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DECISION QUALITY: THE IMPACT OF PROCESS REDESIGN

AS AN INTANGIBLE BENEFIT ON INFORMATION

TECHNOLOGY INVESTMENT DECISIONS

The members of the Committee approve the doctoral dissertation of Atieno Anne Ndede-Amadi

Peter P. Mykytyn Jr.
Supervising Professor

Lawrence L. Schkade

Mary M. Whiteside

Radha Mahapatra

Jeffrey J. Tsay

Dean of the Graduate School

DECISION QUALITY: THE IMPACT OF PROCESS REDESIGN AS AN INTANGIBLE BENEFIT ON INFORMATION TECHNOLOGY INVESTMENT DECISIONS

by

ATIENO ANNE NDEDE-AMADI

Presented to the Faculty of the Graduate School of
The University of Texas at Arlington in Partial Fulfillment
of the Requirements
for the Degree of

DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF TEXAS AT ARLINGTON
May 2001

UMI Number: 3010044

Bell & Howell Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

ACKNOWLEDGMENTS

This terminal degree would not have been successfully completed without the love, support, and sacrifices of my family: my husband Mike, and sons Kevin, Jordan, Jobe, and Keith. They were wonderful throughout the entire process.

I wish to thank Dr. Peter P. Mykytyn, Jr. for his unwavering support and guidance and for the time and knowledge shared with me throughout this effort.

I wish to thank Dr. Lawrence L. Schkade for his inspiration, encouragement, and counsel both during this effort and throughout my post-graduate studies career.

I wish to thank Dr. Mary M. Whiteside for the time and knowledge shared with me towards the completion of this effort.

I wish to thank both Dr. Radha Mahapatra and Dr. Jeffrey J. Tsay for their thoughtful ideas and insightful suggestions and recommendations that made the successful completion of this effort possible.

In addition, I wish to thank my mother, Jane, whose early counseling and guidance instilled the confidence in me to believe in myself.

Finally, but most importantly, I wish to thank my God for providing me with both the energy and insight to be able to undertake this effort to a successful completion.

March 30, 2001

ABSTRACT

DECISION QUALITY: THE IMPACT OF PROCESS REDESIGN AS AN INTANGIBLE BENEFIT ON INFORMATION TECHNOLOGY INVESTMENT DECISIONS

Publication No. _____

Atieno Anne Ndede-Amadi, Ph.D.

The University of Texas at Arlington, 2001

Supervising Professor: Peter P. Mykytyn Jr.

IT investment decisions often focus on tangible costs and benefits such as technical, strategic, and financial issues. Less tangible benefits such as process redesign integration, have been largely ignored. Decisions makers who rely solely on these tangible costs and benefits for their assessment of IT investment value without integrating intangible benefit consideration may be making sub-optimal decisions and investments. This study looked at the important, yet often overlooked, intangible benefits consideration in the IT investment decision process with particular focus on process redesign as an intangible benefit.

Survey questionnaires were sent out to a sample of 949 firms in three industries: healthcare, chemical, and insurance to solicit information from the chief information officer (CIO) on the level at which they integrate process redesign consideration in the IT investment decision.

Several important findings resulted from this research effort. First, the study identified seven component factors of process redesign and used these factors to measure the level of process redesign integration into the IT investment decision. Second, the study confirmed, empirically, that there was an association between the consideration of tangible

and intangible benefits. Those firms that expend large effort or resources towards tangible benefits consideration also spend more effort or resources toward intangible benefits consideration than otherwise. Third, it was empirically determined that certain process redesign benefit factors received greater consideration than others. Fourth, it was determined that decision makers considered tangible benefits to be more important than intangible benefits consideration and expended a greater portion of effort or resources towards the consideration of the former. Finally, this study found that the strategic relevance of IT in an organization was associated with the level of effort or resource deployment towards intangible benefits. Additional areas for further research were also identified.

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CHAPTER 1

INTRODUCTION

1.1 The Nature of the Problem

Traditionally, information technology (IT) investment decisions have focused on cost/benefit analyses that consider only technical, strategic, and financial aspects of the decision (Bacon, 1992; Ryan, 1997). Technical aspects include requisite skills, technical requirements, speed and capacity, integration and compatibility issues, extendibility and open systems issues, technical currency, possibility of modification, vendor support, ability to support future growth, security, recovery, and long-term management and support costs (Harrington, 1991; Ryan, 1997). Strategic issues include such elements as cost reduction, customer service, cycle time reduction, competitive positioning, coordination of global business goals, and organizational survival (Zuboff, 1988; Ryan, 1997). Financial aspects of the decision include cash availability and financial position, capital expenditure and cost, dollar value, budgeting, return on investments, useful life, and price versus features (Ryan, 1997). More recently, however, researchers and practitioners alike (Holden and Wilhelmij, 1995) have suggested that traditional cost/benefit analyses alone are not enough for IT investment valuation. Hitt and Brynjolfsson (1996) have suggested that 'hidden costs and benefits' are generally not included in most IT value analyses but that they need to be. One of the 'hidden costs and benefits' of IT that is often excluded from analysis is the consideration of whether or not a proposed IT will enable process redesign.

The costs of process redesign include time spent by technical people (both in-house personnel and consultants) in analyzing, designing, and implementing new business processes. It also includes management time spent managing the different stages of analysis, design, and implementation, upper level management time, and operating personnel time. Other costs include the actual cost of the technology and the cost of other materials and equipment needed to enable redesign of the processes. All these costs are quantifiable and can be traced to the benefits derived, both tangible and intangible. Because of this ability to measure a large portion of costs incurred, the current study makes the assumption that all costs are not only quantifiable and measurable but can be associated with the benefits that they give rise to.

Seven process redesign benefit factors have been identified for the purpose of the current study Operative Efficiency, Strategic Planning, Organizational Restructuring, Technological Innovation, Customer Satisfaction, Product Quality, and Quality of Work. Operative efficiency refers to the increased speed with which firm operations are carried out due to improved processes (Tinnila, 1995). Strategic planning is a benefit of process redesign so far as business processes are redesigned to align with business strategic plans (Leymann and Altenhuber, 1994, Madrish and Schaffer, 1995). Organizational restructuring benefits accrue from the incremental changes brought about by process redesign that ultimately alter the structure of the organization (Pastore, 1994; Tinnila, 1995). Technological innovation benefits accrue from optimal IT decisions that culminate in the development of optimal IT for the redesigned processes (Davenport, 1993; Frenzel, 1999). Customer satisfaction benefits accrue when business processes are transformed into strategic capabilities that provide superior value to the customer (Stalk et al., 1992). Product quality benefits accrue when more effective processes produce higher quality products (Harrington, 1991). Quality of work benefits accrue from efficiently redesigned

processes that address issues such as who does what and how that leads to giving employees new tools with which to accomplish work (Moad, 1993).

These hidden benefit factors are generally excluded from IT investment analysis because they are often intangible and therefore difficult to quantify. Excluding them from an IT investment decision process while considering only technical, strategic, and financial costs and benefits may mean that the proposed IT investment value is altered, leading to sub-optimal IT investment decisions (Hitt and Brynjolfsson, 1996; Ryan, 1997).

Information systems (IS) research literature strongly supports the ability of an IT component to enable the redesign of business processes (Davenport, 1993; Frenzel, 1999). Without extending the concept of value to include these largely intangible benefits, sub-optimal IT investment decisions may be made that consider only whether or not the IT investment impacts the bottom line of the firm (Hitt and Brynjolfsson, 1996).

Although much research has been done in the area of business process redesign, very little work has been done to determine if in fact IT investment decision-makers include this hidden IT benefit in their decision processes and with what results. Moreover, for those situations where IT investment decision processes have considered this hidden benefit, little is known about how it has been evaluated or about the importance the decision-makers have placed on it relative to other issues (Ryan, 1997).

1.2 Overview of the Research Methodology

The current study investigates the role of the intangible benefit of process redesign in the IT investment decision process. The study attempts to determine if firms that include process redesign benefits consideration in the IT investment decision process (process redesign integration) realize greater productivity gains from IT investments than

otherwise. Significant positive association between productivity and inclusion of process redesign in an IT investment decision might indicate the need to include it in that process.

The first part of the current study is a written survey consisting of a Descriptive Component and a Model-Testing component. Data for the Descriptive and Model-Testing components are collected through a written survey. The sample selection process is described in detail in chapter 3, which deals with methodology.

The Descriptive Component solicits information from IT executives of firms in the sample regarding the IT investment decision process. Respondents are defined as executive information systems (IS) managers with such titles as the chief information officer (CIO), Vice President of IT, IS Manager, or IT Manager (Ryan, 1997). The objective is to determine the degree to which the seven process redesign benefit factors (PRBF) are integrated in the IT decision. The Descriptive Component addresses several issues. First, it evaluates the extent to which IT investment decision-makers differentiate these process redesign benefit factors in terms of importance when making an IT investment decision. Next, it examines the degree to which these process redesign benefit factors are formally, or explicitly, included in an IT investment decision process. Third, it includes information on the weight that IT investment decision-makers place on the process redesign benefit factors as compared to technical, strategic, or financial factors.

The Model-Testing component tests a proposed model, developed more completely in chapter 2, of factors that are related to the degree to which the process redesign benefit factors are considered in an IT investment decision process. The model seeks to identify the types of firms and the types of technologies that demand more attention to be paid to process redesign benefits in an IT investment decision. The Model-Testing component solicits information from IT executives of firms in the sample to test certain organizational and technological factors in terms of the role those factors play in

an IT investment decision. Organizational factors included in the model are: the existence of a Continuous Learning Culture in a firm, the Strategic Relevance of IT in a firm, and Organization Size. It is theorized that the presence of a continuous learning culture in a firm may affect the level at which process redesign benefit factors are integrated into an IT investment decision process. Whether an IT component is considered strategically relevant to the mission of the firm or whether it has a transaction orientation is theorized to affect the degree of process redesign benefits consideration. The size of a firm is also theorized to affect the level at which process redesign benefit factors are considered. One technological factor included in the model is the Type of IT Decision. The type of technology, whether it is strategic and therefore addresses infrastructure issues, and whether it is informational or transaction oriented and therefore supports business processes is also theorized to affect the level of process redesign benefits consideration (Weill, 1992). A similar approach to the one suggested for this study was used by Ryan (1997) in investigating the weight given to human resource benefits and costs (HRBC) in an IT investment decision process. HRBC are considered intangible costs and benefits in that study. The hypothesis that the presence of a continuous learning culture is somehow associated with the weight given to human resource benefits and costs in an IT investment decision was supported.

Part two of the current study uses IT impact ratios to study the relationship between the level of process redesign benefits integration and IT impact. IT impact is defined as the ratio of IT budget to total sales revenue, which measures how much an organization is spending on IT relative to competitors. It is hypothesized that high levels of process redesign benefits integration would lead to high IT impact ratios for firms as they realize greater sales revenues that more than compensate for their increased IT expenditures in the long term. Both IT capital and IT budget represent aggregate

spending on IT (Rai et al., 1997; Hitt and Brynjolfsson, 1996; Mahmood and Mann, 1993). IT capital is defined as replacement cost of computers, and IT budget is defined as the combined capital and operating budget of the IS department under the direct control of the chief information officer (CIO). Examining IT budget is important in an environment of accelerating technological obsolescence in which current expenditure has a significant role in producing short-term business benefits. Moreover, the deployment of IT budgets by firms can reflect deliberate management strategies to influence firm performance. Total capital consists of total property, plant and equipment and can be broken down into IT capital and non-computer capital. IT capital can be broken down further into the key elements of IT infrastructure: hardware, software, telecommunications, and IS staff.

1.3 Research Objectives

Many research studies have found that certain deployments of IT have the potential to enhance and even hasten the achievement of strategic objectives, and that investment in the appropriate IT has the potential to increase the chances of success for a firm (Hammer, 1993; Smith, 1994; Ryan, 1994). The current study hopes to be able to demonstrate that inclusion of the process redesign benefit factors (PRBF) in the IT Investment decision process leads to improved decisions that culminate in value added for the investing firm. Although a high IT impact ratio does not necessarily indicate high productivity, the association between process redesign integration and IT impact would demonstrate that in the long run, firms that undertake high levels of process redesign benefits integration do realize increased sales revenue that more than compensate for their increased IT budgets. Thus productivity is not measured directly in this study. The underlying assumption is that process redesign integration constitutes good IT investment

decisions that have significant positive effects on firm performance by enabling the achievement of strategic objectives through strategic alignment (Leymann & Altenhuber, 1994).

The original objective of the current study was to investigate the association between IT investments and firm performance (the productivity paradox) in general and the association between firm performance and process redesign integration in particular. However, due to lack of data, the study was not able to tie process redesign integration to firm performance directly. Instead, it tried to establish an association between process redesign integration and IT impact. If a relatively large number of firms that undertake process redesign integration aggressively are determined to be high IT impact firms. possible positive association could be indicated.

1.4 Significance of Research Topic

The IT component pertinent to the current study are hardware, software, and IS staff. Hardware includes client/server technology. The software side includes, but is not limited to, communications software, database software, application programs, and systems programs (Weill, 1992; Ahituv et al., 1994; Cash et al., 1994). IS staff costs include hiring, training, and retraining personnel costs. Investments in these IT components are made with the expectation of realizing value added in the form of a better competitive advantage, better customer service, and improved efficiencies, among other benefits. These are critical to implementing new technology infrastructures and developing end-user computing applications in an environment of distributed and client/server computing as a central theme for redesigned processes. Shifting from centralized to client/server computing can result in efficiency gains, as the client needs to formulate only the request for data and, subsequently, process the reduced dataset

returned by the server. The ability of the client/server to deliver the requisite information to empower users is a central tenet of business process redesign (Rai et al., 1997). Such systems can yield improved organizational effectiveness due to an environment of openness and trust and can result in value added.

If an association can be shown to exist between IT investments and value added, then IS managers and senior management can adjust their IT investment decisions in such a way as to increase the likelihood of achieving this goal. Specifically, if process redesign integration is determined to be more likely to result in increased value added, however measured, than exclusion, then it follows that inclusion would be more beneficial to the firm and should therefore be undertaken. By definition, value added resulting in part from effective selection and use of IT means that both measurable and non-measurable value is obtained from the IT component. An attempt is made here to trace process redesign benefits to IT investments and to associate these IT investments with value added to the firm.

1.5 Importance of the Study

A major contribution of the current study is expected to be the discovery of the process redesign benefit factors that IT investment decision-makers fail to include in their decision processes. Some organizations pay more attention to hidden costs and benefits than others. Previous research has shown that organizations that neglect and therefore exclude intangible benefits consideration from their IT investment decision processes run the risk of making sub-optimal IT investment decisions (Ryan, 1997).

1.6 Scope and Limitations of the Study

This study is primarily intended to investigate the inclusion of the identified process redesign benefit factors in the IT investment decision process, in terms of the degree to which IT investment decision-makers expend effort or resources to find out about them and to include them in the decision making process. While the quantification of these process redesign benefit factors into dollar values or the methodologies to rank them are needed areas of investigation, such an effort is beyond the scope of the current study. Statements regarding correlation between model variables can be made, but because the study is cross-sectional rather than longitudinal, strong statements regarding causality are avoided.

1.7 Organization of the Study

The study is organized in the following manner: chapter 2 reviews literature on the performance effects of IT, technical, strategic, and financial issues, and process redesign. It also reviews the literature on the organizational and technological factors that are believed to impact whether or not the process redesign benefit factors are considered in an IT investment decision. The overall research model is presented then the research questions are discussed. The Model-Testing component lays out details of the constructs, the method of measurement for those constructs, and the associated hypotheses.

Chapter 3 describes in detail the parts and components of the study. It starts out with an overview of the research methods and procedures used. It discusses the Written Field Survey with its two components namely: the Descriptive, and the Model-Testing components. A detailed discussion of the five research questions and the hypotheses developed to help answer them are presented. The following methodological issues are also discussed in chapter 3: questionnaire development (the sample selection process and

the process of formulating survey items), the pilot study, and reliability and validity of the measures used. Finally, IT Impact Ratio Analysis is discussed in terms of associating the level of process redesign integration to the IT impact ratio of a firm.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 Introduction

Traditional cost/benefit analysis is used extensively by organizations to compare alternatives and to make IT investment decisions (Semich, 1994). The objective is to select the project that maximizes the net present value of all benefits minus all costs (Ryan, 1997).

The main objective of the current study is to investigate the effects of inclusion of certain process redesign benefit factors in the IT investment decision (PRBF integration). It is theorized that PRBF integration leads to good IT investment decisions that in turn lead to firm productivity, measured as the ratio of IT budget to total sales revenue.

The need to include intangible benefits in the IT investment decision process has been suggested by IS researchers (Holden and Wilhelmij, 1995; Parker et al., 1988; Symons and Walsham, 1988) and practitioners (Semich, 1994). These researchers maintain that the traditional cost/benefit analysis taxonomy is inadequate for the comprehensive conceptualization of value. Hitt and Brynjolfsson (1995) argue that value is commonly assessed for tangible costs and benefits, which are easy to quantify, but must also be assessed for qualitative or intangible benefits.

This literature review focuses on the performance effects of IT investments, on technical, strategic, and financial issues, and on process redesign as an intangible benefit of the IT investment decision process. In addition, the technological and organizational factors

believed to impact the inclusion of process redesign benefits in the IT investment decision are discussed.

2.2 Performance Effects of IT Investments

Bender (1986) surveyed 132 life insurance companies to investigate the financial impact of IT on firms in this industry. Organizational performance was measured in terms of the ratio of total operating expense to total premium income. The IT impact was represented by the ratio of information-processing expense to total operating expense. Bender (1986) concluded that an appropriate level of investment in IT could have a positive impact on total expenses and that the optimal investment in IT for the companies studied was achieved at a level between 20 and 25 percent of total operating expenses.

Using six years of historical data on IT investment and organizational performance, Weill (1988) studied thirty-three valve manufacturing companies. IT investment was categorized as strategic, informational, and transactional, and was tested against organizational performance using six performance measures. Although transactional IT investment was found to be strongly related to superior organizational performance, there was no evidence that strategic IT investment, on a long-term basis, would increase or decrease organizational performance. However, the research results implied that strategic IT investment was beneficial to relatively poor performing firms in the short run.

Harris and Katz (1989) investigated the relationship between organizational performance and the intensity of integration and coordination of organizational activities through IT investment in the insurance industry. A year-by-year analysis of data indicated that the ratio of IT expense to total operating expense (IT expense ratio) was higher and the ratio of information technology costs to premium income (IT cost

efficiency ratio) was lower in the top-performing life insurance organizations relative to the weak performing insurance organizations. A longitudinal analysis of data also indicated that insurance firms with improved organizational performance showed increased premium income growth, decreased operating costs growth, decreased non-IT costs growth, increased IT expense ratio growth, and decreased IT cost efficiency ratio growth. This study of 40 insurance firms found strong support for the hypothesis that the ratio of IT expense to total operating expense (IT expense ratio) was higher in the top performance life insurance firms versus the weak performance life insurance firms. The results of that study supported strongly the hypothesis that the ratio of information technology costs to premium income (IT cost efficiency ratio) was significantly lower in the top performance life insurance firms versus weak performance firms. While organizational performance was measured using the ratio of total operating expense to total premium income (operating cost efficiency ratio) in that study, IT impact was represented by two ratios: the ratio of IT expense to premium income, and the ratio of IT expense to total operating expense (Bender, 1986). This measure of expense efficiency captures a firm's cost advantage or disadvantage from current operations. The operating cost/expense efficiency ratio is a short-run measure of profitability. Top performance firms exhibit low operating cost efficiency ratio values, indicating that a greater proportion of each revenue dollar is set aside for shareholder benefits. Weak performance firms exhibit high or above average values of the operating cost efficiency ratio.

Rai et al. (1997) considered performance using six variables: business output (firm performance) as measured by value added and by sales; financial business performance assessed using return on assets (ROA) and return on equity (ROE); intermediate performance assessed using labor productivity and administrative productivity. Administrative productivity was defined as the ratio of value added to the

total administrative costs of the firm (Strassman, 1988), and labor productivity was defined as the ratio of value added to the total number of employees. Value added was defined as sales less labor expenses. These researchers suggest that while various measures of IT investment can be associated with increased firm output and lower firm costs, their effect on financial measures of business performance is less consistent. They observe that variation in the links between IT, business strategy, and competitive context across firms may significantly influence financial performance. Hitt and Brynjolfsson (1994) observe that IT has the capacity to lower and increase entry barriers and to intensify and reduce competition and that this equivocal effect of IT on competitive strategy and industry structure may be an important reason for the lack of relationships between IT investment and measures of profitability, such as ROA and ROE.

Brynjolfsson (1993) argues that lack of positive evidence in the association between performance and IT investments is due to mis-measurement of outputs and inputs, lags in learning and adjustment, redistribution and dissipation of profits, and mismanagement of IT. Moreover, investments in IT may fail to show performance benefits because many studies are cross sectional in nature and do not account for the lagged effects of an investment, which could occur because of learning and readjustment in an organization. However, Rai et al. (1997) argue, to the contrary, that the effect of lag in obtaining value from IT investments may be much lower than other types of investment because of the accelerated rate of IT obsolescence. Strassman (1988) argues that there is no evidence to indicate that the decline in information-worker productivity can be attributed to time lags in obtaining benefits from IT investments since more than 80% of any firm's information systems cost is in support of current operations and in maintenance, and only 20% can be considered as investments.

Bharadwaj (2000) conducted an empirical study to compare the financial performance of firms identified as IT leaders by InformationWeek and Computer World with other firms in the same industry group of comparable size deemed not to be IT leaders. The study was based on the hypothesis that firms that are successful in creating superior IT capability in turn enjoy superior financial performance by bolstering firm revenues and/or decreasing firm costs.

The general hypothesis tested in that study was whether firms with high IT capability tend to enjoy better profit and cost performance when compared with a matched control sample of firms. That hypothesis was tested by comparing the mean levels of operational performance variables over a four-year period (1991–1994) for the treatment and control samples using a standard t-test. As hypothesized, all of the profit ratios in each of the four years were significantly higher for the IT leaders when compared to the control sample of firms. That study examined the association between superior IT capability and superior firm performance and found the relationship to be positive and significant.

The current study investigates the association between the integration of identified process redesign benefit factors in the IT investment decision process and value added using IT impact, measured as the ratio of IT budget to total sales revenue (Mahmood and Mann, 1993). If a relatively large number of firms that deploy large amounts of resources in PRBF integration are found to have high IT impact, possible positive association could be indicated. Monroe (1989) supports this point of view by observing that firms are faced with a diverse array of possibilities for organizing and structuring their business processes, as a result, some firms will be slower than others at recognizing the strategic opportunities associated with information technology.

The hypothesis that firms that integrate these process redesign benefit factors in their IT investment decisions have relatively higher IT impact ratios is tested. Information on process redesign integration is evaluated to assess if an association exists between deployment of large amounts of resources on process redesign integration and high IT impact ratios. If high IT impact ratio firms tend to have relatively higher process redesign integration than low performance firms, then positive association may be indicated. The rationale is that firms that go to great lengths to factor in costs and benefits, both tangible and intangible, of their IT investments and to measure value added by those investments are more likely to show positive contributions from those investments (McNurlin, 1986).

Rai et al. (1997) make the case that there is need to improve the modeling and measurement of the performance effects of aggregate IT investments. Measures of IT investment have differential effects on the various measures of corporate business performance. A research strategy for modeling IT effects on firm output performance and labor productivity needs to be different from a research strategy for modeling IT effects on management effectiveness and strategic business performance. They observe, however, that disaggregating IT investments in terms of specific activities and IS applications offers tremendous measurement advantages but suffers from two disadvantages: failure to examine the synergies between multiple IT investments and failure to give senior management a clear indication of how IT investments compare with a variety of other investments made by the firm. Mahmood and Mann (1993) support this point of view when they observe that modeling performance effects at the level of specific technologies and activities ignores the strategic and bottom line effects of the portfolio of investments. Measures that directly gauge the relevant aspects of IT investment and organizational performance are more appropriate. Given the complexity

of an organization, it is clear that no single measure will be sufficient to capture all factors contributing to an organization's strategic and economic performance and, therefore, a number of measures will be needed. ComputerWorld, in selecting its 'Premier 100' list of most effective information systems users (Sullivan-Trainor, 1989), used several measures of IT investment: annual organizational IT budget as a percentage of its revenue (which measures how much an organization is spending on IT relative to competitors), IT investment as a percent of revenue (which reflects the currency of a firm's technology); the percentage of IT budget spent for staff and training (which indicate the willingness of the organization to properly manage and train its IT personnel and end-users); and total distribution of personal computers and terminals throughout the corporation (which indicates the extent to which users have access to IT).

Mahmood and Mann (1993) used five ratios to measure an organization's IT investment: IT budget as a percentage of revenue; value of an organization's IT as a percentage of revenue; percentage of IT budget spent on staff; percentage of IT budget spent on staff training; and the number of PCs and terminals as a percentage of total employees.

