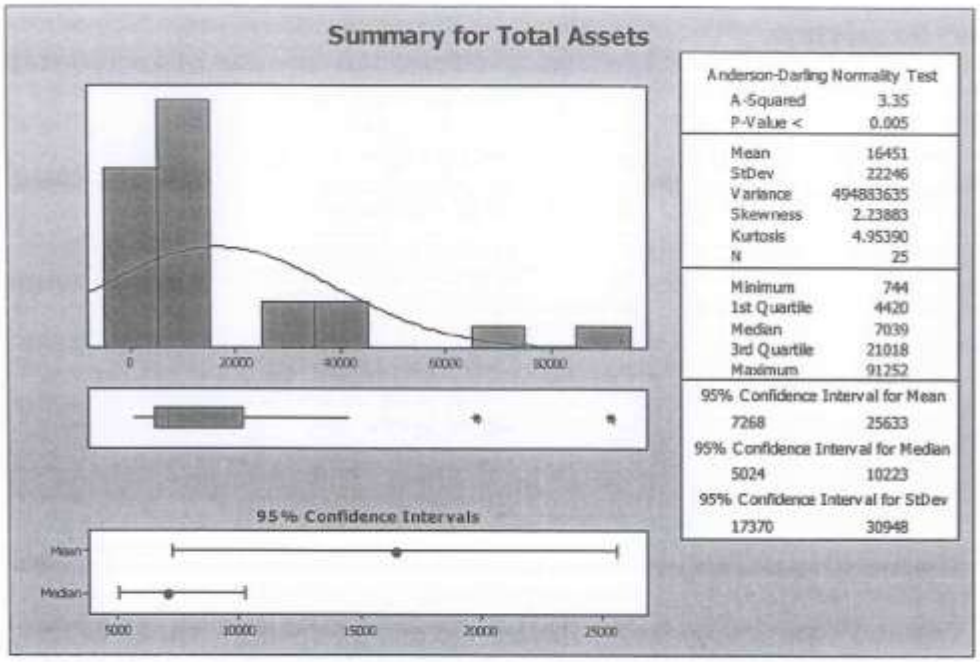

Figure 4.1 Descriptive Statistics by Total Assets

The actual respondents by job title are shown in Table 3.2.

Table 4.1 Survey Responses by Job Title

Job Title	No of Responses
Manager IT	11
Head of ICT	12
Head of Finance, IS and Administration, or Operations	2
Total	**25**

4.2 Appraisal approaches

Respondents were asked the following question:

> Excluding routine maintenance work, which of the following criteria do you use in making the basic go-ahead decision on systems development projects and computer hardware or software facilities?

Frequency distributions were used to determine the level of usage of a technique among responding institutions. For each of the approaches, banks were awarded a score of 1 if they used the approach and 0 if they did not. The survey results in answer to this question provided the percent of companies that use a given IS investment appraisal technique, as shown in Table 4.2. All respondent banks in the survey used more than one approach to make a decision regarding the feasibility of an IS project. This might be indicative of the difficulty of justifying the investment in IS on the basis of one technique or approach.

All of responding institutions indicated that they used at least one of the economic techniques to appraise potential IS projects. Most institutions used more than one fmancial technique to appraise their investments. The most popular economic technique is the Cost Benefit Analysis (CBA) method (92%), while Internal Rate of Return (IRR) ranked the lowest (0%). Ratio based techniques were found to be very popular, with 100% of the respondents using them to evaluate IS projects. Besides CBA, Payback Period and Return on Investment were both used by 60% of the responding institutions. Only 8% of banking institutions use at least one of the discounting techniques. Net Present value is used by 8% of the banks, while IRR is used by none of the responding banks. Overall, the limited use of discounting techniques raises questions as to the extent of the use of cash flows to appraise potential projects.

The results of this study on the use of economic techniques differ with the fmdings of previous research on capital budgeting for general capital investments, where discounting techniques were found to be more popular than ratio-based techniques (Gitman and Forrester, 1977). This study confirms findings in IS literature which reveal that simple ratio techniques such as payback period, CBA and ROI are more commonly used (Bacon, 1992; Ballantine and Stray, 1998; Lin et aI., 2005; Small, 2006). Discounted techniques, which are gaining popularity in general capital investment appraisal, have been found to be unpopular in IS literature.

2.

Table 4.2 Usage and Application of a Given IST Investment (Project Selection) Criterion

Classification	Appraisal technique	No of banks using the technique	% of banks using the technique
	Gut feeling	6	24
ECONOMIC APPROACHES (ratio based)	Cost Benefit Analysis (CBA)	23	92
	Payback period	15	60
	Return on Investment (ROI)	15	60
(discounting techniques)	Net Present Value (NPV)	2	8
	Internal rate of Return (IRR)	0	0
STRATEGIC APPROACHES	Technical importance, operational functionality criteria	23	92
	Competitive advantage	16	64
	Critical success factors	13	52
	SWOT analysis	13	52
	Application portfolio approach	10	40
ANALYTICAL APPROACHES	Risk analysis	19	76
	Value Analysis	7	28
	Scoring models	4	16
	Computer Based techniques	1	4
INTEGRATED APPROACHES	Balanced scorecard	14	56
	Information economics	10	40
	Scenario planning and screening	8	32

The results indicate a strong preference for strategic appraisal techniques. Of the strategic techniques used, technical arguments are used by 92% of responding banks, followed by Competitive Advantage (64%), and Critical Success factors (CSF) and SWOT analysis, both used by 52% of the institutions. These findings confirm the findings of Bacon (1992) who found that 71 % of IS executives in his study highly considered the technical functionality of a

potential system when making investment decisions, and 61 % used a criterion based on competition.

The Applications Portfolio approach was used the least, by 40% of the respondents. Cao et al. (2006) describe the Applications Portfolio as a new approach which is implemented by "fitting" systems into an overall strategic structure. Thus, the limited use of this technique may be attributed to its newness as an IS investment appraisal technique.

Both the analytical and integrated approaches are used the least during IS investment appraisal among Kenyan banking institutions. Of the analytical techniques, the most prevalent technique is Risk Analysis, which is being used by 76% of the respondents. These results differ from the findings of Small (2006), who found that only 6.7% of the firms in his survey of manufacturing plants in the USA conducted a Risk Analysis during investment appraisal. Other surveys on the use of investment appraisal techniques do not discuss the analysis of risk independently of other economic or integrated techniques. However, this does not imply that more effort is applied on risk analysis among Kenyan banks than in US, UK or Australian firms. Rather than conducting an analysis of risk independently, firms consider risk and uncertainty by using DCF techniques, where risk-adjusted discount rates and/or certainty equivalents to adjust for risk are used (Gitman and Forrester, 1977).

It was earlier found that surveys conducted in USA, UK and Australia supplemented ratio-based techniques with DCF techniques to appraise investments. For instance, in Small's (2006) mentioned above, where only 6.7% of the firms in his survey used risk analysis, 35% and 23% of the firms he surveyed used NPV and IRR respectively, increasing the extent of the use of quantitative risk-adjusted evaluation procedures in that population. As Kenyan institutions are not using DCF techniques to appraise IS investments, they resort to using qualitative or informal techniques in the form on contingency plans rather than in quantitative terms.

The least used techniques are the computer based techniques (4%). Among the techniques that adopt an integrated approach, the Balanced Scorecard is the most popular, being used by 56% of respondents. Information economics is used by 40% of respondents.

Small and Chen (1995) explain that as a result of the limitations inherent in traditional investment appraisal techniques, many companies are often forced into an ad hoc approach to the justification process. In the Kenyan banking sector, executives in 24% of responding banks rely on their gut feeling when appraising potential IS investments.

Survey fmdings support, in part, the hypothesis initially stated, i.e.

HI. Economic approaches are more prevalent in IS investment evaluation in Kenyan banks relative to the other three evaluation approaches, i.e. strategic, analytic and integrated approaches.

While economic techniques such as CBA, PP and ROI have been found to be prevalent among Kenyan banks, it appears that strategic approaches such as competitive advantage, SWOT analysis, CSF and Risk Analysis are also popular.

4.3 Determining the Relationship between Appraisal approach and Firm Size

This section examines empirically the correlation between firm size and the IS investment appraisal approach adopted within banking institutions. Two methodologies were used to examine the nature of the relationship between these two variables: chi-square cross tabulation analysis and regression analysis.

4.3.1 Using Chi-square Cross Tabulation Analysis

Preliminary X tests indicated that there was a significant association between the appraisal approach and firm size, with a p-value of 0.000 at the 0.05 level of confidence. To further analyse and explain this relationship, X tests were conducted for each of the appraisal approaches independently.

In addition, the appraisal techniques were cross-tabulated against the firm size. The row percentages, marked with @ were calculated from the total number of institutions that use a particular technique, to determine the utilisation of the technique among banks of different sizes. For instance, in Table 4.3, of the 15 firms that use the Payback Period, 26.7% are large sized, 20% are medium sized, and 53.3% are small banks. The column percentages marked with * determine the usage of each of the techniques among banks of the same size. For instance, among the 6 large banks, 66.7% use Payback Period, 100% use CBA, while 66.7% use ROI, etc.

Following is an analysis ofthe results.

4.3.1.1 The economic approach

Previous researchers have found that economic justification is a key component in the decision process for making IS investments.

Table 4.3 presents an analysis of the usage of appraisal approaches by type of technology portfolio.

