5-1999

New Business Initiatives and Financial Performance

Douglass Cagwin
University of Arkansas, Fayetteville

NEW BUSINESS INITIATIVES AND FINANCIAL PERFORMANCE

NEW BUSINESS INITIATIVES AND FINANCIAL PERFORMANCE

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

By

DOUGLASS CAGWIN, B.B.A, M.Acc.
Iowa State University, 1993
University of Arkansas, 1996

May 1999
University of Arkansas

Table of Contents

Chapter 1

Introduction

The primary purpose of this dissertation is to empirically measure the improvement in financial performance that is associated[1] with use of new business initiatives such as JIT, TQM, and ABC. The dissertation consists of three studies that collectively seek to answer the question: Is the use of these initiatives associated with improved financial performance and if so, what conditions enable this improvement? Only by scientifically, empirically determining the association between these initiatives and improvement in financial performance can we be certain that they are viable, cost-effective business solutions.

As advocated by Elliot[2] (1992), this study will build on several streams of research, specifically the findings and theory-building of prior managerial, behavioral, and systems case studies, field studies, survey research, and conceptual papers. This research, provided by accounting, economics, organizational behavior, and information technology researchers and practitioners will be utilized in building constructs and indices affecting probable efficacy in an attempt to come to a conclusion regarding the financial benefits of

[1] While the most desirable state of affairs is to be able to infer cause and effect, this may not be possible in this study. However, according to Kaplan (1986a), relationships between or among variables can still be useful even without being able to determine causality. Among other benefits, if the relationship is strong and consistent, we can use one variable (or phenomenon) to predict the occurrence of the second variable or phenomenon.

[2] Elliot (1992) stated that accounting research is "stovepiped" into such categories as financial, managerial, auditing, tax, and systems. He advocates that accounting researchers need to break through these stovepipes, because the customers for their new knowledge have scant interest in researchers' categories of subject matter; they are interested only in how the new knowledge will help them solve business problems.

the initiatives. Methodology common to financial accounting research and structural modeling will be drawn upon to provide the link to financial performance.

This research is highly relevant both to practitioners and to academicians. Extensive previous academic and practical prescriptive literature recommending use of these initiatives will be tested. Also, academicians can extend the methodology developed in this dissertation to refine and further test the efficacy of innovations. According to Leisenring and Johnson (1994), there is a serious void of research between that favored by academic journals that emphasize methodological rigor, and the articles favored by professional journals that seem to favor more "business-like" articles -- written in concise business style with immediate practical application. Accordingly, a further goal of this study is to communicate the insights obtained in a form that is easily understandable for practitioners. This, according to Leisenring and Johnson (1994) would be "really useful" research.

BACKGROUND AND MOTIVATION

Over the past twenty years, rapid changes have occurred in the business environment. As early as 1983, researchers such as Kaplan identified some of the changes in the way companies were organizing their production and delivery of their goods and services. These changes were driven by trends in customer demand and expectations. They include smaller lot sizes, shorter product life cycles, and a demand for higher quality (Sullivan and Sawhney 1989). To meet these demands, firms are implementing a variety of specific strategic practices aimed at promoting agility and enriching the customer. The strategies include both internal and external initiatives

(Fliedner and Vokurka 1997). U.S. companies are relying on flexible, advanced manufacturing technologies such as computer-integrated manufacturing (CIM), flexible manufacturing (FMS), automation, and Just-In-Time (JIT) materials management techniques. In addition they are implementing total quality manufacturing (TQM) programs to continuously improve their product and service quality and internal processes, and relying on advanced strategies including business process reengineering (BPR), the theory of constraints (TOC) and the balanced scorecard. These complex arrangements or practices often entail large-scale changes in the ways that firms conduct their businesses (Milgrom and Roberts 1990).

Concurrently with, and in response to these changes in the business environment, the rate of change in management accounting systems has accelerated. Few innovations have generated as much interest[3] as activity-based costing[4] (ABC) (Swenson 1995).

Although new business initiatives have found rapid and wide acceptance, there still is not a significant body of empirical evidence to validate their alleged benefits. Certainly, profit-maximizing firms would not implement them if they did not expect a financial benefit from their use. However, although Young and Selto's (1991) criticism that cost management researchers have not performed "empirical studies that investigate the impact of new manufacturing methods and cost management systems on measures of internal and external performance" is beginning to be addressed by researchers, to date there has been no scientific, empirical evidence that unequivocally demonstrates that any

[3] A review of two of the leading journals for practicing management accountants, Management Accounting and the Journal of Cost Management, revealed that ABC accounted for over 35% of the articles published over the period 1994-1996. Three of the six articles in the body of the 1997 edition of the Journal of Management Accounting Research were devoted exclusively to ABC.

[4] As described in chapter 4, this study defines ABC very broadly to include both activity-based costing and activity-based management (ABM).

of these initiatives improves financial performance. In addition, there has been no empirical investigation of theorized synergistic effects obtained from using these initiatives in combination (for example using ABC to enhance TQM decision-making). It is important that the impact of these initiatives be empirically tested against the ultimate measure of the success of the firm, financial performance. Only by scientifically, empirically determining the association between new business initiatives and financial performance can we be certain that they are viable, cost-effective solutions.

The focus of this dissertation is to advance the investigation of whether use of these initiatives, either singly or in combination, results in improved financial performance, generally operationalized by increase in industry-adjusted ROI. Previous research on these issues has been inconclusive, possibly because it suffered from lack of statistical power caused by use of relatively noisy dichotomous variables to measure initiative implementation, and/or insufficient sample size – conditions that will be remedied in this dissertation through collection of measures of initiative diffusion through large-scale mail surveys.

This investigation is organized into three areas of inquiry that telescope from the general to the specific in an attempt to definitively reach a conclusion as to the efficacy of these initiatives. Therefore, the dissertation is structured into three separate, self-contained studies, rather than a single manuscript.

RESEARCH QUESTIONS

The specific research questions addressed in this dissertation are:

1. What is the level of implementation of new initiatives?

2. Does the level of implementation vary by types and characteristics of companies?
3. Is there an association between use of various initiatives?
4. Is there an association between use of initiatives and improvement in financial performance?
5. Does use of multiple initiatives create a synergistic effect on financial performance?
6. Under what conditions is ABC associated with improvement in financial performance?
7. What is the association of previous researchers' measures of "successful" ABC systems with improvement in financial performance?

THE STUDIES

The first study, "The Association between Use of Business Innovations and Improvement in Financial Performance," is presented in Chapter 2. This first study contains regression analyses of the association between the use of the initiatives (measured with dichotomous variables) and change in financial performance (measured by a self-reported 5-point Likert scale that is validated by testing against actual reported change in performance for the subsample of firms with financial information available on Compustat). Interactions between the initiatives are included as additional explanatory terms to identify possible synergies between use of multiple initiatives. Data is obtained through a cross-sectional mail survey of 1,058 internal auditors, claimed to be knowledgeable and unbiased in the assessment of new initiatives (Tanju and Helmi 1991; Ray and Gupta 1992). Also provided is a descriptive analysis of the use and interrelationships of use of several of the aforementioned initiatives. This study enhances

previous research by contributing an objective source, internal auditors, and is the first attempt to control for implementation of multiple initiatives and include previously theorized synergistic effects in a model.

The second study, "The Association between Use of New Business Initiatives and Financial Performance in the Motor Carrier Industry" is presented in Chapter 3. This study makes use of the model developed in the first, general study to isolate the effects of new initiatives in a single industry, the motor carrier industry. It also includes a more refined, 7-point Likert measure of use of each initiative, time (years) since beginning of use of the initiative, and actual financial performance data obtained from financial statements submitted to the Interstate Commerce Commission. The sample consists of 332 principals of motor carrier industry firms. This is the first study of efficacy of these initiatives, singly or in combination, using actual financial statement data and other than binary variables, thereby strengthening the power of the tests.

An in depth study of a single initiative, ABC, is the focus of the third study, "The Association between ABC and Financial Performance". Its purpose is to develop and test a comprehensive structural model that incorporates factors that have been postulated by previous researchers to affect the efficacy of ABC, including complexity, information system sophistication, importance of costs, the competitive environment, and the existence of intra-company transactions and unused capacity. This study also contributes a composite, continuous measure of ABC diffusion (and hypothesized efficacy). As in the first study, data is obtained from a mail survey of internal auditors. The factors are multi-item measures validated with confirmatory factor analysis, discriminant analysis, and reliability testing. In a subsequent test, measures of "successful" ABC systems, as

defined by previous researchers, are included in the model to determine their association with improvement in financial performance. These models will provide a framework to study different initiatives with respect to their impact on improving financial performance.

Chapter Five summarizes the results and explores avenues for future research.

SUMMARY

Taken together, these three studies provide a significant extension of research into the efficacy of new business initiatives. The studies measure the association with improved financial performance across all industries, within a specific industry, and also provide a model for further advances in empirical testing of these initiatives.

Chapter 2

The Association between Use of New Business Initiatives and Improvement in Financial Performance

INTRODUCTION

The primary purpose of this study is to measure the improvement in financial performance associated with use of new business initiatives such as JIT, TQM, and ABC. The increased interest in and implementation of these initiatives have affected U.S. businesses dramatically (Gupta, et al. 1997). But, a critical issue that remains unproven is whether the use of these initiatives has had a positive overall effect on firm financial performance.

Profit-maximizing firms would not implement these initiatives if they did not expect a financial benefit from their use. However, there has been no empirical evidence that unequivocally demonstrates that any of these initiatives improves (or hinders) financial performance. In addition, there has been no empirical investigation of theorized synergistic effects obtained from using these initiatives in combination (for example using ABC to enhance TQM decision-making). Only by empirically determining the association between new business initiatives and financial performance can we be certain that they are viable business solutions.

This study makes use of a cross-sectional mail survey of 1,058 internal auditors, claimed (Tanju and Helmi 1991; Ray and Gupta 1992) to be knowledgeable and unbiased in the assessment of new initiatives. Multiple regression analysis is used to investigate the association between binary measures of the use of eight initiatives and a self-reported 5-point Likert measure of change in financial performance, a subsample of which is tested

against actual reported performance. In addition, theorized positive synergistic effects from use of multiple initiatives are investigated. Also provided is a descriptive analysis of the use and interrelationships of use of several of the aforementioned initiatives.

The study enhances previous research in five ways:

1) by contributing an unbiased, objective and knowledgeable source, internal auditors, to provide up-to-date measures of the extent of use of initiatives and the extent of concurrent use of multiple initiatives -- in contrast to prior research that uses respondents with a personal stake in initiatives, such as controllers, quality managers or project managers, e.g., Dixon (1996); Easton and Jarrell (1995); Kaynack (1996); Shields (1995); Swenson (1995),

2) by overcoming limitations of previous initiative research by specifically identifying non-users as control firms -- as opposed to testing without control firms e.g., Swenson (1995); Shields (1995), or using a binary measure of implementation derived from archival sources, with selection of non-users as controls by default based on lack of public information regarding implementation, e.g., Balachrishnan (1996); Husan and Nanada (1995);

3) by measuring improvement in financial performance over a relatively long (five year) period, with sensitivity testing over a shorter (three year) period,

4) by controlling for the impact of concurrent use of multiple initiatives, and,

5) by measuring previously theorized synergistic effects of this concurrent use.