They used the Systems Resource Approach (Yuchtman, 1967) framework for measuring organizational performance. Under this approach, organizational performance is measured using the key internal and external factors upon which the organization depends for survival. Although the results of that study indicate that the individual IT investment measures are generally weakly associated with individual organizational strategic and economic performance variables, further analysis suggests that, by considering the combined effect of IT investment measures, the prediction level can be increased significantly. That latter analysis reveals a significant relationship between the IT investment variables and the organizational strategic and economic performance

variables. This supports the findings of Bharadwaj (2000) and Bender (1986). That same analysis also shows that IT budget as a percentage of total revenue is negatively and significantly correlated with return on investment, sales by total assets, and market to book value. A possible interpretation for these negative relationships is that some of the highly rated companies used in that study may be spending excessive amounts on IT as a percentage of total revenue without a proper business strategy. This point of view is supported by Bender (1986) who concluded that there may be an optimum investment in IT at a level between 20 and 25 percent of the total general expense. It is also supported by Rai et al. (1997) who suggest that while IT is likely to improve organizational efficiency, its effects on administrative productivity and business performance might depend on such other factors as the quality of a firm's management processes and IT strategy links. In addition, factors not considered (such as economic conditions, competitive circumstances, and management performance, for example) could also have played a role (Barua et al. (1991). The fundamental conclusion of the Mahmood and Mann (1993) study is that IT investment appears to be related to organizational strategic and economic performance but that many other factors, including but not limited to economic conditions, competitive circumstances, and managerial astuteness are at least equally, or even more, important.

Several researchers suggest that how investment dollars are differentially allocated among various elements of the IT infrastructure should be examined in tandem with how many dollars are spent cumulatively (Mahmood and Mann, 1993; Rai et al., 1997). For example, one of the objectives of the Rai et al. (1997) study was to examine the relationships between investments in different elements of the IT infrastructure and multiple measures of firm performance. Although IT is said to enhance organizational capabilities, resulting in improved product variety, product quality, and customer

satisfaction, while enabling the streamlining of administrative processes and facilitating improved labor and management productivity, such improvements are often not reflected in improved financial performance since benefits may be redistributed within or across organizations or passed on to consumers (Mahmood and Mann, 1993; Hitt and Brynjolfsson, 1996). The overall positive results for labor productivity in the Rai et al. (1997) study suggest that IT has succeeded in reducing production costs and improving the productivity of personnel. Increased efficiency of human resources may be the result of automating repetitive production and clerical processes. The association between IT investments and administrative productivity was found to be weak, suggesting that the ratio of administrative expenses to value added is not improved by increasing IT investments. IT investments may not benefit poorly managed firms as they automate dysfunctional management processes (Strassman, 1995). It can be argued that deriving administrative productivity from IT investments requires simplification of management tasks, reduction of administrative overhead, and redesign of business processes. The legitimacy of this argument may be tested and would hold true, for the current study, if an association was found to exist between firms with high level PRBF integration and either firm or intermediate performance. Organizations failing to redesign management processes while increasing IT investments are likely to see administrative diseconomies of scale and rising overhead expenses without any concomitant increases in administrative productivity. Increasing diseconomies of scale as a result of superimposing IT on inefficient management processes might be responsible for the negative results in administrative productivity despite increased expenditures for IT infrastructure (Hitt and Brynjolfsson, 1996; Rai et al., 1997).

Some positive associations between IT investments and management productivity have been reported. Studying the Maple Leaf Life Insurance, Clement and Gotlieb (1987)

investigated the relationship between managerial control and on-line information systems. The information systems were found to improve managerial control over operations through increased performance reporting to managers. The information systems were also able to shorten the transaction-processing chain (for issuing new policies), leading to increased productivity and improved processing time.

2.3 Technical, Strategic, and Financial Issues

In addition to gathering information on human resource benefits and costs (HRBC), Ryan (1997) sought to obtain information regarding technical, strategic, and financial aspects of the IT investment decision in an exploratory survey. Technical issues addressed in the exploratory surveys included: Requisite Skills; Technical Requirements; Integration and Compatibility issues; Speed and Capacity; Extendibility and (Open Systems); Technical Currency; Possibility of Modification; Vendor Support; Ability to Support Future Growth; Security; Recovery; Long-term Management and Support Costs. Table 1 shows these categories and some example responses received from IT investment decision-makers:

Table 1. Technical Issues (Ryan, 1997)

Issues:	Example:
Requisite Skills	-"We thought about manpower and productivity in terms of the technical support staff." -"Will additional support people be required?" -"I look at the skill-sets of my people".
Technical Requirements	-"Do we have the hardware to run this product?"
Speed/Capacity	-"Features such as speed and capacity are important."
Integration/Compatibility issues	-"We want to integrate it (the software) with our legacy systems." -"We had to make sure that the system we were using down in Dallas was compatible." -"You can argue that the pro of going with a multi-vendor solution is that you get the best in-class. But you lose something that is becoming increasingly important, the integration capabilities that you get when you go with a single vendor".
Extendibility/(Open Systems)	-"We wanted to invest in an architecture that would last."
Technical Currency	-"We were reluctant to go with mainframes – we wanted to go with leading edge technology." -"I never buy a version without some decimals behind it." -"I try to stay on the cutting-edge of this stuff, because it pays you in the long run."
Possibility of Modification	-"When looking at the software, we ask: Can it be modified? What would that cost?"
Vendor Support	-"Can the vendor be a partner instead of just a vendor?"
Ability to Support Future Growth	-"We looked at where we are going to be in two years' time and ask: Will it be able to handle that kind of volume?"
Security	-"We look at secureness of the system. If you unplug the mainframe with the telephone lines, what happens?"
Recovery	-"If we don't have our computers up, we can't handle the customers, we can't provide the customer service, and we can't provide the product knowledge."
Long-term Management and Support Costs	-"What was the cost to run it after we got it done? That's on the IT side." -"I look at the long term management costs of the project."

Strategic issues addressed by Ryan (1997) in the exploratory surveys included: Cost Reduction; Customer Service/Satisfaction; Cycle Time Reduction; Competitive Positioning; Coordination of Global Business Goals; and Organizational Survival. Table 2 shows the different categories and some example responses received from IT investment decision-makers:

Table 2. Strategic Issues (Ryan, 1997)

Issues:	Example:
Cost reduction	-"It reduces our overhead because there're things that we've automated"
Customer service/satisfaction	-"Being able to answer the question right now instead of later"
Cycle time reduction	-"The time to market was one thing that drove us to look at alternatives (to our present system)"
Competitive positioning	-"We have to be quicker to respond to our competitors, what they're doing out there." -"I think this project won't give us competitive advantage, but will give us competitive parity".
Coordination of global business goals	-"IT allows us to execute the business on a global basis."
Organizational survival	-"It was a question of may be not being able to survive, if we didn't do something."

Table 3 shows financial issues addressed by Ryan (1997) in the exploratory surveys:

Table 3. Financial Issues (Ryan, 1997)

Issues:	Example:
Cash Availability/Financial Position	-"The driving force to network? I got to the point where I could afford it." -"The overall financial success of the company determines the kinds of funds the company has in total to invest in infrastructure upgrades of any kind."
Budgeting	-"Major projects, such as putting redundant phone lines, all has to be a part of the budget process."
Dollar value	-"If it's over $50,000 we have to submit a cost/benefit analysis in great detail. Otherwise it is basically saying so, and that we're going to do this."
Cost	-"Economic factors are paramount".
Price vs. Features	-"We were looking for the best price for the best system that had the best features."

One of the hypotheses tested in this study is whether firms integrate the more traditional tangible benefits of technical, strategic, and financial issues in their IT investment decisions than the intangible benefits of process redesign.

2.4 Process Redesign

Process redesign is defined for the purpose of the current study as the deliberate and systematic adjustment of business processes to achieve alignment between business process objectives and organizational objectives (Mandrish and Schaffer, 1995). Process redesign objectives relate to the goal(s) of each individual business process in an organization, whereas organizational objectives relate to the goal(s) of the entire organization. In the absence of or before process redesign, it is possible for each business process to be independent in operation and in objective(s). That same process may be redesigned to ascertain that it meets its objectives and organizational objectives simultaneously (Harrington, 1991). Process redesign has been identified here as one of the intangible benefits, the exclusion of which may render the IT investment decision process ineffective, leading to sub-optimal IT investments. The following literature review discusses the significant role of this hidden benefit in the IT investment decision process.

One of the first technological cost concerns for an enterprise is the redesign of business processes (Davenport, 1993; Ould, 1996). Process redesign project costs include the time and other resources required to implement new processes. This includes the time project team members spend on planning, analyzing, designing, and implementing the process changes; management time spent reviewing these stages; time spent by steering committees reviewing and approving the various stages; and the cost of any new materials and equipment needed (Shelly et al., 1998). But there are also spillover costs

involved. For example, top management involvement and commitment to change to specific projects have been identified as fundamentally important. This means management time away from other projects. Change management, another factor, was identified by Grover et al. (1995) as a critical success factor for process redesign projects and may include retraining affected personnel regarding the new processes and new technologies. These costs are all quantifiable and measurable and can be traced to the benefits derived. This supports the statement made earlier that the majority of costs associated with process redesign benefits are themselves tangible.

Tinnila (1995) identifies three perspectives on process redesign: operational, organizational, and strategic. The operational perspective sees IT as an enabler of business processes by improving operative efficiency. The organizational perspective perceives the potential of business processes in the redesign of organizations (structural changes). Organizational processes are those extending over different functions and having customers as well as suppliers. The focus is on the core and critical processes of the organization. Core processes are defined here as those critical business processes that are geared toward the achievement of strategic objectives. The objective is the development of these processes with predetermined customer segments, suppliers, and products. The strategic perspective recognizes business processes as units of strategic planning and therefore acknowledges the need to connect them more closely to business strategies. The three perspectives all deal with the same phenomenon: radical rethinking of important and crucial processes to achieve dramatic improvements in several measurable operations (Guha et al., 1993).

The perspective of the current study on process redesign aligns more closely with Tinnila's (1995) strategic perspective but encompasses both the organizational and operational perspectives.

IT can alter the type and quantity of operational resources required to carry out a particular function (Banker and Kauffman, 1988). It can also alter the underlying structure of the process itself (Harris, Katz 1988, 1989, 1991, 1992), thereby creating benefits.

The process redesign concept is a less radical approach to process change (Ould, 1995; Cook, 1996) and is distinguished from business process reengineering [BPR], which is considered to be more radical in its approach (Davenport and Short, 1990; Hammer, 1993). In spite of this distinction, however, many research findings related to BPR apply equally to process redesign and are referenced here. BPR and process redesign pose two fundamental questions: "How can IT support business processes?" and "How can business processes be transformed using IT?" (Davenport and Short, 1990; Hammer, 1993). Both are important but the first question is a fundamental one to the current study which suggests that it should be asked every time the IT investment decision is under way. The answer to the first question may play a major role in the selection of specific IT components from a list of alternatives. The second question is important to a firm that has decided to transform its business processes and is looking for ways to go about it using IT. Here value chain techniques may be used to analyze process flow and subsequent value to the organization in terms of technological and other organizational issues such as cycle-time reduction, cost reduction, customer satisfaction level increase, and defects reduction (Porter, 1985, 1990, 1995; Parker et al., 1988).

The importance of process redesign in IT investment decisions is supported by several IS researchers (Moad, 1993; Guha et al., 1993; Bashein et al., 1994) who show that traditionally work and productivity have often not improved with the introduction of new systems and that only a fraction of new systems generally alter business practices unless they support redesigned processes (Davenport, 1993; Ould, 1995).

The concept of process redesign discussed here has been called different things by different IS researchers, such as: process redesign (Ould, 1995); process improvement (Cook, 1996); and process innovation (Davenport, 1993). Other terms used for the same general concept include process change (Talwar, 1993); continuous innovation (Guha et al., 1993); incremental change (Stoddard and Jarvenpaa, 1995); flexible milestones (Bruss and Roos, 1993); gradual change (Dichter et al., 1993); staged approach to change (Drew and Smith, 1995); evolutionary change (Stoddard and Jarvenpaa, 1995); and business process optimization (Petrozzo and Stepper, 1994). All mean basically the same thing with only minor variations: the deliberate and systematic adjustment of business processes in order to achieve alignment between business process objectives and organizational objectives. The entire concept may be perceived as a continuum with BPR at one end, incremental change at the other end, and the others as points along that continuum. For example, Davenport (1993) argues that process innovation involves stepping back from a process to inquire as to its overall business objective, and then effecting improvements in the way that objective is accomplished. According to Petrozzo and Stepper (1994), it is a method of developing a new process or significantly altering a current one to better meet the needs of customers, cut costs, or otherwise improve efficiency. The newly created processes may be significantly different from existing ones (Cook, 1996; Donovan, 1994; Eason, 1988). It is usually more comprehensive than process redesign as it involves understanding customer requirements and developing processes that best match customer needs. In support of Davenport (1993) the current study attempts to show that the consideration of overall business objectives is fundamental at the IT investment decision making stage and can be done more effectively if intangible benefits are included on the benefits side of the analysis.

Many researchers (Hammer, 1993; Davenport and Short, 1990; Davenport, 1993; Rockart, 1982, 1988) recognize core processes as having strategic value. Stalk et al. (1992) proposed business process as an object of strategic planning, connecting processes to capability-based strategy. They maintain that the building blocks of corporate strategy are business processes that have to be transformed into strategic capabilities that provide superior value to the customer. Connecting processes to capability-based strategy is done using IT. This connection is best done at the IT investment decision stage in response to the question: What IT can best connect the redesigned processes to firm strategy? One of the benefits of that connection, as already mentioned, is strategic planning, one of the process redesign benefit factors.

One key to a successful process redesign effort is to examine what Moad (1993) calls end-to-end processes that are vital to the success of a company, then efficiently redesigning them in terms of who does what, and finally giving the people new tools with which to accomplish the work. An alternative approach is to persistently question why a certain existing task is done, what are alternative and better ways of doing it, who should be responsible for it, and which IT best supports the redesigned process (Barrett, 1994). Some IS researchers suggest that tools and techniques are the key to a successful process redesign effort (Drew and Smith, 1995). Others maintain that the development of a process redesign strategy is the key to business success (Talwar, 1993; Guha et al., 1993; Bruss and Roos, 1993; Dichter et al., 1993). The current study supports the later viewpoint by arguing that the inclusion of process redesign benefits consideration in the IT investment decision may lead to superior decisions which may in turn lead to higher productivity gains and ultimately to business success.

Strategic process redesign focuses on redesigning the organization to compete (Harrington, 1991). It realizes that every business process in an organization needs to be

geared toward the strategic objectives of the organization for this goal to be achieved. The ultimate goal of the organization is to compete effectively (Harrington, 1991; Senn, 1991). Competing effectively may lead to a larger market share which may lead to higher productivity gains and ultimately to business success. Toward this end, it is important to determine and prioritize the organization's critical success factors (CSFs), key performance indicators, and performance targets (Rockart, 1988). These vary from customer service, to speed of service and delivery, to product quality, depending on the industry (Harrington, 1991). Business processes are then redesigned as appropriate to gear these processes toward the achievement of the strategic goals of the organization (Schnitt, 1993; Hammer, 1990; Short and Venkatraman, 1992). When the strategic goals, redesigned processes, and critical success factors have been defined, IT needs to be identified that will enable the accomplishment of overall objectives. This is a good example of how process redesign benefits consideration can be integrated into the IT investment decision process.

Hammer (1993) found that organizations that redesign their business processes fall into three distinct categories: those that find themselves in deep trouble and have to do something dramatic to survive; those that are not yet in trouble but whose management has the foresight to see trouble coming; and those that are in peak condition but have ambitious and aggressive management. But process redesign can be proactive and continuous. IT investments can be made on the basis of specific business process requirements (Moad, 1993; Leymann and Altenhuber, 1994). For the strategic alignment of IT goals with corporate goals, enterprises often undertake process redesign and then invest in IT that can help actualize identified strategies through redesigned processes. Such process redesign efforts often culminate in the recommendation of optimal IT components that are required by the individual processes.

The Mandrish and Schaffer (1995) approach supports this point of view. They offer results-driven process redesign as an alternative to a radical all-or-nothing redesign characteristic of the BPR concept (Hammer, 1993). Results-driven process redesign blends many of the techniques of BPR into a continuous improvement process. The essence is to tackle the business-process redesign incrementally in the following ways: (1) start by focusing on the most urgent business improvement requirements, (2) set some realistic goals and identify the business processes whose improvement could contribute the most to the achievement of those goals, (3) designate a small team to map the process and design improvements that can yield some measurable results within a reasonable time frame, and (4) use successes as learning experiences for attacking the next round of redesign work (Mandrish and Schaffer, 1995).

Leymann and Altenhuber (1994) discuss the concept of managing business processes as an information resource. Because the quality of the business processes eventually influences the level of performance for an enterprise, some firms start information management at the process level. Such firms treat process models as information resources. These information resources include data about all resources needed to reach the objectives and goals of the enterprise. The collection of actions needed to achieve this goal is referred to as 'enterprise modeling'. Enterprise models have two components: a data model, which describes what can be used by the enterprise to reach its goal; and the knowledge model, which describes how the enterprise uses its resources in order to reach its goal. Some organizations often develop detailed analysis of data flows and interrelationships that map their information needs into a fully integrated systems development plan (Leymann and Altenhuber, 1994; Framel, 1993). This data architecture helps the organization understand what is actually being done to accomplish corporate objectives through specific tasks and processes in the operations of the business

(Framel, 1993). Without this ability, firms usually do not tie their system acquisitions to their business needs, resulting in investments that only make bad processes faster, not more effective (Blumenthal and Silverman, 1994; Goodman, 1994; Framel, 1993; Parker et al., 1988; Appleton, 1986). This perspective supports the premise of the current study which advocates the consideration of the business needs of the firm at the IT investment decision stage.

Specific benefits accruing from IT may be in the form of operational savings, time reductions, and other process efficiency gains. In terms of operational savings, the implementation of an IT intervention may cause a procedure to be more efficient, save materials, and save time or other resources. These cost savings are quantifiable benefits that can result from an IT intervention. Any paradigm that only looks at these and other tangible costs and benefits provides an incomplete view of total value. This is especially true now as the purpose of many IT systems have shifted from cost efficiency to strategic advantage or organizational survival (Zuboff, 1988).

Information supports decision, judgment, analysis, and organizational processes (Goodman, 1994; Hamilton and Chervany, 1981; Glazer, 1993). For example, information can be instrumental in helping organizations reengineer, redesign, or transform processes and restructure the organization. These can result in the improvement of total quality and productivity which can in turn result in competitive advantage for the organization (Leymann and Altenhuber, 1994). By evaluating IT investment costs and benefits solely from a cost/benefit frame of reference, decision-makers may choose less than optimal investment alternatives. A richer taxonomy for such decisions is needed that also includes intangible benefits (Ryan, 1997). It is in this spirit that the current study investigates the impact of specific process redesign benefit factors in IT selection. Table 4 summarizes this discussion on the characteristics of process redesign benefits.

Table 4. Characteristics of Benefits

Nature of Benefits	High Level Gains	Mid Level Gains	Low Level Gains
Tangible Benefits of IT to The Firm	Total Quality Profitability Productivity Consumer Surplus	Operational Savings Cost Savings Other process efficiency gains	Save material Save labor Save time
Intangible Benefits of IT to The Firm	Operative Efficiency Strategic Planning Organizational Restructuring Technological Innovation Customer Satisfaction Product Quality Quality of Work	Supports Decision Supports Judgment Supports Analysis Supports Processes ▪ Reengineering ▪ Redesign	Greater information availability Greater information reliability

2.4.1 Process Redesign Benefit Factors

Table 5 lists specific benefit factors that may accrue to the enterprise as a result of process redesign benefits consideration in the IT investment process, based on a review of relevant literature.

Table 5. Process Redesign Benefit Factors

Factors	Selected Literature Citations
Operative Efficiency	Tinnila, 1995; Petrozzo & Stepper, 1994
Strategic Planning	Tinnila, 1995; Stalk et al., 1992; Madrish & Schaffer, 1995
Organizational Restructure	Tinnila, 1995; Guha et al., 1993; Goodman, 1994; Harrington, 1991
Technological Innovation	Davenport, 1993; Frenzel, 1999)
Customer Satisfaction	Stalk et al., 1992; Ryan, 1997
Product Quality	Harrington, 1991; Leymann and Altenhuber, 1994
Quality of Work	Moad, 1993; Guha et al., 1993; Bashein et al., 1994)

Operative efficiency may result from processes more efficient than they were before redesign. Strategic planning is enhanced as the redesigned processes are aligned with organizational strategies (Madrish & Schaffer, 1995). Organizational restructuring is possible as the process changes may ultimately change the posture of the entire organization (Tinnila, 1995). Technological innovation may result from optimal IT developed for the redesigned processes (Davenport, 1993). Customer satisfaction is realized to the extent that business processes are transformed into strategic capabilities that provide superior value to the customer (Stalk et al., 1992). Product quality is realized to the extent that more effective processes produce higher quality products (Harrington, 1991). Quality of work results from efficiently redesigning processes in terms of who does what, and finally giving the people new tools with which to accomplish the work (Moad, 1993).

The above literature review on process redesign brings out its prominent role in the IT investment decision process and the potential for its inclusion to lead to firm productivity and ultimately to performance. Exclusion of such a significant component in any process would inarguably render that process flawed. Yet, not much research work has been done to determine the level at which this intangible benefit is included in the IT investment decision process.

2.5 Factors Impacting PRBF Integration

Because every organization is unique, an IT selection process is needed that is tailored to fit the specific environment and needs of each. Such uniqueness arises from differences in organizational cultures, organizational structures, management styles, information user needs, and technologies (Taylor, 1986; Ryan, 1997). In the Model-Testing component of the current study, similar factors are evaluated for their impact on

the consideration of process redesign benefits in the IT investment decision process. These are categorized into organizational factors: a continuous learning culture, strategic relevance of IT, and organization size; and technological factors: the type of IT decision. It is expected that firms with continuous learning cultures, firms in which IT plays a strategic role, and large firms include process redesign benefits consideration in their IT investment processes to a greater extent than firms without continuous learning cultures, firms in which IT plays an operational role, and small and medium firms. It is also expected that the type of IT decision may impact the importance of including process redesign benefits in the IT investment decision process.

2.5.1 Organizational Factors

Three organizational factors are believed to impact the inclusion of process redesign benefits consideration in the IT investment decision process. These are a continuous learning culture, strategic relevance of IT in the organization, and organization size.

2.5.1.1 A Continuous Learning Culture

A continuous learning culture places value on new and innovative processes and technology and encourages systems thinking (Senge, 1990). A continuous learning organizational culture is a social system whose members have learned conscious communal processes for continuity: 1) generating, retaining, and leveraging individual and collective learning to improve performance of the organizational system in ways important to all stakeholders; and (2) monitoring, and improving performance (Smith, 1993). The concept of organizational learning has gained recognition because organizations are attempting to develop processes and organizational structures that are

adaptable to change (Dodgson, 1993). A learning organization is one that is skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights (Garvin, 1993). According to Lipshitz et al. (1996), the learning organization consists of two aspects: structural and cultural. The structural aspect consists of what they term Organizational Learning Mechanisms (OLMs). OLMs are established structures and procedures by which the organization systematically collects, analyzes, stores, disseminates and uses information that is pertinent to organizational effectiveness. The structural aspect of organizational learning is accomplished through the intentional actions and plans of an organization, not by random chance (Garvin, 1993; Henderson & Lentz, 1995). Often, the organization is structured so that information can flow quickly throughout (Wick & Leon, 1995). This information allows the organization to adapt or innovate in a rapid manner (Frenzel, 1999).

The second aspect of a learning organization is cultural (Lipshitz et al., 1996). Here organizational learning is the result of shared values and experiences, which aggregates individual experiences into a corporate awareness (Henderson & Lentz, 1995).

IT is often used by learning organizations to rapidly disseminate knowledge and overcome "the learning curve" when introducing employees to new procedures or products (Quinn et al., 1996). For example, knowledge from past experts can be codified and stored via such IT as expert systems so that other organizational members can access this knowledge as needed (Ahituv et al., 1993; McCleod, 1993).

Organizations with continuous learning environments are believed to be more likely to include process redesign benefits consideration in their IT investment decision processes.

2.5.1.2 Strategic relevance of IT

Information systems (IS) have been grouped into data processing systems, management information systems, and decision support systems by some researchers (Sprague and McNurlin, 1986). Weill (1989) categorized IT into strategic, informational, and transactional systems in an investigation that tried to tie IT to firm performance. Findings there indicated that IT transactional systems investments are strongly associated with increased performance, and IT strategic systems are associated with poorly performing firms in the short run. Weill (1989) explains that strategic IT can provide competitive advantage to early adopters and then become common and the competitive advantage lost as other firms acquire the same IT. This echoes the conclusions drawn by Hitt and Brynjolfsson (1996) discussed earlier. The Weill (1989) study upholds to some extent the business value of IT and validates the argument that due to their very nature, transactional IT improve current processes and their effects are likely felt in the same fiscal period (Parker et al., 1988). Strategic systems, on the other hand, are long-term in nature and their effects are more likely to be felt toward the end of the strategic period. Strategic information systems (SIS) are an integral part of a firm's success and survival through influencing corporate strategy or directly supporting company strategy (Sabherwal & King, 1991; Frenzel, 1999). Although IT may be used as a key strategic tool in some firms, it may play only a supportive role in others (McFarland & McKinney, 1983). Much of the literature on SIS has concentrated on the ability of SIS to allow a firm to capitalize on either a cost-based market strategy or a product differentiation strategy (Bakos & Treacy, 1986; Porter and Millar, 1995; Wiseman, 1988). Some of the literature has focused on the use of SIS to build in customer switching costs (Clemons, 1986; Clemons & Row, 1991; Feeny, 1988).