Table 4.3 Cross tabulation statistics for Economic Appraisal Techniques and Firm Size

Economic Appraisal Techniques	*Firm Size*			
	Large	*Medium*	*Small*	*Total*
Payback Period	(66.7)* 4 (26.7)@	(33.3) 3 (20.0)@	(80.0) 8 (53.3)@	(60.0) 15 (100.0)@
Cost Benefit Analysis	(100.0)* 6 (26.1)	(88.9) 8 (34.8)	(90.0) 9 (39.1)	(92.0) 23 (100.0)
Return on Investment	(66.7)* 4 (26.7)	(77.8) 7 (46.7)	(40.0) 4 (26.7)	(60.0) 15 (100.0)
Net Present Value	(16.7)* 1 (50.0)	(0.0) 0 (0.0)	(10.0) 1 (50.0)	(8.0) 2 (100.0)
Internal Rate of Return	(0)* 0 (0)	(0) 0 (0)	(0) 0 (0)	(0) 0 (100)
Totals	(100)* 6	(100) 9	(100) 10	(100) 25

Chi-Sq = 43.153, DF = 6, P-Value = 0.000 (from column percentages)
Chi-Sq = 68.177, DF = 6, P-Value = 0.000 (from row percentages)

* = Column percentage; @=Rowpercentage

As mentioned earlier, ratio-based techniques are utilised the most among all bank categories. Further, Payback Period and CBA are most popular among small banks than in large and medium sized banks. These are ratio-based techniques may be common among banking institutions, particularly smaller banks because they are relatively easier to compute. However, the proportion of large banks that use these techniques is low (26.7% and 26.1% for PP and CBA respectively). These results corroborate Gitman and Forrester's (1977) findings and inference that few large firms (9%) tend to use ratio-based techniques, usually for secondary analysis.

However, unlike the findings in this research, large firms in previous studies tend to focus more on using DCF techniques for investment appraisal, when compared to small firms. Pike (1992, 1996) found that large firms continue to increase their level of usage of IRR and NPV, as compared to small firms. Arnold and Hatzopoulos (2000) also found that DCF

techniques were used by 100% of the large firms in their survey, with about 90% of small and medium-sized firms using DCF techniques. In contrast, DCF techniques are not used by large and medium-sized banks in Kenya. NPV is used in one large and small bank, while IRR is not used at all.

This phenomenon may be attributed to the complexity of the appraisal techniques which require the computation of future cash flows, discount rates and rates of return. Since IS investments have intangible returns, researchers have found that it is difficult to quantify and discount these returns.

4.3.1.2 The strategic approach

As seen earlier, strategic approaches have been found to be more popular economic approaches for appraising potential IS projects in Kenyan banks. These results indicate that, besides the financial costs and benefits of a project, the technical fit of the project is considered the most important criteria when evaluating potential IS projects.

Among the strategic techniques, the utilisation of technical arguments is highest among small (90%) and medium sized banks (100%). These high proportions signify that these banks are likely to highly prioritise the functionality and the non-functional qualities of IT -systems such as data quality, security and maintainability in the IS investment decision (Ward, Hertogh and Viaene, 2007). This technique focuses on the internal operational efficiencies that would result from acquiring information technology, neglecting strategic implications of the acquisition.

Over 80% of the banks that consider the impact of the potential IS investment on the competitive positioning of the institution are medium and small sized, while for large firms, competition appears not to be a priority. Medium-sized banks have also been found to use Critical Success Factors (CSF) and SWOT analysis more than large and small banks,

reinforcing the importance they place on the strategic positioning of the firm. Interestingly, small banks have not focused their IS investment decisions on strategic considerations as much as medium-sized banks. It was expected that both these categories would be focusing on expansion and strategic positioning of their firms.

Generally, medium-sized banks rank the highest in usage of the five strategic techniques to appraise potential IS investment projects, as shown in Table 4.4.

Table 4.4 Cross tabulation statistics for Strategic Appraisal Techniques and Firm Size

Strategic Appraisal	*Firm Size*			
Techniques	*Large*	*Medium*	*Small*	*Total*
	(83.33)*	(100.00)	(90.00)	(92.00)
Technical arguments	5	9	9	23
	(21.74)@	(39.13)@	(39.13)@	(100.00)@
	(50.00)*	(77.78)	(60.00)	(64.00)
Competition	3	7	6	16
	(18.75)	(43.75)	(37.50)	(100.00)
	(50.00)*	(77.78)	(30.00)	(52.00)
Critical Success Factors	3	7	3	13
	(23.08)	(53.85)	(23.08)	(100.00)
	(50.00)*	(66.67)	(40.00)	(52.00)
SWOT Analysis	3	6	4	13
	(23.08)	(46.15)	(30.77)	(100.00)
	(50.00)*	(55.56)	(20.00)	(40.00)
Application Portfolio	3	5	2	10
	(30.00)	(50.00)	(20.00)	(100.00)
	(100.00)*	(100.00)	(100.00)	(100.00)
Totals	6	9	10	25

Chi-Square = 23.480, DF = 8, P-Value = 0.003 (from column percentages)
Chi-Square = 15.357, DF = 8, P-Value = 0.053 (from row percentages)
* = Column percentage; @=Row percentage

Applications Portfolio technique is used the least among all bank size categories. This technique adopts a portfolio management approach to evaluate how potential IS investments can be fitted into the existing collection of information systems. Executives have only recently begun to apply the portfolio approach to IS investment management in developed economies.

4.3.1.3 The analytical and integrated approaches

Techniques classified under this approach adopt weighted scoring models that factor tangible and intangible costs and benefits of potential projects (Locher et aI., 2004). Both the analytical and integrated approaches are used the least during IS investment appraisal among Kenyan banking institutions.

Table 4.5 Cross tabulation statistics for Analytical Appraisal Techniques and Firm Size

Analytical Appraisal Techniques	*Firm Size*			
	Large	*Medium*	*Small*	*Total*
Risk analysis	(100.00)* 6 (31.58)@	(77.78) 7 (36.84)@	(60.00) 6 (31.58)@	(76.00) *19* (100.00)@
Value analysis	(33.33)* 2 (28.57)	(33.33) 3 (42.86)	(20.00) 2 (28.57)	(28.00) *7* (100.00)
Scoring models	(50.00)* 3 (75.00)	(11.11) 1 (25.00)	- 0 -	(16.00) *4* (100.00)
Computer based techniques	(16.67)* 1 (100.00)	- 0 -	- 0 -	(4.00) *1* (100.00)
Totals	(100.00)* *6*	(100.00) *9*	(100.00) *10*	(100.00) *25*

Chi-Square = 47.681, DF = 6, P-Value = 0.000 (from column percentages)
Chi-Square = 153.377, DF = 6, P-Value = 0.000 (from row percentages)

* = Column percentage; @= Row percentage

As shown on Table 4.5, the most prevalent technique is Risk Analysis, which is being used by 76% of the respondents. Ballantine and Stray (1998) in their survey also found that risk analysis was prevalent among UK organisations. However, while 100% of large banks incorporate Risk Analysis when appraising IS investments, only 60% of small banks incorporate it. Value analysis, which concentrates on value added than cost saved, attempts to evaluate a wide range of benefits, including intangible benefits (Money, Tromp, and Wegner, 1988). The results indicate that value analysis is not used pervasively in Kenyan banks.

Similarly, the use of scoring models and computer-based techniques is limited among large and medium sized banks, and absent among small banks. The least used techniques are the computer based techniques (4%).

The integrated approach combines fmancial and non-financial dimensions through the acknowledgement and assignment of weighting factors to the intangible implications of the project, usually incorporating project risk (Stewart and Mohamed, 2002a). Among the techniques that adopt the integrated approach to appraising potential IS projects, the Balanced Scorecard is the most popular, being used by 56% of respondents, and 100% of large banks. From the analysis, large banks are more likely to use integrated techniques than small and medium-sized banks.

Table 4.6 Cross tabulation statistics for Integrated Appraisal Techniques and Firm Size

Integrated Appraisal Techniques	*Firm Size*			
	Large	*Medium*	*Small*	*Total*
Scenario Planning	(66.67)* 4 (50.00)@	(22.22) 2 (25.00)@	(20.00) 2 (25.00)@	(32.00) *8* (100.00)@
Information Economics	(33.33)* 2 (20.00)	(66.67) 6 (60.00)	(20.00) 2 (20.00)	(40.00) *10* (100.00)
Balanced Scorecard	(100.00)* 6 (42.86)	(44.44) 4 (28.57)	(40.00) 4 (28.57)	(56.00) *14* (100.00)
Totals	(100.00)* *6*	(100.00) *9*	(100.00) *10*	(100.00) *25*

Chi-Square = 46.681, DF = 4, P-Value = 0.000 (from column percentages)
Chi-Square = 34.115, DF = 4, P-Value = 0.000 (from row percentages)

* = Column percentage; @= Row percentage

4.3.2 Using Simple Linear Regression Analysis

In addition to the analysis described above, simple linear regressions were also performed on the two variables (the usage of an IS appraisal approach and the size of the firm). The dependent variable used in the regression analysis is the IS investment appraisal approach, i.e. the economic, strategic, analytical or integrated approach. The independent variable is the size of the firm, measured by the Total Asset value of the firm.

The basic regression model is:

$ITA = \beta_0 + \beta_1 TA$ where

ITA - the level of usage of an IS Appraisal Approach TA -

Total Asset value of a firm

The results of the regression are similar to the results obtained from the cross-tabulation analysis described above. An examination of the regression equations summarised in Tables 4.7,4.8,4.9 and 4.10 reveals that all coefficients have the expected signs. However, some relationships are more statistically significant than others.

4.3.2.1 The economic approach

Table 4.7 shows the analysis results obtained when the regression analysis between the size of the firm and the usage of the economic approach to appraise IS investments was conducted. The results show that there is a significant relationship between the two variables for only one combination, i.e. for medium sized and small banks, at the 0.05 level of significance, with a p-value of 0.02. The relationship indicates that as the Total Asset value increases, i.e. as the size of the firm increases, the usage of economic appraisal techniques reduces. Thus, small banks are more likely to prioritise the use of economic techniques than medium sized banks. However, although the result is not statistically significant, a similar

relationship has been found when large banks are compared to small banks. This inference confirms the results obtained from the chi-square cross tabulation analysis discussed earlier.