Findings include that use of initiatives is common, with 78% of firms reporting that they are significant users of at least one initiative. Most firms use multiple initiatives concurrently and only 22% use a single initiative in isolation. Manufacturers, with mean

use of 2.06 initiatives, appear to be heavier users than non-manufacturers (1.32 initiatives).

For the sub-sample of manufacturers, TQM, JIT, CIM. VCA, and FMS are significantly associated with ROI improvement. In addition, the concurrent use of JIT*TQM, JIT*CIM, and BPR*TQM are identified as contributing a positive synergy.

Knowledge of the efficacy and synergy of these initiatives is of significant interest to three communities: 1) practitioners including accountants, managerial decision-makers, potential project leaders, professional associations, and consultants using, promoting, instructing in the use of, or contemplating the implementation of initiatives, 2) researchers contributing to the substantial theoretical and limited empirical literature regarding these initiatives, and 3) educators who communicate the reputed benefits and instruct in the use of the initiatives.

NEW BUSINESS INITIATIVES

Anyone reading a business periodical such as the *Wall Street Journal* or *Business Week* will quickly find a reference to a "revolutionary" business initiative, defined as an innovative business technique, strategy or technology, that is purported to increase corporate success. For example, according to CEO Jack Welch, General Electric received benefits of $170 million in 1996 that are expected to increase to $1.2 billion annually by 2000 from its Six Sigma TQM program (Henry, *USA Today,* February 27, 1998).

Beginning in the 1970s with initiatives such as Management by Objectives (MBO) and quality circles, there has been a constantly expanding list of these new business initiatives, generally known by three-letter acronyms that claim to increase business

success (e.g., TQM, JIT, ABC). All initiatives broadly advocate a change in the business paradigm through continuous improvement and increased personnel involvement, but each accomplishes continuous improvement differently (Gupta et al. 1997). For example, TQM emphasizes "doing the right things the first time"; JIT stresses lean manufacturing; ABC advocates activity-based performance measures; and the theory of constraints (TOC) concentrates on the constraints—the weakest links in the chain.

Several of the most established of these initiatives have been selected for investigation in this study, including the technology based computer integrated manufacturing (CIM) and flexible manufacturing systems (FMS). Also included are the advanced strategies total quality management (TQM), just-in-time (JIT), business process re-engineering (BPR) and value-chain analysis (VCA). Finally, initiatives of particularly interest to the accounting profession, activity-based costing (ABC) and the theory of constraints (TOC) are included.

LITERATURE REVIEW

New business initiatives have found rapid and wide acceptance and there are ample anecdotal reports of benefits (e.g., General Electric). However, there still is not a significant body of empirical evidence to validate their alleged benefits. Evidence of the benefits of these systems is largely restricted to theoretical models and anecdotal information obtained from case studies[1] and often related by practitioners. Typically, empirical research has either 1) measured success or satisfaction with the initiatives

[1] For examples, see Goyal and Deshmukh (1992) and Golhar and Stamm (1991) – JIT; Barnes (1991), Brimson (1991), Bruns and Kaplan (1987), and Harris (1990) – ABC; Dean (1996) and Romney (1995) – BPR; Sankar (1995) – TQM.

rather than using measures of financial performance (McGowan and Klammer 1997; Shields 1995, Swenson 1995), or 2) failed to establish that financial performance is indeed improved (Dixon 1996; Balakrishnan et al. 1996; Engelkemeyer 1991; Boyd 1996; Biggart 1997; Dusseau 1996; Granzol and Gershon 1997). However, some recent studies have had limited success (Husan and Nanda 1995; Kaynak 1996; Easton and Jarrell 1995). These studies, their limitations and weaknesses, and the remedies implemented in the current study are discussed in succeeding paragraphs. In addition, a summary of the key characteristics and findings of each study is included as Table 2-1. As a prelude the importance of assessing initiatives through measures of financial performance is discussed.

Importance of Financial (vs. Non-Financial) Performance Measures

Studying whether initiatives are viable requires evaluations of outcomes, namely performance measures (Grandzol and Gershon 1997). It is important to measure the success of new initiatives with measures of *financial* performance for two reasons: 1) most technologies and investments are justified on the basis of their impact on financial and accounting measures, not operational measures (Husan and Nanda 1995), and 2) financial performance measures are the only internally generated measures that *directly* reflect whether the company's strategy, implementation, and execution are generating wealth by contributing to firm value (Atkinson et al. (1995) as demonstrated by Edwards and Bell (1961) and Ohlson (1991, 1995).[2] For these reasons, even though impacts of initiatives are not easily quantified (Husan and Nanda 1995), financial performance

measures are the most important measures of the efficacy of these initiatives and serve as dependent variables in this study.

Empirical Literature

In the last several years, researchers have made the first attempts to measure whether use of the initiatives JIT and TQM is in fact associated with financial performance. To date, there have been no studies empirically measuring financial performance benefits obtained from using initiatives other than JIT or TQM. The existing studies of JIT and TQM have met with limited success. Balakrishnan et al. (1996) and Biggart (1997) found no significant overall return on investment (ROI) response to JIT adoption through univariate testing with control groups, although Balakrishnan et al. found that firms without significant customer influence did benefit from adoption. Boyd (1996) found no definitive response to a variety of tests of levels of multiple performance variables. Engelkeyer (1991), Dixon (1996), and Dusseau (1996) found no relationship between complex measures of TQM infusion and diffusion and financial performance. Grandzol and Gershon (1997) are unsuccessful in their attempt to link financial "quality", a construct consisting of measures of ROI, market share, and capital investment ratio, to latent constructs and endogenous dependent outcomes (although by fitting their structural model to their data, did find that financial quality is a function of continuous improvement -- a construct consisting of demonstrated non-financial improvements).

---

[2]Ohlson (1995) derives the value of the firm (P_t) as a function of its book value (y_t) plus the present value of expected future (to infinity) abnormal earnings (earnings (x_t) above cost of capital (r) times beginning book value): $P_t = y_t + \Sigma E_t [x_t - r\, y_{t-1}]_{t+\tau}$

However, Huson and Nanda (1995) did find that JIT adopters have enhanced earnings per share after controlling for average industry unit costs, margins, turnover and employees per sales dollar. Kaynak (1996) found that "financial and market" performance are enhanced for firms using a combination of TQM and JIT purchasing. Easton and Jarrell (1995) found evidence that a very broadly defined TQM is associated with the variance between actual financial performance and that forecasted by Value-line analysts. Unfortunately, none of these studies included control for concurrent use of other initiatives and therefore the findings cannot be attributed specifically to single initiatives. In addition, Kaynak's measure of performance is not truly a measure of financial performance, but a combination of level and change variables including both financial and "market" factors, e.g., market share, and he relied on self-reported responses of potentially biased quality managers. Easton and Jarrell defined TQM in a manner that included initiatives and management practices other than TQM, and measured deviation from Value-Line forecast, which may or may not have incorporated subjective valuation of the initiative, rather than demonstrated improvement in financial performance.

Possible reasons for the limited success of most studies include:

1. Reliance on public sources of information to identify users and non-users; non-users are typically defined as companies where there is no *public* discussion of adoption of the initiative (Balachrishnan 1996; Biggart 1997; Husan and Nanda 1995). Consequently, firms that adopt the initiative are probably incorrectly classified as non-adopters because of the lack of public release of implementation information, thereby biasing against finding a distinction between groups; in addition, public announcement of adoption is not a reliable measure of the primary

determinant of the efficacy of the innovation, the extent of diffusion throughout the organization,

2. Inadequate sample size because of the difficulty of identification of users that also release financial information (Dusseau 1996, sample size of 10; Balachrishnan 1996, 92 ; Engelkeyer 1991, 9; Biggart 1996, 85; Boyd 1996, 115).

Other limitations of previous studies include:

1. Reliance on responses furnished by potentially biased subjects to measure the variables of interest, primarily project managers and controllers (Dixon 1996; Shields 1995; Kaynak 1996; Easton and Jarrell 1995),
2. Failure to control for the effect of concurrent use of multiple initiatives (all previous studies), a potentially fatal limitation that is discussed in the next section.
3. Measurement of *level* of, rather than *change* in financial performance (Dixon 1996; Boyd 1996; Engelkeyer 1991; Kaynak 1996). Use of levels is a weakness in that performance improvement after implementation of an initiative is not accurately captured by an attained level of performance if the level was very low before implementation; conversely, high performers may have attained their level before implementation of the initiative. "Levels" are a limitation in that statistical significance of the initiative gives no information as to whether the use of the initiative occurred concurrently with a *change* in performance.

Concurrent Use of Multiple Initiatives

Organizations are not restricted to using only one initiative at a time and are simultaneously exploring multiple programs such as TQM, BPR, CIM, TOC, and ABC

(Kaplan 1993). These practices overlap and often complement each other. For example, many companies are implementing JIT not only to reduce inventory, but to improve quality (Frazier et al. 1988), and several empirical studies have found evidence that JIT does improve quality (Ansari and Modarress 1987 and 1988; Dion et al. 1990; Alles et al. 1997).

Although there appears to be an association between use of the various initiatives, previous research has not controlled for possible statistical effects of this correlation, and consequently have not isolated the effect of a single initiative. Another issue concerning concurrent use of multiple initiatives is that there may be synergies (positive and negative) leading to various optimal combinations of factor inputs, i.e., initiatives (Capon et al. 1990). This study tests the initiatives individually and together to determine if separate effects can be isolated and whether there are positive synergistic effects from use of more than one initiative.

Extensions of Research in the Current Study

This study addresses the limitations of prior research by 1) testing a relatively large sample size of 204 responses (to 1,058 surveys mailed), 2) identifying users and specifically *non-users* of individual initiatives through a mail survey 3) using unbiased, objective and knowledgeable internal auditors rather than potentially biased controllers or project managers, 4) identifying (through the survey) and controlling for the concurrent use of multiple initiatives in 5) measuring change in composite measures of financial performance.

Research Questions and Hypotheses

This study investigates the following research questions:

1. What is the level of use of new business initiatives?
2. Does the level of use vary by type of company?
3. Is there an association between use of various initiatives?
4. Is there an association between use of initiatives and improvement in financial performance?
5. Is use of multiple initiatives associated with synergistic improvement in financial performance?