Organizations that use IT strategically are believed to be more likely than others to include process redesign benefits consideration in their IT investment decision processes.

2.5.1.3 Organization Size

DeLone (1988) found that CEO involvement was the strongest factor linked with computer effectiveness in a small business. Small businesses are typically constrained by more limited resources than are large companies. Therefore, small firms often fail to justify the expense and time of a formal process to evaluate computer systems (Raymond, 1985). In addition, small firms do not use quantitative financial techniques (e.g., net present value) when making a software or hardware selection decision (Chau, 1995). On the contrary, Chau (1994; 1995) found that qualitative information related to the opinions of end-users significantly impact IT decision maker choices when selecting application software.

Large firms are believed to be more likely to consider process redesign benefits more explicitly in their IT investment decisions than small and medium firms.

2.5.2 Technological Factors

One technological factor, the type of IT decision, is believed to impact the inclusion of process redesign benefits consideration in the IT investment decision process.

2.5.2.1 Type of IT Decision

Ryan (1997) conducted exploratory interviews of IS executives involved in IT investment decisions which revealed that the type of IT decision under consideration

impacts the steps in the decision process and the degree to which IT decision makers consider human resource benefits and costs (HRBC) issues. Three basic types of IT decisions emerged from those interviews: (1) infrastructure decisions, (2) renewing or enhancing existing business capability and (3) deploying a new capability often in conjunction with a new business venture.

2.5.2.1.1 Infrastructure Decisions

IT infrastructure has been defined as a shared set of tangible IT resources that provide foundation to enable present and future business applications (Duncan, 1995). Examples of IT infrastructure components include computer hardware, operating systems, and networking capabilities. These provide an underlying framework for the organization's information systems (Ryan, 1997; Frenzel, 1999).

2.5.2.1.2 Renewing or Enchancing Existing Business Capacity

Renewing or enhancing existing business capability can take several forms: 1) automating a business process that was not previously automated, (2) extending the functionality of existing IT to meet the current needs of the business, and (3) redesigning or reengineering a business process with the support of IT (Ryan, 1997).

In automation, the process itself may not change but becomes automated through the use of technology. This may eliminate the need for human intervention altogether, or may change the employee's work in that technology is leveraged to help accomplish the required tasks. Extending the functionality of existing IT to meet current business needs will impact the way in which a particular task gets accomplished. In process redesign, the actual flow of work changes (Ould, 1996; Cook, 1996).

2.5.2.1.3 Developing a New Business Capability

The third major IT decision is made in conjunction with an organizational strategic initiative. This typically is a decision by the senior executives in the organization to engage in a particular business venture. The technology implications are then explored in terms of the most cost effective way to enter into the business (Davenport, 1993).

2.5.2.2 Impact of Type of IT Decision on Process Redesign Benefits

For the purpose of surveying IT executives, the three basic types of IT decisions that emerged from the interviews conducted by Ryan (1997): (1) infrastructure decisions, (2) renewing or enhancing existing business capability, and (3) deploying a new capability often in conjunction with a new business venture, were combined into two major categories. IT decision type one (1) was called Infrastructure type IT decision. IT decision types 2 and 3 were collapsed into one major category called Business Process type IT decision. The current study adapts the Ryan (1997) approach and classifies IT decisions into Infrastructure type IT decisions and Business Process type IT decisions.

The results of the exploratory interviews conducted by Ryan (1997) indicated that IT decisions do not uniformly engender the same degree of human resource benefits and costs consideration. The greatest consideration is given when the IT in question is one of renewing or enhancing existing business capability. Moreover, decision makers believe that more human resource benefits and costs consideration should be given when the proposed IT will greatly impact the daily work flows of employees. The hypothesis that the type of IT decision would affect the degree to which HRBC are included in the IT investment decision was supported in the Ryan (1997) study. The rationale for adapting the Ryan (1997) study is discussed later in this chapter.

Process redesign benefits, like most other intangible benefits, are strategic in nature (Frenzel, 1999). Given the long term orientation of strategic benefits, the logic in the findings of Ryan (1997) can be extended to the current study and an argument made that IT decisions do not uniformly engender the same degree of process redesign benefits consideration. Thus, the greatest process redesign benefits consideration is given when the IT in question is not one of renewing or enhancing existing business capability nor developing a new business capability (Business Process), but rather of a more strategic nature (Infrastructure). Given this line of logic, then, it is expected that firms consider process redesign benefits to a greater extent when they make Infrastructure type IT decisions than when they make Business Process type IT decisions. A comparison of responses between the two scenarios will give indication of the validity of this argument and address the hypothesis that the type of IT decision may impact the consideration of process redesign benefits. A discussion of how this is accomplished is included in chapter 3, section 3.2.2: Model-Testing Component.

2.5.3 Industry Sector

Information concerning the influence of industry in testing the model was desired. Industry sector impact is identified as an organizational mediating variable. The application of information technology is believed to vary by industry (Harris and Katz, 1988, 92; Bender, 1986; Lin and Vassar, 1996). Further, some industries are believed to have been involved in process redesign to a greater extent than others (DiRomualdo and Gurbaxani, 1998). To be able to capture the differences in IT deployment in general and process redesign in particular, across industries, the current study identified three industries that span the entire spectrum of process redesign efforts. The insurance industry was selected as one that is believed to be among those that have employed

process redesign relatively more aggressively than others (Lin and Vassar, 1996; DiRomualdo and Gurbaxani, 1998). The health care industry, on the other hand, was identified as one of the industries that have employed process redesign with the least intensity (Lin and Vassar, 1996; Banta, 1990; Lin and Clousing, 1995). The chemical industry was selected as one that has employed process redesign with moderate intensity (Lin and Vassar, 1996; Hunter and Schmitt, 1999; Center, 1994).

2.5.4 Individual Control Variables

Gender, tenure in position (Stevens et al., 1978), age (Norburn and Birley, 1988), and functional background (Jarvenpaa and Ives, 1991) have been shown to impact the attitudes of executives. Therefore, these items are included as mediating variables in the Model-Testing component and are made part of the survey instrument (appendix C, Items 65 through 76). Functional background is measured as the percentage of working career spent in each of the following areas by the respondent: Accounting/Finance, Human Resources, Information Systems, Manufacturing or Production/Operations Management, Marketing, or Other (appendix C, Item# 76). A similar approach, using the same categories, was used by Ryan (1997) in the investigation of the level of consideration given to HRBC in the IT investment decision.

Figure 1 shows the factors that are proposed to impact how much process redesign benefits are included in the IT investment decision.

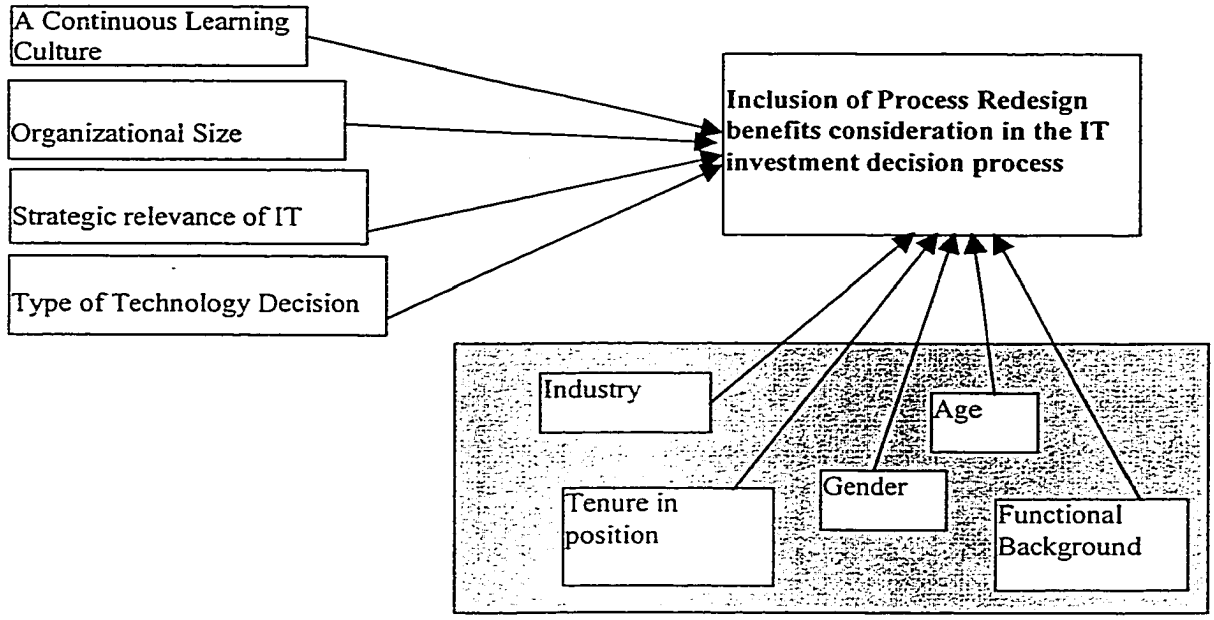

Figure 1. Factors Impacting Inclusion of Process Redesign Benefits in an IT Investment Decision (Adapted from Ryan, 1997).

2.5.5 IT Impact

This study makes the case that IT investments are undertaken to improve the position of the investing firm. This improvement in position is referred to in this study as value added. The rationale is that use of IT adds value to the organization. Some of this value is more tangible and measurable than others. Intangible value, although not easily measurable is important and needs to be captured and measured somehow. Due to limited resources in the firm, providing justification for potential IT investments is an important function that improves the resource allocation process. The justification process is more effective when value added by the investment is assessed considering all potential costs and benefits of the investment, both tangible and intangible.

Value added by IT investments is captured in this study using IT impact, defined as the ratio of the IT budget to total sales revenue. It measures the degree to which a firm

invests in IT relative to other firms in the same industry (Bharadwaj, 2000). This study theorizes that firms that set aside larger portions of their sales revenue for the purchase of IT, relative to other firms in the same industry, realize greater benefits from those expenditures (Mahmood and Mann, 1993) than otherwise. Benefits realized from expenditures on IT, both tangible and intangible, are theorized to lead to value added. High IT impact ratio firms are expected to show high levels of process redesign integration indicating that their increased IT budget outlays are overcompensated by increased sales revenue. The implication would be that firms that invest aggressively in their business processes are reaping some returns. These returns are demonstrated by high IT impact ratios and are called value added in this study. An additional implication of this determination would the ability to measure what is otherwise largely an intangible benefit, process redesign integration. This theory is related to and disproves the 'productivity paradox', which argues that investments in IT have failed to generate verifiable returns. The argument in this study is that IT investments have and continue to yield returns. However, the verifiability of these returns depends on whether a firm takes adequate measures to quantify all returns, both tangible and intangible. This point of view is supported by Hochstrasser and Griffiths (1991), who found that firms with strict standards of IT evaluation have more positive views about the return on IT investments. They concluded that if the value of IT is an unresolved issue in a firm, then this is usually due to one of two factors: either value is not delivered, or value is delivered but not recognized. Measures of value added, both tangible and intangible, have to be established and reported.

This study posits that redesigned processes may result in increased operational efficiency, more effective strategic planning, ability to restructure the organization, increased technological innovation, increased customer satisfaction, improved product

quality, and enhanced quality of work (Harrington, 1991; Stalk et al., 1992; Framel, 1993; Moad, 1993; Guha et al., 1993; Davenport, 1993; Petrozzo and Stepper, 1994; Goodman, 1994, Leymann and Altenbuher, 1994; Bashein et al., 1994, Madrish and Schaffer, 1995; Tinnila, 1995; Frenzel, 1999). Process redesign integration is believed to lead to good IT investment decisions that lead to value added. The concept of good IT investment decisions refers to the notion that firms that consistently make sound investment decisions come out ahead in the long run. By demonstrating that firms that deploy more resources towards process redesign integration realized greater sales revenue than otherwise, this study is in effect showing that intangible benefits integration lead to value added.

2.6 Rationale for Adapting the Ryan (1997) Study

The Ryan (1997) study investigated the integration of human resource costs and benefits (HRBC), into the IT investment decision by comparing the level of that integration to the inclusion of more tangible costs and benefits. HRBC are considered intangible costs and benefits That study surveyed IT executives regarding their integration of HRBC in the IT investment decision, about the strategic relevance of IT in their organization, and the presence of a continuous learning culture in their organization, among other issues. It also conducted telephone interviews with some IT executives regarding specific issues related to the more tangible factors in the IT investment decision identified as technical, strategic, and financial issues.

The current study adapts the Ryan (1997) study for several reasons. First both studies are interested in the role of intangible costs and benefits in the IT investment decision process. Second both studies are interested in looking at similar factors that impact whether or not intangible benefits are included in the IT investment decision such

as the presence of a continuous learning culture in a firm, the strategic relevance of IT in the organization, size of the organization, and the type of IT decision under consideration. The similarities notwithstanding, the studies take different directions. While the Ryan (1997) study looks at both the cost and benefit sides of Labor Savings, Improved Productivity, Improved Quality of Work, Greater Employee Empowerment, Arousal, Increased Job Satisfaction, Improved Decision Making Quality, and More Timely Decisions as the factors that make up HRBC, the constructs of interest in the current study are Operative Efficiency, Strategic Planning, Organizational Restructuring, Technological Innovation, Customer Satisfaction, Product Quality, and Quality of Employee Work. Moreover only the benefits of these constructs are investigated, as this study assumes that all costs are measurable and therefore not intangible.

2.7 Research Model

Tangible costs and benefits include technical, strategic, and financial issues (Ryan, 1997), which are discussed in greater detail in a prior section of this chapter. Included among intangible benefits that might accrue to an organization from an IT investment are process redesign benefits. Seven factors have been identified as those most frequently associated with process redesign benefits in the IS research literature. These are Operative Efficiency, Strategic Planning, Organizational Restructuring, Technological Innovation, Customer Satisfaction, Product Quality, and Quality of Work (Harrington, 1991; Stalk et al., 1992; Framel, 1993; Moad, 1993; Guha et al., 1993; Davenport, 1993; Petrozzo & Stepper 1994; Goodman 1994; Leymann and Altenhuber, 1994; Bashein et al., 1994; Madrish & Schaffer, 1995; Tinnila 1995; Ryan, 1997; Frenzel, 1999).

Certain organizational and technological factors are believed to impact whether or not intangible benefits are integrated into the IT investment decision. Organizational

factors include a continuous learning culture, the strategic relevance of IT in an organization, and organization size. Technological factors include the type of IT decision.

The research model attempts to bring together all the cost and benefit factors that go into the IT investment decision to ensure that high quality decisions are made. Inclusion of all the elements of value into the IT investment decision process is believed to lead to good IT investments. Good IT investments are theorized to lead to value added. Table 6 depicts the elements of the research model whereas figure 2 is a layout of the research model itself.

Table 6. Elements in the Research Model

Costs and Benefits	Factors Impacting Consideration of Intangible Benefits	Quality of IT Investment	IT Impact
Tangible: Technical, Strategic, & Financial Issues	Organizational: Continuous Learning Culture Strategic Relevance of IT Organization Size	Low Quality: Does not include intangible benefits consideration	Low IT Impact: Small degree consideration of intangible benefits
Intangible: Process Redesign ✓ operative efficiency; ✓ strategic planning; ✓ organizational restructuring; ✓ technological innovation; ✓ customer satisfaction; ✓ product quality; ✓ quality of work	Technological: Type of IT Decision	High Quality: Includes intangible benefits consideration	High IT Impact: Large degree consideration of intangible benefits

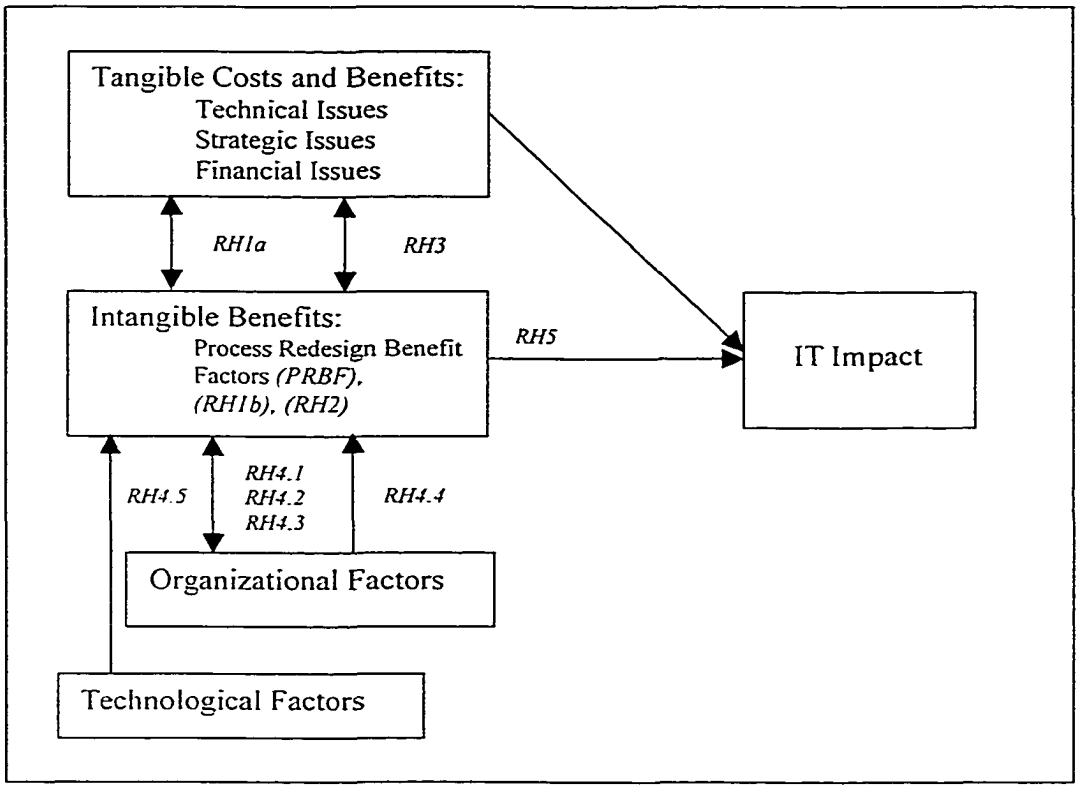

Figure 2. Research Model.

2.8 Research Questions

The five research questions in the current study are discussed here in the context of the research methods used to help answer them.

2.8.1 Research Methods

This study uses two main research methods. A Written Field Survey is used to solicit information from IT executives regarding IT investment decisions. The field survey method is divided into the Descriptive and Model-Testing components, discussed below. An IT impact ratio analysis is used to study the association between process

redesign integration and IT impact, defined in this study as the ratio of IT budget to total sales revenue.

2.8.1.1 Written Field Survey

The Written Field Survey addresses two major objectives: (1) to gather descriptive data on the current state of practice in industry regarding inclusion of the process redesign benefit factors in the IT investment decision process (Descriptive Component); and (2) to test a proposed model of factors believed to impact the inclusion of the process redesign benefit factors in the IT investment decision (Model-Testing Component). Discussion on the development of the survey instrument is deferred to chapter 3.

2.8.1.1.1 Descriptive Component

The Descriptive Component (adopted from Ryan, 1997), attempts to answer research questions 1, 2 and 3. The formulation of the survey instrument, discussed in section 3.4 of chapter 3 is in terms of acquiring data to answer each of these research questions.

RQ1: To what extent do IT investment decision-makers differentiate the intangible benefit of process redesign in terms of importance when making the IT investment decision?

This question investigates the importance of the process redesign benefit factors to IT investment decision-makers. The objective is to examine whether process redesign benefits consideration is likely to lead to better IT investment decisions than investment decisions made without process redesign benefits consideration. An association between integration of the process redesign benefit factors and good IT investment decisions

would indicate the importance of including this intangible benefit in the IT investment decision process. The current study posits that redesigned processes may result in increased operational efficiency, more effective strategic planning, ability to restructure the organization, increased technological innovation, increased customer satisfaction, improved product quality, and enhanced quality of work (Harrington, 1991; Stalk et al., 1992; Framel, 1993; Moad, 1993; Guha et al., 1993; Davenport, 1993; Petrozzo & Stepper 1994; Goodman 1994; Leymann and Altenhuber, 1994; Bashein et al., 1994; Madrish & Schaffer, 1995; Tinnila 1995; Ryan, 1997; Frenzel, 1999).

In the context of the current study, the concept of good IT investment decisions refers to the notion that high IT impact firms are more productive as a result of their IT investment decisions, as they are able to realize greater sales revenue relative to their increased IT budget Should analysis of the survey results indicate that high IT impact firms include process redesign benefits consideration in their IT investment decisions to a greater extent than low IT impact firms, then those in the first group can be said to make good IT investment decisions relative to the second group.

RQ2: To what extent do IT investment decision-makers consider process redesign benefit factors in an explicit manner versus an implicit manner?

Explicit process redesign consideration means that information is quantified and included in a financial formula that produces a rate of return for the investment in question. The Unbridged Webster's dictionary (1989) gives a definition of explicit as "clearly developed or formulated." Implicit is defined in the same dictionary as "implied, tacitly understood, rather than expressly stated." Using these definitions, a broader perspective of explicit versus implicit consideration of process redesign benefits refers to whether the decision-makers take specific, observable or manifest actions to measure the process redesign benefits of the IT investment decision. Implicit consideration would

mean that these factors are solely cognitive considerations of the decision-maker (Ryan, 1997).

RQ3: What weight does the IT investment decision-maker place on the intangible benefit of process redesign compared to the tangible benefits of technical, strategic, and financial factors when making the IT investment decision?

Research question three compares the inclusion of process redesign benefit factors in the IT investment decision to consideration of the more traditional decision factors such as technical, strategic, and financial issues in terms of the weight placed on each decision variable. Research shows that including only tangible costs and benefits in the assessment of value without considering intangible costs and benefits may lead to sub-optimal decisions. The level of process redesign integration for a firm is compared to its consideration of tangible costs and benefits. It is anticipated that, all things equal, those firms with higher process redesign integration will demonstrate high IT impact than otherwise, showing more value added.

2.8.1.1.2 Model-Testing Component

Three *organizational constructs* are used in this model: a continuous learning culture; strategic relevance of IT; and organization size with industry used as a statistical mediating variable. Four additional *individual constructs* are also used as statistical mediating variables: functional background, tenure in position; gender; and age. All the eight constructs are used to examine variances between firms (between firm variance). A ninth variable, type of IT decision, is used to determine within firm variation (within firm variance) based upon the type of technology decision.

This Model-Testing component of the Written Field Survey attempts to answer one main research question:

RQ4: What are the factors that impact how much process redesign benefits are included in the IT investment decision?

Research question four proposes to examine factors that determine the extent to which the process redesign benefit factors are included for consideration in the IT investment decision process. This research question gives rise to five hypotheses. Testing these hypotheses provides a basis for determining whether or not a continuous learning culture, the strategic relevance of IT, organization size, industry, and type of IT decision are associated with the inclusion of process redesign benefits consideration in the IT investment process, and if so, to what extent.

2.8.1.1.3 IT Impact Ratio Analysis

The second research method, IT impact ratio analysis, addresses the fourth and last research question:

RQ5: Does the level of IT impact differ between firms that deploy large amounts of resources towards process redesign integration and those that don't?

It was theorized that there is an association between the level of process redesign benefit factor integration and IT impact. Research hypothesis 5 (RH5) is set up and tested to help answer this research question.

2.9 Hypotheses

Following is a brief discussion of each of the hypotheses developed to help answer research questions 1, 2, 3, 4, and 5 (RQ1, RQ2, RQ3, RQ4, and RQ5). A more detailed discussion of each, including the methods of measurement, is deferred to chapter 3.

RH1a: The weight that decision-makers place on the intangible benefit of process redesign when making an IT investment decision is positively correlated to the weight they place on tangible benefits.

It is hypothesized that organizations that expend extraordinary amounts of resources assessing value arising from IT investments in terms of quantifying the more tangible benefits such as technical, strategic, and financial issues also expend relatively larger amounts of effort or resources towards process redesign integration.

RH1b: Decision makers consider certain process redesign benefit factors to be more important than others in the IT investment decision process.

It is hypothesized that the level at which the individual process redesign benefit factors (PRBF) are integrated into the IT investment decision differs. Some PRBF may be considered by the decision makers to be more important and therefore receive greater weight than others.

RH2: For a given process redesign benefit factor. the level of explicit versus implicit consideration differs.

It is hypothesized that some PRBFs receive greater explicit consideration than implicit and vice versa. In explicit consideration, financial forecasting tools are used to project and measure potential benefits from alternative IT investments. In implicit consideration, cursory discussions and considerations regarding the pros and cons of an investment are undertaken.

RH3: Decision makers place greater weight on the consideration of tangible benefits than on intangible benefits.

It is hypothesized that in assessing value added to the organization from IT investments, more effort or resources are deployed towards consideration of the more

tangible benefits such as technical, strategic, and financial issues than towards intangible benefits such as process redesign.

RH4.1: There is a direct relationship between the intensity of a Continuous Learning Culture in an organization and consideration of process redesign benefit factors in the IT investment decision.