Table 4.7 The Effect of Firm Size on the Usage of Economic Appraisal Techniques

Firm size combinations	Regression results for economic appraisal techniques
Large and medium sized banks	Economic = 0.438 + 0.00006 TA ANOVA p-value = 0.973
Large and small banks	Economic = 0.488 - 0.00063 TA ANOVA p-value = 0.662
Medium-sized and small banks	Economic = 0.589 - 0.0268 TA ANOVA p-value = 0.021

4.3.2.2 The strategic approach

Results in Table 4.8 show that there is a statistically significant relationship between the firm size and the appraisal approach used among medium-sized and small banks, denoted by the p-value of 0.008. This result suggests that medium-sized banks are more likely to more focus more on strategic implications of potential IS investments than small banks. Although the relationship between the two variables among large and medium sized banks is statistically insignificant, it suggests that large banks do not prioritise the strategic analysis of IS investments as much as medium sized banks. These results also confirm the results of the chi-square cross tabulation analysis.

Table 4.8 The Effect of Firm Size on the Usage of Strategic Appraisal Techniques

Firm size combinations	Regression results for strategic appraisal techniques
Large and medium sized banks	Strategic = 0.779 - 0.00395 TA ANOVA p-value = 0.134
Large and small banks	Strategic = 0.499 + 0.00066 TA ANOVA p-value = 0.764
Medium-sized and small banks	Strategic = 0.349 + 0.0445 TA ANOVA p-value = 0.008

4.3.2.3 The analytical approach

Table 4.9 also reports the results of the regression analysis between the size ofthe finn and the usage of the analytical approach. From the results, large banks are likely to use analytical techniques more than small banks. Similarly, although the relationship is weak, medium sized banks are also likely to use analytical techniques more than small banks. There is no difference in the level of usage of analytical techniques between large and medium sized banks.

Table 4.9 The Effect of Firm Size on the Usage of Analytical Appraisal Techniques

Firm size combinations	Regression results for analytical appraisal techniques
Large and medium sized banks	Analytical = 0.336 + 0.00189 TA ANOVA p-value = 0.351
Large and small banks	Analytical = 0.237 + 0.00359 TA ANOVA p-value = 0.048
Medium-sized and small banks	Analytical = 0.159 + 0.0155 TA ANOVA p-value = 0.177

4.3.2.4 The integrated approach

The results of the regression analysis between the size of the finn and the usage of the integrated approach to appraise IS investments show that there is no significant relationship between the two variables for any combination of bank sizes. Thus, there is generally no difference in the level of usage of these techniques among the three bank sizes. However, a weak difference in the level of usage of integrated techniques between large and small banks may be inferred, as the p-value of this relationship ranks highest. This inference has also been made during the chi-square cross tabulation analysis.

Table 4.10 The Effect of Firm Size on the Usage of Integrated Appraisal Techniques

Firm size combinations	Regression results for analytical appraisal techniques
Large and medium sized banks	Integrated = 0.531 + 0.00009 TA ANOVA p-value = 0.980
Large and small banks	Integrated = 0.345 + 0.00335 TA ANOVA p-value = 0.275
Medium-sized and small banks	Integrated = 0.260 + 0.0154 TA ANOVA p-value = 0.505

Therefore, survey findings support the second hypothesis initially stated, i.e.

H2. There is a relationship between the approach a finn adopts when evaluating potential IS investments and the size of the finn. In particular, firms that use more complex evaluation techniques will tend to be larger than those that use simpler techniques

Small firms are likely to use simple appraisal techniques that adopt the economic or strategic approach, such as ROI, PP, CBA, technical arguments, SWOT analysis and CSF. On the other hand, large firms are likely to use more complex techniques like risk analysis, value analysis, information economics and the balanced scorecard.

Chapter 5 . DISCUSSION AND CONCLUSIONS

5.1 Discussion

5.1.1 The Usage of IS Investment Appraisal Techniques

Ratio-based techniques, especially the Payback Period and Cost Benefit Analysis are utilised heavily among small banks. The high usage of these techniques is probably best explained by their simplicity (Ashford, et al., 1988, Ballantine and Stray, 1998). However, IS executives should be cautioned about relying much on these techniques. Payback ignores medium- and long-term cash flows, and too much stress on their use can operate against proposals for new technology. CBA, on the other hand, entails the use of artificial surrogate measures for intangible benefits, whose subjective nature may affect the overall valuation of the potential project, leading to an unsound decision.

Due to the limitations of each technique, those responsible for appraising IS investments prefer to use a combination of techniques for decision-making. IS literature is fairly dismissive in it's rejection of financial techniques for appraisal. However, the results reported here do show that financial techniques are widely used by organizations to appraise IS/IT investments.

Besides the use of ratio-based techniques, strategic approaches have also been found to be very popular for appraising potential IS projects in Kenyan banks. Results from this survey indicate jhat, besides the fmancial costs and benefits of a project, the strategic fit of the project is considered the most important criteria when evaluating potential IS projects, more so by medium-sized banks, which have been found to focus more on strategic implications of potential IS investments than large and small banks.

The utilisation of technical arguments is highest among small and medium sized banks. Technical arguments focus on the internal operational efficiencies that would result from acquiring information technology. The degree of usage of technical arguments to justify an investment is not surprising as such requirements are a necessity in most IS projects. For example, a firm can invest in new upgraded computer hardware because the current hardware cannot cope with increasing information processing needs. However, firms should be cautious when using technical requirements to approve an IS project by ensuring that overall, IS investment decisions are not driven by technical system requirements, but strategic objectives. Bacon (1992) refers to such a scenario as "the tail ... wagging the dog", in which case, according to Parker and Benson (1988), IS investments are effectively decided by "technology managers" and not "business managers".

64% of responding banks consider competition to be a priority while appraising IS investments. This indicates that IS is considered significant in today's competitive business environment. Firms may be investing in IS to improve their competitive standing among other firms that have invested in similar technologies, for example the deployment of Automatic Teller Machines, which is now considered to be a fundamental capital investment for any banking institution. Interestingly, over 80% of the banks that consider the impact of the potential IS investment on the competitive positioning of the institution are medium and small sized, while for large firms, competition appears not to be a priority. This may indicate that large banks are first movers in IS investment and innovation, and other banks are clambering to upgrade their IS systems to catch up to trends being set by large banks in the market. Consequently, many of their investment decisions may be motivated by the fact that they "cannot afford not to invest" (Bacon, 1992, pp 346).

Applications Portfolio technique is used the least among all bank size categories. This technique adopts a portfolio management approach to evaluate how potential IS investments can be fitted into the existing collection of information systems. Executives have only recently

begun to apply the portfolio approach to IS investment management in developed economies. Thus, its limited use in Kenya may be attributed to its complexity, and lack of awareness.

While the adoption of a strategic approach to IS investment appraisal is beneficial for firms as illustrated in literature, there are downsides to the exclusive use of these methods. Powell (1992) argues that firms that adopt the strategic perspective to IS investments devote less effort in appraising projects due to competition or "perceived competition". In a different survey of the use of Decision Support Systems in accounting, Powell (1992) found that firms adopted the new technology for the sake of corporate image, so as not to be seen as lagging behind their competition.

Generally, analytical techniques are not as widely used as either economic or strategic techniques. However, Risk Analysis is conducted by 76% of responding banks, ranking third in popularity after CBA and technical analysis. IS executives acknowledge that conducting a risk analysis of IS investments is important. However, they find that models developed for risk analysis are difficult to understand and apply (Stewart and Mohamed, 2002b, Benaroch and Kauffman, 2000). Therefore, they have resorted to using qualitative contingency plans as opposed to quantitative risk-adjusted techniques like DCF techniques. This may be the predicament facing IS executives in large banks, with small and medium-sized banks in Kenya facing a bigger challenge even when developing contingency plans to substitute quantitative risk analysis. Locher et aI., (2004) underline the importance of analysing the risk of potential IS investments. Due to their far reaching strategic implications, IS investments have an effect on the risk profile of the bank, thus necessitating that their operational risk be considered during appraisal.

Like analytical techniques, integrated techniques are not widely used. The integrated approach combines somewhat subjective strategic approaches with formal structure found in economic approaches, and is considered the most sophisticated approach to investment appraisal. The Balanced Scorecard is the most popular among these techniques, being used by

all large banks. Bricknall et al (2007) found that this technique is usually employed in its simplest form where the process can be just one or two steps. This technique may be more popular than the Scenario Planning and Screening or Information Economics because many executives have been exposed to it, and are now challenged to apply it in business decision making.

It is important to note that the limited use of integrated techniques does not imply that firms are not considering both tangible and intangible factors in their IS investment appraisal. Due to the limitations of each economic and strategic appraisal technique, firms are using various combinations of these techniques in their assessment, where management formally or informally assign weights to each tangible and intangible factor under consideration. ill this survey, 100% of fmns are using multiple techniques selected from both the economic and strategic classifications. The use of a hybrid of appraisal techniques may substitute for the use of integrated techniques like the balanced scorecard. However, the information generated from such analysis may not be as comprehensive or equivalent to that of analysis using the balanced scorecard or information economics, as according to Small (2006), weights assigned to tangible and intangible factors are generally not measured for consistency. Furthermore, the assumption of linear additivity of the weighted scores may not be accurate.

From this discussion, fundamental problems exist with the appraisal process in the banking sector in Kenya. The first concerns the limited use of the more sophisticated techniques within the banking sector. Another concern is the general lack of rigor in the appraisal process in small banks. More research needs to be undertaken, to ascertain what barriers discourage the use of sophisticated techniques, and the laxity of the appraisal process in small banks.

3.

Figure 5.1 presents the revised conceptual model of the relationship between the complexity of IS investment appraisal techniques adopted and the size of the firm in the banking industry.