Although not tested through statistical inference, investigation of the first two research questions, level of use of initiatives and variance of use between different types and size of companies, is included to emphasize the importance of this research. Significant use is indicative of interest and importance to practitioners. While research has prescribed the benefits of initiatives for all types of companies (Atkinson et al. 1995; Rotch 1990), extent of use has generally been documented with surveys of narrowly defined groups such as the cost management group of the Institute of Management Accountants, (Shields 1995, Krumwiede 1996), and the American Society for Quality Control (1994) in the U.S.; the Chartered Institute of Management Accountants (Innes and Mitchell 1995) in the U.K.; or groups of specific computer software vendors customer bases (Geishecker 1996). In addition, extent of use is dynamic and purportedly is increasing (Innes and Mitchell 1995), so any data generated by past large cross-sectional studies is no longer accurate. Current cross-sectional use information is therefore a valuable contribution of this study.

The third research question, regarding the extent of the concurrent use of multiple initiatives, has not been documented through cross-sectional studies. It is important to establish the level of concurrent use initiatives. Obviously, if concurrent use is not common, it is difficult, if not impossible, to measure synergistic benefits from concurrent use. In addition, low concurrent use would enhance the credibility of previous research that did not control for this condition.

The third research question regarding identification of association between use of initiatives is tested through Hypothesis 1 (alternate form):

H1: The likelihood of use of multiple initiatives exceeds the likelihood of use of one initiative.

The theories of diffusion of innovations (Kwon and Zmud 1987), transaction cost economics (Roberts and Silvester 1996), and information technology (Dixon 1996) suggest that organizations adopt an innovation such as ABC, TQM, or automation to garner benefits that directly or indirectly impact financial performance measures. In addition, the academic and practitioner literatures contain voluminous references to the potential benefits of each of these initiatives. However, no scientific, empirical evidence unequivocally demonstrates that any of these initiatives improves (or hinders) financial performance.

Hypotheses H2 and H3 specifically address research question four, the association between the individual initiatives and improved financial performance. H2 is a first step, the approach often used in previous research, to identify the improvement in financial performance associated with an *individual* initiative, without regard for the simultaneous use of other initiatives. Each initiative is tested individually, without control for

concurrent use of other initiatives. Significance would indicate that the initiative is associated with improved financial performance, but, as noted by Wempe (1997) and Biggart (1997), interpretation is limited, in that the variable may be a proxy for the effects of other concurrent initiatives or the synergistic effect of multiple initiatives.

H2: Without control for concurrent use of other initiatives, there is a positive association between use of a single business initiative and improvement in financial performance.

The testing of H2 is analogous to previous empirical research (e.g., Balachrishnan 1996, Biggart 1997; Husan and Nanda 1995; Easton and Jarrell 1995) that tested the effect of one initiative without consideration of possible complementary effects associated with simultaneous use of other initiatives. H3 addresses this possible limitation by introducing control for the concurrent significant use effects of other initiatives. This control isolates the effects of the individual initiatives and measures the partial correlation contributed by each initiative.

H3: After control for concurrent use of other initiatives, there is a positive association between use of an individual business initiative and improvement in financial performance.

H4 addresses research question five regarding the possible synergistic effect of multiple initiatives. It is quite possible that a combination of new manufacturing practices, technologies, TQM, and ABC leads to a synergy where the effects of the sum exceed the sum of the effects individually (conversely, it is possible that the effects of adding initiatives are reduced for each succeeding initiative). The literature contains

frequent references, of virtually all possible combinations of initiatives, to possible synergy. For example, Dean (1996) states that BPR can be used to bring about major internal and external quality increases. Brinker (1997) states that the theory of constraints (TOC) ties in well with TQM programs. Hooks et al. (1995) feel that quality analysis should be tied into CIM, and that these goals depend on satisfying customers, the objective of TQM. Finally, Rafii and Carr (1997) state that "too many performance improvement initiatives fail to meet their objectives," and attribute many of these failures to inadequate managerial accounting (non-ABC) systems. To-date, no previous empirical research on financial performance has studied this possible synergy and its effect on financial performance.

Previous testing (H2 and H3) has determined whether the addition of an initiative furnishes incremental effects on financial performance. Whether the effects are synergistic as theorized, or suffer from the principal of diminishing returns has yet to be explained. The preceding discussion leads to the following formal hypothesis:

H4: The financial performance of firms that use multiple initiatives has increased more than the increase associated with a single initiative.

MODEL DEVELOPMENT -- RESEARCH DESIGN

This section contains a detailed description of the research model, its constructs and the hypothesized relationships between constructs. The section begins with a description of each of the variables contained in the research model and concludes with a description of the methodology and statistical analysis techniques. The following sections contain the results of the statistical analysis, and the limitations and conclusions of the research.

Variables and Hypothesized Relationships

Measures of Financial Performance

Financial performance measures indicate whether the company's strategy, implementation, and execution are contributing to bottom-line improvement. Typical financial goals have to do with profitability (Kaplan and Norton 1996). Testing improvement in financial performance poses significant measurement problems. For example, consider an obvious measure of financial performance, return on investment (ROI). Determining an appropriate methodology to measure ROI improvement is no minor issue. As Roberts and Silvester (1996) observe, numerous complications arise, including:

1. Determining the appropriate time period of study (does the profit improvement appear immediately, or by the end of some other period—for example one year, three years, or five years),
2. Modeling a company's "expected" profitability against which to compare realized profitability after an implementation,
3. Controlling for concurrent changes in the organization,
4. Controlling for the length and breadth of implementation and integration of initiatives throughout the firm.

In selecting appropriate time periods to test, one must consider the offsetting effects of two factors: 1) previous research has posited (Shields 1995; Player and Keys 1995; Easton and Jarrell 1995) that profit improvements are expected to grow over time so a relatively long window is probably necessary to yield results (because the organization

may still be in a learning process and also may incur "start-up" costs that temporarily reduce profitability). The literature has indicated that at least five years are needed to experience the positive effects of JIT adoption (Boyd 1996); and in his field studies of TQM users, Dusseau (1996) found non-statistical indications that performance began to improve after a minimum of eight years.

However, 2) a longer window increases the effect of non-initiative factors on financial performance. Although research suggests that a longer period is appropriate to obtain maximum benefits, most previous empirical studies have opted to use a relatively short window of one to four years for testing, presumably to mitigate the effect of intervening events; e.g., Kaynack used a one-year window, Balachrishnan (1996) and Biggart (1997) used three-year windows, and Husan and Nanda (1995) tested over four years. This study measures change in performance over five years, and provides sensitivity testing over the shorter three year period commonly tested in other studies.

In general, comparison of "expected profitability" requires either specification of control variables which describe the industry in which the firm operates, or alternatively the use of "industry mean-adjusted" measures. The underlying assumption is that firms in the same line of business share the same production technology, in terms of the production function, but cross-sectional variation between firms is created due to the use of differing management and control systems (Husan and Nanda 1995). In the current study, comparison of expected profitability is addressed through 1) obtaining industry mean-adjusted responses whereby respondents are asked the extent to which performance has improved "relative to other business units in your industry," as in Huson and Nanda (1995), and Balakrishnan (1996), and, 2) as in Easton

and Jarrell (1995), separate testing of manufacturing and non-manufacturing entities. These restrictions allow comparison of the profitability of initiative users (against that "expected" without use, proxied by the performance of equivalent non-users. These restrictions allow comparison of the profitability of initiative users (78% of respondents) against that expected without use, proxied by the performance of equivalent non-users (22%). In addition, control for use of other initiatives separates the effects of individual initiatives and allows comparison of users of an individual initiative (4 to 47% of firms) to non-users of that initiative.

Concurrent changes in the organization are partially addressed through identifying and controlling for use of other initiatives. Partial control for length and breadth of implementation is accomplished by specifically identifying both those firms that actively use initiatives and those that do not. Further extension of length and breadth provides an opportunity for future research.

Return on investment (ROI). The ratio selected for use in this study is change in return on investment (ROI). ROI is the most common investment center performance measure (Hilton 1994), and is generally accepted as a financial performance variable in empirical research. Six studies that recently attempted to measure improvement in financial performance resulting from the implementation of JIT (Balakrishnan et al. 1996; Biggart 1997; Boyd 1996) and TQM (Dixon 1996; Engelkeyer 1991; Easton and Jarrell 1995) have operationalized financial performance through the use of ROI. Furthermore, previous research shows a high correlation between ROI and other profitability measures

(Prescott et al. 1986) and suggests that ROI can be more readily available in business units than other measures (Jacobson 1987).

Industry mean-adjusted ROI is measured by the self-reported 5-point Likert response provided by company internal auditors to the survey item "Over the last five years, the ROI of your business unit has improved relative to other business units in your industry".

Self-reported vs. archival measures of performance. Much of the research regarding financial performance associated with initiatives has relied on self-reported measures of performance. However, as noted by Young (1996), a self-report of performance may have no clear connection to actual performance. Young (1996) reviewed ten years of management accounting research and could find no published studies that collected both self-reported and objective measures of performance, or even discussed the issue critically. Although internal auditors are unbiased and objective, some may consider the dependent measures used in this study to be more subjective than other possible sources of information, i.e., databases containing data from audited financial statements.[3]

To obtain information as to the efficacy of self-reported measures, a comparison of actual financial statement information as contained in Compustat and the self-reported measures collected in this study is performed. Fifty-four internal auditors reported company-wide information for a company that is included in the Compustat database. For

[3]However, using archival data sources is not problem-free. For example, there are significant discrepancies in financial data between the COMPUSTAT and Value Line databases (Kern and Morris 1994) and SIC

those companies with complete information (ranging from 47 to 52 for an individual test), actual ROI, industry-adjusted by subtracting the median performance of the subject's primary 3-digit SIC code, is compared with the applicable 5-point Likert scale survey instrument response. As shown in Table 2-2, the survey responses exhibit a high degree of reliability. Spearman correlation coefficients range from .71 for ROI change over five years to .78 for ROI change over three years.[4] When the continuous measures obtained from Compustat are converted to ranks on the same basis as the survey responses, correlations increase to .76 for 5-year ROI change and .86 for 3-year ROI change. The majority (66.3%) of responses are identical, and 99% of responses are within one value (e.g., report "4" on the survey and compute "5" from Compustat data).[5]

Variables of interest (ABC, JIT, CIM, BPR, VCA, FMS, TOC, and TQM).

The variables of interest in this study are binary responses to the item introduced as "Check if the following is used to a significant extent in your business unit:" Possible responses are (full description omitted) ABC, JIT, CIM, BPR, VCA, FMS, TOC, and TQM.

Control Variables (SIZE and TYPE)

The implications of two control variables, business unit SIZE and TYPE of company are considered. These variables have been demonstrated as important in

---

codes (limiting ability to compute accurate industry mean-adjusted variables) between CRSP and COMPUSTAT (Ong and Jensen 1994).

[4] Should I include this in research questions? Also, could include sales growth data.

[5] Variances can occur for reasons other than lack of knowledge by the internal auditor. For example, choosing "4" (agree) vs. "5" (strongly agree) requires a value judgement that can vary between subjects.

previous work e.g., size – Fama and French (1992) and Bartov (1993); and type of firm – Watts and Zimmerman 1986, Zmijewski and Hagerman (1981), and Healy (1985) explaining cross-sectional variation in financial performance.