As technological innovations are introduced into organizations, it is hypothesized that those with continuous learning cultures will be more apt to adopt strategies that will enhance and speed up the achievement of overall organizational goals. Not only will they recognize the requirements of organizational members in terms of learning and assimilating the proper skills to master the new technology, they will also recognize the necessity of including consideration of the process redesign benefit factors in their IT investment decision processes on the outset

RH4.2: There is a direct relationship between the Strategic Relevance of IT in an organization and consideration of process redesign benefit factors in the IT investment decision.

IT alone does not provide organizations with strategic competitive advantage. Moreover, different types of IT make different contributions to organizational strategy. It is the strategic deployment of IT that leads to competitive advantage. It is hypothesized that firms in which IT is relevant to the organization's strategic posture will recognize the importance of the process redesign benefit factors in the success of IT deployment, and will incorporate these considerations into their investment decision processes.

RH4.3: Large firms will integrate process redesign benefit factors into the IT investment decision to a greater extent than small and medium size firms.

Small firms typically do not use traditional capital budgeting techniques (e.g., net present value), in making a software selection decision (Chau, 1995; Ryan, 1997).

Instead, qualitative information related to the opinions of end-users significantly impacts IT decision-maker choices when selecting application software (Chau, 1994; 1995). The same logic may be extended to the selection of hardware. As firms become larger, the decision processes may become more formalized. Large firms, therefore, may be very sophisticated in their analysis of the impact IT will have on their organizations (Neumann et al., 1992). It is hypothesized that large firms consider process redesign benefits implications in IT investments to a greater extent than small and medium-sized firms.

RH4.4 Industry sector will have an effect on the level of process redesign benefit factor integration into the IT investment decision.

A review of the literature revealed that some industries have used IT more extensively than others (Neumann, 1991) and that some have pursued process redesign with greater intensity than others. Three different levels of process redesign integration intensity were identified on a continuum then three different industries were mapped against that continuum. The health care industry was mapped against low intensity, the chemical industry was mapped against medium intensity, and the insurance industry was against high intensity. It is theorized that the level of process redesign benefit factor integration within a firm will differ by industry.

RH4.5 The type of IT decision will have an effect on process redesign benefit factor integration into the IT investment decision.

IT investment decisions are divided into two broad categories of Business Process and Infrastructure type IT decisions. IT is theorized that the type of IT decision will impact the level at which process redesign benefit factors are integrated into the IT investment decision.

RH5: There is a direct relationship between the level of process redesign benefits integration in an organization and IT impact.

To help answer research question five, statistical procedures are performed to test this hypothesis and to study the association between process redesign integration and IT impact. High IT impact ratio firms are expected to show high levels of process redesign integration indicating that their increased IT budget outlays are overcompensated by increased sales revenue. The implication would be that firms that invest aggressively in their business processes are reaping returns in the form of value added.

2.10 Summary

This chapter begins with a literary review of the performance effects of IT investments, followed by technical, strategic, and financial issues of IT investments. Next, the importance of process redesign, an intangible benefit, is discussed in the context of its place in and contribution to this study. Organizational as well as technological factors believed to impact the inclusion of this intangible benefit in the IT investment decision are also discussed. A research model is presented and then the five research questions that the study hopes to answer are described. These research questions are discussed in the context of the research methods used to attempt to answer them. For each research question, the hypotheses to be tested are stated. Testing these hypotheses will provide a means for determining whether or not the associations suggested in the study do in fact exist between the specified variables, and if so to what extent.

CHAPTER 3

METHODOLOGY

The research methods and procedures described in this chapter were developed to answer the five research questions discussed in chapter two. These methods and procedures include the use of a Written Field Survey consisting of a Descriptive and a Model-Testing components and an IT Impact Ratio Analysis.

3.1 Methodology Overview

First, a Written Field Survey was administered to obtain information on the actual practice of IT executives in terms of the degree to which they include certain process redesign benefit factors in the IT investment decision. In the Descriptive Component of the survey, these factors were identified as Operational Efficiency, Strategic Planning, Organizational Restructuring, Technological Innovation, Customer Satisfaction, Product Quality, and Quality of Work (Harrington, 1991; Stalk et al., 1992; Framel, 1993; Moad, 1993; Guha et al., 1993; Davenport, 1993; Petrozzo & Stepper 1994; Goodman 1994; Leymann and Altenhuber, 1994; Bashein et al., 1994; Madrish & Schaffer, 1995; Tinnila 1995; Ryan, 1997; Frenzel, 1999). The Model-Testing component tested three hypotheses relating to certain factors that were believed to impact whether or not a firm integrates process redesign in the IT investment decision.

Next, IT impact ratio analysis was performed to assess the ratio of IT budget to total sales revenue, a measure of how firms rank in IT investments relative to other firms in the same industry. IT impact was assessed against process redesign integration to study the association. For example, a firm with a high IT impact ratio and whose mean response score indicated *an extraordinary amount of effort or resources* deployment in process redesign benefits consideration, was indicative of a positive association. Firms with relatively high IT impact and relatively high levels of process redesign integration indicated that these firms were able to generate increased sales revenues that more than compensated for their increased IT budgets.

3.1.1 The Relationship Between Research Methods and Questions

The current study used two main research methods and procedures to answer the following five research questions:

1) ***To what extent do IT investment decision-makers differentiate the intangible benefit of process redesign in terms of importance when making the IT investment decision?***
2) ***To what extent do IT investment decision-makers consider process redesign benefit factors in an explicit manner versus an implicit manner?***
3) ***What weight does the IT investment decision-maker place on the intangible benefit of process redesign compared to the tangible benefits of technical, strategic, and financial factors when making the IT investment decision?***
4) ***What are the factors that impact how much process redesign benefits are included in the IT investment decision?***
5) ***Does the level of IT impact differ between firms that deploy large amounts of resources towards process redesign integration and those that don't?***

The Descriptive Component of the Written Field Survey was employed to help answer research questions #1, #2, and #3. For each research question, at least one hypothesis was set up and tested. The intangible benefit of process redesign was categorized into seven different factors. The survey instruments (appendices C and D) were developed around these seven factors, but first the development of the items of interest was done in appendix A for the Infrastructure scenario and in appendix B for the Business Process scenario. These items were later developed into the actual survey items captured in the two survey instruments. These two major IT type categories were captured on the survey instrument by creating two scenarios in the context of which the survey items were developed. For example, appendix A items #1 through #25 relate to IT investment decisions when the IT type falls under the Infrastructure category. By the same logic, appendix B items #1 through #25 relate to IT investment decisions when the IT type falls under the Business Process category. Survey responses under the two scenarios are compared to determine if there is a difference in the consideration of process redesign benefits depending on the type of IT decision (Infrastructure or Business Process).

A process redesign benefit factors grid (table 2.2) was developed with the seven different categories. These categories were the individual process redesign benefit factors (PEBF) that accrue to the organization as a result of including process redesign benefits consideration in the IT investment decision. For each of the seven PRBF, a total of 4 survey items were created, two for Infrastructure decisions: one implicit and the other explicit; and two for Business Process decisions: one implicit and the other explicit. On a scale of one to five (with one representing No Effort or Resources and five representing Extraordinary Effort or Resources), IT executives were asked to indicate the degree to which they include these process redesign benefit factors in an IT investment process.

Written survey questionnaires were sent out to IT executives in a sample of companies to solicit the needed information. The contention was that due to the significant role of this intangible benefit in a firm, failing to include it in the decision process may result in sub-optimal decisions regarding IT investments.

To help answer research question #1, two hypotheses (RH1a and RH1b) were developed. The first of the two hypotheses examined the association between intangible benefits (survey items #12 through #25) and tangible benefits (survey items #1 through #11). The second of the two hypotheses compared statistically responses to survey items #12 through #25 to determine the extent to which IT investment decision-makers differentiate each process redesign benefit factor in terms of importance when making the IT investment decision. For example, a mean response score of five for Operative Efficiency for an organization would indicate that IT investment decision-makers in that organization consider this factor to be important and therefore expend extraordinary amount of resources assessing its impact. The reverse conclusion would be drawn for a mean response score of one. The mean response scores for the different factors were compared to assess if different weights were given to any of them.

To help answer research question #2, survey items #12 through #25 were alternated between implicit and explicit consideration of the same process redesign benefit factors. To accomplish this, survey instruments (appendices C and D) were designed to capture responses under alternating explicit (extrinsic) and implicit (intrinsic) scenarios for each of the seven process redesign benefit factors. A more detailed discussion of this procedure is deferred to section 3.4 of chapter 3 (Formulation of Survey Items). Statistical comparisons were then done to assess whether certain factors receive more consideration than others, both explicit and implicit. For example, if survey item #13 (explicit) received a higher average response score than item #20 (implicit) for

the same firm, there would be indication that Strategic Planning received higher explicit consideration (than implicit) in the IT investment decision for that firm.

To help answer research question #3, responses to survey items #1 through #11 (which relate to the extent to which IT investment decision-makers consider technical, strategic, and financial issues) were compared statistically to responses to survey items #12 through #25. Survey items were developed to gauge the amount of effort or resources decision-makers spent considering technical issues (survey items #1 to #5), strategic issues (survey items #6 to #8), and financial issues (survey items #9 to #11). On a scale of one to five (with one representing No Effort or Resources and five representing Extraordinary Effort or Resources), IT executives were asked to indicate the extent to which they included technical, strategic, and financial issues in the IT investment decision. These results were compared to survey responses relating to the inclusion of the process redesign benefit factors (survey items #12 to #25). An average score for each of these scales was calculated so that the mean scores of the scales were compared statistically (appendices A, B, C, and D).

Several statistical analyses were made. For example, if the average response score for survey items #1 through #5 of appendix C was higher than the average response score for survey items #12 through #18 of appendix C for a particular firm, it could be argued that technical issues received greater weight than process redesign benefit factors under the Infrastructure type IT decision. Moreover, if the mean response score for survey items #1 through #11 of appendix D was greater than the mean response score for survey items #12 through #18 of appendix D, it could be argued that intangible benefits received greater consideration than intangible benefits in the IT investment decision under the Business Process type of IT decision.

The Model-Testing Component of the Written Field Survey was used to answer research question #4. It was hypothesized that certain organizational factors impacted whether or not the intangible benefit of process redesign was included in the IT investment decision: the intensity of a Continuous Learning Culture; the Strategic Relevance of IT in the organization; and Organization Size. It was also hypothesized that certain technological factors impacted whether or not the intangible benefit of process redesign was included in the IT investment decision: the Type of IT Decision. Industry sector was also believed to impact the level at which process redesign integration was undertaken by a firm. Each of these factors was developed into a hypothesis. Five hypotheses were set up and tested to derive conclusions regarding the impact of the five factors. The first of the five hypotheses used correlation analysis to test the association between the intensity of a continuous learning culture and process redesign integration. The second hypothesis also used correlation analysis to test the relationship between the strategic relevance of IT in an organization and process redesign integration. The third hypothesis associated firm size to process redesign integration. The fourth hypothesis tested to see if industry sector had an impact on process redesign integration. For the technological factor of the Type of IT Decision, survey responses under the Infrastructure and Business Process types with respect to process redesign integration were compared and conclusions drawn regarding the impact of this particular technological factor. This was accomplished by comparing survey responses of appendix C to those of appendix D. The mean response scores to survey items #12 through #25 on appendix C were compared to the same items on appendix D to determine if the level of importance placed on these factors differed by type of IT decision. Figure 3 is a layout of the research methodology overview.

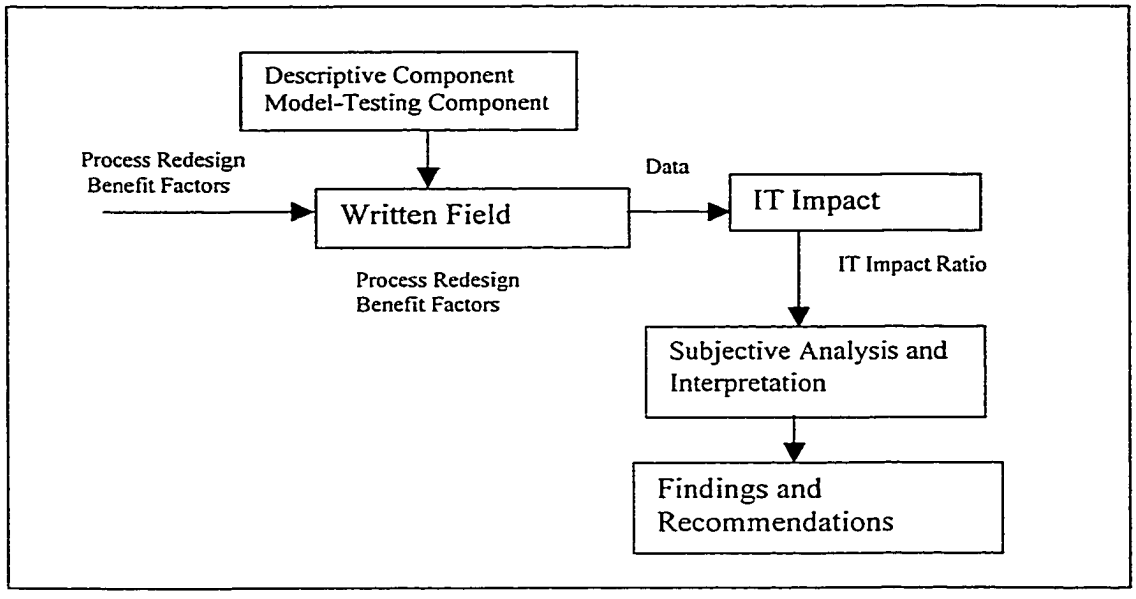

Figure 3. Methodology Overview.

3.2 Written Field Survey

The primary research method used in this study was a Written Field Survey that had two major objectives: (1) to gather descriptive data on the current state of practice in industry regarding consideration of process redesign benefits in the IT investment decision (Descriptive Component), and (2) to test a proposed model of factors believed to impact the consideration of process design benefits in the IT investment decision (Model-Testing Component).

3.2.1 Descriptive Component

The Descriptive Component addressed three main research questions discussed in chapter 2 as research questions #1, #2, and #3.

Research Question #1: To what extent do IT investment decision-makers differentiate the intangible benefit of process redesign in terms of importance when making the IT investment decision?

This research question led to the development of a set of hypotheses:

RH1a: The weight that decision-makers place on the intangible benefit of process redesign when making an IT investment decision is positively correlated to the weight they place on tangible benefits.

RH1b: Decision-makers consider certain process redesign benefit factors to be more important than others in the IT investment decision process.

It is believed that in an effort to assess value added by IT investments, organizations conduct aggressive evaluations of the more tangible factors such as technical, strategic, and financial issues. It is further theorized that those organizations that expend extraordinary amounts of resources assessing tangible benefits also expend relatively larger amounts of effort or resources in the consideration of the intangible benefit of process redesign in the IT investment decision. This hypothesis is tested by performing correlation analysis procedures to study the association between the consideration of tangible benefits and the consideration of process redesign benefits.

Organizations place different weights on the importance of process redesign benefits when they make IT investment decisions. For example, when different IT alternatives are evaluated, one firm may decide to go with one set of alternatives over another set due to greater potential for process redesign benefits, while another firm may neglect this consideration altogether. IT investment decisions have been classified into two broad categories for the purpose of the current study: Infrastructure decisions and Business Process decisions (Ryan, 1997). Seven process redesign benefit factors have been identified and are discussed in greater detail in section 2.4.1 of chapter 2. Two

survey instruments (appendices C and D) have been developed based on these two broad categorizations of IT investment decisions and the seven process redesign benefit factors. Survey items #12 through #25 of appendix C solicit responses from the IT executive in terms of the amount of effort or resources spent on the consideration of these process redesign benefit factors when the IT investment decision at hand involves information infrastructure (Infrastructure decision). Survey items #12 through #25 of appendix D solicit responses from the IT executive in terms of the amount of effort or resources spent on the consideration of the same process redesign benefit factors when the IT investment decision at hand has business process orientation (Business Process decision). On a scale of one to five, with five being the highest consideration of the process redesign benefits factor, IT executives were asked to indicate the importance they place on each factor when they make the IT investment decision of either type. Survey results were compared statistically between the individual process redesign benefit factors to determine which factor(s) received greater resource deployment. For example, should survey item #12 receive a higher score on the Likert-like scale than survey item #13 for the same type of IT decision in an organization, an argument can be made that decision-makers place greater importance on Operative Efficiency relative to Strategic Planning. The reverse argument can also be made. In addition, the mean response score to survey item #12 of appendix C was compared to the mean response score to survey item #12 on appendix D for the same firm to assess the difference in importance placed on Operative Efficiency between the two IT decision types. For example, an average response rate of five for item #12 on appendix C and an average response rate of four for item #12 on appendix D would indicate that more importance was placed on Operative Efficiency when the IT investment decision was an Infrastructure type decision than when it was a Business Process type decision.

Research Question #2: To what extent do IT investment decision-makers consider process redesign benefit factors in an explicit manner versus an implicit manner?

This research question led to the development of one research hypothesis:

RH2: For a given process redesign benefit factor, the level of explicit versus implicit consideration differs.

Some firms will consider process redesign benefits implications in an explicit manner by using financial forecasting tools and financial ratios (Ryan, 1997). Others will consider them at a more casual level by merely talking about them. In both appendices A and C, survey items #12 through #25, process redesign benefit factors have been classified alternately as extrinsic (explicit) and intrinsic (implicit) under an Infrastructure type IT investment decision. Likewise in appendices B and D, the same process redesign benefit factors have been classified alternately as intrinsic (implicit) and extrinsic (explicit) under a Business Process type IT investment decision. On the actual survey instruments (appendices C and D), one survey item was created for each of the process redesign benefit factors to measure *explicit* consideration under either decision type scenario (Infrastructure and Business Process). A second survey item was created to measure *implicit* consideration. For example, the two survey items below (one explicit and the other implicit) would be developed and used to solicit information on the consideration given to the Operative Efficiency benefit factor under either an Infrastructure or a Business Process type IT investment decision:

1) *Explicit: In my organization, we spend _____effort or resources forecasting with input from line managers, how much the choices will affect the Operative Efficiency of the organization.*

2) *Implicit: In my organization, we spend _____effort or resources discussing about the impact this project will have on the Operative Efficiency of the organization.*

On a scale of one to five, with five being the highest consideration, IT executives were asked to indicate the degree to which they considered these process redesign benefit factors (both explicitly and implicitly) when making the IT investment decision. For example, an average response score of five for survey item #13 and an average response score of four for item #20 would indicate that Strategic Planning received more explicit than implicit consideration. Comparing the average response scores for the same two survey items between appendices C and D would give information on the difference in implicit versus explicit consideration for the Strategic Planning factor between the two types of IT decisions.

Research Question #3: What weight does the IT investment decision-maker place on the intangible benefit of process redesign compared to the tangible benefits of technical, strategic, and financial factors when making the IT investment decision?

This research question led to the development of one research hypothesis:

RH3: Decision makers place greater weight on the consideration of tangible benefits than on intangible benefits.

As already discussed elsewhere in the study, many firms generally include the consideration of technical, strategic and financial issues in the IT investment decision. Both the costs and benefits associated with these tangible issues are quantifiable and therefore much more straightforward to deal with. Although process redesign costs may be quantifiable, like all other costs associated with intangible benefits, the benefits are often intangible and not easy to measure. This research question compares the weight placed on process redesign benefit factors consideration to the weight placed on the

consideration of the more tangible factors such as technical, strategic, and financial issues.

These technical, strategic, and financial issues found to be important to decision makers were identified on the instruments (appendices A and B) which formed the basis for the questionnaires (appendices C and D) in the current study. Survey items #1 through #11 (appendix C) solicit information from IT executives regarding the level at which they consider technical, strategic, and financial issues when making an Infrastructure type decision. Survey items #1 through #11 (appendix D) solicit responses from IT executives regarding the level at which they considered these issues when making a Business Process type decision.

At a more detailed level, survey items #1 through #5 of appendix C solicited information from IT executives regarding specific technical issues believed to be important when making IT investment decisions under the Infrastructure decision scenario. Strategic issues believed to be important to IT executives when making Infrastructure type IT decisions were captured under survey items #6 through #8 of appendix C. In similar fashion, financial issues believed to be important to IT executives when making Infrastructure decisions were captured under survey items #9 through #11 of appendix C. Responses to these eleven questions indicate the importance placed on those issues by the IT executive when making an Infrastructure type decision. These results were compared statistically to survey responses relating to process redesign benefits consideration under the Infrastructure decision scenario captured under survey items #12 through #25 of appendix C.

Survey items #1 through #5 of appendix D addressed the consideration of technical issues as they relate to Business Process type IT investment decisions. By the same analogy, survey items #6 through #8 of appendix D address strategic issues, and

items #9 through #11 of appendix D address financial issues, all within the context of a Business Process IT decision. These results were compared statistically to survey responses relating to process redesign benefits consideration under Business Process scenario captured under survey items #12 through #25 of appendix D. This comparison gave an indication of the weight given to process redesign benefits (an intangible benefit) compared to the more tangible benefits derived from technical, strategic, and financial issues

First the mean response score for technical issues (#1 through #5), strategic issues (#6 through #8), and financial issues (#9 through #11) was determined. A comparison was then made to determine if there was a difference between the weight given to each of the three tangible benefits. This provided information on the difference between the weights given to each of the tangible benefit factors. Next, a statistical average of all the three tangible factors (#1 through #11) was calculated and compared to the statistical average response score for items #12 through #25 (process redesign benefit factors). This provided information on the difference between the weight given to tangible versus intangible benefit factors.

3.2.2 Model-Testing Component

The Model-Testing Component of the Written Field Survey addressed one main research question:

Research Question #4: What are the factors that impact how much process redesign benefit factors are included in the IT investment decision?

3.2.2.1 Factors Impacting PRBF Integration

Because every organization is unique, an IT selection process is required that is tailored to fit the specific environment and needs of each. Such uniqueness arises from differences in organizational cultures, organizational structures, management styles, information user needs, and technologies (Taylor, 1986; Ryan, 1997). In this Model-Testing component, similar factors were evaluated for their impact on the consideration of process redesign benefits in the IT investment decision process. These were categorized into organizational factors: a Continuous Learning Culture, Strategic Relevance of IT, and Organization Size; and technological factors: the Type of IT Decision. It is expected that firms with continuous learning cultures, firms in which IT play a strategic role, and large firms include process redesign benefits consideration in their IT investment processes to a greater extent than firms without continuous learning cultures, firms in which IT play an operational role, and small and medium firms thereby realizing greater value added from such inclusion. It is theorized that industry has an impact on process redesign integration as different industries are believed to employ process redesign integration with differing intensity. It is also expected that the type of IT decision may impact the importance placed on process redesign integration in the IT investment decision process. Five hypotheses were developed to help answer this research question.

3.2.2.2 Hypotheses for Research Question 4

Certain organizational factors such as a continuous learning culture, the strategic relevance of IT in an organization, and organization size are believed to impact both whether or not process redesign benefits consideration are included in the IT investment decision and the importance placed on process redesign integration within a firm. These

led to hypotheses RH4.1, RH4.2 and RH4.3. Research hypothesis RH4.4 had to do with the effect of industry on process redesign integration. RH4.5 had to do with the impact of the type of IT decision on process redesign integration.

RH4.1: There is a direct relationship between the Intensity of a Continuous Learning Culture in an organization and consideration of process redesign benefit factors in the IT investment decision.

Survey items #44 through #64 (appendices C and D) were developed to solicit responses that enabled the researcher to determine if the organization had a continuous learning culture. On a scale of one to five, with a score of one representing low degree existence of a continuous learning culture and a score of five representing high degree existence of a continuous learning culture, the IT executive indicated the degree to which certain aspects of management and employee characteristics were present in their organization (1=Never, 2=Infrequently, 3=Sometimes, 4=Frequently, 5=Always). These scores were compared statistically to the scores on the degree of consideration of process redesign benefits (survey items #12 through #25 of appendices C and D). This comparison helped determine if an association existed between the consideration of process redesign benefits in the IT investment decision and the presence of a continuous learning culture in the organization, and the direction of such an association. For example, if the survey results indicated that a continuous learning culture existed for a firm and that the degree of consideration for process redesign benefits was high, then a positive association would seem to be indicated. A similar approach to the one suggested here was employed by Ryan (1997) in investigating the weight given to HRBC in the IT investment decision process. The survey results in that study showed that there was a direct relationship between organizations with a continuous learning culture and inclusion of HRBC in the IT investment decision process.

RH4.2: There is a direct relationship between the Strategic Relevance of IT in an organization and the consideration of process redesign benefit factors in the IT investment decision.

Survey items #34 through #43 (appendices C and D) were designed to solicit information regarding the strategic relevance of IT in an organization. On a scale of one to five (a score of one is considered low strategic relevance and a five, high strategic relevance), the IT executive was asked to indicate the strategic relevance of IT in the organization. This information was compared to responses regarding the degree of process redesign benefits consideration (survey items #12 through #25 of appendices C and D) to determine if an association did, in fact, exist between the strategic relevance of IT in the organization and process redesign integration. It also provided information on the direction of such an association. For example, if survey results indicate high strategic relevance of IT in an organization and high degree process redesign integration (an extraordinary amount of effort or resources), there would be indication of a positive association. There may be indications that IT relevant to the strategic mission of the firm engender greater process redesign integration than otherwise. The reverse may also be true.