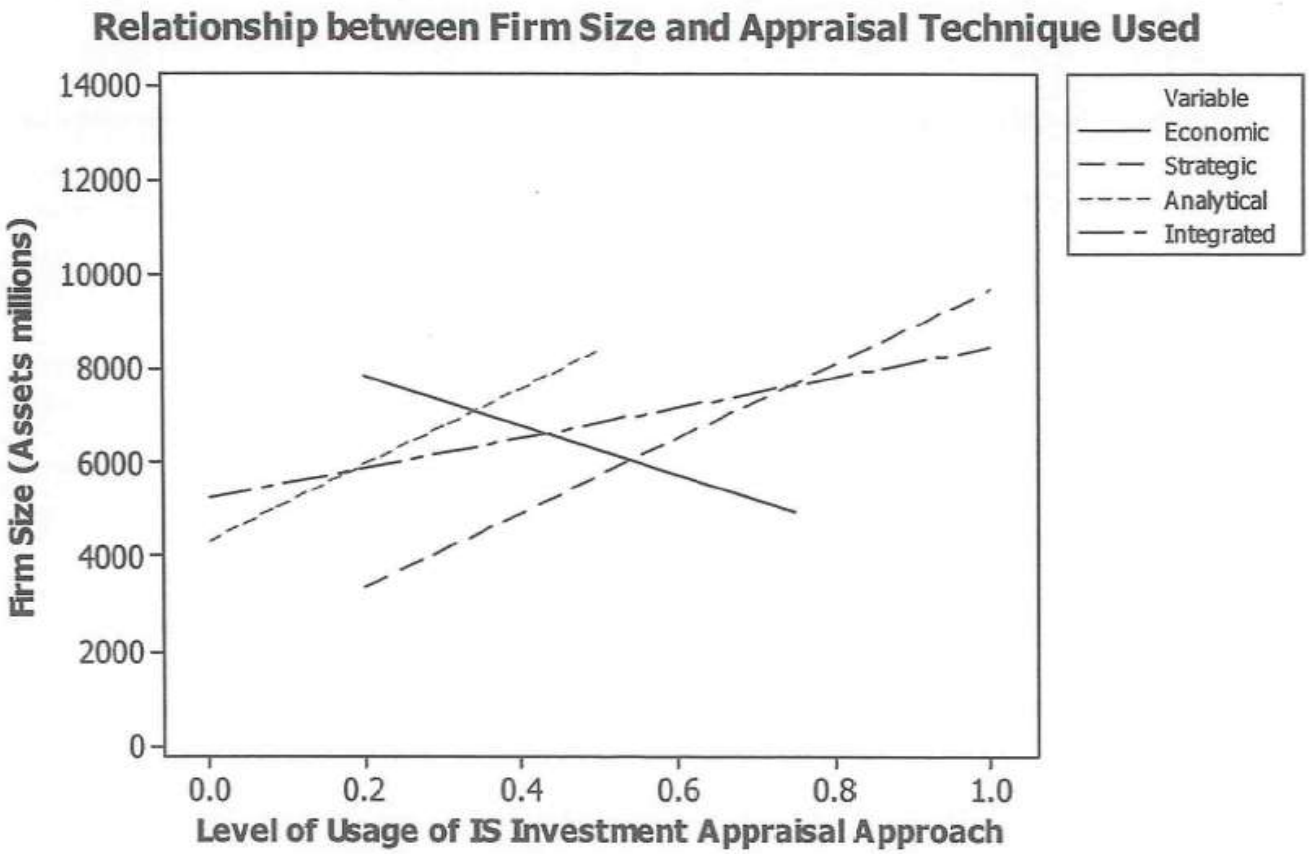

Figure 5.1 A revised conceptual model illustrating how firms select IS/IT Investment appraisal techniques based on firm size

!

5.1.2 Analysis of Theory and Practice

Financial investment appraisal techniques have been developed and refined over time in an attempt to make them suitable for investment analysis. Theoretically, an investment decision is considered effective only if formal financial appraisal is conducted, especially when expected returns are quantitatively adjusted for risk and uncertainty. However, studies by Gitman & Forrester (1977) and Pike (1983) suggest that this might be violated in practice, as many corporate executives are not employing financial appraisal techniques to inform their decisions on potential investments. Therefore, it appears that there is a difference between theoretically correct investment evaluation and optimal choice of investment appraisal techniques in practice. The results of this survey corroborate this premise.

The following section reviews the contradictions between theory and practice of investment appraisal identified when analyzing the findings of this survey.

5.1.2.1 Appraising benefits

Development of theory and technique of appraising benefits has run from ratio-based techniques such as pay-back period and the average annual accounting rate of return, to the presently acknowledged discounted cash flow methods. The latter methods recognize the time value of money by applying a discount rate to the estimated net cash flows to be produced by the capital investment. The two specific techniques employed are IRR and NPV.

In this survey, ratio based techniques i.e. PP, CBA and ROI are employed widely, and DCF techniques are not employed almost not at all. These findings are inconsistent with investment theory that prescribes the use of DCF techniques. Previous IS researchers have attributed this difference in theory and practice to the inappropriateness of DCF techniques for appraising ISIIT investments (Clemons and Weber, 1990; Bacon, 1992; Hochstrasser, 1992; Silvius, 2006). It is difficult, or even impossible to quantify all expected net cashflows from an

IS investment ex ante, considering that many expected benefits are intangible. IS executives know there will be unanticipated benefits from such investments, but cannot estimate either the benefits or the useful life of the project. Consequently, the value of the project cannot be determined ex ante. Thus, it is easier to employ PP and CBA for IS investment appraisal since their requirement is only to estimate expected net cashflows in the short-term, i.e. the initial investment and expected returns in the first few months or years.

5.1.2.2 Methods of incorporating risk analysis

Theoretically, risk analysis has been incorporated in investment appraisal by discounting the estimated future net differentials cash inflows by a risk-adjusted discount rate, usually the estimated cost of capital. The investment is viable if the resulting value is positive. In addition, the firm is required to evaluate the effect of a new IS investment on the risk profile of the entire portfolio of existing IS projects.

Although, many firms consider risk using risk-adjusted techniques, some firms use methods of risk analysis that are inconsistent with investment theory, such as adjusting the required payback period (Gitman and Forrester, 1977), or formulating contingency plans after qualitative risk assessment, where the projected return is modified based on probabilities generated through gut feeling (Bardhan, 2004). Results of this survey show that, since Kenyan banking institutions are not using risk-adjustment techniques to appraise IS investments, they are deviating from theoretically effective evaluation. Further, only 40% of the institutions are using the application portfolio approach.

Why are risk-adjusted discounting rates not computed during IS investment appraisal?
As discussed earlier, estimating all future net cashflows for an IS project is difficult due to the nature of IS investments, i.e. the unpredictability of the life of the project, and the intangible nature of expected benefits (Bardhan et aI., 2004; Locher et aI., 2004; Silvius, 2006). In

addition, as technological innovation is very dynamic, the level of uncertainty surrounding an IS investment is unpredictable. Consequently, it is difficult to determine how to adjust the estimated discounting rate for risk. In addition, IS executives have expressed difficulty in applying quantitative risk analysis techniques to potential projects, and to the existing portfolio of projects. They attribute this difficulty of the complexity of the techniques available.

5.1.2.3 Use **of non-financial appraisal techniques to appraise financial investments**

Normative theory does not prescribe any qualitative factors that should be used in conjunction with capital investment decisions. In fact, the consideration of purely qualitative factors to appraise an investment is theoretically considered ineffective and inadequate. Results of this survey, however, show that IS executives have a predilection for using qualitative techniques to appraise potential investments. Consequently, qualitative considerations appear to be very significant in the investment decision making process. Previous researchers have drawn similar conclusions (Hochstrasser, 1992; Arnold and Hatzopolos, 2000; Chen, 2008).

The benefits that result from IS investments, such as improved customer service, reduced cycle time, reduced waste and efficiency in data storage and security, are mostly intangible. In addition, IS investment returns are rarely in the form of cash inflows, but rather in the form of cost savings, which are usually determined accurately *ex post.* Therefore, purely quantitative justification approaches such as NPV and IRR are inappropriate for measuring such expected benefits (Clemons and Weber, 1990; Bacon, 1992; Hochstrasser, 1992; Silvius, 2006). Financial benefits only address one dimension of the value derived from an information system - the impact on the shareholder, but no insight is provided into the impact on other stakeholders like customers and end users (Simmons, 1994).

5.1.3 Proposed Improvements on Investment Theory

After reviewing fixed assets investment theory, reviewing extant literature and analysing the usage of both fmancial and non-fmancial techniques for investment appraisal among Kenyan banking institutions, the author concludes that much of the gap can be attributed to deficiencies in the capital budgeting models.

The evidence of this study suggest the following ways in which current investment theory can be modified to make it more useful for IS investment appraisal:

- Normative investment theory prescribes that potential investments should be analysed based on expected net cashflows. Cashflow forecasting has been found to be difficult or impossible when analysing potential IS investments due to the nature of the benefits. Theory can be improved by developing techniques that managers can use to quantify intangible benefits in order to generate expected cashflows, and establish the useful life of various IS investments.
- Investment theory cites the necessity of quantitatively incorporating risk and uncertainty in the inputs of the investment appraisal models. Currently, theory does not provide a satisfactory way of quantifying and incorporating uncertainty into the models. This premise is accentuated when applied to IS investments where the level of uncertainty is more difficult to predict and quantify due to the nature of technology and the environment surrounding it. Some theorists have proposed that the major problems of risk and uncertainty can be handled through the employment of probability theory. However, Kolb (1968) submits that probabilistic approaches to uncertainty are unsatisfactory because "(1) by defmition the probability distribution is not predictable, and (2) the number of projects of any uncertainty class undertaken by a particular firm would not (in most cases) be anywhere near large enough for the laws of probability to work out (even if the probability distribution were known)" (pp. 172). Consequently,

investment theorists may need to tolerate subjective, qualitative judgements on the relative differences in uncertainty among various IS investment proposals.