Company size (SIZE). The projected sign of company size is problematic. Anderson (1995a) concluded that implementation of initiatives is most likely to be disruptive if it occurs over a protracted period and disrupts familiar routines. Large, vertically integrated firms are more likely to have lengthy implementation processes that cause significant organizational disruption. However, Selto and Jasinski (1996) propose that, other than in some large companies that are well staffed, well trained, and well funded, there is not much evidence that ABC is understood well enough to be designed or implemented successfully as a stand-alone system, let alone one that is integrated with strategy.

Other research has failed to confirm that firm size moderates the relationship between JIT and nonfinancial performance measures (Inman and Mehra 1990; Manoochehri 1988; Gilbert 1990; Kaynak 1996). However, to forestall a missing variables issue, as in Kaynak (1996), sales is used to control for size. Because the research in the relationship between organization size and innovations suggests a curvilinear relationship (as size increases, innovation increases, but at a decreasing rate (Ettlie 1983; Kimberly and Evanisko 1981; Moch and Morse (1977), the business unit size variable is measured as the natural logarithm of the mid-point of the sales category identified in question I8 of the survey reproduced as Exhibit 1.

Also, subjects could be reporting their belief in "true" unobservable financial performance rather than

Type of company (TYPE). Environmental variables, measured at the industry level, have a significant impact on firm performance (Capon et al. 1990). Georgantzas and Shapiro (1993) and Schroeder (1990) analytically demonstrate that industry type moderates the relationship between innovation and performance. In this study, macro-economic differences between industries are controlled through the use of industry-adjusted dependent variables. However, previous researchers (e.g., Rotch 1990 and Cooper 1988, 1989) argue that the efficacy of initiatives may fundamentally differ between manufacturing and service companies. Because of a lack of stability of coefficients between manufacturers and non-manufacturers, rather than including control variables, separate multiple regressions are run for each group.[6]

Subjects

The firms studied are "for profit" firms that employ internal auditors who are members of the Institute of Internal Auditors (IIA). It is contended that these firms have well-developed systems that measure performance accurately and are sophisticated enough to properly implement and use new business initiatives.

One of the limitations of research regarding efficacy of initiatives is that often e.g., Dixon (1996); Shields (1995); Grandzol and Gershon (1997) implications have been weakened because findings have been based on the responses or information provided by potentially biased subjects, those responsible for design, implementation, and operation

---

reported financial performance.

of the innovation.[7] For example, McGowan and Klammer (1997) and Foster and Swenson (1997) found that perceptions related to ABC vary depending on the role of the individuals involved -- specifically preparers reported more favorable attitudes towards the initiative than users, with project leaders or champions reporting the most favorable. Because of this limitation, Shields (1995) called for further research to verify and extend results obtained in previous studies.

The current study makes use of internal auditors as subjects. The *Statements of Responsibilities in Internal Auditing* (1990), and Section 100 of the *Standards of Practice for Internal Auditors* (IIA 1995) require that internal auditors be independent of the activities they audit, presumably overcoming a serious limitation of previous research, potential lack of subjects' objectivity. "Independence permits internal auditors to render impartial and unbiased judgments" (Standards, Section 100.01). In addition to their independence and objectivity, internal auditors are appropriate subjects because they are knowledgeable, possess varied talents and expertise, and have access to relevant information (Tatikonda and Tatikonda 1993; Stoner and Werner 1995).

On the practical side, another consideration is that subjects need to have an interest in the project, and a willingness to complete the survey instrument accurately. According to the literature, internal auditors have an interest in initiatives that can improve firm performance (Sawyer 1993; Tanju and Helmi 1991).

---

[6] Even though the hypothesis of coefficient stability is not rejected by a Chow test (F=.644), the dramatic difference in initiative coefficients and t-statistics between manufacturers and non-manufacturers requires separation to avoid misinterpretation of results.

[7] As with other studies, because this research relies on self-reported data, it is potentially subject to reporting biases and measurement error called common-method bias (Johnson et al. 1995). However, Miller and Roth (1994) suggest that care in the selection of respondents can contribute to overcoming common method bias. The selection of unbiased, objective and knowledgeable internal auditors eliminates most, if not all potential effects from common methods bias that may be present in other research.

In summary, this study extends prior research by making use, for the first time, of a unique and ideal pool of subjects, contributing to construct validity and enhancing the external validity[8] of previous findings. Internal auditors are ideal subjects for the study of business initiatives because they are unbiased, knowledgeable, and interested respondents.

Population and Sampling Procedures

The primary interest of this study is to measure the association of ABC with improvement in financial performance, measured as improvement in profitability. The population of subject firms is limited because many firms do not employ internal auditors.[9] In addition, internal auditors employed in the banking industry often have highly specialized responsibilities, limiting their exposure to new business initiatives, and are therefore omitted from the sample. Another consideration is that because non-profit organizations do not measure improved financial performance as improvement in profitability, internal auditors employed by these organizations are not appropriate subjects for this study. Therefore, the sample is drawn from the population of those practicing members of ten geographically diverse U.S. chapters of the Institute of Internal Auditors (IIA)[10] where information is available to the researcher, who are not employed

[8] Construct validity, the ability of the studies to measure what they purport to measure, is threatened by mono-operation bias. The solution to this problem is to vary the subjects of the treatment (Cook and Campbell 1979). To increase external validity, a researcher can replicate in various settings and at different times (Cook and Campbell 1979).

[9] Although this restriction places some limitation on the population, probably eliminating the smallest companies from the study, the median size of the business units responding is $501 million to $1 billion, indicating that small to medium size companies are well represented, mitigating any significant threat to external validity.

[10] The IIA serves as the internal auditing profession's authority on significant issues affecting internal auditors, and is the only organization dedicated solely to the advancement of the internal auditor and the profession on a world-wide basis. The IIA is the world's leader in research and educational issues for

in the banking industry, or by governmental or nonprofit organizations. Sample size is further limited to five randomly drawn subjects per organization.[11] A mail survey with a second mailing to non-respondents is used to collect information. As shown in Table 2-3, IIA members of the Chicago (59 responses) and Houston (52) chapters represent 54 percent of the total of 204 responses.

The questionnaire was distributed to 1,058 internal auditing professionals. This sample is reduced by 68 that were returned unopened because of incorrect address or change of employment with no forwarding address. In addition, as presented in Table 2-4, 28 uncompleted or partially completed surveys were returned because the subjects are not knowledgeable about their company's systems, company policies against response to surveys, or other reasons, leaving an adjusted sample size of 962. 204 usable responses were received, 137 from the first and 67 from the second mailings yielding a response rate of 21.2 percent. 160 responses (78.4%) indicate some use of initiatives. The remaining 46 respondents serve as a non-using control group.

Non-response bias is tested by comparing the median responses of the first mailing to those of the second mailing for statistical difference in responses. This test is based on Oppenheim (1966), who found late survey respondents are similar to non-respondents. Wilcoxon 2-sample signed rank tests (Hollander and Wolfe 1973) and Pearson chi-square tests of proportions (binary variables, Feinberg 1983) on the raw data and on the INIT and USE additive constructs reveal significant differences ($p<.05$) on three of the seventeen variables tested, somewhat more than the one that would be expected by

---

internal auditors and is the standards-setting body for the profession. It has approximately 53,000 members in 196 local chapters, national institutes and audit clubs in more than 100 countries (IIA 1996, 1997).

chance. Second mailing respondents tend to report at a somewhat higher level of aggregation (e.g., company vs. division; median 4.82 vs. 4.29 – $p<.0385$), have less tendency to be manufacturers (.42 vs. .57—$p<.044$), and to be less likely to use CIM (.10 vs. .22 – $p<.047$). It is not suprising that the test reveals some differences. For example, a possible explanation for slower responses by internal auditors with country or company-wide responsibilities is that they tend to travel more often, and are thus likely to have delayed responses. Early vs. late responses are tested further by including an indicator variable for late response in the regressions as in Johnson et al. (1995). Lack of significance of the indicator variable in all tests suggests that any bias does not affect overall results.

Survey Instrument

Data are extracted from a 96 item instrument that is used to collect data intended for use in both this study and also for an in-depth study of ABC. As in Kaynak (1996), Shields (1995); Swenson (1995), and Grandzol and Gershon (1997), the instrument is constructed (both dependent and independent variable information are collected at the same level) so that analysis could be conducted at the appropriate level of knowledge (plant, division, region, subsidiary, country, or entire company) of the individual respondents, thereby reducing measurement error and measurement problems associated with use of aggregated data when there are differing levels of initiative use in different segments of firms.

[11] In six instances, there are multiple responses from the same business unit. Differences are minor, and responses are combined into a single observation by averaging scores.

Large survey techniques are used to collect initiative use data for two reasons. First is the volume of available data. Collection of a sufficiently large data set enhances the power of any significant findings. A large data set also enhances the external validity of the findings in an area that is receiving a considerable amount of attention from both researchers and practitioners. Secondly, information regarding the use of initiatives from archival sources such as the *Wall Street Journal Index* is not complete and, in particular, only includes those companies that have publicly released information regarding use of initiatives (Husan and Nanda 1995). Therefore, use of archival information results in a mix of unidentified users and non-users as controls, thereby weakening the power of statistical testing.

In addition to the questions relating to use of initiatives, financial performance and control variables described previously, additional information is gathered in the questionnaire to address research question two relating to the characteristics of the users of initiatives, and in future analysis. Most of the questions are close-ended and ask the respondent to rate or assess on a five-point Likert scale, anchored by 1 = "Strongly Disagree" and 5 = or "Strongly Agree".

As recommended by Young (1996), procedures prescribed by Dillman (1978) are followed to maximize response rates. Specific steps taken to strengthen this study include 1) using a second mailing, 2) promising confidentiality of responses, 3) including deadline dates for reply, 4) including a personalized cover letter, 5) including a postage-paid, self-addressed envelope for reply, and 6) promising to send a summary of results on request. Content validity is addressed by asking a group of faculty experienced in management innovation and survey research to review the instrument for clarity and

meaning. Modifications were made as appropriate. The survey instrument is included as Exhibit I.

Models Tested

Hypothesis 1 posits that there is a positive association between use of initiatives and is tested with a binomial test of the number of business units using multiple initiatives against the number using one initiative. This test is supplemented with correlation analysis, with separate analyses for manufacturing and non-manufacturing firms. Statistically significant positive correlations would indicate that firms tend to concurrently use the significant pairs in tandem.

The remaining hypotheses are tested with cross-sectional multiple regression analysis, partitioning manufacturing and non-manufacturing firms. Hypotheses H2 posits that the improvement in financial performance is positively associated with the use of the individual business initiatives, without controlling for concurrent use of multiple initiatives.