RH4.3: Large firms will integrate process redesign benefits into the IT investment decision to a greater extent than small and medium-sized firms.

To test the hypothesis that organization size may have an impact on the consideration of process redesign benefits, we have included in the sample large, small, and medium size organizations. Responses from large organizations regarding consideration of process redesign benefits were compared statistically to responses from small and medium organizations. This information was used to determine if an association did, in fact, exist between organization size and process redesign integration

in the IT investment decision, and the nature of that association. Sales revenue was used as a proxy measure for firm size (Harris and Katz, 1991). Firms were ranked at three different levels within each industry. Ranking I represented firms with less than $50 million in sales revenue; ranking II represented firms with between $50 million and $500 million in sales revenue; and ranking III represented firms with greater than $500 million in sales revenue for small, medium, and large firms respectively. Hypotheses 4.1, 4.2, and 4.3 test the impact that organizational factors may have in the integration of process redesign benefit factors in the IT investment decision.

RH4.4: Industry will have an effect on the level of process redesign benefit factor integration.

Firms in the sample were selected from three different industries. The industries of interest, health care, chemical, and insurance were selected based on a review of the literature that revealed that these three industries represented different levels of process redesign integration intensity on a continuum. Heath Care represented low process redesign intensity, chemical represented medium process redesign integration intensity, and insurance represented high process redesign integration intensity. The mean response score for PRBF (survey items #12 through #25) were examined for an association between industry and process redesign integration.

RH4.5: The type of IT decision will have an effect on process redesign benefit factor integration into the IT investment decision.

The type of IT decision was believed to impact the inclusion of the process redesign benefit factors in the IT investment decision. To assess the impact of the type of IT decision, the current study classified IT decisions into Infrastructure type and Business Process type IT decisions. These two major IT type categories were captured on the survey instrument by creating two scenarios in the context of which the survey items

were developed. Survey items #12 through #25 of appendix C were developed in the context of Infrastructure type IT and survey items #12 through #25 of appendix D were developed in the context of Business Process type IT. Survey responses under the two scenarios were compared to determine if there was a difference in the consideration of process redesign benefits depending on the type of IT decision. For example, if the average response score on the Likert-like scale for survey items #12 through #25 of appendix C was higher than those for survey items #12 through #25 of appendix D, an argument could be made that more resources were deployed towards the integration of process redesign benefit factors in the IT investment decision for Infrastructure type decisions than for Business Process type decisions.

3.3 IT Impact Ratio Analysis

The second research method, IT Impact Ratio Analysis, addresses the fifth and last research question in this study:

RQ5: Does the level of IT impact differ between firms that deploy large amounts of effort or resources toward process redesign integration than those that don't?

This research question led to the development of research hypothesis 5 (RH5).

RH5: There is a direct relationship between the level of process redesign benefits integration in an organization and IT impact.

IT impact for firms in the sample was measured as the ratio of IT budget to total sales revenue. This ratio reflected the level of a firm's investment in IT relative to other firms in the same industry. For the survey data, the association between IT impact and process redesign integration was tested by performing correlation analysis procedures. The results of these tests provided information on whether that association existed and the direction of such an association. A positive association would indicate that high levels

of process redesign integration contribute to higher sales revenue in spite of increased investments in IT.

3.4 Sample Selection

It is believed that some industries have pursued process redesign integration with more intensity than others. For this reason, three different industries that were believed to have pursued process redesign at three different levels of intensity, high, medium, and low, were investigated. The three industries were identified as those that cut across the entire spectrum of the variation in information technology use in general and in process redesign benefit factor integration in particular. The insurance industry was believed to be among those that employ process redesign integration with relatively greater intensity than most (DiRomualdo and Gurbaxani, 1998; Lin and Vassar, 1996). The health care industry was believed to be among those that employ process redesign integration with relatively less intensity than most (Lin and Vassar, 1996; Lin and Clousing, 1995). The chemical industry, along with other manufacturing industries, was believed to employ process redesign with moderate intensity (Center, 1994; Lin and Vassar, 1996; Hunter and Schmitt, 1999).

The data set for the three industries was obtained from Standard & Poor's Research Insight COMPUSTAT (North America), which contains corporations of all sizes (Standard & Poor's Research Insight, 1999). All 262 insurance companies, 562 chemical companies, and 164 health care companies in the COMPUSTAT database were selected for inclusion in the sample. However, because interest was only in North American companies, the number of firms in the three industries was reduced to 252, 540, and 157 firms for the insurance, chemical, and health care industries, respectively, after deleting all non-North American firms from the list. An industry consists of all New

York Stock Exchange (NYSE), American Stock Exchange (AMEX), and National Association of Security Dealers Quote (NASDAQ) listed firms having the same standard industrial codes (SIC). A closer examination of the data set revealed the SIC classifier to be a rather narrow one such that many SIC categories resulted in industries with a sample size of one. Moreover, many SICs have six or less companies in their classification. A review of the COMPUSTAT manual (Standard & Poor's Research Insight, 1999) confirmed that this can be expected. It became necessary, therefore, to aggregate the classification into a broader industrial classification (Courtney, 1993). In the four digit SIC identifier, the first two digits represent a broad industrial category and the last two represent the specific classification within the broad category. By confining the SIC identifier to the first two digits, therefore, we were able to combine several SICs into a composite industrial category. This reclassification resulted in the aggregate SICs shown on table 7:

Table 7. Aggregated SICs

Agg SIC	Industry Category
28	Chemical & Pharmaceutical Mfg
63	Insurance & Casualty
64	Insurance Agents, Brokers, & Service
80	Health Care Services

The next step involved the creation of a database from the data set, containing company information including company name, standard industrial classification (SIC),

postal code, address, and name and title of the contact person. This database containing information needed at the time of administering written sample surveys was called MAILING_LIST. The contact person was identified as the individual classified as "top computer executive" or the individual in the company with responsibility for MIS (Ryan, 1997). However, because mailing information for the top computer executive was not readily available, the cover letter was addressed to the chief executive officer (CEO) with a request to forward the survey to the top computer person in the organization. The CEO information was readily available in the COMPUSTAT database. An approach similar to this was used by Lee (1994) in a dissertation entitled: "Factors Affecting Information Systems Sourcing Decisions: Data Processing Services In The Banking Industry" in which no significant difference in the response rates occurred when the cover letter and questionnaire were sent directly to the CIO and when the cover letter was sent to the CEO with a request to forward the survey to the CIO.

The final instrument was mailed to the 945 firms selected for the sample from the three industries. A cover letter and postage-paid return envelope were included with the survey. A copy of the cover letter is shown in appendix E. Respondents were asked to enclose a copy of their business card if they wanted to receive a summary of the findings.

3.5 Summary

The two main research methods employed in the current study are reviewed in this chapter: a Written Field Survey consisting of the Descriptive and Model-Testing components; and an IT Impact Ratio Analysis. The research question(s) associated with each methodology are discussed. The constructs of the proposed model and the associated hypotheses are also discussed. The sample selection process is described.

CHAPTER 4

RESEARCH RESULTS

4.1 Introduction

Discussion of the demographic data and of the survey respondents and their firms is presented first in this chapter. This is followed by a discussion of the counter-balancing of scenarios on the survey instruments. The pilot study is discussed next, followed by a discussion of the reliability and validity measures in the study. The research findings are then presented in three sections: The Descriptive Component, Model Testing Component, and IT Impact Ratio Analysis. The three sections that deal with research results correspond to the three groupings discussed in chapters 2 and 3 and to the associated research questions and the hypotheses developed to help answer them.

4.2 Demographic Data

The final survey instrument was mailed out to 945 firms selected for the sample from the three industries as discussed in chapter 3. A cover letter and postage-paid return envelope were included with the survey. A copy of the cover letter is shown in appendix E. Respondents were asked to enclose a copy of their business card if they wanted to receive a summary of the findings. After the surveys were mailed out, follow up phone calls were made by graduate assistants, both the week before the surveys actually left the post office and the week after, for a total of two weeks. About 60% of health care firms, 40% of insurance firms, and 40% of chemical firms were contacted, for a total of about 410 phone calls. Table 8 summarizes the results of the follow-up phone calls.

Table 8. Summary of Follow up Telephone Calls

1	A recording prompting GA to leave a voice message	28%
2	They don't participate in surveys	25%
3	Phone number no longer in service.	15%
4	We have not received the survey.	12%
5	We have not received the survey. Please fax us a copy.	7%
6	CEO has received the survey but has not forwarded to the CIO	5%
7	We have received survey, will fill it out and return to you.	5%
8	The CEO has left the firm.	3%
	Total	**100%**

Of the 945 surveys mailed out, not all were delivered to the addressee. A total of about 20 had some kind of problem varying from a wrong zip code to a wrong address to the firm no longer at that address. A total of 19 firms responded to the written survey yielding a response rate of a little over 2%. Ten responses were from the insurance industry, five were from the chemical industry, and four were from the health care industry. In terms of firm size, five were large firms, seven were small firms, and another seven were medium size firms. Table 9 summarizes firm size, sales revenue, industry, and type of IT decision information.

Table 9. Firm Size, Revenue, Industry, and Type of IT Decision

Small Firms		Medium Firms		Large Firms	
Annual Sales Revenue ($)	**Industry/Type**	**Annual Sales Revenue ($)**	**Industry/Type**	**Annual Sales Revenue ($)**	**Industry/Type**
1,000,000	Healthcare/IBF	90,000,000	Healthcare/IBF	550,000,000	Chemical/NS
6,000,000	Insurance/NS	100,000,000	Chemical/IBF	2,000,000,000	Chemical/NS
20,000,000	Insurance/IBF	100,000,000	Insurance/IBF	2,300,000,000	Insurance/NS
21,000,000	Insurance/IBF	180,000,000	Healthcare/IBF	30,000,000,000	Insurance/IBF
25,000,000	Insurance/NS	300,000,000	Healthcare/IBF	35,000,000,000	Chemical/IBF
26,000,000	Insurance/NS	315,000,000	Chemical/IBF		
Not Given	Insurance/IBF	500,000,000	Insurance/NS		

Table 10 summarizes firm size, sales revenue, and IT budget information.

Table 10. Firm Size, Revenue, and IT Budget

Small Firms		Medium Firms		Large Firms	
Annual Sales Revenue in $	**IT Budget**	**Annual Sales Revenue in $**	**IT Budget**	**Annual Sales Revenue in $**	**IT Budget**
1,000,000	Not Locked in	90,000,000	500,000	550,000,000	10,000,000
6,000,000	200,000	100,000,000	500,000	2,000,000,000	30,000,000
20,000,000	21,000	100,000,000	5,000,000	2,300,000,000	30,000,000
21,000,000	20,000	180,000,000	2,000,000	30,000,000,000	1,000,000,000
25,000,000	600,000	300,000,000	15,000,000	35,000,000,000	1,500,000,000
26,000,000	600,000	315,000,000	12,000,000		
Not Given	150,000	500,000,000	10,000,000		

The target respondent for this study was the senior IT executive responsible for making the IT investment decision. Benbasat (1981) argues that the validity of survey results is dependent on the appropriate individual responding to the survey. To ensure that the appropriate individuals responded, several steps were taken. First the survey recipients were identified individually by name. As already discussed, the lists of contacts for this research were restricted to the Chief Executive Officer who was requested through the cover letter to pass the survey on to the CIO. Second, the respondents were asked to provide their title on the survey. As shown in table 11, those responding had titles that indicated their appropriateness as respondents. To receive further indication of the decision-making responsibility of the individual completing the survey, the question was asked: "How many levels are you from the Chief Executive Officer of the organization?" This information is also provided in table 11. Being appropriate as a respondent was not determined by this level. Rather, the job title was used to help make a subjective assessment and to convey the fact that the respondent was indeed the top computer executive in the organization. Other demographic characteristics of the respondents include the following: the average length of respondent tenure in the current position was seven years; the average number of years the respondent had made this kind of IT decision was nine years, the average age of the respondent was 49 years, and 68% of the respondents were male.

Table 11. Respondent Data, Firm Size, and Industry

Industry	Firm Size	Respondent Title	Tenure in Current Position	Years making this decision	Levels from CEO	Age	Gender
Insurance	Large	Vice President & CIO	3	3	1	50	Female
Chemical	Medium	MIS Manager	11	10		44	Male
Chemical	Medium	Chief Technical Officer	.10	15	2	53	Male
Chemical	Large	Sr. Vice President	5	12	1	53	Male
Insurance	Large	CIO	1	4	2	45	Female
Insurance	Small	Vice President	12		1	62	Male
Insurance	Small	Controller	21	9	2	48	Male
Insurance		Director-Media Communication	4	5	2	44	Male
Healthcare	Medium	CIO	2	15	1	40	Male
Healthcare	Small	VP Information Technology	12		3	48	Female
Insurance	Small	VP Information Technology	12	8	1	46	Female
Chemical	Large	Vice President & CIO	3	3	1	55	Female
Healthcare	Medium	MIS Manager	11	10		45	Male
Healthcare	Medium	Chief Technical Officer	.10	15	2	52	Male
Insurance	Medium	Sr. Vice President	5	12	1	41	Male
Chemical	Large	CIO	1	4	2	47	Female
Insurance	Small	Vice President	12		1	59	Male
Insurance	Small	Controller	21	9	2	50	Male
Insurance	Medium	IS Director	3	15	2	55	Male

4.3 Counter-Balancing and Sequencing of Scenarios

As discussed previously, three industries were targeted for this study. In addition, firms in the sample were divided into three size categories of large, medium, and small. Moreover, there were two different types of IT decisions under study, Infrastructure and Business Process. Two survey instruments (appendices C and D) were developed for the two types of IT decisions. These three factors of industry, firm size, and type of IT decision made it necessary to counter-balance scenarios so that the two survey instruments were sent out to a proportionate number of firms in each industry and in each

size category. The scenarios were counter-balanced so that approximately half of the surveys had the "Infrastructure" scenario (appendices A and C) and the other half had the "Business Process" scenario (appendices B and D) (Ryan, 1997). At the time of mailing out the surveys, it was ascertained that half of the firms in each of the three industries got the Infrastructure scenario and the other half got the Business Process scenario. Further, it was ascertained that half of the small firms, medium firms, and large firms got the Infrastructure scenario and the other half got the Business Process scenario.

4.4 Pilot Study

The survey instrument was refined through three iterations. First, it was reviewed by several experts in the research field (Cronbach, 1971; Ryan, 1997). For this research, an expert is defined as a senior professor of information systems, statistics, and management science at a four-year college or university. Next, the questionnaire was given to several holders of doctoral degrees in the area of information systems and some doctoral students of information systems. Modifications to the survey instrument were made based on comments and suggestions from these individuals. In the third iteration of the survey instrument, several IT executives from the three industries of interest, insurance, chemical, and health care, completed the pilot survey and provided comments as to the appropriateness and clarity of the questions and the scenarios. All the pilot participants were asked about the realism of the scenarios and what changes, if any, would be appropriate. After receiving feedback from these experts, recommended modifications were made to the instrument as appropriate. After reviewing their comments and making the necessary changes, the final survey document was created.

4.5 Reliability and Validity Measures

Venkatraman and Grant (1986) recommended three rules for well-developed survey instruments:

(1) scales use multiple, higher-level items rather than single, nominal items (to provide measures with high discriminatory power and low levels of measurement error),

(2) scales be internally consistent, and

(3) scales be valid

The scales used in the survey in this study met criteria (1) in that it used higher-level nominal items that provided measures with discriminatory power and low levels of measurement error. The survey contained multiple items.

The most common method of assessing the reliability of an instrument is through the use of Cronbach's alpha (Zmud and Boynton, 1991). Values between 0.80 and 1.00 are acceptable and are considered to show high internal consistency. As can be observed from table 12, three of the six scales used were internally consistent with values exceeding 0.80. The other three were not.

Table 12. Cronbach's Coefficient Alpha

Measure	Raw	Standardized
Continuous Learning Culture	0.8765	0.8902
Strategic Relevance of IT	0.6639	0.6636
Process Redesign Integration	0.9144	0.9100
Technological Issues	0.5989	0.6215
Strategic Issues	0.7691	0.7709
Financial Issues	0.9236	0.9255

Validity is often discussed in terms of two distinguishable types: content and construct validity (Zmud and Boynton, 1991). A content valid scale is one that has drawn representative questions from a "universal pool" (Kerlinger, 1986). Cronbach (1971) suggested that content validity can be established by having the instrument reviewed by experts in the field. The content validity of this survey instrument was established by having experts in the field participate in the pilot study and give written and oral feedback concerning the process redesign benefit factors of interest in the study. The second type of validity, construct validity, determines whether the scale measures what it purports to measure. Construct validity is generally accomplished through factor analysis as suggested by Zmud and Boynton (1989). Due to the very low response rate to the survey questionnaire, there were not sufficient data with which to perform factor analysis for this study, and so it was not possible to verify the construct validity of the survey instrument.

4.6 Descriptive Component

The descriptive component provides statistical analyses of data gathered from the written survey. These analyses relate to Research Questions 1, 2, and 3 (RQ1, RQ2, RQ3) which give rise to Research Hypotheses 1, 2, and 3 (RH1, RH2, and RH3).

RQ1: To what extent do IT investment decision-makers differentiate the intangible benefit of process redesign in terms of importance when making an IT investment decision?

This research question gives rise to the first research hypothesis which has been divided into RH1a and RH1b:

RH1a: The weight that decision-makers place on the intangible benefit of process redesign when making an IT investment decision is positively correlated to the weight they place on tangible benefits.

To test this hypothesis, the correlation between intangible benefits (PRBF) as a group, and tangible benefits was computed and showed significant positive association r=.55 (*p=0.0142*). This hypothesis (RH1a) was supported.

RH1b: Decision-makers consider certain process redesign benefit factors to be more important than others in the IT investment decision process.

The objective of this test was to determine if decision makers consider some PRBF to be more important than others and expend disproportionately larger amounts of effort or resources towards the integration of the factors considered important in to the IT investment decision.

To test this hypothesis, an analysis of variance to study the difference in the mean response scores among the individual PRBF determined there to be a significant difference between the mean response scores of the different factors $F_{6,126}=2.37$ (*p=0.0337*).

The Tukey procedure was used to compare the mean response scores of the individual PRBF with a 95 percent family confidence coefficient. These pair-wise comparisons showed that the average amount of effort or resources expended on Operative Efficiency is significantly more than that expended on Organizational Restructuring but that there are no significant differences among any of the other factors.

Figure 4, a graphical representation of the mean response scores for the individual PRBF under both the Business Process and Infrastructure types of IT Decision, supports these research findings by showing that Operative Efficiency has the largest mean response score and that Organizational Restructuring has the lowest mean response score.

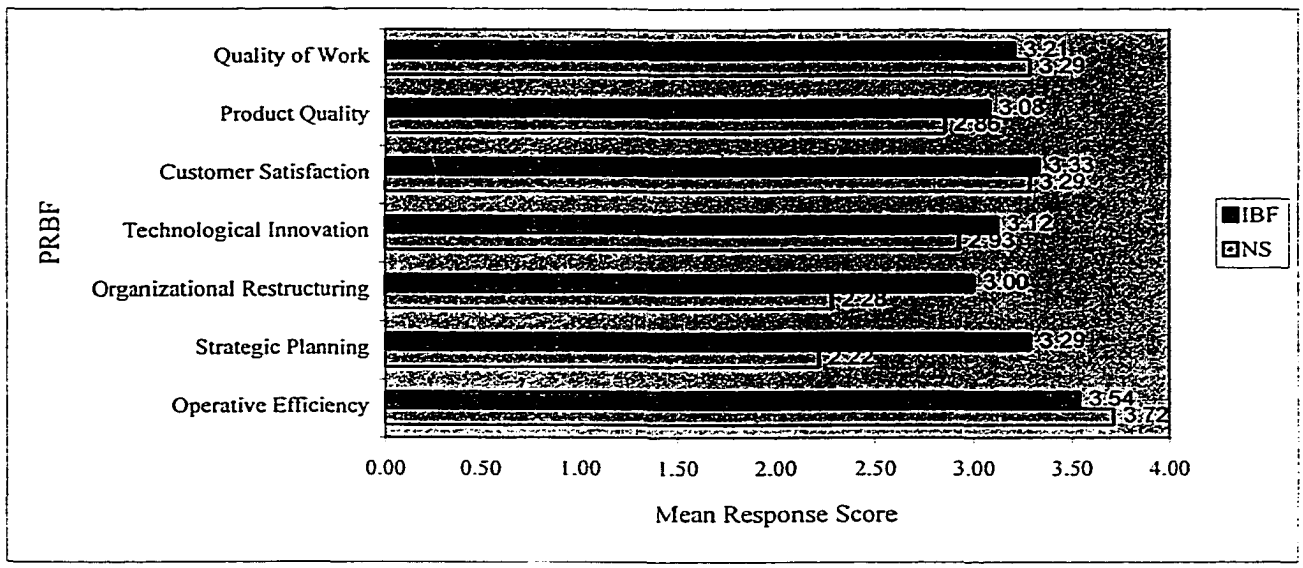

Figure 4. Means of PRBF for Business Process (IBF) and Infrastructure (NS).

Note that although there is significant difference in the amount of effort or resources expended on the individual PRBF, their rank order in the Business Process and Infrastructure decisions are very similar. In both types of IT decision, Operative Efficiency is ranked highest, followed by Customer Satisfaction. In the Infrastructure type, however, Quality of Work ties with Customer Satisfaction in second place but comes third in the Business Process type. Strategic Planning ties with Quality of Work in third position in the Business Process type but comes last in Infrastructure. Technological Innovation comes third in Infrastructure but fifth in Business Process, and Product Quality comes third in Infrastructure but sixth in Business Process. As already mentioned, Organizational Restructuring comes last in Business Process but second to last in Infrastructure. No factor is reversed in rank, which indicates that the relative importance of the factors do not differ significantly between the two groups. This hypothesis (RH1b) was supported.

A multiple linear regression procedure to test the effect of the individual PRBF and type of IT decision on tangible benefits (technical, strategic, and financial issues pooled as the dependent variable) found a significant effect of these factors on the model F8,10=11.30 (*p=0.0004*), explaining about 90% of the variation in tangible benefits. The effect of each of the following individual PRBF was significant: Operative Efficiency (*p=0.0473*); Organizational Restructuring (*p=0.0141*); Technological Innovation (*p=0.0118*); Product Quality (*p=0.0011*); and Quality of Work (*p=0.0046*). The effect of two of the factors and type of IT decision was found to be insignificant at the *=0.05* level: Strategic Planning (*p=0.0780*); Customer Satisfaction (*p=0.6908*); and Type of IT Decision *(p=0.0727)*. This was a test to determine the effect of the individual PRBF and type of IT decision on effort or resources for tangible benefits and found that effect to exist for five of the seven PRBF. Table 13 summarizes these test results.

Table 13. Summary of Test Results (RH1b)

Factor	p-Value	RH#	Result
Operative Efficiency	0.0473*	1b	Supported
Strategic Planning	0.0780	1b	Not Supported
Organizational Restructuring	0.0141*	1b	Supported
Technological Innovation	0.0118*	1b	Supported
Customer Satisfaction	0.6908	1b	Not Supported
Product Quality	0.0011	1b	Supported
Quality of Employee Work	0.0046	1b	Supported
Type of IT Decision	0.0727	4.5	Not Supported
Legend: *=significant at =0.05			

RQ#2: To what extent do IT investment decision-makers consider process redesign benefit factors in an explicit manner versus an implicit manner?

This research question gives rise to the second research hypothesis (RH2) in this study:

RH2: For a given process redesign benefit factor, the level of explicit versus implicit consideration differs.

Initially, a t-test procedure was used to compare the mean responses between the two groups of implicit and explicit consideration of PRBF. This test showed no significant difference for explicit versus implicit consideration when factors are pooled *(p=0.9419)*.

Figure 5 depicts the overall means of implicit and explicit consideration of PRBF for the two IT decision types, and shows that within each type of IT decision, there is

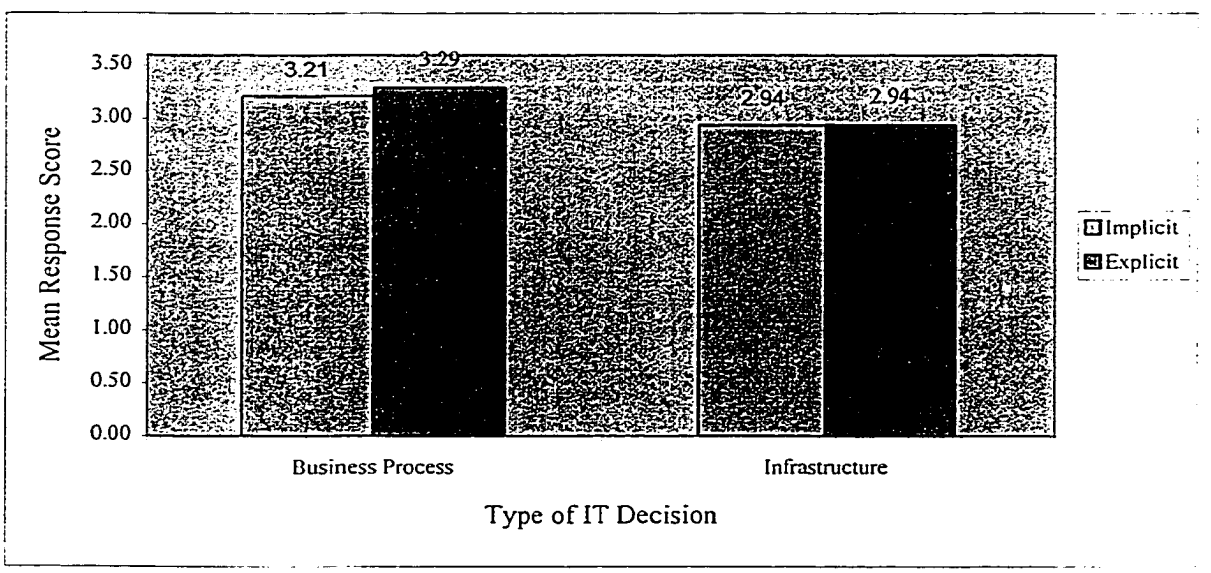

Figure 5. Mean Implicit & Explicit Response.

basically no difference between implicit and explicit consideration of PRBF, in support of the test results.