- Normative fixed asset investment theory requires that all projects be subjected to formal fmancial analysis. However, non-financial factors have been found to be useful when considering IS investments whose expected benefits contain intangible elements. Rather than outlaw non-fmancial analysis as ineffective for investment appraisal, investment theorists should acknowledge qualitative techniques, when applied correctly, as equally effective for appraising IS investments, when used in conjunction with quantitative techniques.

5.2 Conclusion

In this thesis new empirical evidence has been presented on current practice in appraising potential IS investments. A survey whose aim was to investigate the gap between theory and practise of IS investment appraisal was conducted between July and September 2008. The cross-sectional survey explored the state of practice of IS investment appraisal in the banking sector in Kenya.

Results of the survey show that the level of usage of discounted cashflow (DCF) techniques to appraise IS investments is low compared to the usage of simple fmancial techniques. Similarly, the usage of sophisticated analytical and integrated techniques was low compared to the usage of strategic techniques. To illustrate, simple ratio-based techniques were found to be very popular, with Cost Benefit analysis being used by 92% of responding banks, Payback Period (60%) and Return on Investment (60%). Appraisal techniques that consider strategic arguments were also found to be very popular, i.e, technical considerations (92%), competitive advantage (64%) and Critical Success Factors and SWOT analysis (56% each). On the other hand, DCF techniques were unpopular i.e. Net Present Value (8%) and Internal Rate of Return (0%). Further, hybrid appraisal techniques were also found to be relatively unpopular: value analysis (28%), scoring models (16%), computer based techniques (4%), the Balanced Scorecard (56%) and Information Economics (40%). These findings confirm the existence of a gap between theoretically correct investment appraisal practices that lay emphasis on the use ofDCF techniques, and practice.

The gap between theory and practise of investment appraisal can be attributed to deficiencies in the capital budgeting models. Investment theory can be improved by:

- developing techniques that managers can use to quantify intangible benefits in order to generate expected cashflows, and establish the useful life of various IS investments.

- incorporating subjective, qualitative judgements on risk and uncertainty when evaluating IS investment proposals.
- acknowledging qualitative techniques as equally effective for appraising IS investments, when used in conjunction with quantitative techniques.

Further findings of this research show that there is a partial relationship between the adoption of investment appraisal techniques and the size of a firm. Large firms have been found to use more complex integrated appraisal techniques as compared to small and medium-sized firms. However, with regard to the use of DCF techniques, the level of usage is not associated with the size of the firm. Therefore the gap between the fixed asset investment theory and practice cannot be explained by the size of the firm.

Methodologies of IS investment appraisal developed are numerous, suggesting that the field is already a little crowded and that a 'new' method would be likely to add little (powell, 1992). Academics and practitioners should collaborate to investigate how currently available techniques might be employed and possibly amended to overcome some of the difficulties business executives encounter when applying these techniques to IS appraisal. Business and IS executives should also be encouraged to make a deliberate effort to understand and formally use investment appraisal techniques while developing business cases for potential IS investments.

5.3 Limitations and further research

Some limitations concern the reliability of the data. Findings could have been influenced by the data collection method. Firms were asked to submit information consistent with the defmitions that were specified in the questionnaire. Respondents may have understood the definitions of the techniques differently. Findings may also have been influenced by prestige bias where as Oppenheim (1982) discovered, respondents indicate that they use the appraisal techniques so that they can be seen to use the techniques.

Several assumptions were made in conducting this study. Among them are those applicable to the statistical methodology used when attempting to establish a relationship between the choice of IS investment appraisal techniques and the size of the firm. The results are observations of the relationships between these two variables, and therefore no claims of cause and effect can be made. Further research can be conducted to statistically establish cause and effect between these variables, and their practical implications.

The findings in this thesis could be strengthened and expanded by replicating the study at a different point in time and in other industries. In addition, many of the subjective interpretations of the data made in this paper could be strengthened with formal data.

Future researchers can also investigate potential causes and effects of the adoption of different combinations of appraisal techniques. This may help develop the understanding of levels of maturity in using investment appraisal techniques in firms and the reasons for them.

6. REFERENCES

Alshawi, S., Irani, Z. & Baldwin, L. (2003). Benchmarking information technology investment and benefits extraction. *Benchmarking: An International Journal*, 10 (4), 414-423.

Arnold, C. and Hatzopoulos, P. (2000). The theory-practice gap in capital budgeting: Evidence from the United Kingdom. *The Journal of Business Finance & Accounting*, 27(5) & (6),603-626.

Ashford, R. W., Dyson, R. G. and Hodges, S. D. (1988). The capital-investment appraisal of new technology: problems, misconceptions and research directions. *The Journal of the Operational Research Society*, 39(7),637-642.

Bacon, C.J. (1992). The use of decision criteria in selecting information systems/technology investments. *MIS Quarterly, September, 335-53.*

Ballantine, J. and Stray, S. (1999). Information systems and other capital investments: appraisal practice compared. *Logistics and Information Management*, 12(1-2), 78-93.

Bandyopadhyay, K., Mykytyn, P. P. and Mykytyn, K. (1999). A framework for integrated risk management in information technology. *Management Decision*, 37(5), 437-444

Bardhan, LR., Sougstad, R., and Bagchi, S. (2004). Prioritization of a portfolio of information technology projects. *Journal of Management Information Systems*, 21(2) 33-60.

Barua, A" H. C. Kriebel and T. Mukhopadhyay. (1995). Information technologies and business value: an analytic and empirical investigation. *MIS Quarterly*, 15(3), Special Issue: [Strategic Use of Information Systems] 313-331.

Beimbom, D., Wagner, H., Franke, J. and Weitzel, T. (2007). The Influence of Alignment on the Post-Implementation Success of a Core Banking Information System: An Embedded Case Study. *Proceedings of the 40th Annual Hawaii International Conference on System Sciences (HICSS'07)*

Benaroch, M. and Kauffman, R. J. (2000). Justifying Electronic Banking Network Expansion Using Real Options Analysis. *MIS Quarterly*, 24(2), 197-225.

Berger, A. N. (2003). The Economic Effects of Technological Progress: Evidence from the Banking Industry. *Journal of Money, Credit and Banking*, 35(2), 141-176.

Bharadwaj, A. S., Bharadwaj, S. G. and Konsynski, B. R. (1999). Information Technology Effects on Firm Performance as Measured by Tobin's q. *Management Science, 45(7),* 1008-1024.

Bricknall, R., Darrell, G., Nilsson, H. and Pessi, K. (2007). Aligning IT Strategy with Business Strategy through the Balanced Scorecard in a multinational pharmaceutical company. *Proceedings of the 40th Annual Hawaii International Conference on System Sciences (HICSS'07)*

Brynjolfsson, E. and Hitt, L. (1993). Is Information Systems Spending Productive? New Evidence and New Results. *Proceedings of the 14th International Conference on Information Systems,* Orlando, FL.

Brynjolfsson, E. and Hitt, L. (1996). Productivity, Business Profitability, and Consumer Surplus: Three Different Measures of Information Technology Value. *WS Quarterly,* 20(2), 121-142.

Cao, R., Ding, W. and Tian, C. (2006). Using Resource and Portfolio Management Solution to Align IS Investment with Business. *International Journal of Electronic Business, 4(3-* 4),239-246.

Central Bank of Kenya. (200S). Commercial Banks Directory. Accessed 7 Apri1200S, available at http://www.centralbank.go.kelbankinfo/banks.asp

Chan, F.T.S., Chan, M. H., Lau, H. and IP, R.W.L. (2001). Investment appraisal techniques for advanced manufacturing technology (AMT): a literature review. *Integrated Manufacturing Systems,* 12(1),35-47

Chaya, A. and Mitra, S. (1996). Exploring the relationships between IT investments and organizational performance: Preliminary empirical evidence. *Proceedings of the 29th Annual Hawaii International Conference on System Sciences* - 1996

Chen, S. (2008). DCF Techniques and Nonfinancial Measures in Capital Budgeting: A Contingency Approach Analysis. *Behavioural Research in Accounting,* 20(1), 13-29.

Chen, T., Zeng, Y., Wang, L. and Zhang, J. (2000). Evaluating IS investment using a hybrid approach of fuzzy risk analysis and real options.

Clemons, E.K. and Weber, B. (1990) "Strategic information technology investments: . Guidelines for decision making." *Journal of Management Information Systems,* 7(2), 9- 28.

Clemons, E.K. and Weber, B. (1990). Making the Information Technology Investment Decision: A Principled Approach. *Proceedings of the Twenty-Third Annual Hawaii International Coriference on System Sciences,* 4, 147-156.

Cumps, B., Viaene, S. and Dedene, G. (2006, September/ October). Managing for Better Business-IT Alignment. *IEEE Computer Society, 17-24*

Dixit, A.K. and Pindyck, R.S. (1994). Investment *under Uncertainty.* Princeton University Press

Dos Santos, B. L., K. G. Peffers and D. C. Mauer, (1993). The Impact of Information Technology Investment Announcements on the Market Value of the Firm. *Information Systems Research,* 4 (1&127), 1-23.

Dugdale, D. (1991). Is there a correct method of investment appraisal? *Management Accounting,* 69, 46-50.

Fairchild, A. M. (2003). Enabling Usage-Based IS Costing in the Banking Sector. *Electronic Journal of Information Systems Appraisal,* 6(2), 87-94.

Farbey, B, Land, F, Targett, D (1992), IS Investment - A Study of Methods and Practice, *Butterworth-Heinemann,* London.

Fasheng, Q. and Teck, Y.K. (2000). ISIIT Project Investment Decision Making. *Proceedings of the 2000 IEEE International Conference on Management of Innovation and Technology,* 2, 502-507.

Ferguson, R. W. (2000, October). Information technology in banking and supervision. *Remarks at the Financial Services Conference,* St. Louis University, St. Louis, Missouri.