This hypothesis is tested with a simple model whereby each performance measure is regressed against one initiative at a time, analogous to Balachrishnan (1996) and Husan and Nanda (1995), and Kaynak (1996). Firm SIZE is included as a control variable. There are eight separate regressions (one for each initiative) for manufacturers and six for non-manufacturers (FMS and CIM are exclusively manufacturing initiatives).

$$ROI = \alpha + \beta_1 INIT + \beta_2 SIZE \qquad (1)$$

where

ROI is the vector of two industry mean-adjusted dependent measures of change in financial performance, measured for period t minus t-5,

and where	Expected sign
INIT = is the vector of eight binary measures of initiative use, regressed one at a time	+
SIZE = the natural log of the mid-point of the sales of the organizational unit	?

Using methodology employed by Cheng (1998), significance of the median t-statistic of the seven initiative variables would provide confirmation of H2. Conditional confirmation of H2 is claimed for those initiatives that are significant in at least one of the models at the $\alpha = 0.05$ level. It is expected that the testing of H2 will yield positive results for at least some of the initiatives. Positive results could indicate that the use of the initiative results in improvement in performance. Alternatively, the tested initiative is a proxy for the use of another, highly correlated initiative, and this highly correlated initiative affects financial performance.

H3 addresses the limitation described above. It states that there is an association between use of each initiative and improved financial performance and requires testing of all initiatives simultaneously in two multiple regressions (one each for manufacturers and non-manufacturers):

$$ROI = \alpha + \beta_1 JIT + B_2 TQM + \beta_3 ABC + B_4 BPR + \beta_5 CIM + B_6 TOC + B_7 FMS + \beta_8 VCA + \beta_9 SIZE \quad (2)$$

where	Expected sign
JIT = a binary variable coded "1" if the organizational unit uses JIT, "0" otherwise,	+
TQM = a binary variable coded "1" if the organizational unit uses TQM, "0" otherwise,	+

ABC = a binary variable coded "1" if the organizational unit uses ABC, "0" otherwise, +

BPR = a binary variable coded "1" if the organizational unit uses BPR, "0" otherwise, +

CIM = a binary variable coded "1" if the organizational unit uses CIM, "0" otherwise, +

TOC = a binary variable coded "1" if the organizational unit uses TOC, "0" otherwise, +

FMS = a binary variable coded "1" if the organizational unit uses FMS, "0" otherwise, +

VCA = a binary variable coded "1" if the organizational unit uses FMS, "0" otherwise, +

If the median t-statistic of the initiatives is significant at the $\alpha = 0.05$ level, H3 is confirmed. Conditional confirmation of the hypothesis is claimed for those initiatives that are significant at the $\alpha = 0.05$ level. This model eliminates a significant limitation of model (1) and prior research. A significant t-statistic would indicate that the tested initiative is associated with improvement in financial performance *over and above* the effect of other initiatives.

Hypothesis H4 posits that the improvement in financial performance is positively associated with the synergy created by the use of multiple initiatives. To ascertain which initiatives create this synergy, interactions of those initiatives with the highest concurrent use (see Table 2-5) are added to model 2.

$$PERF = \alpha + \beta_1 JIT + B_2 TQM + \beta_3 ABC + B_4 BPR + \beta_5 CIM + B_6 TOC + B_7 FMS + \beta_8 VCA + \beta_9 JIT*TQM + B_{10} JIT*ABC + \beta_{11} JIT*BPR + B_{12} JIT*CIM + B_{13} TQM*ABC + B_{14} TQM*BPR + \beta_{15} TQM*CIM + \beta_{16} SIZE \quad (3)$$

A significant. positively signed interaction term indicates that there is a synergy created from concurrent use of the two tested initiatives, i.e., there is an association with improvement in financial performance over and above the sum of the effects of the initiatives used in isolation.

STATISTICAL ANALYSIS

Descriptive Statistics

The first two research issues, the level of use of new business initiatives and the characteristics of users, are addressed through descriptive statistics. First general background information is presented (Tables 2-6 and 2-7). 50% of the respondents reported for their entire company, with the remainder spread among plant, division, group, subsidiary, and country business units. 46.6% reported that their business unit revenues exceeded $1 billion, while, as is not suprising for firms employing internal auditors, only 17 reported for business units with revenues under $50 million. 52 percent of the firms are in the manufacturing industries.

As reported in Table 2-8, all but 45 (22.1%) of the respondents indicated that their business unit is significantly using at least one business initiative. The median firm is using two practices (range from zero to six) with JIT and TQM the most often referenced at 46 percent. Manufacturers have more mean use (2.56 vs. 1.32) than non-manufacturers and companies over $1 billion in revenues have higher use than smaller companies (2.2 vs. 1.5). Discounting the purely manufacturing initiatives CIM and FMS, the difference in use between manufacturers and non-manufacturers reduces to 2.06 initiatives to 1.32 initiatives. There appear to be a balance of numbers of users and non-users (control

firms), both overall and of individual initiatives to provide the contrast needed for statistical testing power.

Regression Diagnostics

Multiple regression analysis is used to test hypotheses 2 through 4. Although many of the correlations between use of initiatives are statistically significant, regression diagnostics reveal no serious problems with multi-collinearity. The maximum condition index is 37 for model (2) and 28 for model (3). 37 is slightly higher than the ideal 30 recommended by Belsley et al. (1980), but the maximum variance inflation factors are only 1.51 for model (2) and 1.57 for model (3), well below the threshold of concern of 5. Unsurprisingly, those condition indices model (4) are somewhat higher because of the inclusion of interaction terms.

White's (1980) chi-square test is used to test the null of correct model specification and homoskedasticity. In cases where the null is rejected, t-statistics are based on White's (1980) heteroscedasticity-consistent standard errors. Analysis of the Durbin-Watson statistics indicates no misspecification of variables. As expected, with of the use of 5-point dependent measures no influential data points are identified through analysis of the R-student residuals.

Hypothesis Testing

Hypothesis 1 posits that there is a positive association between use of initiatives and is tested with binomial tests of the number of firms in the overall sample, manufacturing sample, and non-manufacturing sample using multiple initiatives (144, 73, 41) against the

number using one initiative (45, 19, 26). The test yields z test statistics of 6.186[12], 5.526, and 1.710 ($p<.0001$, .0001, and .0436), prompting strong confirmation of H1.

The correlation matrix portraying the univariate relationships between new business initiatives is presented as Table 2-9. For the full sample, thirty-nine percent of the relationships are significant at the $\alpha=0.05$ level, and all significant relationships are positive except that of Business Process Reengineering (BPR) and the Theory of Constraints (TOC). JIT exhibits the strongest relationship with other initiatives, with significant correlations between it and all other relationships except TOC. The relationships are qualitatively similar for the partition including manufacturing firms only, but much weaker for non-manufacturers with only five of 28 (17.9%) relationships significantly correlated. These correlations, along with the binomial test results provide support for the supposition that use of an initiative may serve as a proxy for use of others.

Hypothesis H2 posits that financial performance is positively associated with the use of the individual business initiatives, without controlling for concurrent use of multiple initiatives. The results of testing model (1) are shown in Table 2-10. The mean and median t-statistic values of the eight initiatives tested are 2.447 and 2.666, respectively, for manufacturers ($p< 0.007$ and < 0.004), providing confirmation of H2. Seven of the eight initiatives (TOC is the exception) tested are significantly positively associated with improvement in ROI at the $\alpha = 0.05$ level. This result is consistent with expectations but can be explained as either resulting from efficacy of the tested initiative or the initiative serving as a proxy for the use of other initiatives or for some other missing variable.

[12] For example, $Z_{+,Right} = (S_+ - 0.5 - .5n)/.5\sqrt{n} = (114 - .5 - 74.5)/(.5*\sqrt{159}) = 6.186$ where S_+ is number of firms

The mean and median t-statistics for non-manufacturers against the initiatives are 0.101 and 0.513 ($p<.460$ and $<.304$). Four of the six non-manufacturing initiatives have positive signs, but none are significant at conventional levels, providing no support for H2 for non-manufacturers. It appears that there is a difference in efficacy of new business initiatives between manufacturers and non-manufacturers, and the evidence supporting the positive association between use of initiatives and improvement in financial performance is limited to manufacturing firms.

H3 states that there is an association between use of each initiative and financial performance and is tested through model (2) which incorporates control for use of other initiatives into model (1). The results of these regression are presented as Table 2-11. For manufacturers, the mean and median t-statistics of the eight initiatives are 1.227 and 1.753 ($p<.110$ and .040), providing confirmation of H3.ABC, TQM, CIM, and VCA are significant at the $\alpha = 0.05$ level and FMS has a p-value of .084. Although JIT and BPR, significant in Model (1), have positive signs, they are no longer significant at conventional levels (p-values $<.154$ and $<.158$). Their association with improvement in performance appears to be due to the concurrent use of other initiatives, although lack of power due to use of binary variables of interest cannot be disqualified.

For non-manufacturers, none of the initiatives are significant predictors at $\alpha = .10$. These weaker results are consistent with the findings in testing H2. In summary, the most important finding is that, for manufacturers, five of the eight initiatives, ABC, TQM, CIM, VCA and FMS have a positive association with improvement in financial performance separate from the effect of other initiatives.

---

using more than 1 initiative and n = 204 total firms – 45 using no initiatives = 159 firms.

H4 posits that financial performance is positively associated with the synergy created by the use of multiple initiatives. Prior to formal hypothesis testing, two exploratory analyses are performed whereby 5-year change in ROI is regressed against summary measures of initiative use and the control variable SIZE. As recommended by Babbie (1990), in the absence of compelling reasons for differential weighting, the practices are weighted equally. In the first analysis, ROI is regressed against a variable USE defined as the sum of the binary measures of significant initiative use:

$$ROI = \alpha + \beta 1 \Sigma USE + \beta_2 SIZE \qquad (4a)$$

where	Expected sign
ΣUSE = is the sum of the eight binary measures of initiative use,	+

In the second analysis, binary variables are created that indicate whether an observation uses one, or more than one initiative:

$$ROI = \alpha + \beta_1 USE(1) + \beta_2 USE(>1) + \beta_3 + \beta_3 SIZE \qquad (4b)$$

where	Expected sign
USE( ) = are binary variables coded one if the subject uses the number of initiatives denoted in parentheses	+

The results of this analysis are reported in Table 2-12. In model 4a, the sum of use variable is significant for manufacturers ($p<.0001$) but not for non-manufacturers ($p<.182$). In general, for manufacturers, increasing use of initiatives is associated with improvement in financial performance. In model 4b, there is no evidence that firms

obtain benefit from use of a single initiative, but there is strong evidence ($p<.0001$) that manufacturing firms obtain benefit from concurrent use of multiple initiatives.