A repeated measures analysis of variance was then used to investigate the difference between implicit versus explicit consideration given to individual PRBFs by decision makers for each type of IT investment decision. This test found no significant difference for Operative Efficiency, Strategic Planning, Technological Innovation, Customer Satisfaction, Product Quality, and Quality of Employee Work, both within the factors and between the two IT decision types. However, the Wilks' Lambda test showed a statistically significant difference between implicit and explicit consideration given to the Organizational Restructuring factor $F_{1,17}=4.969$ $(p=0.0396)$. Table 14 shows the means for these tests and shows that the level of implicit consideration given to Organizational Restructuring is significantly higher than the level given to explicit consideration.

Table 14. Implicit vs. Explicit Consideration of PRBF by Type of IT Decision

PRBF	TYPE	Implicit		Explicit	
		Mean	SD	Mean	SD
Operative Efficiency	IBF	3.75	0.62	3.33	0.89
	NS	3.57	0.79	3.86	0.69
Strategic Planning	IBF	3.50	0.67	3.08	0.90
	NS	2.14	1.35	2.29	1.11
Technological Innovation	IBF	3.42	0.79	2.83	0.72
	NS	2.86	0.69	3.00	1.00
Customer Satisfaction	IBF	3.42	0.90	3.25	0.87
	NS	3.29	1.11	3.29	1.11
Product Quality	IBF	3.08	0.67	3.08	0.51
	NS	3.00	1.00	2.71	1.11
Quality of Employee Work	IBF	3.42	0.67	3.00	0.85
	NS	3.29	1.11	3.29	1.11
**Organizational Restructuring	IBF	3.08	0.67	2.92	0.90
	NS	2.43	1.13	2.14	1.35

Legend: IBF = Business Process IT Decision
NS = Infrastructure IT Decision
N = 12 for IBF
N = 7 for NS
** = Significant at $=0.05$

The correlation between explicit and implicit effort or resource deployment of .95 is significant at F1,17=162.50 ($p=0.0004$). This hypothesis (RH2) was supported, only with respect to the Organizational Restructuring factor.

Figure 6 depicts the mean response scores for implicit and explicit consideration of PRBF for the Business Process type of IT decision. Figure 7 depicts the mean response scores for explicit and implicit consideration of PRBF for the Infrastructure type of IT decision.

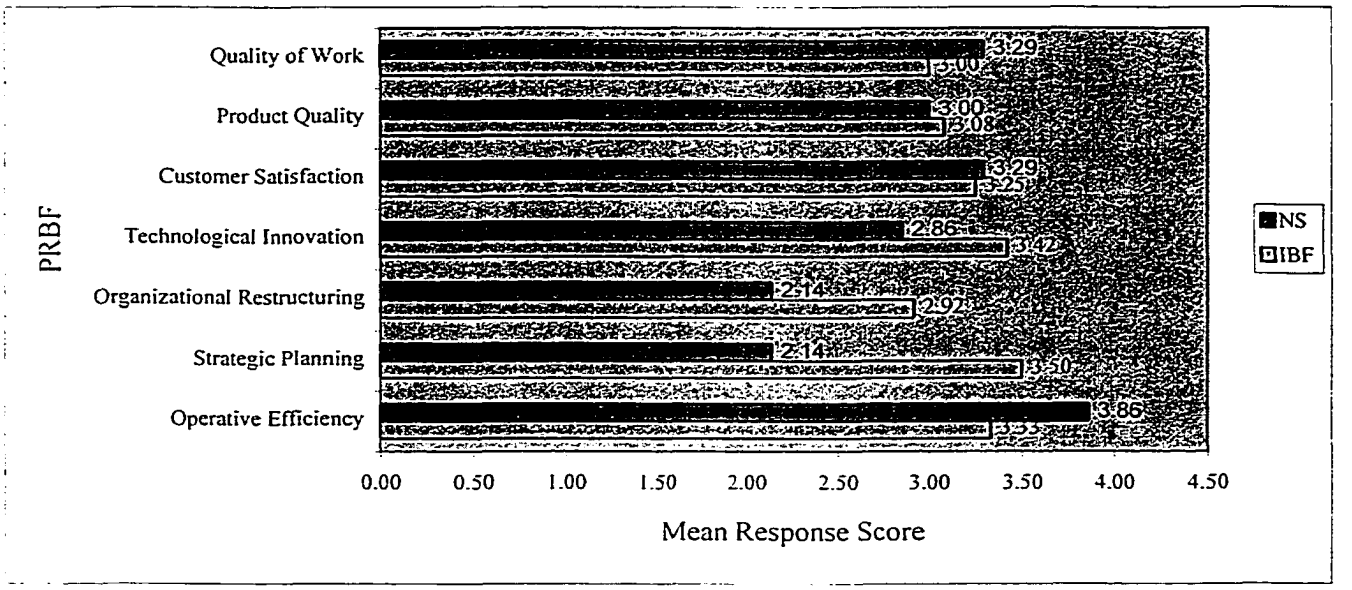

Figure 6. Mean Implicit & Explicit Response for Business Process (IBF).

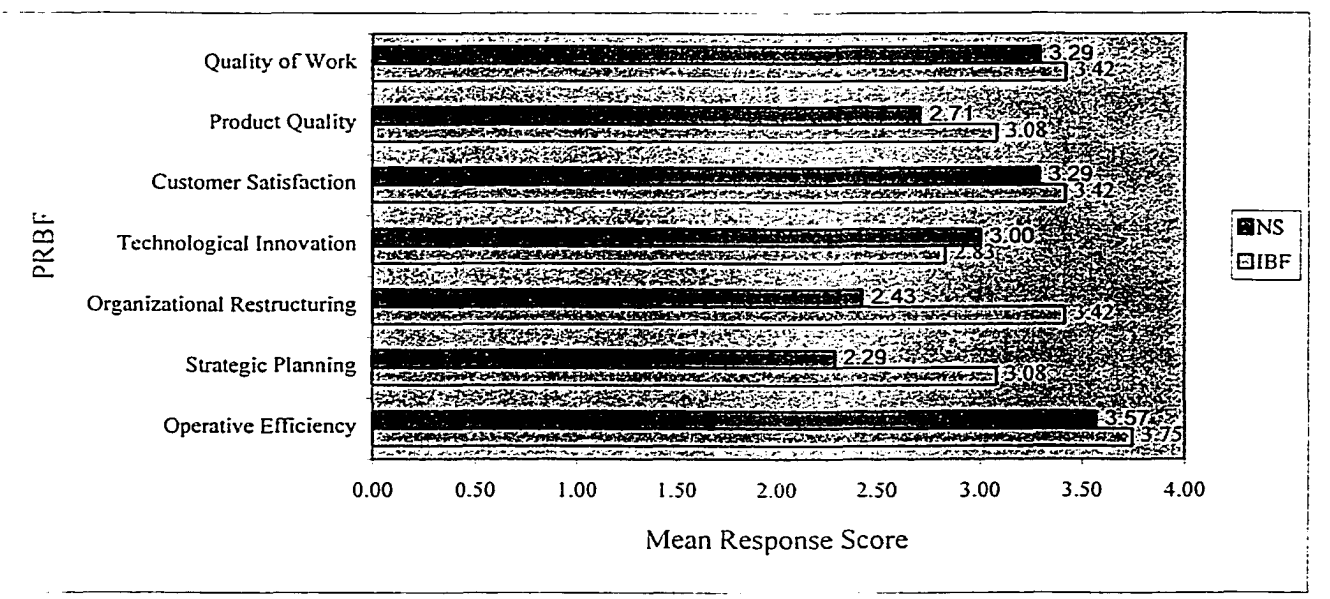

Figure 7. Mean Implicit & Explicit Response for Infrastructure (NS).

It can be observed from the two figures (Fig. 6 and 7) that the mean response scores are indeed similar for most of the PRBF between the two types of IT decisions. For example, Operative Efficiency is ranked highest for both types of IT decision; Customer Satisfaction and Quality of Work have the same mean response score for both implicit and explicit for Infrastructure; Product Quality has the same mean response score for both implicit and explicit for Business Process; and Strategic Planning has the lowest mean response for both implicit and explicit consideration for Infrastructure followed by Organizational Restructuring. In the case of Organizational Restructuring, implicit consideration has the lowest mean response score for Infrastructure decisions (Strategic Planning ties for this position) while explicit consideration has one of the highest mean response scores for the Business Process type of IT decision, hence the significant difference in implicit versus explicit consideration found by the repeated measures analysis of variance test for this factor.

RQ#3: What weight does the IT investment decision-maker place on the intangible benefit of process redesign compared to the tangible benefits of technical, strategic, and financial factors when making the IT investment decision?

This research question gives rise to the third research hypothesis (RH3) in this study:

RH3: Decision makers place greater weight on the consideration of tangible benefits than on intangible benefits.

A repeated measures analysis of variance tested the pair effect on an IT investment decision of tangible and intangible benefits on two models, one adjusted for size of the firm and the other adjusted for Type of IT decision. Both tests found means for tangible benefits to be significantly greater than for intangible benefits. Table 15 shows

the cell means and standard deviations when adjusting for firm size F1,16=13.1585 (*p=0.0023*).

Table 15. Table of Means for Firm Size, Tangible vs. Intangible Benefits

		Tangible		Intangible	
SIZE	**N**	**Mean**	**SD**	**Mean**	**SD**
Small	7	3.67	0.44	3.33	0.78
Medium	5	3.53	0.47	3.11	0.63
Large	7	3.55	0.51	2.91	0.44

Table 16 shows the cell means and standard deviations when adjusting for type of IT decision *F1,17=15.1578 (p=0.0012)*.

Table 16. Table of Means for Type of IT Decision

		Tangible		**Intangible**	
TYPE	**N**	**Mean**	**SD**	**Mean**	**SD**
IBF	12	3.61	0.45	3.23	0.40
NS	7	3.55	0.49	2.94	0.90
Legend: IBF = Business Process IT Decision NS = Infrastructure IT Decision					

Figure 8 is a depiction of the mean response scores for the tangible and the intangible benefits (PRBF) for each of the two types of IT decision, and shows that for both types of IT decision, PRBF as a group receives the lowest effort or resource

deployment compared to each of the tangible benefit factors. It is important to note that PRBF consideration ranked lowest under both types of IT decision, which confirms the earlier finding that less effort or fewer resources are deployed towards the consideration of intangible benefits relative to tangible benefits.

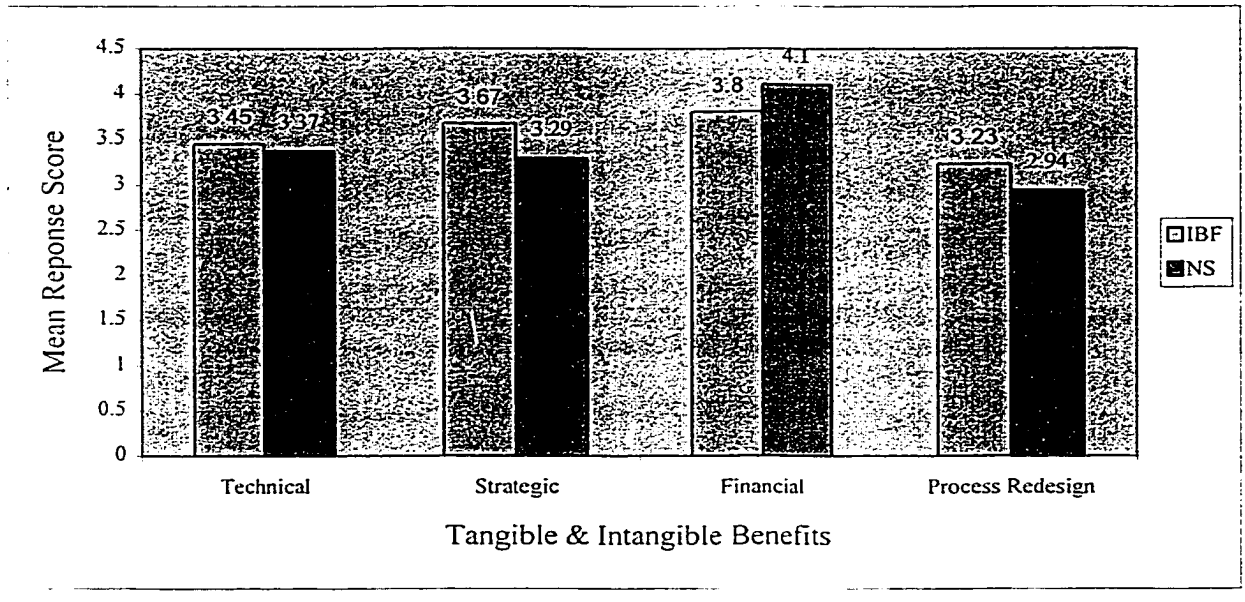

Figure 8. Mean Tangible & Intangible Benefit Factors Score.

Figure 9 compares the mean response scores for tangible benefits as a group to intangible benefits (PRBF) for each of the two types of IT decision, and shows that tangible benefits receive greater effort or resource deployment. This difference was found to be statistically significant. This hypothesis (RH3) was supported.

These are significant findings that confirm the theory that decision makers do indeed deploy different levels of effort or resources in the consideration of tangible benefits versus

intangible benefits when making an IT investment decision. More resources are deployed towards consideration of tangible benefits than intangible benefits.

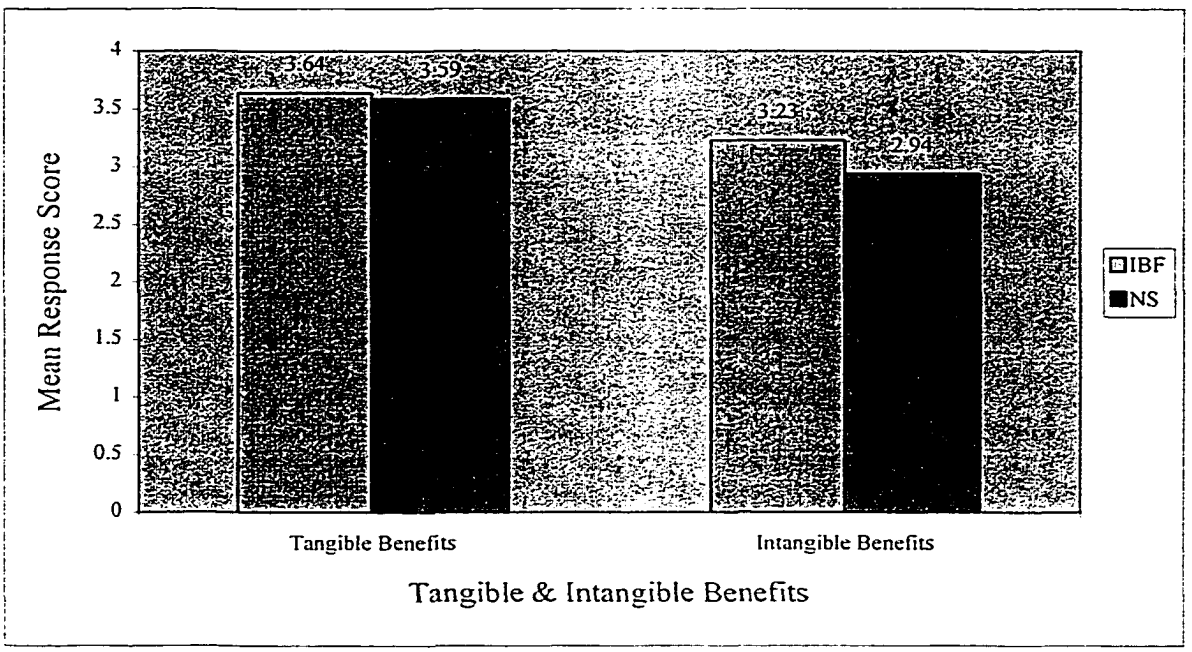

Figure 9. Mean Tangible & Intangible Benefit Factor Scores (Grouped).

4.7 Model-Testing Component

This Model-Testing component of the Written Field Survey (adopted from Ryan, 1997) attempts to answer one main research question:

RQ4. What are the factors that impact how much process redesign benefit factors are included in an IT investment decision?

This research question gives rise to five research hypotheses: RH4.1, RH4.2, RH4.3, RH4.4, and RH4.5. These hypotheses relate to the first three variables in the model: Continuous Learning Culture, Strategic Relevance of IS, Organization Size,

Industry, and Type of IT Decision. Several different statistical procedures were used to test these hypotheses.

4.7.1 Test of Hypothesis 4.1

RH4.1: There is a direct relationship between the intensity of a Continuous Learning Culture in an organization and consideration of process redesign benefit factors in the IT investment decision.

To test this hypothesis, a correlation analysis using the Pearson Correlation Coefficients between the intensity of a continuous learning culture in an organization and PRBF integration was used and showed no significant correlation *r19=0.07294 (p= 0.7667).* A Spearman Correlation Coefficients analysis also failed to show a significant association between the two variables *r19=-0.03363 (p=0.8913).* This hypothesis (RH4.1) was not supported.

4.7.2 Test of Hypothesis 4.2

RH4.2: There is a direct relationship between the Strategic Relevance of IT in an organization and consideration of process redesign benefit factors in the IT investment decision.

The Pearson Correlation Coefficients analysis confirmed an association between the two variables of *r19=0.55851 (p=0.0129).* However, the Spearman Correlation Coefficients analysis failed to support this finding *r19=0.16996 (p=0.4867).*

In addition, a multiple regression to test the relationship between the strategic relevance of IT and intangible benefits in a model that is adjusted for type of IT decision found the association between the two variables still to be significant and positive *p=0.0029.* This hypothesis (RH4.2) was supported.

4.7.3 Test of Hypothesis 4.3

RH4.3: Large firms will integrate process redesign benefit factors into the IT investment decision to a greater extent than small and medium size firms.

Firms in the sample were divided into three major categories by size of small, medium, and large. Firms with sales revenue less than $50 million were categorized as small, between $50 million and $500 million were categorized as medium, and greater than $500 million were categorized as large. An analysis of variance to test the effect of firm size on PRBF integration found no significant effect F2,16=0.73 (*p=0.4970*). Firm size alone is not useful for predicting PRBF integration. Hypothesis RH4.3 was not supported.

4.7.4 Test of Hypothesis 4.4

RH4.4: Industry will have an effect on the level of process redesign benefit factor integration into the IT investment decision.

The relevant research literature suggested that some industries have pursued process redesign with greater intensity than others. Three different levels of process redesign integration intensity were identified on a continuum: low intensity, medium intensity, and high intensity. The three industries matched to these levels of PRBF integration intensity were health care, chemical, and insurance respectively. It was theorized that the level of PRBF integration within a firm will differ by industry.

An analysis of variance was used to test the theory that industry could have a significant effect on intangible benefits. The model used industry sector as a categorical control variable, with values of 1=chemical, 2=insurance, and 3=health care. Industry did not have a significant effect on PRBF integration F2,16=0.37(p=0.6960). Another

analysis of variance to study the effect of industry on tangible benefits found no significant effect either F2,16=0.41 (*p=0.6729*). This hypothesis was not supported.

4.7.5 Test of Hypothesis 4.5

RH4.5: The type of IT decision will have an effect on process redesign benefit factor integration into the IT investment decision.

IT investment decisions are divided into two broad categories of Business Process and Infrastructure type IT decisions. It was theorized that the type of IT decision would impact the level at which PRBF are integrated into an IT investment decision.

To test this, a general linear model procedure to test the association between PRBF integration and type of IT decision found the difference in means to be insignificant F1,17=0.94 (p=0.3459). A general linear model to test for differences in mean consideration

of tangible benefits by type of IT decision also found the difference to be insignificant F1,17=0.08 (p=0.7869).

A multiple linear regression to test the effect of the type of IT decision in the association between the presence of a continuous learning culture and PRBF integration found no association between the two variables and no significant type of IT effect *p=0.6147* for the test of utility. This hypothesis was not supported. However, as reported previously, the type of IT decision does make a significant contribution to the consideration of intangible benefits after adjusting for the strategic relevance of IT.

A multiple linear regression procedure was performed to investigate the simultaneous effect of several variables in the model: the presence of a continuous learning culture, the strategic relevance of IT, firm size, type of IT decision, and industry. This statistical procedure at the .10 level of significance determined that the effect of the

strategic relevance of IT F=12.88 (*p=0.0948*) and the type of IT decision F=3.90 (*p=0.0740*) were significant. The model explained about 62.2% of the variation of PRBF integration. Table 17 summarizes the results.

Table 17. Summary of Test Results (RH4.5)

Variable	p-Value	Hypothesis	Result
Continuous Learning Culture	0.7667	RH#4.1	Not Supported
Strategic Relevance of IT	0.0948*	RH#4.2	Supported
Size of Firm	0.6022	RH#4.3	Not Supported
Industry	0.8092	RH#4.4	Not Supported
Type of IT Decision	0.0740*	RH#4.5	Supported
Legend: *=significant at *p=0.10* level			

4.8 IT Impact Ratio Analysis

The second research method, IT impact ratio analysis, addresses the fifth and last research question. IT impact refers to the degree to which a firm invests in IT relative to other firms in the same industry (Bharadwaj, 2000). IT impact is measured as the ratio of IT budget to total sales revenue. It is theorized that firms that set aside larger portions of their sales revenue for the purchase of IT realize greater benefits from those expenditures (Mahmood and Mann, 1993; Rai et al., 1997). Benefits realized from expenditures on IT, both tangible and intangible, are theorized to lead to value added. This study examined the association between IT impact and both tangible and intangible benefits consideration in the IT investment decision, in response to research question #5:

RQ5: Does the level of IT impact differ between firms that deploy large amounts of resources towards process redesign integration and those that don't?

It was theorized that there is an association between the level of PRBF integration and IT impact, which led to research hypothesis five (RH5).

RH5: There is a direct relationship between the level of process redesign benefits integration in an organization and IT impact.

A correlation analysis was performed to test this hypothesis. The Pearson Correlation Coefficients between IT impact and PRBF is negative but not significant r19=-0.12772 (p=0.6023). The Spearman Correlation Coefficients test of correlation found similar results r19=-0.26013 (p=0.2821). It is noteworthy that the correlation with tangible benefits and IT impact also fails to be significant F1,17=0.50 (p=0.4882).

A multiple regression to study the multiple effect of both tangible and intangible benefits integration on IT impact found no significant association to exist among the three variables F2,16=0.88 (p=0.4337). This hypothesis was not supported. Table 18 summarizes the research findings in this study.

Table 18. Summary of Research Findings

Variable	Hypothesis	Result
Importance of PRBF	RH1a	Supported*
Importance of PRBF	RH1b	Supported*
Implicit Consideration	RH2	Supported*
Tangible vs. Intangible benefits	RH3	Supported*
Continuous Learning Culture	RH4.1	Not Supported
Strategic Relevance of IT	RH4.2	Supported*
Size of Firm	RH4.3	Not Supported
Industry	RH4.4	Not Supported
Type of IT Decision	RH4.5	Supported**
IT Impact	RH5	Not Supported

Legend: * = significant at p 0.05
** = significant at p 0.10

4.9 Summary

This chapter on research results starts out with a discussion of the demographic data and then proceeds to discuss the counter-balancing and sequencing of scenarios, the pilot study, and the reliability and validity measures. It then discusses the research results of the descriptive component in terms of the three tests of hypothesis under that category, followed by a discussion of the model-testing component in terms of the five tests of hypothesis under that category. Finally, research results for the IT Impact Ratio Analysis are discussed.

CHAPTER 5

DISCUSSIONS AND CONCLUSIONS

5.1 Introduction

Discussions of the research findings begin with a summary of the study's major contributions to the body of IS knowledge. Next, more detailed discussions of the findings are presented in three sections: Descriptive Component, Model Testing Component, and IT Impact Ratio Analysis. In addition, the limitations of this study are described, future research possibilities are considered, and the strengths and implications of the study are discussed.

5.2 Summary of Contributions

This study makes several contributions to the body of IS knowledge. First, it discovered the process redesign benefit factors (PRBF) that decision makers fail to include in the IT investment decision process. Second, it found the weight that decision makers place on the intangible benefit of process redesign when making the IT investment decision to be positively correlated to the weight they place on the more tangible benefits of technical, strategic, and financial factors. The implication of this finding is that those decision makers who expend extraordinary effort or resources on the consideration of tangible benefits in the IT investment decision process also expend relatively larger amounts of effort or resources on process redesign integration than otherwise. This is an important finding as IS research literature shows that firms that place much emphasis on the identification and measurement of value added are more

likely to find a strong association between IT investments and various measures of both productivity and performance in the firm (McNurlin, 1986; Monroe, 1989; Hochstrasser and Griffiths, 1991).