Francalanci, C. and Maggiolini, P. (1994). Justifying the changing Information Technology budget within changing environments. *Proceedings of the ACM Computer Personnel Research Conference on Reinventing IS: Managing Information Technology in Changing Organizations,* Alexandria, VI, *EVA.*

Giaglis, G. M., Paul, RJ. and O'Keefe, R. M. (1999). Combining Business and Network Simulation Models for IS Investment Appraisal. *Proceedings of the 32nd Hawaii International Conference on System Sciences.*

Gitman, L., and Forrester, J. (1977) A Survey of Capital Budgeting Techniques Used by Major US Firms. *Financial Management,* 6 (3): 66-71.

Grembergen, W. V. (2001). Information Technology Appraisal Methods and Management. *Idea Group Publishing,*

Griffiths, P. and Remenyi, P. (2003). Information Technology in Financial Services: A Model for Value Creation. *Electronic Journal of Information Systems Appraisal,* 6(2), 107- 116.

Hares, J. and Royle, D. (1994). *Measuring the Value of Information Technology*. John Wiley and Sons, Chichester, UK.

Harris, S. E. and Katz, L. J. (1991). Firm Size and the Information Technology Investment Intensity of Life Insurers. *MIS Quarterly,* 15(3) Special Issue: [Strategic Use of Information Systems], 333-352.

Harris, S. E. and Katz, L. J. (1991). Organizational Performance and Information Technology Investment Intensity in the Insurance Industry. *Organization Science*, 2(3) 263-295.

Hochstrasser, B. (1992). Justifying IS Investments. *Proceedings of the Conference on Advanced Information Systems*, New Technologies in Today's Business Environment, 17-28.

Hu, Q. and Huang, D. C (2005). Aligning IS with Firm Business Strategies Using the Balance Scorecard System. *Proceedings of the 38th Hawaii International Conference on System Science.*

Irani, Z., Ezingeard, J.N. and Grieve, RJ. (1997). Integrating the costs of an ITIiS infrastructure into the investment decision making process. *The International Journal of Technological Innovation and Entepreneurship (Technovation)*, 17(11-12),637-47.

Kakati, M. and Dhar, U. (1991). Investment justification of flexible manufacturing systems. *Engineering Costs and Production Economics*, 21, 30-43.

Kambil, A., Henderson, J. C. and Mohsenzadeh, H. (1993). *Strategic management of information technology investments: An Options perspective.* Idea group Publishing, Chapter 9.

Kaplan, R. S. and Norton, D. P. (1992). The Balanced Scorecard - Measures That Drive Performance. *Harvard Business Review*, Jan. - Feb., 71-79.

Kauffman, R. J. and Sougstad, R. (2007): Value-at-Risk in IT Services Contracts. *HICSS 2007 - 40th Hawaii International Conference on Systems Science* 3-6 January, 2007, Waikoloa, Big Island, HI, USA. p. 63.

Kennedy, A. J. and Sugden, K. (1986). Post Completion Auditing: A Source of Strategic Direction? *Management Accounting*, 67, 34-37.

Klammer, T. (1972). Empirical evidence of the adoption of sophisticated capitalbudgeting techniques. *Journal of Business*, 5(3), 387-397.

Kolb, B. (1968). Problems and Pitfalls in Capital Budgeting. *Financial Analysts Journal*, 24(6), 170-174

Kumar, K.B., Rajan, RG. and Zingales, L. (2001). What determines firm size? *Working paper*, University of Chicago.

Lee, 1. (2004). Evaluating business process-integrated information technology investment. *Business Process Management Journal*, 10 (2), 214-233.

Leek, C. (1997). Information systems frameworks and strategy. *Industrial Management & Data Systems*, 97(3), 86-89

Lin, C., Pervan, G., McDermin, D. (2005). ISIIT Investment Evaluation and Benefits Realization Issues in Australia. *Journal of Research and Practice in Information Technology,* 37(3), 235-251.

Locher, C., Mehlau, J. 1. and Wild, O. (2004). Towards Risk Adjusted Controlling of Strategic IS Projects in Banks in the Light of Basel Il. *Proceedings of the 37th Hawaii International Conference on System Sciences.*

Lumby, S. (1981) *Investment Appraisal and Related Decisions* (Van Nostrand Reinhold, London).

McFarlan, F.W. (1984). *Information technology changes the way you compete,* Harvard Business Review, May-June.

Meredith, J.R, Suresh, N (1986), "Justification techniques for advanced manufacturing technologies", *International Journal of Production Research,* 24(5), 1043-58.

Money, A., Tromp, D. and Wegner, T. (1988). The quantification of decision support benefits within the context of value analysis. *MIS Quarterly,* June, 137-156.

Mukherjee , T. K., and Henderson, G. V. (1987). The Capital Budgeting Process: Theory and Practice. *Interfaces,* 17(2), 78-90

Naik, B. and Chakravarty, A.K.. (1992). Strategic Acquisition of New Manufacturing Technology: A Review and research Framework. *International Journal of Production and Research,* 30, 1575-1601.

Nelson, CA. (1986). A Scoring Model for Flexible Manufacturing Systems Project Selection. *European Journal of Operations Research,* 24, 346-359.

Oppenheim A.N. (1982) *Questionnaire Design and Attitude Measurement* (Sage, London).

Parker, M.M. and Benson, R.J. (1988). *Information Economics.* Prentice Hall, Englewood Cliffs, NJ.

Paul, L.G. & Tate, P. (2002). *CFO Mind Shift: Technology Creates Value.* CFO Publishing Corporation, Boston, MA.

Pike, R.H. (1983). A Review of Recent Trends ıı Formal Capital Budgeting Processes. *Accounting and Business Research, 201-208*

Pike, R.H. (1988). An empirical study of the adoption of sophisticated capital budgeting practices and decision-making effectiveness. *Accounting & Business Research, 18(72),* 341-51.

Pike, R.H. (1996). A longitudinal survey on capital budgeting practices. *Journal of Business Finance & Accounting,* 23, 79-92.

Pisello, T. and Strassmann, P.A., (2003). IS Value Chain Management=Maximizing the ROI from IS Investments. *Digital Publications from The Information Economics Press,* DI0, The Information Economics Press, New Canaan, Connecticut, USA.

Powell, P. (1992). Information Technology Appraisal: Is It Different? *The Journal of the Operational Research Society,* 43(1), 29-42.

Primrose, P.L. and Leonard, R. (1987). Performing Investment Appraisal for Advanced Manufacturing Technology. *Journal of Cost Management for the Manufacturing Industry,* 1,34-42.

Remenyi, D. and Heafield, A. (1995). Business Process Re-engineering: Some Aspects of How to Evaluate and Manage the Risk Exposure. *Proceedings of the 2nd European Conference on Information Technology Investment Appraisal, 161-173.*

Remenyi, D. and Sherwood-Smith, M. (1998). *Another Look at Appraisal to Achieve Maximum Value from Information Systems.* Henley Management College, Henley.

Renkema, T.J.W. (2000). *The IS Value Question: how to capture the business value of IT-based infrastructure,* John Wiley & Sons, New York, NY, .

Renkema TJ.W. & Berghout E.W. (1997). Methodologies for information systems investment appraisal at the proposal stage: a comparative review. *Information and Software Technology 39*

Samakovitis, G. and Fleck, J. (2006). Technological Investment Decision-making and the 'Anomaly of Practice' in Internet Banking Assessment. *SPRU 40th Anniversary Conference.*

Sangster, A. (1993). Capital investment appraisal techniques: A survey of current usage. *Journal of Business Finance & Accounting,* 20(3),307-332

Schniederjans, M.J., Hamaker, J. L., and Schniederjans, A.M. (2004). *Information Technology Investment: Decision-Making Methodology.* World Scientific Publishing Company.

Schneiderman, A. (1999). Why balanced scorecards fail. *Journal of Strategic Performance Management,* 2(1), 6-11.

Schwartz, E. S. and Zozaya-Gorostiza, C. (2003). Investment under Uncertainty in Information Technology: Acquisition and Development Projects. *Management Science,* 49(1) 57- 70.

Shapiro, A. C. (2004). Capital Budgeting and Investment Analysis. *Prentice Hall.*

Sherer, S. A. (2004). IS Project Selection: The Role of Strategic Vision and IT Governance. *Proceedings of the 37th Hawaii International Conference on System Sciences - 2004*

Silvius A.J.G. (2006). Does ROI Matter? Insights into the true Business Value of IT. *The Electronic Journal Information Systems Appraisal*, 9(2), 93 - 104, available online at www.ejise.com

Simmons, P., (1994). Measurement and the appraisal of IS investments. *Proceedings of the Second International Software Metrics Symposium, 74-83.*

Sloggy, J.E. (1984). How to Justify the Cost ofFMS. *Tooling and Production,* 50, 72-75.

Small, M.H. (2006). Justifying investment in advanced manufacturing technology: a portfolio analysis. *Industrial Management & Data Systems,* 106 (4), 485-508

Small, M.H. and Chen, I.J. (1995). Investment justification of advanced manufacturing technology: an empirical analysis. *Journal of Engineering & Technology Management,* 12,27-55.

Stewart, R. & Mohamed, S. (2002a). ITIIS project selection using multi-criteria utility theory. *Logistics Information Management,* 15(4),254-270.

Stewart, R. & Mohamed, S. (2002b). Lifecycle management of Information Technology projects in construction. Doctoral dissertation, Griffith University.

Strassmann, P. A. (1990). *The Business Value of Computers,* Information Economics Press, New Canaan, Connecticut.

Strassmann, P. A. and Bienkowski, D. (1999). *Alignment o[IS and Business: Key to Realizing Business Value.* Chicago: ABT Corporation, 243p.

Suresh, N. and Meredith, J. (1985). Justifying multimachine systems: an integrated strategic approach. *Journal of Manufacturing Systems,* 4(2), 117-34.

Turner, J. (1982). Organizational Performance, Size and the Use of Data Processing Resources. Working Paper No. 58, Centre for Research in Information Systems, New York University.

Ward, J. (1990). A Portfolio Approach to Evaluating Information Systems Investments and Setting Priorities. *Journal of Information Technology,* 5, 222-231.