To identify which initiatives are associated with positive synergy (H4), interactions of the eight initiatives with the highest concurrent use (Table 2-5) are added to model 2. The results are reported in Table 2-13. For manufacturers, the model is somewhat improved over model (2) with an adjusted R^2 of .301 versus .246. The mean and median t-statistics of the seven initiatives are reduced to 0.190 and 0.214 from the 1.227 and 1.753 obtained for model (2). Only FMS retains its significance level, improving to $p<.002$, and indicating that the contribution of ABC, CIM, TQM, and VCA, identified in model (2), arises from concurrent use with other initiatives. Of the eight interaction terms, JIT*CIM is significant at $\alpha = 0.05$ ($p<.002$), and JIT*TQM, ABC*JIT, and BPR*TQM at $\alpha = 0.10$. It appears there is a positive synergy created from concurrent use of these pairs of initiatives. Lack of significance of other pairs does not show that concurrent use is harmful, rather it can be interpreted that concurrent use is either harmful or there are diminishing returns from concurrent use. Consistent with the results of previous analysis, fewer initiatives and interactions are significant for non-manufacturers. TQM has a marginal direct effect ($p<.099$) and the JIT*BPR and ABC*JIT interactions are significant at the 0.05 level. ABC*JIT is therefore significant for both manufacturers and non-manufacturers.

Sensitivity Tests

As additional checks on the specification of the models, 1) equations (1) through (4) are re-estimated using an alternative measure for change in ROI (three-year rather than

five-year change), 2) interaction terms are included for all combinations of the set of individually significant initiatives rather than frequency of use, 3) pooled, rather than separate regressions of models (2) & (4) are run, combining manufacturers and non-manufacturers, and 4) sales is substituted for log (sales) as a control variable in models (1) – (4). All models are generally robust to these alternative specifications.

3-year model. The power of the 3-year ROI change model is very similar to that of the 5-year model, with differences in r^2 and mean t-statistics generally under ten percent. A possible explanation is that the model improvement associated with introduction of less noise from irrelevant factors offsets the shorter time period for initiatives to affect returns. In model (2), TQM is no longer significant for manufacturers at conventional levels, deteriorating from a p-value of <.040 to <.177. VCA's p-value drops from <.050 to <.078, but JIT becomes marginally significant at p<.056. In model (4), for manufacturers the direct effect of FMS becomes significant only at p<.053) and the JIT*TQM and BPR*TQM interaction's significance reduces below conventional levels.

Alternative interactions. All possible interactions (including three and four way) of the initiatives ABC, VCA, TQM and CIM that are significant at the $\alpha = 0.05$ level in model (2) are substituted into model (4). None of these interactions are tested in the original model (4). As reported for the original model, the main effect of FMS is significant. In addition, the main effect of CIM becomes significant (p<.0060) and that of JIT becomes marginally significant (p<.0751). None of the interactions are significant.

Pooled regressions. The results of the pooled regressions are qualitatively similar to those of the manufacturing sample, but as expected, t-statistics are somewhat weakened by the inclusion of manufacturers. When size is measured as sales, rather than log of sales, significance of individual variables is unchanged.

SUMMARY & CONCLUSIONS

This study investigates the use of new business initiatives and the association of those initiatives with improvement in financial performance. Information regarding initiative use is collected for a sample of 204 firms through a survey of internal auditors. Use of initiatives is common, with 78% of firms reporting that they are significant users of at least one initiative. Most firms use multiple initiatives concurrently and only 22% use a single initiative in isolation. Manufacturers appear to be heavier users than non-manufacturers, with mean use of 2.06 initiatives versus 1.32 for non-manufacturers.

Self-reported industry-adjusted 5-year change in ROI is regressed against initiative use. For manufacturers (non-manufacturers), seven (none) of the eight (six) initiatives tested are significantly positively associated with improvement in ROI in an approach analogous to that used in prior research. An important finding is that after control for use of other initiatives, *TQM, ABC*[13]*, CIM. VCA, and FMS remain as significantly associated with ROI improvement for manufacturers. The concurrent use of JIT*TQM, JIT*CIM, BPR*TQM, and JIT*ABC are identified as contributing a positive synergy.*

[13] In general, there is an association between ABC and improvement in financial performance. However, as shown in Chapter 4, the association is not maintained under all firm and industry-specific environmental conditions.

LIMITATIONS

A limitation of survey research is the lack of variable manipulation. Because of this limitation, cause cannot be inferred from this study. A positive relationship between use of business initiatives and improved financial performance does not necessarily indicate a causal relationship. There is a lack of genuinely dynamic analysis that tracks operationizations as they evolve over time. Although cause cannot be inferred from this study, the relationships found in this research help to motivate further research in which more manipulative research methods may be used.

CONTRIBUTIONS

This research adds to the limited body of empirical business initiative research and contribute to the development of the theory of new business initiatives in five ways. The first and most important contribution is to provide empirical evidence on the assertions made by advocates concerning the benefits of the initiatives. Second, this study eliminates a significant limitation of previous research, i.e., the lack of control for simultaneous use of multiple initiatives. Third, synergistic benefits obtained from concurrent use of multiple initiatives are identified. Fourth, the current study extends the use of inductive empirical methodology into research on technological change. Information systems and production management research often refer to the problem of

measuring the effect of change on firm value (Biggart 1997) This study offers a partial solution to the problem. Fifth, the study enhances the credibility of previous research by using unbiased and objective internal auditors as respondents.

Table 2-1
Empirical Research on Financial Performance and New Business Initiatives

Study	Journal/ Dissertation	Initiative	Primary Statistical Tools (3)	Sample Size	Dependent Variables: Measure (3	Period	Levels/ Changes	Scale?	Type	Industry-Adjusted?	Archival/ Self-reported
Dixon 1996	Dissertation Florida State	TQM	Princomp Regression	635	ROI (2)	NA	Levels	No	Continuou	No	Archival
Dusseau 1996	Dissertation Missouri-Rolla	TQM	Regression (1)	6	FS	NA	Levels	Index	Continuou	Control (7)	Archival
		TQM	Plot	1	FS	NA	Levels	Index	Continuou	No	Archival
		TQM	Regression (1)	10	FS	12 Yr	Levels	Index	Continuou	Control (7)	Archival
Easton and Jarrell 1995	Working Paper Chicago	TQM	Regression	108 Pairs	ROA	1,2, 3-5avg	Changes	No	Continuou	Control (7)	Archival
Engelkeyer 1991	Dissertation Clemson	TQM	Princomp	9	ROI	Na	Levels	No	Continuou	No	Archival
Grandzol and Gershon 1997	American Society for Quality	TQM	LISREL	275	Finance Quality	NA	Changes	Scale	Continuou	No	Self
Balachrishnan et al. 1996	Accounting Revie	JIT	Paired T	46 Pairs	ROI	3 years	Changes	No	Continuou	Control (7)	Archival
Biggart 1997	Dissertation Florida State	JIT	T, Sign	85	ROI	3 Years	Changes	No	Continuou	Yes	Archival
Boyd 1996	Dissertation Louisiana Tech	JIT	Regression	115	ROI, ROE	NA	Levels	No	Continuou	No	Archival
Husan and Nanda 1995	JOM	JIT	3SLS	55	EPS	4 Years	Changes	No	Continuou	(6)	Compustat
Kaynak 1996	Dissertation North Texas	TQM/JIT (4	Regression (Hierarchical)	214	Fin & Marke Performance	1 Year	omposit (Both)	Scale	Continuou	Some	Self
Shields 1995	JMAR	ABC	Descriptive	143	Success	NA	NA	No	7-point	No	Self
			Correlation		Fin. Benefit	NA	NA	No	Binary	No	Self
Swenson 1995	JMAR	ABC	Correlation	60	Satisfaction	Na	Levels	No	4-point	No	Self

1 = 2nd Order Regression
2 = Weighted average of four years weighted toward fourth year.
3 = Other methods or measures may have been used; disclosed are those that most closely pertain to this research
4 = JIT Purchasing
5 = Intersection of National Association of Purchasing Management and American Society for Quality Control
6 = Indirectly by including industry exogenous variables in prediction of endogenous variables
7= Control firms matched on industry and other criteria
FS = Financial Strength, an index of liquidity, leverage and performance variables based on Kristy (1991)
JMAR = Journal of Management Accounting Research
JOM = Journal of Operations Management
? = Not disclosed in paper

Table 2-1
Empirical Research on Financial Performance and New Business Initiatives (Cont'd)

	Variables of Interest					Control for Other		
Study	**Measure**	**Respondents**	**Limits**	**Scale?**	**Controls**	**Initiatives**	**Results**	**Weaknesses & limitations**
Dixon 1996	Survey	QA/QC mgrs	ISO-9000	Scale	No	No	Inconclusive	Use of Levels; not industry-adjusted no controls
Dusseau 1996	Interview Interview NA	? ? ?	Miss Qual Award Case Study Public Baldrige	Scale NA NA	No No No	No	Inconclusive Inconclusive Inconclusive; Performance deteriorates in short-term, improves in long-term (8+ years)	Sample size
Easton and Jarrell 1995	Telephone Interview	QA Senior Mgr	Text/ValueLine Compustat	Tertiary	No	No	TQM positively associated with variance from analyst forecast	TQM definition very broad Control group weak
Engelkeyer 1991	Survey	Top ranking	Electronic Circuits	Scale	No	No	Inconclusive	Sample size; levels; no controls
Grandzol and Gershon 1997	Survey	Senior Site Managers	Navy Contractors	Scale	No	No	Continuous Improvement = financial quality through operational quality	Data mining; definition of "financial quality"
Balachrishnan et al. 1996	Annual Report/10k	NA	< SICs	Binary	No	No	Inconclusive; firms with low customer concentration benefit	Binary independent; rely on public info;
Biggart 1997	Lexis/anecdotal	NA	Compustat, Users	Binary	No	No	Inconclusive	Binary independent, No controls
Boyd 1996	Survey	?	Compustat? 3 Industries	Scale	Time	No	Inconclusive	Levels variables; no controls
Husan and Nanda 1995	WSJ Index Anecdotal	NA	Compustat	Binary	No	No	JIT positively associated	Control for other;control for pre-JIT performance
Kaynak 1996	Survey	Quality Mgrs	NAPM, ASQM (5)	Scale	Size, Type Time	No	Together make a difference	Doesn't separate; self-reported; dependent measure not pure; period
Shields 1995	Survey	80% Controllers 100% Involved	ABC Users	NA	No	No	Diverse and Moderate 75% Yes; Correlation of .53 with success	Self-reported; vagueness of dependent
Swenson 1995	Interviews	Controllers, Managers	Users, Manufacturers	4-point	No	No	Higher satisfaction after ABC	Sample size; dependent variable

1 = 2nd Order Regression
2 = Weighted average of four years weighted toward fourth year.
3 = Other methods or measures may have been used; disclosed are those that most closely pertain to this research
4 = JIT Purchasing
5 = Intersection of National Association of Purchasing Management and American Society for Quality Control
6 = Indirectly by including industry exogenous variables in prediction of endogenous variables
7= Control firms matched on industry and other criteria
FS = Financial Strength, an index of liquidity, leverage and performance variables based on Kristy (1991)
JMAR = Journal of Management Accounting Research
JOM = Journal of Operations Management
? = Not disclosed in paper

Table 2-2
Correlations of Self-Reported Dependent Measures with Actual Reported (Compustat) Performance Measures Adjusted for Industry Performance (3-Digit)

		Likert Dependent Measure with Continuous Measure		Likert Dependent Measure with Ranked Measure	
Measure	n	Pearson	Spearman	Pearson	Spearman
ROI Change - 3 Years	51	0.77	0.78	0.86	0.86
ROI Change - 5 Years	47	0.62	0.71	0.75	0.76

Likert Dependent Measure with Ranked Compustat Measure

		Ranks Identical		Ranks Differ by 1		Ranks Differ by>1	
	n	Number	%	Number	%	Number	%
ROI Change - 3 Years	51	37	72.5%	14	27.5%	0	0.0%
ROI Change - 5 Years	47	28	59.6%	18	38.3%	1	2.1%
	98	65	66.3%	32	32.7%	1	1.0%

Subject firms actual reported performance is adjusted by the median performance of firms in the subject firm's primary 3-digit SIC code

The number of industry firms ranges from 4(SICs 376 and 799) to 226 (SIC 131).