Prior to this study, IS research literature discussed the importance of including intangible benefits in the IT investment decision process without any definitive suggestions on how this objective can be accomplished. IS research literature also discussed process redesign as an intangible benefit with respect to its significant role in enabling Operative Efficiency, Organizational Restructuring, Technological Innovation, Customer Satisfaction, and in enhancing Strategic Planning, Product Quality, and the Quality of Employee Work. This study broke down process redesign into these seven component parts (factors), as described in the research literature, and studied the effect of each factor on the IT investment decision process. Up until the time of this study, no IS research literature was found that took as close a look at the intangible benefit of process redesign the way this study did, in terms of its component parts and studying the effect of each part on the IT investment decision. This study posits intangible benefit issues as those that should be considered when IT investment decisions are made, and addresses the consequences that are likely to result when these issues are neglected during this process. This study found that decision makers consider the role of process redesign as an intangible benefit to be an important one in the IT investment decision process. What this means in terms of the individual PRBF is that decision makers view the benefits associated with Operative Efficiency, Organizational Restructuring, Strategic Planning, Technological Innovation, Customer Satisfaction, Product Quality, and Quality of Employee Work to be important in the IT investment process and should, therefore, not be excluded. Failure to include these factors in that process will mean that sub-optimal decisions and IT investments are being made.

This study isolated the seven different process redesign benefit factors and made assessments to see if some of them were more important in the IT investment decision making process than others. It was found that Operative Efficiency, in terms of process redesign integration enabling more efficient processes, was the most important factor for decision makers. Organizational Restructuring, in terms of the redesigned processes leading to changes in the structure of the organization, was the least important. There was no significant difference in the importance that decision makers placed on the remaining five factors of Technological Innovation, in terms of process redesign integration enabling a firm to introduce new technology; Product Quality, in terms of process redesign integration leading to improved quality of products; Customer Satisfaction, in terms of better processes leading to more satisfied customers; and Improved Quality of Work, in terms of redesigned processes giving employees new tools with which to perform work. Of noteworthy concern was the low importance decision makers placed on the costs associated with the ability for an IT to restructure the organization, as prior IS research has shown that Organizational Restructuring is a key benefit of process redesign (Zuboff, 1988; Harrington, 1991; Tinnila, 1995). A possible explanation is that Organizational Restructuring is considered not important only relative to the other six factors. Decision makers may just believe that the other factors are more important.

Third, the study found that there was no significant difference between implicit and explicit consideration that decision makers give to the individual PRBF, except for Organizational Restructuring. This means that decision makers think about and even discuss the integration of PRBF when making an IT investment decision, as often as they formally or explicitly include them in that process. A possible explanation might be that tools are available with which to perform formal evaluation and assessment of viable investment alternatives, and so for the six factors, both implicit and explicit consideration

is given as appropriate. For Organizational Restructuring (the same factor that was found to not be very important to decision makers), this finding may suggest that those decision makers who think it is important tend to give it explicit consideration in terms of using available techniques to formally evaluate the impact it will have on redesigned processes.

Fourth, this study empirically confirmed that intangible benefits are significantly less important in the IT investment decision than tangible benefits. This is a concern because prior research shows that firms that downplay the integration of intangible benefits in the IT investment decision process may fail to achieve (or achieve less of) the benefits that were originally anticipated (Brynjolfsson & Hitt, 1995; Ryan, 1997).

Fifth, this research found the partial association between the intensity of a continuous learning culture in an organization and process redesign benefits integration to be significant. The implication is that whether an organization has a continuous learning culture or not and whether or not that culture is intensive has some bearing on the level at which the organization will consider PRBF in the IT investment process. This result was expected as IS research literature has shown that organizations with intensive continuous learning cultures adopt IT much more rapidly and gain value from such assimilation (Seng, 1990; Smith, 1993; Dodgson, 1993; Garvin, 1993; Wick and Leon, 1995; Ahituv et al., 1993; McCleod, 1993; Henderson and Lentz, 1995; Lipshitz et al., 1996; Frenzel, 1999).

Sixth, the association between the strategic relevance of IT in the organization and process redesign integration was found to be positive and significant. This is an important result that supports prior IS research findings that strategic information systems are an integral part of a firm's success and survival through influencing corporate strategy or directly supporting company strategy (Weill, 1989; Sabherwal & King, 1991; Frenzel, 1999).

This study found no association to exist between the size of the firm and process redesign integration. This was not expected as prior research literature has found such association to exist since small firms are typically constrained by more limited resources than are large firms. Therefore, small firms often cannot justify the expense and time of a formal process to evaluate computer systems (Raymond, 1985; DeLone, 1988; Chau, 1995). It was expected that large firms deploy greater amounts of effort or resources towards process redesign integration than small and medium firms.

This study found no association to exist between industry and process redesign integration. This result was not expected as prior IS research has shown that the level of investments in IT in general and that of process redesign integration in particular differs by industry (Harris and Katz, 1988, 92; Bender, 1986; Lin and Vassar, 1996; DiRomualdo and Gurbaxani, 1998; Banta, 1990; Lin and Clousing, 1995). In addition, the three industries studied, health care, chemical, and insurance, were considered to have low, medium, and high process redesign integration intensity, respectively.

This study found an association to exist between the type of IT decision and process redesign integration. This result was expected as prior research has found such an association to exist. For example, Ryan (1997) conducted exploratory interviews with IT investment decision makers who indicated that various types of IT decisions do not engender the same level of Human Resource Benefits and Costs (HRBC). HRBC were considered to be intangible costs and benefits in that study. The level of HRBC consideration varied, based on the degree to which the IT under consideration impacted the daily work of employees. While some decisions changed the way in which particular tasks got done, other IT decisions affected the work processes themselves. The interviews indicated that most IT decisions can be visualized as occurring along a continuum. At one end of that continuum are IT decisions in which, upon their implementation, little or no

process disruption occur for current system users or non-users. At the other end of the continuum are IT decisions that do result in notable process disruption. The interviews indicated that infrastructure decisions typically cause less process disruption than decisions to renew or enhance existing business capacity. This study supports those findings.

Finally, certain individual differences between decision makers such as age, tenure in position, functional background, and gender were hypothesized to help predict the degree to which process redesign integration was included in the IT investment decision. However, because of the very small number of responding firms, statistical tests were not performed on these variables (Cohen, 1977), and no conclusions are drawn. Future research efforts are encouraged to focus on these and other organizational factors that may affect PRBF integration.

For both the hypotheses that were supported and those that were not, the implications of the above research findings should be interpreted with caution for the following reason. The very small number of responses received and subsequently used as the basis for evaluating the hypotheses, may mean that the sample may not be representative of the population on which it was drawn. Consequently, for future research direction, it is recommended that these same tests, in addition to others suggested later in this chapter, be conducted using a larger sample size and sample that may be more representative of the targeted population.

5.3 Descriptive Data on Process Redesign Integration

Statistical results show not only that certain individual factors received greater consideration than others, but also that the level of consideration differed between the two types of IT decisions. Operative Efficiency was by far the most frequently considered

benefit factor, under both Infrastructure and Business Process types of IT decision. However, its consideration was higher under Infrastructure than under Business Process. Customer Satisfaction was the second most considered benefit factor under both types of IT decision. Quality of Work was considered at an equal level with Customer Satisfaction under Infrastructure. Under Business Process, it was considered fourth after Strategic Planning. Organizational Restructuring was considered lowest under Business Process, but it still received higher consideration than each of the four factors that received the lowest consideration under Infrastructure: Strategic Planning, Organizational Restructuring, Product Quality and Technological Innovation, from lowest to highest, in that order. Both the normative literature and the telephone interviews by Ryan (1997) found that many decision makers are skeptical of existing methods used to quantify individual benefit factors. Moreover, even if a given benefit factor is determined to be effective, there is no guarantee that efficiency gains from it are used for the benefit of the organization. Therefore, attaching a monetary value to individual process level efficiency gains may not be appropriate. This concern has caused some researchers to abandon process level efficiency measures and, instead, focus on intermediate or firm level efficiency and productivity implications (Rai et al., 1997; Hitt and Brynjolfsson, 1996). While both normative and statistical data agree that efficiency gains should be included as an important IT investment decision variable, this study was not able to demonstrate that, in practice, decision makers fare well in quantifying value added resulting from improved efficiencies at the process level.

5.4 The Descriptive Component

The next major component of this study was the Descriptive Component, which addressed three research questions (RQ1, RQ2, and RQ3). The following discussion pertains to each of these three questions.

5.4.1 Research Question 1

The findings from research question 1 (RQ1) gave two indications. First, there is an association between the level of effort or resources IT decision makers place on tangible benefits and intangible benefits. Organizations that deploy large amounts of effort or resources on the consideration of tangible benefits are more likely to expend proportionately large amounts of effort or resources on intangible benefits consideration than otherwise. Second, decision makers do differentiate the individual PRBF in terms of importance when making the IT investment decision. For both types of IT decisions of Infrastructure and Business Process, the PRBF of Operative Efficiency was found to be of primary importance. This finding is consistent with the findings from the exploratory interviews of Ryan (1997).

In both Business Process and Infrastructure IT decisions, Operative Efficiency and Product Quality were viewed as most important, significantly differing from the importance placed on Organizational Restructuring and Strategic Planning issues. In fact, for both Business Process and Infrastructure decisions, the effort or resources decision makers spend on the consideration Organizational Restructuring had the lowest mean response score. This finding was rather disturbing, particularly for the Business Process type of IT decision, as past research has shown that Organizational Restructuring is a significant by-product of business process reengineering (Tinnila, 1995; Harrington, 1991). It was expected that firms place significant importance on the role of

Organizational Restructuring in the IT investment decision process. As is the case with all the tests conducted for this study, a possible explanation for this unexpected finding is the small number of firms responding to the survey questionnaire.

5.4.2 Research Question 2

Research question 2 (RQ2) investigated the method decision makers use when evaluating the individual PRBF in the IT investment decision process in terms of whether they use explicit or implicit consideration. Research findings show that there is no significant difference between the level of explicit consideration for the group of all the PRBF compared to implicit consideration. A second comparison of explicit and implicit consideration of PRBF was done between the two types of IT decisions, and no significant difference was found to exist. A third test procedure looked at individual PRBF and compared the levels of both explicit and implicit consideration, both within the factors and between the two IT decisions types, and found no significant difference in explicit and implicit consideration for Operative Efficiency, Strategic Planning, Customer Satisfaction, Technological Innovation, Product Quality, and Quality of Employee Work. This test determined that the level of implicit consideration given to Organizational Restructuring was significantly higher than the level of explicit consideration. These test results indicate that, overall, decision makers may think about or have implicit consideration of PRBF when making IT investment decisions, but have less clearly formulated or explicit approaches to considering the issues surrounding these factors. Perhaps this is because there are not good metrics or methodologies for formally evaluating many of the PRBF issues, relative to the more tangible factors of technical, strategic, and financial issues (Due, 1994).

5.4.3 Research Question 3

Research question 3 (RQ#3) compared the weights decision makers place on PRBF to technical, strategic, and financial issues. Several tests were conducted. The first test compared the weight placed on the two groups of variables for the three different firm sizes of small, medium and large. The second test compared the weight placed on the two groups of factors for the two different types of IT decisions. Both tests found that the level of effort or resource deployment on tangible benefits was significantly greater than for intangible benefits. The same test results show that for both types of IT decisions, financial issues had the highest average score followed by technical, and then strategic issues. PRB factors ranked last. The predominance of financial consideration is congruent with prior IS research that indicates that organizations often require IT investments to be evaluated using traditional measures such as net present value and return on investment (Silk, 1990). Financial quantification is considered desirable because alternatives are easy to compare and choices easy to justify. Technical issues were weighed more heavily than strategic and PRBF issues. One explanation could be that these issues also tend to be more tangible, and, therefore, easier to quantify and to include in the investment decision. From a strategic perspective, however, it indicates lack of systemic thinking in terms of failing to optimize total value added to the firm.

An interesting observation is that financial, technical, and strategic issues were weighed almost identically in both the business process and infrastructure decision. In addition, the technical issues were secondary to financial issues in both decision types. This is somewhat surprising because, at least some interviewees in the exploratory interviews (Ryan, 1997) expressed the opinion that technical issues were the primary consideration in infrastructure decisions. It might be argued that in Infrastructure decisions, where there is less process disruption during technology implementation, it

may be reasonable to consider PRBF substantially less than under Business Process decisions, where there is more process disruption. However, in Business Process decisions, where there is greater process disruption, PRBF were also considered substantially less.

These findings are not surprising but rather reaffirm the initial proposition that organizations place the most importance on financial, technical, and strategic issues and substantially less importance on PRB factors. This study argues that, historically, insufficient effort or resources have been expended towards process redesign integration. The risk is that firms that continue this trend may be making sub-optimal decisions and IT investments (Hitt and Brynjolfsson, 1996; Ryan, 1997).

5.5 Model Testing Component

This component of the study addressed research question 4 (RQ4) by testing five hypotheses (RH4.1, RH4.2, RH4.3, RH4.4, and RH4.5). It examined some factors that were believed to impact how much PRBF were included in the IT investment decision. These factors were divided into two categories of organizational and technological factors.

5.5.1 Research Hypothesis 4.1

First, tests were performed to study the relationship between the intensity of a Continuous Learning Culture (an organizational factor) in an organization and the level of effort or resource deployment towards process redesign integration. Only an insignificant association was found to exist between the two variables. This finding was not expected as process redesign integration is considered an integral part of organizations with continuous learning cultures. This shared organizational culture was

believed to place value on employee knowledge acquisition and application. Therefore, it was expected that when decisions are made which are likely to affect business processes, the PRBF are more apt to be evaluated or evaluated with greater effort and resources. IT was thought to facilitate organizational learning by allowing the rapid dissemination of knowledge, making codified knowledge retrievable, and providing access to individuals with specialized knowledge (Stein and Zwass, 1995). It was believed that organizations with intense continuous learning cultures were more proactive in their adoption and integration of IT (Senge, 1990; Smith, 1993).

It is possible that there is a reciprocal relationship between IT and continuous learning cultures. IT may facilitate the development of a continuous learning culture, and, a continuous learning culture, in turn, may impact the decisions of which information technologies to acquire. While causal direction was not directly inferable in this study, it was shown that there is no relationship between a continuous learning culture and the inclusion of PRBF in the IT decision process. As may be the case with all test results in this study, the small sample size may play a role in this unexpected finding.

5.5.2 Research Hypothesis 4.2

Next, several tests were performed to study the relationship between the Strategic Relevance of IT in the organization and the level at which effort or resources were deployed for process redesign integration. A test of correlation found significant association to exist. A second test studied this association for the two different types of IT decision and found such association to be present and significant. Organizations in which IT played a strategic role deployed more effort or resources towards process redesign integration. This finding had been expected and has support in the IS literature (Sprague and McNurlin, 1986). Weill (1989) (McFarland & McKinney, 1983; Bakos & Treacy,

1986; Porter and Millar, 1995; Wiseman, 1988). The initial rationale for this hypothesis was drawn from IS research literature that indicated firms could not use strategic IS systems for organizational advantage unless the employees who interacted with those systems were willing and able to use them effectively (Davenport, 1989). It was therefore proposed that organizations that recognized the strategic relevance of IT would also realize this linkage and would therefore consider PRBF to a greater extent.

It should be noted, however, that the salient focus of these two constructs, strategic relevance of IT and the inclusion of PRBF in an IT investment decision, differ. Strategic use of IT is externally focused, concerned, at the policy level of the organization, with competitive positioning and customer responses (Clemons and Weber, 1990). An important consideration is the congruence of IT goals and strategies with organizational objectives so that corporate goals such as market share growth, or profitability, can be achieved (Clemons, 1987). Conversely, PRBF integration issues have traditionally been internally focused, concerned with operational and tactical issues. Recent strategic process redesign integration research has highlighted the importance of process redesign strategies as an important source of competitive advantage (Wright and McMahon, 1992); Huselid, 1995). In fact, some IS researchers argue that the most important factor in maintaining competitive advantage is redesigned processes (Davenport, 1993). It appears, from the findings in this study, that the importance of PRBF integration issues from a strategic perspective has been assimilated into the IT decision making process.

5.5.3 Research Hypothesis 4.3

Hypothesis 3, which predicted that size of the organization would impact the degree to which PRBF are considered in the IT investment decision process, also was not

supported. The hypothesis was initially tested using three categories of size: small firms with annual sales revenue of less than $50 million; medium firms with annual sales revenue of between $50 million and $500 million; and large firms with annual sales revenue of over $500 million. These results indicate that size has no bearing on the degree to which organizations include PRBF in their IT investment decisions. These results were rather surprising as prior IS research literature indicated that large firms had the resources to perform the studies and analyses necessary in the IT investment decision process. Small firms, on the other hand, were not expected to be able to justify such expenditures and to rely on user opinions when it came to selecting IT alternatives (Raymond, 1985). As may be the case with all test results in this study, the small sample size may play a role in this unexpected finding.

5.5.4 Research Hypothesis 4.4

The fourth hypothesis under the model-testing component theorized that industry had an effect on the level at which effort or resources were deployed towards process redesign integration. Both tests performed to test this hypothesis rejected the hypothesis, showing that industry was not an important factor. This finding was contrary to prior IS research literature findings that different industries had different levels of intensity of process redesign integration (Lin and Vassar, 1996; Banta, 1990; Lin and Clousing, 1995; DiRomualdo and Gurbaxani, 1998). As may be the case with all test results in this study, the small sample size may play a role in this unexpected finding.

5.5.5 Research Hypothesis 4.5

The fifth hypothesis under the Model-Testing component hypothesized that the type of technology under consideration would affect the degree to which PRBF are

included in the IT investment decision. Several tests were performed to evaluate this hypothesis. The first several tests found the association to be insignificant. However, a test to study the simultaneous effect of the intensity of a continuous learning culture, the strategic relevance of IT in the organization, firm size, type of IT decision, and industry found the intensity of a continuous learning culture, strategic relevance of IT, and type of IT decision to have significant effect. The type of IT decision under consideration was operationalized by creating two scenarios describing Infrastructure and Business Process integration decisions. These scenarios represented decisions on varying points on the 'process disruption continuum'. The results show that greater attention is given to PRBF integration when the IT under consideration will greatly disrupt business process (Business Process) than when the IT is thought to have minimal impact on business process (Infrastructure).

Although this finding reveals the current state of practice regarding IT decisions, it has normative implications. It suggests that decision makers should evaluate the degree of process disruption they believe the IT in question will induce. The greater the impact, the more effort or resources they should expend on determining PRBF integration. Future research could develop a series of questions to help position IT under consideration on the process disruption continuum.

5.6 IT Impact Ratio Analysis

The hypothesis that there is a direct relationship between the level of process redesign benefits integration in an organization and IT impact ratio was tested. Several tests were performed. Correlation tests found no significant association between the variables. A third test studied the multiple effect of both tangible and intangible benefits integration on IT impact and found no significant association.

The results of these tests were not expected. This study posited that the assessment of value added by IT investments ought to include both tangible benefits and intangible benefits. Failure to include both types of benefits in the IT decision and to consider only tangible benefits may mean that sub-optimal decisions and IT investments are being made. Following this logic, it was expected that an association would be found to exist between process redesign integration and IT impact, the ratio of IT budget to total sales revenue. An even stronger association was expected between the three variables of tangible benefits, intangible benefits, and IT impact, indicating that when all value added is considered, firms are more likely to be able to demonstrate IT value. High IT impact ratios were expected to indicate that high levels of investments in IT were resulting in increased revenue that more than compensated for the increased IT expenses. The test results did not support these expectations. Again, one possible explanation would be the very low response rate for respondents in the survey. With a sample size this small, it is not possible to infer conclusions to the entire population even in cases where the results show significant effect/association (Kerlinger, 1986).

5.7 Limitations of the Study

There are several limitations of this study in terms of internal and external validity. First, this study is cross-sectional in nature, therefore the conclusions are limited to correlational rather causal inferences. A longitudinal study further examining the causal relationships would add insight to these findings.

Another limitation is the response rate to the survey which was only a little more than 2%. No national surveys of top executives was known to have had similar response rates. It was more common to find response rates between 10% and 15% (Chan et al., 1997; Rai and Patnayakuni, 1996; Ryan, 1997). There is a possibility of bias or lack of

representativeness to the population of IT executives due to this low level of response. This notwithstanding, the survey responses had multiple sources of variance, supporting the generalizability of conclusions. First, the sample was national. Because the organizations were promised that responses would be anonymous, it was not possible to identify the organization's location unless a business card was returned with the survey or a postmark was present on the return envelope. The majority of envelopes did not contain postmark because a business reply envelope was used. Three (15%) of the 19 survey respondents enclosed a business card. These respondents were from organizations in three different states. This is one indicator of the breadth of the survey response. Second, there was variance in the size of organizations that responded, ranging from $1 million to $30 billion in annual sales revenue. Third, the three industries of interest were adequately represented.

A third limitation of this study is common method variance. Because all of the data were obtained from self-reports from one executive per organization, the possibility for inflated correlations is high.

5.8 Future Research Directions

A great deal of work has yet to be done in terms of investigating PRBF integration into the IT investment decision. First, although this study found significant associations between PRBF and some of the variables examined, such as the Strategic Relevance of IT in the firm, much of the variance is still unaccounted for. Other organizational and environmental variables should also be investigated as to whether they provide explanatory power in predicting PRBF integration in the IT investment decision. On the other hand, this study found insignificant associations between PRBF integration and many variables where significant positive association had been expected. Future

research efforts ought to study these relationships using alternative research methods and larger sample sizes, as already pointed out.

Additional research in terms of the cross-cultural implications of these findings would be interesting. This would involve gathering the same type of data that was collected for this study in one or more additional countries, then comparing the differences. As the world continues to become a global economy, the question of: "What national cultures do a more thorough job of PRBF integration in their IT investment decisions?" becomes an important one.

The relationship between PRBF integration and the intensity of a Continuous Learning Culture needs additional investigation, along with the relationship between PRBF integration and such other factors as firm size, and industry. Causal direction of the relationships between these constructs should be explored. Additional research concentrating specifically on the Continuous Learning Culture construct would be interesting, including whether certain technologies not only structurally support learning organizations, but also contribute to the development of shared cultural values. A case study methodology using multiple organizations could enhance further theory development in this area. Kling (1991) observes that case studies are excellent vehicles for learning about the social processes that shape computerization. Data collection could occur at various points in time so that causal processes could be examined.

5.9 Strengths and Implications for the Study

This study combined qualitative and quantitative methodologies to investigate an important but under-considered aspect of IT investment decisions, namely process redesign integration. Theory testing was performed via a national sample survey of IT executives.

The small number of respondents notwithstanding, this study empirically showed that IT decision makers did consider some process redesign issues in their IT investment decisions. However, the consideration of these issues was not weighted heavily, as compared to, for example, financial, technical, and strategic issues. Nor was it frequently done formally or explicitly. Bacon (1992) warns that formal consideration in terms of quantification is important because otherwise there may be an absence of disciplined analysis, no real basis for objective measurement, and limited awareness of the true costs and benefits of IT investments.

Findings from this study imply that greater consideration should be given to process redesign integration issues both when the IT under consideration will substantially alter daily work processes (Business Process) and otherwise (Infrastructure). Yet, even when a proposed IT will cause considerable process disruption, IT decision makers view process redesign integration issues as significantly less important than financial, technical, and strategic issues. In addition, consideration of Organizational Restructuring was rated the least important PRBF, even when process disruption (Business Process) is expected to be substantial. Combined, these findings were rather unsettling for several reasons. First, the exploratory interviews (Ryan, 1997), as well as past IS research literature (Robey, 1979) has shown that inadequate attention to and lack of management of the IT selection process leads to system failure. Also, from a project perspective, a failure to include important costs and benefits, such as those associated with managing change, when process disruption is significant, may lead to the selection of projects that are far more expensive than originally anticipated. It could also result in the wrong selection of projects in terms of bringing the most value to the organization.

Although it is true that measurement procedures are lacking for most of these PRBF, there are quantifiable metrics available for both the cost and benefit sides of a few

of the ones that showed no significant difference in explicit and implicit consideration. For example, for Operative Efficiency, the number of jobs eliminated as a result of an IT implementation can be measured and easily translated into dollar values. So far as Product Quality is concerned, much work has been done in the area of quality, including the development of metrics such as the Cost of Quality Index, which translates quality improvements into monetary terms (Strassman, 1995). Third, for the Quality of Employee Work factor, procedures are available for calculating training costs (Fitz-enz, 1988; Kearsley, 1984). However, when business process changes are proposed, it may be difficult to ascertain exactly what training will be required because employees may need to learn new work skills above and beyond those required for new IT. Quantification of costs can be much more difficult if training requirements are not well understood. Therefore, while decision makers may think about employee training issues in a process redesign setting, the associated training costs may not be formally included in the decision process (Ryan, 1997).