Ward, J., De Hertogh, S. and Viaene, S. (2007). Managing Benefits from IS/IT Investments: an Empirical Investigation into Current Practice. *Proceedings of the 40th Hawaii International Conference on System Sciences.*

Ward, J. and Griffiths, P. (1996). *Strategic Planning for Information Systems,* Wiley Chichester.

Weill, P. (1992). The relationship between investment in information technology and firm performance: a study of the valve manufacturing sector. *Information Systems Research.* 3(4) 307-333.

Weill, P. and Olson, M. H. (1989). Managing Investment in Information technology: Mini Case Examples and Implications. *MIS Quarterly*, 13(1),3-18.

Xiao-Lin, S., Tie-Nan, W. and Ye-Zhuang, T. (2006). The ENPV Model Based on Option Theory in IS Investments. *IEEE International Conference on Management of Innovation and Technology*, 1,518-521

APPENDICES

Appendix A

Sample Invitation Letter to the Study

Appendix A presents a sample introductory letter that was sent to each of the participants of the study. The letter was accompanied by a questionnaire (Appendix B).

[Date]
[Addressee]
[Company Name]
[Company address]

Dear [Addressee N arne]

RE: Invitation to participate in an Information Technology Investment Survey for Banks

I would like to invite you, on behalf of your bank, to participate in an Information Technology Investment Survey of the banking sector.

The intent of this survey is to provide insight into the practice of Information Technology investment evaluation in the banking sector. The results of the survey will be used to develop industry-wide benchmarks on investment evaluation. Thus, results will help participants to make more informed decisions on future IT investments and resource commitments.

I guarantee that any data or information collected will be treated in the strictest confidence, and will not be directly referenced in oral or written reports. The results of the data analysis will be published in a research paper, and disseminated in business conferences.

Kindly complete the brief questionnaire enclosed. Jfyou have any questions about the study, or need clarifications on the questionnaire, please contact me. My contact details are as follows:

Ms. Elsie Khakasa Onsongo
Faculty of Commerce, Strathmore University
Office phone: (+254-20) 606268, 606380, 606155 ext 2495
Cell phone: +254720402338
Email: eonsongo@strathmore.edu

Thank you very much for all your assistance. I look forward to receiving feedback from you.

Yours faithfully
Elsie Khakasa Onsongo

Appendix B
Sample Survey Questionnaire

A sample questionnaire is presented on the following pages. The questionnaire was delivered to the respondents with the introductory letter (Appendix A)

STRATHMORE UNIVERSITY

Information Technology Investment Evaluation
— The Banking Sector 2008

QUESTIONNAIRE

Name _____

Title _____

Institution _____

Email _____

Phone _____

To ensure confidentiality of responses, this cover page will be detached upon receipt prior to tabulation and analysis.

Please return your completed survey by mail to:

Ms. Elsie Khakasa Onsongo
Strathmore University, Faculty of Commerce
Ole Sangale Road, Madaraka Estate
P. O. Box 59857 00200
Nairobi.

For any queries, contact me on:
Office phone: (+254-20) 606268, 606380, 606155 ext 2495
Cell phone: +254 720 402338
Email: eonsongo@strathmore.edu

IS/IT INVESTMENT EVALUATION CRITERIA

4. Excluding routine maintenance costs, operating costs, user support costs and administrative costs, which of the following methods, criteria, or justification does your institution use in making the basic go-ahead decision on IS/IT investments (IS acquisitions, development and upgrading projects, computer hardware, software or telecommunication facilities, outsourcing contracts)? Please **tick** them off as applicable in the column to the right of the table.

Classification	**Appraisal** .technique	**Explanatory notes** ;';~{:;	**Tick** *(-1')*
	Gut feeling	No formal analysis is conducted. Decisions based on personal feelings about potential investments	
ECONOMIC APPROACHES (ratio based)	**Payback period**	Compute the time required to recoup the initial cost	
	Return on **Investment (ROI)**	Compute the expected profit from the **IT** investment	
	Cost Benefit Analysis (CBA)	All costs and benefits (direct and indirect) are considered and quantified.	
(discounting techniques)	Net Present **Value (NPV)**	The value of a future stream of cash, discounted to present value is calculated using an appropriate discount rate.	
	Internal rate of Return (IRR)	Calculate the rate of return for an investment, in which the present value of cash inflows are balanced against the present value of outflows.	
(future value technique)	Real option **pricing theory**	Calculate the additional value of an investment that exists because it provides the option for a second subsequent investment. Investing in one type of IS/IT may provide the option of investing in another type; thus the additional value of this option is considered in the evaluation of the original investment.	
STRATEGIC APPROACHES	**Technical importance, operational functionality criteria**	Projects selected on the basis of the technical functionalities of the potential information system	
	Competitive advantage	The impact of the potential IS/IT investment on the competitive positioning of the institution are considered before the decision	
	Critical success factors	The impact of potential **IT** projects on key performance indicators is determined, and the project selected on this basis	
	SWOT analysis	An analysis of the IS/IT project's Strengths and Weaknesses, Opportunities and Threats is conducted before the decision	
	Application portfolio	Potential IS/IT investments are fitted into the existing collection of IS/IT, and the overall	

	approach	strategic structure. Business strategy, information system provision and information technology support are considered in the analysis.
ANALYTICAL APPROACHES	**Scoring models**	This technique enables decision makers to experiment with various alternative decisions and assess the impact of each alternative on business performance for investments that are expected to yield intangible and/or indirect benefits such as IS/IT investments
	Computer based techniques	Involves analytic formulations with computer-generated numerical solutions and different programming techniques. An example is Fuzzy logic systems, whose rules resemble the following: 'if this set of criteria is satisfied, in combination, to a given degree, then take action'.
	Risk analysis	The 'service' value of potential IS/IT investments is identified, the threats to which the IS/IT project might be exposed, and the vulnerability of those projects to the threats identified
	Value analysis	Based on making value-costs assessments of proposed **IT** investments. Involves prototyping and surveying to determine the value of benefits of an IT investment. An **IT** prototype is proposed, its costs determined, and potential benefits identified, valued and compared to the costs.
INTEGRATED APPROACHES	**Multi-attribute utility theory**	Integrated approach where strategic, operational and financial decisions are integrated while evaluation potential IS/IT projects
	Scenario planning and screening	Involves testing the potential IS/IT investment against a series of alternative future occurrences. While considering the potential IS/IT investment, flexible long-term plans are made based on its expected impact, and the most favourable selected
	Information economics	This scoring approach to cost/benefit analysis assesses technical and tangible and intangible benefits and costs expected by the introduction of the new IS/IT. Considers business factors such as strategic match, competitive advantage, management information support, competitive response and project and organisational risk and technical factors such as strategic IS architecture and IS infrastructure risk.
	Balanced scorecard	This technique balances measures of financial performance, internal operations, innovation and learning, and customer satisfaction during IS/IT project appraisal. During project appraisal, strategic objectives of the potential IS/IT are linked to a comprehensive range of key performance indicators

OTHER *(Please specify):*

Appendix C
Chi square analysis

This appendix details the Chi-square analysis output of the relationship between evaluation approaches and finn size

Correlation between finn size and the IT investment evaluation approach adopted within banking institutions. Preliminary .:t tests indicated that there was a significant association between the appraisal approach and firm size, with a p-value of 0.000 at the 0.05 level of confidence. To further analyse and explain this relationship, .:t tests were conducted for each of the appraisal approaches independently.

The *chi-square test* provides a method for testing the association between the row and column variables in a two-way table. The null hypothesis *Ho* assumes that there is no association between the variables (in other words, one variable does not vary according to the other variable), while the alternative hypothesis *H,* claims that some association does exist. The alternative hypothesis does not specify the *type* of association, so close attention to the data is required to interpret the information provided by the test.

Null hypothesis *Ho* - there is no relationship between the variables
Alternative hypothesis *H;* - some relationship does exist.

Table C Chi-Square Test of Independence Output

USING COLUMN PERCENTAGES

Chi-Square Test of Independence between Firm size and Economic appraisal techniques

```
Expected counts   are printed below observed counts
Chi-Square contributions     are printed below expected   counts
```

	Large	Medium	Small	Total
Payback Period	67 67.23 0.001	33 53.84 8.066	80 58.93 7.535	180
Cost Benefit Analysis	100 104.21 0.170	89 83.45 0.369	90 91. 34 0.020	279
Return on Investment	67 69.10 0.064	78 55.33 9.284	40 60.57 6.983	185
Net Present Value	17 10.46 4.092	1 8.38 6.494	10 9.17 0.076	28
Total	251	201	220	672

```
Chi-Sq    43.153,  DF = 6,  P-Value    0.000
```

Chi-Square Test of Independence between Firm size and Strategic appraisal techniques

```
Expected counts are printed below observed counts
```

Chi-Square contributions are printed below expected counts

	Large	Medium	Small	Total
Technical	83 85.65 0.082	100 114.71 1. 886	90 72.64 4.150	273
Competition	50 58.98 1. 369	78 78.99 0.012	60 50.02 1.990	188
Critical Success Factors	50 49.57 0.004	78 66.39 2.031	30 42.04 3.448	158
SWOT Analysis	50 49.26 0.011	67 65.97 0.016	40 41. 77 0.075	157
Application Portfolio	50 39.53 2.772	56 52.94 0.177	20 33.53 5.457	126
Total	283	379	240	902

Chi-Sq 23.480, OF 8, P-Value 0.003

Chi-Square Test of Independence between Finn size and Analytical appraisal techniques

Expected counts are printed below observed counts Chi-Square contributions are printed below expected counts

	Large	Medium	Small	Total
Risk Analysis	100 117.23 2.533	78 72.46 0.424	60 48.31 2.830	238
Value Analysis	33 42.36 2.069	33 26.18 1. 775	20 17.46 0.371	86
Scoring Models	50 30.54 12.401	11 18.88 3.286	**1** 12.58 10.664	6 2
Computer based	16 8.87 5.740	**1** 5.48 3.663	**1** 3.65 1.927	1 8
Total	199	123	82	40 4

Chi-Sq 47.681, OF 6, P-Value 0.000 1 cells with expected counts less than 5.