Compustat firms are ranked 1-5 with the equivalent number of individual ranks as the dependent variable.

Table 2-3
Institute of Internal Auditors (IIA) Chapters

Chapter Name	Number Mailed	Responses: First Mailing	Responses: Second Mailing	Responses: Total	Percent Returned	Percent of Total
Albuqurque, New Mexico	8	0	2	2	25.0%	1.0%
Chicago, Illinois	240	44	15	59	24.6%	28.9%
Dallas, Texas	237	25	17	42	17.7%	20.6%
Fort Worth, Texas	61	12	2	14	23.0%	6.9%
Houston, Texas	316	32	20	52	16.5%	25.5%
Long Island, New York	44	8	2	10	22.7%	4.9%
Miami, Florida	89	10	7	17	19.1%	8.3%
Northeast Pennsylvania	12	0	1	1	8.3%	0.5%
Santa Fe, New Mexico	1	0	0	0	0.0%	0.0%
Tampa, Florida	50	6	1	7	14.0%	3.4%
	1,058	137	67	204		100.0%

Table 2-4
Summary of Sample

Questionnaires Mailed		1,058
Less: Undeliverable		68
Net Questionnaires Delivered		990
Less: Incomplete Responses:		
Company does not use cost allocation methods	12	
Company policy against responding to surveys	6	
Respondent is consultant	1	
Respondent is no longer employed at subject firm	7	
Respondent is not knowledgeable about cost systems*	2	28
Net Responses Possible		962
Responses Received		
First Mailing	137	
Second Mailing	67	204
Response Rate		21.2%

* Generally because the position is extremely specialized (i.e., rate auditor)

Table 2-5
Concurrent Use of Two Initiatives

Rank	Initiative Combination		Number Using Both	Possible*	%	% Rank
1	JIT	TQM	61	94	64.9%	6
2	JIT	BPR	50	79	63.3%	7
3	BPR	TQM	49	79	62.0%	9
4	ABC	JIT	32	47	68.1%	4
5	JIT	CIM	28	37	75.7%	1
6	ABC	TQM	26	47	55.3%	12
7	CIM	TQM	23	37	62.2%	8
8	ABC	BPR	23	47	48.9%	16
9	JIT	VCA	16	23	69.6%	3
10	CIM	BPR	16	37	43.2%	18
11	BPR	VCA	13	23	56.5%	10
12	JIT	FMS	12	16	75.0%	2
13	VCA	TQM	12	23	52.2%	13
14	CIM	FMS	8	16	50.0%	14
15	FMS	TQM	8	16	50.0%	15
16	ABC	VCA	7	23	30.4%	21
17	ABC	CIM	7	37	18.9%	27
18	JIT	TOC	6	9	66.7%	5
19	VCA	FMS	6	16	37.5%	19
20	CIM	VCA	6	23	26.1%	22
21	VCA	TOC	5	9	55.6%	11
22	FMS	TOC	4	9	44.4%	17
23	ABC	FMS	4	16	25.0%	23
24	BPR	FMS	4	16	25.0%	24
25	TOC	TQM	3	9	33.3%	20
26	ABC	TOC	2	9	22.2%	25
27	CIM	TOC	2	9	22.2%	26
28	BPR	TOC	0	9	0.0%	28
			433	815	53.1%	

*Smallest number of firms using the one of the two listed initiatives.

Table 2-6
Descriptive Statistics
Number of Respondents By Size Within Business Unit

n=204

Survey Items	Business Unit	Annual Revenue: Under $5 Million	$5-20M	$21-50M	$51-100M	$101-500M	$501M-$1	$1B-$5B	Over $5Billion	Total	%
1,18	Plant	0	2	0	2	3	4	2	0	13	6.4%
	Division	0	2	1	2	8	5	12	5	35	17.2%
	Group	2	0	0	0	4	1	7	4	18	8.8%
	Subsidiary	0	2	0	4	6	5	4	4	25	12.3%
	Country	0	0	3	0	2	0	0	6	11	5.4%
	Company	1	3	1	6	17	23	25	26	102	50.0%
	Total	3	9	5	14	40	38	50	45	204	100.0%
	%	1.5%	4.4%	2.5%	6.9%	19.6%	18.6%	24.5%	22.1%		

Table 2-7
Descriptive Statistics
Number of Respondents By Size Within Industry
n=204

Surve Items	Industry	Annual Revenue: Under $5 Million	$5-20M	$21-50M	$51-100M	$101-500M	$501M-$1	$1B-$5B	Over $5Billion	Total	%
I6,I8	Manufacturing	1	2	0	8	22	23	28	22	106	52.0%
	Financial Services	0	0	2	0	0	2	7	5	16	7.8%
	Wholesale/Retail	0	2	1	1	4	1	2	0	11	5.4%
	Transportation	0	0	0	0	5	2	1	6	14	6.9%
	Utilities	0	0	0	1	4	6	4	5	20	9.8%
	Other Services	0	4	1	0	0	1	2	1	9	4.4%
	Other	2	1	1	4	5	3	6	6	28	13.7%
	Total	3	9	5	14	40	38	50	45	204	100.0%
	%	1.5%	4.4%	2.5%	6.9%	19.6%	18.6%	24.5%	22.1%	100.0%	

Table 2-8
Use of Innovative Business Practices

n=204

Survey Item	Business Initiative	Number Using	Percent of Total	Manufacturers Number (n=106)	Manufacturers Percent (n=106)	Non-Manufacturers Number (n=98)	Non-Manufacturers Percent (n=98)	Percent of Users with $1 Billion Revenues*
I12	Activity-Based Costing (ABC)	47	23.0%	33	31.1%	14	14.3%	40.4%
	Total Quality Management (TQM)	94	46.1%	65	61.3%	29	29.6%	58.5%
	Just-In-Time (JIT)	95	46.6%	66	62.3%	29	29.6%	56.8%
	Computer-Integrated Manufacturing (CIM)	37	18.1%	37	34.9%	0	0.0%	54.1%
	Business Process Reengineering (BPR)	79	38.7%	42	39.6%	37	37.8%	49.4%
	Value Chain Analysis (VCA)	23	11.3%	16	15.1%	7	7.1%	43.5%
	Flexible Manufacturing Systems (FMS)	16	7.8%	16	15.1%	0	0.0%	68.8%
	Theory of Constraints (TOC)	9	4.4%	6	5.7%	3	3.1%	66.7%

Number of Initiatives in Use	0	1	2	3	4	5	6	Total
Responses (Total)	45	45	34	47	23	6	4	204
Responses (Manufacturing)	14	19	12	30	21	6	4	106
Responses (Non-Manufacturing)	31	26	22	17	2	0	0	98
% (Total)	22.1%	22.1%	16.7%	23.0%	11.3%	2.9%	2.0%	100.0%
% (Manufacturing)	13.2%	17.9%	11.3%	28.3%	19.8%	5.7%	3.8%	100.0%
% (Non-Manufacturing)	31.6%	26.5%	22.4%	17.3%	2.0%	0.0%	0.0%	100.0%

	All Initiatives			Omitting Purely Manufacturing Initiative		
	Total	Manuf.	Non-Manuf.	Total	Manuf.	Non-Man
Mean Number of Initiatives	1.96	2.56	1.32	1.70	2.06	1.32
Median	2	3	1	2	2	1

Responses to question "Check if the following is used to a significant extent in your business unit."
* 46.6% of responses were from business units over $1 billion.

Table 2-9
Correlation Matrix of New Business Initiatives

Manufacturers, n=106, to the Lower Left of the Diagonal
All Firms, n=204, to the upper Right
(Spearman Correlations)

	ABC	JIT	CIM	BPR	VCA	FMS	TQC	TQM
Activity-Based Costing (ABC)	1.000	**0.202**	-0.041	0.125	0.030	-0.027	-0.059	0.090
Just-In-Time (JIT)	**0.252**	1.000	**0.249**	**0.267**	**0.164**	**0.276**	0.087	**0.340**
Computer Integrated Manufacturing (CIM)	-0.058	**0.241**	1.000	0.018	0.074	**0.147**	0.023	0.126
Business Process Reengineering (BPR)	0.126	**0.273**	0.074	1.000	0.130	0.030	**-0.171**	**0.254**
Value Chain Analysis (VCA)	0.056	**0.234**	0.040	0.052	1.000	**0.300**	**0.301**	0.044
Flexible Manufacturing Systems (FMS)	-0.004	**0.229**	0.129	-0.093	**0.349**	1.000	**0.295**	-0.014
Theory of Constraints (TOC)	-0.049	0.115	0.002	-0.019	**0.467**	**0.428**	1.000	-0.055
Total Quality Management (TQM)	0.174	**0.313**	0.049	**0.485**	-0.081	-0.069	-0.130	1.000

Bold = significant at the 0.05 level
Underlined = significant at the 0.10 level

	Total	Full Sample		Manufacturers		Non-Manufacturers	
	Possible	Number	%	Number	%	Number	%
Significant at 5%	28	11	39.3%	10	35.7%	5	17.9%
Significant at 10%	28	14	50.0%	11	39.3%	5	17.9%

Table 2-10

Model 1, Hypothesis 2

Regression of ROI on Individual Initiatives

with Control for Size and Separate Regresions for Type of Firm

Model is ROI5 = add to word where etc.