Although no commonly accepted framework or methodology for determining PRBF is available, work has been done in attempting to quantify intangible strategic benefits. Parker and Benson (1988) proposed a "value-linking framework" which measures, based on the organization's value-added chain, intermediate level process variables in the transformation of inputs to outputs. Based upon this framework, the value of an IT investment is equated to the summation of the investment's economic impact, business (strategy) domain assessment, and technology domain assessment. The Parker and Benson framework could possibly be extended to include each of the components of process redesign in the evaluation of IT value.

5.10 Summary

This chapter summarizes the contributions that this study has added to the IS body of knowledge. It then gives a description of the data set used in assessing process redesign integration. It discusses the research findings of the descriptive component of the written survey with respect to the three research questions under this category. Research findings related to the model-testing component are discussed next in terms of the results of the five hypotheses tested under this category. The results of the IT Impact Ratio analysis are then discussed, followed by a discussion of the limitations of the study, future research directions, and the strengths and implications of the study.

APPENDIX A

INFRASTRUCTURE SCENARIO RELATED ITEMS

Item Number	Decision Type	Intrinsic or Extrinsic	Category
1	Infrastructure	-	Technical Issues
2	Infrastructure	-	Technical Issues
3	Infrastructure	-	Technical Issues
4	Infrastructure	-	Technical Issues
5	Infrastructure	-	Technical Issues
6	Infrastructure	-	Strategic Issues
7	Infrastructure	-	Strategic Issues
8	Infrastructure	-	Strategic Issues
9	Infrastructure	-	Financial Issues
10	Infrastructure	-	Financial Issues
11	Infrastructure	-	Financial Issues
12	Infrastructure	Intrinsic	PR-Operative Efficiency (OE)
13	Infrastructure	Extrinsic	PR-Strategic Planning (SP)
14	Infrastructure	Intrinsic	PR-Organizational Restructuring (OR)
15	Infrastructure	Extrinsic	PR-Technological Innovation (TI)
16	Infrastructure	Intrinsic	PR-Customer Satisfaction (CS)
17	Infrastructure	Extrinsic	PR-Product Quality (PQ)
18	Infrastructure	Intrinsic	PR-Quality of Employee Work (QW)
19	Infrastructure	Extrinsic	PR-Operative Efficiency (OE)
20	Infrastructure	Intrinsic	PR-Strategic Planning (SP)
21	Infrastructure	Extrinsic	PR-Organizational Restructuring (OR)
22	Infrastructure	Intrinsic	PR-Technological Innovation (TI)
23	Infrastructure	Extrinsic	PR-Customer Satisfaction (CS)
24	Infrastructure	Intrinsic	PR-Product Quality (PQ)
25	Infrastructure	Extrinsic	PR-Quality of Employee Work (QW)

APPENDIX B

BUSINESS PROCESS SCENARIO RELATED ITEMS

Item Number	Decision Type	Intrinsic or Extrinsic	Category
1	Business Process	-	Technical Issues
2	Business Process	-	Technical Issues
3	Business Process	-	Technical Issues
4	Business Process	-	Technical Issues
5	Business Process	-	Technical Issues
6	Business Process	-	Strategic Issues
7	Business Process	-	Strategic Issues
8	Business Process	-	Strategic Issues
9	Business Process	-	Financial Issues
10	Business Process	-	Financial Issues
11	Business Process	-	Financial Issues
12	Business Process	Intrinsic	PR-Operative Efficiency (OE)
13	Business Process	Extrinsic	PR-Strategic Planning (SP)
14	Business Process	Intrinsic	PR-Organizational Restructuring (OR)
15	Business Process	Extrinsic	PR-Technological Innovation (TI)
16	Business Process	Intrinsic	PR-Customer Satisfaction (CS)
17	Business Process	Extrinsic	PR-Product Quality (PQ)
18	Business Process	Intrinsic	PR-Quality of Employee Work (QW)
19	Business Process	Extrinsic	PR-Operative Efficiency (OE)
20	Business Process	Intrinsic	PR-Strategic Planning (SP)
21	Business Process	Extrinsic	PR-Organizational Restructuring (OR)
22	Business Process	Intrinsic	PR-Technological Innovation (TI)
23	Business Process	Extrinsic	PR-Customer Satisfaction (CS)
24	Business Process	Intrinsic	PR-Product Quality (PQ)
25	Business Process	Extrinsic	PR-Quality of Employee Work (QW)

APPENDIX C

SURVEY INSTRUMENT, INFRASTRUCTURE SCENARIO

HOW DOES YOUR ORGANIZATION MAKE INFORMATION TECHNOLOGYINVESTMENT DECISIONS?

On the next few pages a situation is presented about a type of IT investment decision: ***Network Server(s)*** *(Infrastructure). An IT infrastructure has been defined as a shared set of tangible IT resources that provide foundation to enable present and future business applications. Examples of IT infrastructure components include computer hardware, operating systems, and networking capabilities. These provide an underlying framework for the organization's information systems. Please read the situation below carefully and answer the questions that follow. Please read the situation described below carefully and answer the questions that follow in terms of the DECISION PROCESS your organization would select.*

Network Server(s):
You have received complaints that access to information on the network is slow. Your technical personnel insist that the applications have been written and tuned properly; however, the server(s) does not have enough processing capability. You are considering several options:

(1) Upgrade the server(s)
(2) Partition the workload by getting another server(s), so that some users can access one server, while the others access another
(3) Set up a multi-tiered environment, so the database or file access is on one system and the application access is on another
(4) Move the application to a midrange or mainframe system

The selected option will be referred to as 'the project' in the remainder of the questionnaire.

Below is a list of possible actions your organization might consider when making this ***Network Server(s)*** *investment decision. Please indicate how much EFFORT and/or RESOURCE(S) your organization would spend on each of the following actions in terms of the DECISION PROCESS, by circling the appropriate number using the scale below. Operating a firm's IT infrastructure often consumes approximately 50% of its IT budget on average.*

1=None 2=Below Average 3=Average 4=Above Average 5=Extraordinary

In my organization, we would spend the following amount of effort or resources ...

(1)	evaluating if we have the technical skills to implement and support the options.	1 2 3 4 5
(2)	assessing the need for additional co-requisite hardware or software.	1 2 3 4 5
(3)	investigating the ability to expand or modify our option to meet changing requirements.	1 2 3 4 5
(4)	evaluating performance and capacity characteristics.	1 2 3 4 5
(5)	evaluating how easily the options can be integrated with existing systems.	1 2 3 4 5
(6)	considering the extent to which the choices are consistent with the organization's business strategy and objectives.	1 2 3 4 5
(7)	discussing with line managers the impact this decision will have on customer service.	1 2 3 4 5
(8)	questioning if the various options can help us achieve our organizational goals.	1 2 3 4 5
(9)	weighing the monetary costs and benefits of the various options.	1 2 3 4 5
(10)	considering whether the budget allows for this project.	1 2 3 4 5
(11)	gathering information about the total financial outlay of each option.	1 2 3 4 5
(12)	considering whether this decision will add to operative efficiency.	1 2 3 4 5
(13)	projecting the benefits of strategic planning that result because of this project.	1 2 3 4 5
(14)	thinking about the impact of the decision on the structure of the organization.	1 2 3 4 5
(15)	evaluating the costs of the options in terms of technological innovation benefits achieved.	1 2 3 4 5
(16)	considering the impact that the decision will have on customer satisfaction.	1 2 3 4 5
(17)	projecting the effect this project will have on product quality.	1 2 3 4 5
(18)	thinking about the impact this decision will have on the quality of employee work.	1 2 3 4 5
(19)	projecting the benefits of operative efficiency that result because of this project.	1 2 3 4 5
(20)	discussing with managers strategic planning benefits that may result from this project.	1 2 3 4 5

(21) forecasting with input from line managers the impact of the decision on the structure of the organization. 1 2 3 4 5
(22) thinking about the impact this project will have on technological innovation. 1 2 3 4 5
(23) evaluating the benefits of customer satisfaction resulting from this investment. 1 2 3 4 5
(24) thinking about the impact this project will have on product quality. 1 2 3 4 5
(25) evaluating the benefits this project will have on the quality of employee work. 1 2 3 4 5
(26) How often have you (the organization) made this type of decision in the last three years? (circle one)
0 times 1 time 2 times 3 times 4 or more times
(27) How much do you (the individual) think this project will affect the way the users do their business from day -to-day?
None Fairly Much Completely
1 2 3 4 5 6 7
(28) How important would this decision be in your organization?
Not important Fairly Important Extremely Important
1 2 3 4 5 6 7
(29) In your organization, whose "buy-in" would be required for this type of decision? (circle all that apply)
Mine My manager The CEO/Pres. An exec/mgmt. Committee Functional managers
Other: _____ (please specify)

*Assume you and your managers have selected one of the options on how to handle this **Integrating Business Functions** problem and are now considering its implementation. Please indicate how much EFFORT or RESOURCE(S) you would spend on each of the following actions in terms of CREATING AN IMPLEMENTATION PLAN, by circling the appropriate number using the scale below.*

1=None 2=Below Average 3=Average 4=Above average 5=Extraordinary

In my organization, we would spend the following amount of effort or resources ...

(30) thinking about the impact this project will have on technological innovation. 1 2 3 4 5
(31) evaluating the benefits of customer satisfaction resulting from this investment. 1 2 3 4 5
(32) thinking about the impact this project will have on product quality. 1 2 3 4 5
(33) evaluating the benefits this project will have on the quality of employee work. 1 2 3 4 5

ABOUT INFORMATION TECHNOLOGY AT YOUR ORGANIZATION

Please consider the following statements as they relate to Information Technology (IT) at your organization. Use the following scale to evaluate each statement, then circle the appropriate number.

1=Not at all 2=To a small extent 3=To some extent 4=To a great extent 5=To an extraordinary extent

In my organization, information technology at the PRESENT time ...

(34) is applied to advance the organization's critical success factors. 1 2 3 4 5
(35) aids the organization in competing in the market 1 2 3 4 5
(36) serves the middle management echelon. 1 2 3 4 5
(37) aids the organization in increasing profitability. 1 2 3 4 5
(38) enables significant financial status improvements in the operational areas. 1 2 3 4 5

1=Not at all 2=To a small extent 3=To some extent 4=To a great extent 5=To an extraordinary extent

In the FUTURE, I believe information technology in my organization ...

(39) will be applied to advance the organization's critical success factors.	1 2 3 4 5
(40) will be used for administrative and operational applications.	1 2 3 4 5
(41) will serve the middle management echelon.	1 2 3 4 5
(42) will enable significant financial status improvements in the operational areas.	1 2 3 4 5
(43) will be critical to the functioning of the organization.	1 2 3 4 5

The next set of questions relate to the ORGANIZATIONAL CULTURE at your firm. Please use the following scale to evaluate each statement, then circle the appropriate number.

1=Never 2=Infrequently 3=Sometimes 4=Frequently 5=Always

In my organization ...

(44) job assignments are challenges that stretch a manager's knowledge.	1 2 3 4 5
(45) supervisors give recognition and credit to those who apply new knowledge and skills to their work.	1 2 3 4 5
(46) co-workers are able to provide reliable information about ways to improve job performance.	1 2 3 4 5
(47) there is a job rotation program to give managers diverse job assignments during the first years of employment.	1 2 3 4 5
(48) co-workers are willing to listen to new ideas.	1 2 3 4 5
(49) supervisors match employee needs for personal and professional development with opportunities to attend training.	1 2 3 4 5
(50) co-workers tell each other about new information that can be used to increase job performance.	1 2 3 4 5
(51) there is excellent on-the-job training.	1 2 3 4 5
(52) job assignments are made in the manager's area of interest and designed to promote personal development.	1 2 3 4 5
(53) co-workers consistently suggest new approaches to solving problems based upon their own experiences.	1 2 3 4 5
(54) employees are provided with equipment and facilities to acquire and apply new knowledge and skills.	1 2 3 4 5
(55) job assignments include free time to explore new, advanced ideas and methods for improving performance.	1 2 3 4 5
(56) we are highly innovative.	1 2 3 4 5
(57) we have a progressive atmosphere.	1 2 3 4 5
(58) supervisors ask for ideas about how to solve technical, work-related problems.	1 2 3 4 5
(59) job assignments continually require the evaluation of alternative solutions to problems.	1 2 3 4 5
(60) supervisors openly express their support of continuous learning.	1 2 3 4 5
(61) co-workers encourage each other to use new knowledge and skills on the job.	1 2 3 4 5
(62) independent and innovative thinking is encouraged by supervisors.	1 2 3 4 5
(63) there is a performance appraisal system that ties financial rewards to technical competence.	1 2 3 4 5
(64) job assignments consistently expose managers to new technical information.	1 2 3 4 5

PLEASE PROVIDE THE FOLLOWING INFOMRATION ABOUT YOU AND YOUR ORGANIZATION

(65) Title: _____ (66) Age: _____ years
(67) Years in your current position: _____ years
(68) Years making this type of IT investment decision: _____ years
(69) Approximate number of company employees: _____ people
(70) Estimated annual revenue of your organization: $_____ per year
(71) Estimated annual IT budget: $_____ per year
(72) Number of employees are in your IT department: _____ people
(73) Please check all of the following types of technologies that your organization uses:

☐ Mainframes	☐ Client/Server Applications	☐ E-Mail
☐ Midrange computers	☐ LANs	☐ Groupware
☐ PCs	☐ Data Warehouses	☐ Intranets

(74) How many levels are you from the Chief Executive Officer (CEO) of the organization?
☐ 0 (I am the CEO) ☐ 1 ☐ 2 ☐ 3 ☐ 4+
(75) What is your Gender? ☐ Male ☐ Female
(76) What percentage of your working career have you spent in each of the following areas?

_____ Accounting/Finance	_____ Human Resources
_____ Information Systems	_____ Marketing
_____ Manufacturing or Production/Operations Management	
_____ Other _____ (please specify)	
_____ TOTAL EMPLOYMENT	

APPENDIX D

SURVEY INSTRUMENT, BUSINESS PROCESS SCENARIO

HOW DOES YOUR ORGANIZATION MAKE INFORMATION TECHNOLOGY INVESTMENT DECISIONS?

On the next few pages a hypothetical situation is presented about a type of IT investment decision: ***Integrating Business Functions****. Enhancing existing business capability can take several forms, including: 1) extending the functionality of existing IT to meet current business needs, which will impact the way in which a particular task gets accomplished, and (2) redesigning or reengineering a business process with the support of IT, which changes the actual work flow. Please read the situation described below carefully and answer the questions that follow in terms of the DECISION PROCESS your organization would select.*

Integrating Business Functions:
The managers in your organization have expressed concern that the information systems supporting your core business functions are not well integrated. The suggestion has been made to reengineer these business processes using IT capabilities to better support the business areas. The following options are being considered:

(1) Modify the existing software so that business functions can become more integrated.
(2) Purchase an integrated package which contains modules for your core business functions
(3) Have either in-house programmers or a consultant custom design a solution

The selected option will be referred to as 'the project' in the remainder of the questionnaire.

Below is a list of possible actions your organization might consider when making this ***Integrating Business Functions*** *investment decision. Please indicate how much EFFORT and/or RESOURCE(S) your organization would spend on each of the following actions in terms of the DECISION PROCESS, by circling the appropriate number using the scale below. Integrating business functions often absorbs 70% of the IT budget for most firms on average.*

1=None 2=Below Average 3=Average 4=Above Average 5=Extraordinary

In my organization, we would spend the following amount of effort or resources ...

(1)	evaluating if we have the technical skills to implement and support the options.	1 2 3 4 5
(2)	assessing the need for additional co-requisite hardware or software.	1 2 3 4 5
(3)	investigating the ability to expand or modify our option to meet changing requirements.	1 2 3 4 5
(4)	evaluating performance and capacity characteristics.	1 2 3 4 5
(5)	evaluating how easily the options can be integrated with existing systems.	1 2 3 4 5
(6)	considering the extent to which the choices are consistent with the organization's business strategy and objectives.	1 2 3 4 5
(7)	discussing with line managers the impact this decision will have on customer service.	1 2 3 4 5
(8)	questioning if the various options can help us achieve our organizational goals.	1 2 3 4 5
(9)	weighing the monetary costs and benefits of the various options.	1 2 3 4 5
(10)	considering whether the budget allows for this project.	1 2 3 4 5
(11)	gathering information about the total financial outlay of each option.	1 2 3 4 5
(12)	considering whether this decision will add to operative efficiency.	1 2 3 4 5
(13)	projecting the benefits of strategic planning that result because of this project.	1 2 3 4 5
(14)	thinking about the impact of the decision on the structure of the organization.	1 2 3 4 5
(15)	evaluating the costs of the options in terms of technological innovation benefits achieved.	1 2 3 4 5
(16)	considering the impact that the decision will have on customer satisfaction.	1 2 3 4 5
(17)	projecting the effect this project will have on product quality.	1 2 3 4 5
(18)	thinking about the impact this decision will have on the quality of employee work.	1 2 3 4 5
(19)	projecting the benefits of operative efficiency that result because of this project.	1 2 3 4 5
(20)	discussing with managers strategic planning benefits that may result from this project.	1 2 3 4 5

(21) forecasting with input from line managers the impact of the decision on the structure of the organization. 1 2 3 4 5
(22) thinking about the impact this project will have on technological innovation. 1 2 3 4 5
(23) evaluating the benefits of customer satisfaction resulting from this investment. 1 2 3 4 5
(24) thinking about the impact this project will have on product quality. 1 2 3 4 5
(25) evaluating the benefits this project will have on the quality of employee work. 1 2 3 4 5
(26) How often have you (the organization) made this type of decision in the last three years? (circle one)
0 times 1 time 2 times 3 times 4 or more times
(27) How much do you (the individual) think this project will affect the way the users do their business from day -to-day?
None Fairly Much Completely
1 2 3 4 5 6 7
(28) How important would this decision be in your organization?
Not important Fairly Important Extremely Important
1 2 3 4 5 6 7
(29) In your organization, whose "buy-in" would be required for this type of decision? (circle all that apply)
Mine My manager The CEO/Pres. An exec/mgmt. Committee Functional managers
Other: _____ (please specify)

*Assume you and your managers have selected one of the options on how to handle this **Integrating Business Functions** problem and are now considering its implementation. Please indicate how much EFFORT or RESOURCE(S) you would spend on each of the following actions in terms of CREATING AN IMPLEMENTATION PLAN, by circling the appropriate number using the scale below.*

1=None 2=Below Average 3=Average 4=Above average 5=Extraordinary

In my organization, we would spend the following amount of effort or resources ...

(30) thinking about the impact this project will have on technological innovation. 1 2 3 4 5
(31) evaluating the benefits of customer satisfaction resulting from this investment. 1 2 3 4 5
(32) thinking about the impact this project will have on product quality. 1 2 3 4 5
(33) evaluating the benefits this project will have on the quality of employee work. 1 2 3 4 5

ABOUT INFORMATION TECHNOLOGY AT YOUR ORGANIZATION

Please consider the following statements as they relate to Information Technology (IT) at your organization. Use the following scale to evaluate each statement, then circle the appropriate number.

1=Not at all 2=To a small extent 3=To some extent 4=To a great extent 5=To an extraordinary extent

In my organization, information technology at the PRESENT time ...

(34) is applied to advance the organization's critical success factors. 1 2 3 4 5
(35) aids the organization in competing in the market 1 2 3 4 5
(36) serves the middle management echelon. 1 2 3 4 5
(37) aids the organization in increasing profitability. 1 2 3 4 5
(38) enables significant financial status improvements in the operational areas. 1 2 3 4 5

1=Not at all 2=To a small extent 3=To some extent 4=To a great extent 5=To an extraordinary extent

In the FUTURE, I believe information technology in my organization ...

(39) will be applied to advance the organization's critical success factors.	1 2 3 4 5
(40) will be used for administrative and operational applications.	1 2 3 4 5
(41) will serve the middle management echelon.	1 2 3 4 5
(42) will enable significant financial status improvements in the operational areas.	1 2 3 4 5
(43) will be critical to the functioning of the organization.	1 2 3 4 5

The next set of questions relate to the ORGANIZATIONAL CULTURE at your firm. Please use the following scale to evaluate each statement, then circle the appropriate number.

1=Never 2=Infrequently 3=Sometimes 4=Frequently 5=Always

In my organization ...

(44) job assignments are challenges that stretch a manager's knowledge.	1 2 3 4 5
(45) supervisors give recognition and credit to those who apply new knowledge and skills to their work.	1 2 3 4 5
(46) co-workers are able to provide reliable information about ways to improve job performance.	1 2 3 4 5
(47) there is a job rotation program to give managers diverse job assignments during the first years of employment.	1 2 3 4 5
(48) co-workers are willing to listen to new ideas.	1 2 3 4 5
(49) supervisors match employee needs for personal and professional development with opportunities to attend training.	1 2 3 4 5
(51) co-workers tell each other about new information that can be used to increase job performance.	1 2 3 4 5
(51) there is excellent on-the-job training.	1 2 3 4 5
(56) job assignments are made in the manager's area of interest and designed to promote personal development.	1 2 3 4 5
(57) co-workers consistently suggest new approaches to solving problems based upon their own experiences.	1 2 3 4 5
(58) employees are provided with equipment and facilities to acquire and apply new knowledge and skills.	1 2 3 4 5
(59) job assignments include free time to explore new, advanced ideas and methods for improving performance.	1 2 3 4 5
(56) we are highly innovative.	1 2 3 4 5
(57) we have a progressive atmosphere.	1 2 3 4 5
(58) supervisors ask for ideas about how to solve technical, work-related problems.	1 2 3 4 5
(59) job assignments continually require the evaluation of alternative solutions to problems.	1 2 3 4 5
(60) supervisors openly express their support of continuous learning.	1 2 3 4 5
(61) co-workers encourage each other to use new knowledge and skills on the job	1 2 3 4 5
(62) independent and innovative thinking is encouraged by supervisors.	1 2 3 4 5
(63) there is a performance appraisal system that ties financial rewards to technical competence.	1 2 3 4 5
(64) job assignments consistently expose managers to new technical information	1 2 3 4 5

PLEASE PROVIDE THE FOLLOWING INFOMRATION ABOUT YOU AND YOUR ORGANIZATION

(65) Title: _____ (66) Age: _____ years
(73) Years in your current position: _____ years
(74) Years making this type of IT investment decision: _____ years
(75) Approximate number of company employees: _____ people
(76) Estimated annual revenue of your organization: $_____ per year
(77) Estimated annual IT budget: $_____ per year
(78) Number of employees are in your IT department: _____ people
(73) Please check all of the following types of technologies that your organization uses:

☐ Mainframes ☐ Client/Server Applications ☐ E-Mail
☐ Midrange computers ☐ LANs ☐ Groupware
☐ PCs ☐ Data Warehouses ☐ Intranets

(74) How many levels are you from the Chief Executive Officer (CEO) of the organization?

☐ 0 (I am the CEO) ☐ 1 ☐ 2 ☐ 3 ☐ 4+

(75) What is your Gender? ☐ Male ☐ Female
(77) What percentage of your working career have you spent in each of the following areas?

_____ Accounting/Finance _____ Human Resources
_____ Information Systems _____ Marketing
_____ Manufacturing or Production/Operations Management _____ Other
_____ (please specify) _____ TOTAL EMPLOYMENT

APPENDIX E

COVER LETTER ACCOMPANYING THE SURVEY INSTRUMENT

«Title» «Name»
«JobTitle»
«Company»
«Address»
«City» «State» «PostalCode»

Dear «Title» «LastName»:

RE: INFORMATION TECHNOLOGY INVESTMENT DECISIONS

The issues surrounding the decisions to make investments in information technology (IT) are most important today for many organizations as they strive to achieve and sustain a competitive position. Incorrect or untimely decisions can literally spell disaster for a firm! I am conducting a research study to ascertain how these IT decisions are made. How are alternatives weighed? How do executives in similar positions make similar decisions and choices? These issues are of significant interest to me as I complete my Ph.D. dissertation.

I invite you to participate in this research project on these issues. I am asking that the appropriate **senior IT executive, such as the CIO**, in your organization complete the enclosed questionnaire. Please direct this letter and the questionnaire to that person.

HERE'S WHAT'S IN IT FOR YOU...
You win when you:

- find out how other IT executives make those same decisions (through research findings).
- discover what other decision makers think and contrast those with your own opinions.
- help the IS profession find answers to these puzzling questions.
- feel good about helping a Ph.D. student achieve research objectives.

This survey is being sent out to 949 CIOs and individuals in three specific industries (Insurance; Health Care; and Chemical) around the country who have IT investment decision making authority and responsibility at the organizational or divisional level. I will be more than happy to send you a summary of the research findings as soon as the study is completed, before the end of this year. To enable me to do this, please enclose your business card when you return the survey in the enclosed, postage-paid envelope.

Your responses will be held in complete anonymity and confidentiality. No one but the University of Texas at Arlington research team will see your answers, and only aggregate responses will be reported. If you have any questions, you may reach me at (419) 372-8960 or by email at aamadi@omega.uta.edu.

I know how valuable your time and that of your senior executives is, but this is the kind of information that can only be obtained from someone who is at a senior IT level. Research findings like these go a long way toward helping executives do their jobs better.

Sincerely,

Atieno Amadi

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BIOGRAPHICAL INFORMATION

The author received her doctorate in Business Administration with Information Systems major and Accounting minor from The University of Texas at Arlington in May 2001.