Chi-Square Test of Independence between Firm size and Integrated appraisal techniques

Expected counts are printed below observed counts Chi-Square contributions are printed below expected counts

	Large	Medium	Small	Total
Scenario Planning	67 52.78 3.828	22 35.10 4.890	20 21.11 0.059	109
Information Economics	33 58.11	67 38.64	20 23.24	120

	10.851	20.807	0.453	
Balanced	100	44	40	184
Scorecard	89.10	59.25	35.64	
	1.332	3.927	0.533	
Total	200	133	80	413

Chi-Sq 46.681, DF 4, P-Value 0.000

USING ROW PERCENTAGES

Chi-Square Test of Independence between Firm size and Economic appraisal techniques

Expected counts are printed below observed counts Chi-Square contributions are printed below expected counts

	large	medium	small	Total
1	27	20	53	100
	32.34	25.62	42.04	
	0.881	1.234	2.857	
2	26	35	39	100
	32.34	25.62	42.04	
	1. 242	3.433	0.220	
3	27	47	27	101
	32.66	25.88	42.46	
	0.981	17.240	5.629	
4	50	1	50	101
	32.66	25.88	42.46	
	9.204	23.917	1.339	
Total	130	103	169	402

Chi-Sq 68.177, DF = 6, P-Value = 0.000

Chi-Square Test of Independence between Firm size and Strategic appraisal techniques

Expected counts are printed below observed counts

Chi-Square contributions are printed below expected counts

	large	medium	small	Total
1	22	39	39	100
	23.35	46.51	30.14	
	0.078	1. 212	2.605	
2	19	44	38	101
	23.59	46.97	30.44	
	0.892	0.188	1. 877	
3	23	54	23	100
	23.35	46.51	30.14	
	0.005	1.207	1.691	
4	23	46	31	100
	23.35	46.51	30.14	
	0.005	0.006	0.025	
5	30	50	20	100
	23.35	46.51	30.14	
	1.892	0.262	3.411	

Total	117	233	151	501

Chi-Sq 15.357, DF = 8, P-Value = 0.053

Chi-Square Test of Independence between Firm size and Analytical appraisal techniques

Expected counts are printed below observed counts

Chi-Square contributions are printed below expected counts

	large	medium	small	Total
1	32	37	32	101
	58.79	26.38	15.83	
	12.209	4.275	16.522	
2	29	43	29	101
	58.79	26.38	15.83	
	15.096	10.470	10.961	
3	75	24	1	100
	58.21	26.12	15.67	
	4.844	0.172	13.735	
4	98	1	1	100
	58.21	26.12	15.67	
	27.201	24.158	13.735	
Total	234	105	63	402

Chi-Sq 153.377, DF = 6, P-Value = 0.000

Chi-Square Test of Independence between Firm size and Integrated appraisal techniques

Expected counts are printed below observed counts Chi-Square contributions are printed below expected counts

	large	medium	small	Total
1	50	25	25	10
	37.54	37.87	24.58	0
	4.134	4.376	0.007	
2	20	60	20	100
	37.54	37.87	24.58	
	8.196	12.926	0.855	
3	43	29	29	101
	37.92	38.25	24.83	
	0.681	2.238	0.700	
Total	113	114	7	301
			4	

Chi-Sq 34.115, DF = 4, P-Value = 0.000

Appendix D
Simple Regression analysis

This appendix details the simple regression analysis output of the relationship between evaluation approaches and firm size

Table D Simple regression analysis output of the relationship between appraisal approaches and firm size

	Economic approach	Strategic approach
Large and medium sized banks	**No relationship** The regression equation is Economic = 0.438 + 0.00006 Assets billions Predictor Coef SE Coef T P Constant 0.43840 0.06577 6.67 0.000 Assets billions 0.000054 0.001874 0.03 0.973 S = 0.178877 R-Sq = 0.0% R-Sq(adj) = 0.0% Analysis of Variance Source DF SS MS F P Regression 1 0.00004 0.00004 0.00 0.973 Residual Error 13 0.41596 0.03200 Total 14 0.41600	**No relationship** The regression equation is Strategic = 0.779 - 0.00395 Assets billions Predictor Coef SE Coef T P Constant 0.77866 0.08665 8.99 0.000 Assets billions -0.003948 0.002469 -1.60 0.134 S = 0.235659 R-Sq = 16.4% R-Sq(adj) = 10.0% Analysis of Variance Source DF SS MS F P Regression 1 0.14205 0.14205 2.56 0.134 Residual Error 13 0.72195 0.05553 Total 14 0.86400
Large and small banks	**No relationship** The regression equation is Economic = 0.488 - 0.00063 Assets billions Predictor Coef SE Coef T P Constant 0.48825 0.04738 10.30 0.000 Assets billions -0.000631 0.001413 -0.45 0.662 S = 0.147756 R-Sq = 1.4% R-Sq(adj) = 0.0% Analysis of Variance Source DF SS MS F P Regression 1 0.00435 0.00435 0.20 0.662 Residual Error 14 0.30565 0.02183 Total 15 0.31000	**No relationship** The regression equation is Strategic = 0.499 + 0.00066 Assets billions Predictor Coef SE Coef T P Constant 0.49862 0.07236 6.89 0.000 Assets billions 0.000661 0.002158 0.31 0.764 S = 0.225630 R-Sq = 0.7% R-Sq(adj) = 0.0% Analysis of Variance Source DF SS MS F P Regression 1 0.00477 0.00477 0.09 0.764 Residual Error 14 0.71273 0.05091 Total 15 0.71750
Medium-sized and small banks	**Strong relationship. As asset value increases, use of economic reduces** The regression equation is Economic = 0.589 - 0.0268 Assets billions Predictor Coef SE Coef T P Constant 0.58893 0.06890 8.55 0.000 Assets billions -0.02677 0.01049 -2.55 0.021 S = 0.133833 R-Sq = 27.7% R-Sq(adj) = 23.4% Analysis of Variance Source DF SS MS F P Regression 1 0.11656 0.11656 6.51 0.021 Residual Error 17 0.30449 0.01791 Total 18 0.42105	**Strong relationship. As asset value increases, use of strategic increases** The regression equation is Strategic = 0.349 + 0.0445 Assets billions Predictor Coef SE Coef T P Constant 0.34904 0.09640 3.62 0.002 Assets billions 0.04448 0.01468 3.03 0.008 S = 0.187243 R-Sq = 35.1% R-Sq(adj) = 31.2% Analysis of Variance Source DF SS MS F P Regression 1 0.32188 0.32188 9.18 0.008 Residual Error 17 0.59602 0.03506 Total 18 0.91789

	Analytical approach	Integrated approach
Large and medium sized banks	**No relationship** The regression equation is Analytical = 0.336 + 0.00189 Assets billions Predictor Coef SE Coef T P Constant 0.33621 0.06848 4.91 0.000 Assets billions 0.001886 0.001951 0.97 0.351 S = 0.186244 R-Sq = 6.7% R-Sq(adj) = 0.0% Analysis of Variance Source DF SS MS F P Regression 1 0.03240 0.03240 0.93 0.351 Residual Error 13 0.45093 0.03469 Total 14 0.48333	**No relationship** The regression equation is Integrated = 0.531 + 0.00009 Assets billions Predictor Coef SE Coef T P Constant 0.5310 0.1258 4.22 0.001 Assets billions 0.000092 0.003584 0.03 0.980 S = 0.342194 R-Sq = 0.0% R-Sq(adj) = 0.0% Analysis of Variance Source DF SS MS F P Regression 1 0.0001 0.0001 0.00 0.980 Residual Error 13 1.5223 0.1171 Total 14 1.5223
Large and small banks	**Strong relationship. As asset value increases, use of analytic techniques increases** The regression equation is Analytical = 0.237 + 0.00359 Assets billions Predictor Coef SE Coef T P Constant 0.23713 0.05566 4.26 0.001 Assets billions 0.003589 0.001660 2.16 0.048 S = 0.173556 R-Sq = 25.0% R-Sq(adj) = 19.7% Analysis of Variance Source DF SS MS F P Regression 1 0.14079 0.14079 4.67 0.048 Residual Error 14 0.42171 0.03012 Total 15 0.56250	**No relationship** The regression equation is Integrated = 0.345 + 0.00335 Assets billions Predictor Coef SE Coef T P Constant 0.34527 0.09889 3.49 0.004 Assets billions 0.003351 0.002950 1.14 0.275 S = 0.308371 R-Sq = 8.4% R-Sq(adj) = 1.9% Analysis of Variance Source DF SS MS F P Regression 1 0.12270 0.12270 1.29 0.275 Residual Error 14 1.33130 0.09509 Total 15 1.45399
Medium-sized and small banks	**No relationship** The regression equation is Analytical = 0.159 + 0.0155 Assets billions Predictor Coef SE Coef T P Constant 0.15884 0.07237 2.19 0.042 Assets billions 0.01551 0.01102 1.41 0.177 S = 0.140563 R-Sq = 10.4% R-Sq(adj) = 5.2% Analysis of Variance Source DF SS MS F P Regression 1 0.03912 0.03912 1.98 0.177 Residual Error 17 0.33588 0.01976 Total 18 0.37500	**No relationship** The regression equation is Integrated = 0.260 + 0.0154 Assets billions Predictor Coef SE Coef T P Constant 0.2595 0.1483 1.75 0.098 Assets billions 0.01539 0.02258 0.68 0.505 S = 0.287962 R-Sq = 2.7% R-Sq(adj) = 0.0% Analysis of Variance Source DF SS MS F P Regression 1 0.03853 0.03853 0.46 0.505 Residual Error 17 1.40967 0.08292 Total 18 1.44820