Initiative	Predicted Sign	5-year Change in ROI Manufacturers n=106 Coefficient	T-stat	p-value	5-year Change in ROI Non-Manufacturers n=98 Coefficient	T-stat	p-value
Activity-Based Costing (ABC)	+	0.506	**2.450**	**0.008**	0.105	0.4805*	0.315
Total Quality Management (TQM)	+	0.560	**3.066**	**0.001**	0.130	0.546	0.293
Just-in-Time (JIT)	+	0.653	**3.660**	**0.000**	0.187	0.772	0.221
Computer-integrated Manufacturing (CIM)	+	0.557	**3.351***	**0.000**			
Business Process Reengineering (BPR)	+	0.533	**2.881**	**0.002**	0.143	0.634	0.264
Value Chain Analysis (VCA)	+	0.512	**2.019**	**0.023**	(0.398)	(0.951)	0.829
Flexible Manufacturing Systems (FMS)	+	0.503	**2.447***	**0.007**			
Theory of Constraints (TOC)	+	(0.119)	(0.296)	0.616	(0.565)	(0.878)	0.810
Intercept Mean	?	1.006	1.023	0.143	1.829	**2.425**	**0.016**
Size Mean	?	0.104	**2.203**	**0.014**	0.033	0.682	0.495
Initiative Mean	+	0.463	**2.447**	**0.007**	(0.066)	0.101	0.460
Initiative Median	+	0.523	**2.666**	**0.004**	0.117	0.513	0.304

Bold = significant at the 0.05 level (one-tailed test when predicted sign is +; two-tailed otherwise

Italicized = significant at the 0.10 level

* = t-statistics based on White's (1980) heteroscedasticity-consistent errors.

Table 2-11
Model 2, Hypothesis 3
Regression of 5-Year Change in ROI on All Initiatives Together
with Separate Regressions for Manufacturers and Non-Manufacturers

Model F	4.795	0.492
Model p-value	0.000	0.838
R2	0.310	0.037
Adjusted R2	0.246	-0.038

		Manufacturers n=106			Non-manufacturers n=98		
Initiative	Predicted Sign	Parameter	t-stat	p-value	Parameter	t-stat	p-value
INTERCEPT	?	0.940	0.987	0.326	2.486	**2.360**	**0.021**
Activity-Based Costing (ABC)	+	0.358	**1.807**	**0.036**	0.043	0.151	0.440
Total Quality Management (TQM)	+	0.339	**1.699**	**0.046**	0.116	0.619	0.269
Just-in-Time (JIT)	+	0.203	1.026	0.154	0.089	0.338	0.368
Computer-Integrated Manufacturing (CIM)	+	0.454	**2.494**	**0.007**			
Business Process Reengineering (BPR)	+	0.203	1.009	0.158	0.161	0.635	0.264
Value Chain Analysis (VCA)	+	0.451	**1.659**	**0.050**	(0.531)	(1.175)	0.880
Flexible Manufacturing Systems (FMS)	+	0.417	*1.391*	*0.084*			
Theory of Constraints (TOC)	+	(0.550)	(1.266)	0.897	(0.474)	(0.709)	0.761
SIZE	?	0.080	*1.752*	*0.083*	0.024	0.461	0.646
Initiative Mean	+	0.234	1.227	0.110	(0.099)	(0.024)	0.510
Initiative Median	+	0.349	**1.753**	**0.040**	0.066	0.245	0.403

Bold = significant at the 0.05 level (one-tailed test when predicted sign is +; two-tailed otherwise)
Italicized = significant at the 0.10 level

Table 2-12
Model 4, Hypothesis 4
Regression of 5-Year Change in ROI on Number of Initatives in Use
with Separate Regressions for Manufacturers and non-Manufacturers
n=204

Model 4a

Model F	10.574	0.374
Model p-value	0.000	0.772
R2	0.237	0.012
Adjusted R2	0.215	(0.020)

	Manufacturers n=106			Non-manufacturers n=98		
	Parameter	t-stat	p-value	Parameter	t-stat*	p-value
INTERCEPT	1.691	*1.725*	*0.088*	2.512	**2.542**	**0.011**
Use 1 Initiative	-0.151	-0.514	0.560	0.057	0.196	0.424
Use >1 Initiative	0.852	**3.657**	**0.000**	2.003	0.735	0.232
Size	0.053	1.120	0.265	0.023	0.506	0.613

Model 4b

Model F	19.376	0.633
Model p-value	0.000	0.533
R2	0.273	0.013
Adjusted R2	0.259	-0.008

	Predicted Sign	Manufacturers n=106			Non-manufacturers n=98		
		Parameter	t-stat	p-value	Parameter	t-stat*	p-value
INTERCEPT	?	0.839	0.909	0.366	2.545	2.614	0.009
sum of binary use	+	0.286	**5.696**	**0.000**	0.082	0.907	0.182
Size	?	0.086	**1.941**	**0.004**	0.021	0.447	0.655

Bold = significant at the 0.05 level (one-tailed when predicted sign is +; two-tailed otherwise)
Italics = significant at the 0.10 level
* = t-statistics based on White's (1980) heteroscedasticity-consistent errors.

Table 2-13
Model 3, Hypothesis 3
Regression of ROI on Initiatives with Separate Regressions for Manufacturers and Non-Manufacturersand Including Interactions of Commonly Used Combinations of Initiatives

(T-statistics adjusted for heteroskedastic error variances)

Model F			3.658			0.800	
Model p-value			0.000			0.658	
R2			0.414			0.110	
Adjusted R2			0.301			(0.028)	
			Manufacturers			Non-manufacturers	
	Predicted		n=106			n=98	
Variable	Sign	Parameter	t-stat*	p-value	Parameter	t-stat*	p-value
Intercept	?	0.915	1.147	0.252	2.382	**2.238**	**0.025**
Activity-Based Costing (ABC)	+	(0.412)	(0.572)	0.284	0.438	1.214	0.112
Total Quality Management (TQM)	+	(0.272)	(0.918)	0.821	0.408	*1.288*	*0.099*
Just-In-Time (JIT)	+	(0.057)	(0.147)	0.559	(0.824)	(2.545)	0.995
Computer-Integrated Manufacturing (CIM)	+	0.235	0.880	0.189			
Business Process Reengineering (BPR)	+	0.395	0.575	0.283	0.423	1.240	0.108
Value Chain Analysis (VCA)	+	0.259	0.891	0.186	(0.523)	(1.079)	0.860
Flexible Manufacturing Systems (FMS)	+	0.674	**2.906**	**0.002**			
Theory of Constraints (TOC)	+	(0.749)	(2.091)	0.982	(0.358)	(0.630)	0.736
JIT*TQM	+	0.672	*1.437*	*0.075*	0.462	1.100	0.136
JIT*BPR	+	(1.033)	(2.015)	0.978	0.797	**1.979**	**0.024**
BPR*TQM	+	0.878	*1.531*	*0.063*	(0.578)	(1.413)	0.921
ABC*JIT	+	0.897	*1.468*	*0.071*	0.686	**1.781**	**0.038**
JIT*CIM	+	0.679	**1.936**	**0.026**			
ABC*TQM	+	0.236	0.489	0.312	(0.162)	(0.430)	0.334
CIM*TQM	+	(0.601)	(1.722)	0.958			
ABC*BPR	+	(0.125)	(0.288)	0.613	(1.132)	(2.842)	0.998
Size	?	0.090	**2.266**	**0.023**	0.027	0.547	0.584
Initiative Mean	+	0.009	0.190	0.425	(0.073)	(0.085)	0.534
Interaction Mean	+	0.200	0.355	0.361	0.012	0.029	0.431
Initiative Median	+	0.083	0.214	0.415	0.025	0.292	0.385
Interaction Median	+	0.458	0.963	0.168	0.150	0.335	0.369

Bold = significant at the 0.05 level (one-tailed test when predicted sign is +; two-tailed otherwise)
Italics = significant at the 0.10 level
* = t-statistics based on White's (1980) heteroscedasticity-consistent errors.

Chapter 3

The Association between Use of New Business Initiatives and Financial Performance: Evidence from the Motor Carrier Industry

INTRODUCTION

The primary purpose of this study is to measure whether improvement in financial performance is associated with use of new business initiatives e.g., BPR, TQM, and ABC, in the motor carrier industry. The increased interest in and implementation of these initiatives have affected U.S. businesses dramatically (Gupta, et al. 1997). A critical question that remains unanswered is whether the use of these initiatives has had a positive overall effect on financial performance.

Profit-maximizing trucking firms would not implement these initiatives if they did not expect a financial benefit from their use. However, there has been no empirical evidence that unequivocally demonstrates that any of these initiatives improves financial performance in any industry. In addition, there has been no empirical investigation of theorized synergistic effects obtained from using these initiatives in combination (for example using ABC to enhance TQM decision-making). Only by empirically determining the association between new business initiatives and financial performance can we be certain that they are viable business solutions.

This study makes use of a cross-sectional mail survey of 332 top executives of firms operating in the for-hire motor carrier industry. Multiple regression analysis is used to investigate 1) the association between use of seven initiatives and a set of two archival measures of change in financial performance and 2) possible positive synergistic effects

from the use of multiple initiatives. Also provided is a descriptive analysis of the use of the aforementioned initiatives.

The study enhances previous research in six ways:

1) by incorporating the combination of an unbiased, objective source of archival financial information and non-binary, time-sensitive measures of the extent of use of initiatives and the extent of concurrent use of multiple initiatives,
2) by overcoming limitations of previous research by specifically identifying non-users as control firms (in contrast to selection of non-users as controls based on lack of disclosure in archival sources regarding implementation e.g., Balachrishnan (1996) and Husan and Nanda (1995),
3) by measuring improvement in financial performance over a relatively long (five year) time period, with sensitivity testing over a shorter (three year) period,
4) by controlling for the effects of mean reversion through the inclusion of prior level of performance,
5) by controlling for the impact of concurrent use of multiple initiatives, and,
6) by measuring previously theorized synergistic effects of this concurrent use.

Findings include that use of initiatives is common in the industry, with 72% of firms reporting that they are heavy users of at least one initiative. Most firms concurrently use multiple initiatives, with only 21% using a single initiative in isolation. In general, poor performers tend to implement initiatives, presumably to improve their performance, while top performers appear to be more satisfied with the status quo rather than adopting initiatives.

Partnerships with suppliers (PWS), electronic data interchange (EDI), satellite tracking systems (STS) and activity-based costing (ABC) are significantly associated with ROI improvement. The concurrent use of PWS with STS, and EDI with ABC are identified as contributing a positive synergy.

The findings of this study are of interest to those directly affiliated with the industry under study: the motor carrier industry and by extension the entire transportation industry and logistic functions of other industries. More generally, knowledge of the efficacy and synergy of these initiatives is of significant interest to three communities: 1) practitioners including accountants, managerial decision-makers, potential project leaders, professional associations, and consultants using, promoting, instructing in the use of, or contemplating the implementation of initiatives, 2) researchers contributing to the substantial theoretical and limited empirical literature regarding these initiatives, and 3) educators who communicate the reputed benefits and instruct in the use of the initiatives.

BACKGROUND

New Business Initiatives

Anyone reading a business periodical such as the *Wall Street Journal* or *Business Week* will quickly find a reference to a "revolutionary" business initiative, defined as an innovative business technique, strategy or technology that is purported to increase corporate success. For example CEO Jack Welch, recently stated that General Electric received benefits of $170 in 1996 that are expected to increase to $1.2 billion annually by 2000 from its Six Sigma TQM program (Henry, *USA Today,* February 27, 1998).

Beginning in the 1970s with initiatives such as Management by Objectives (MBO) and quality circles, there has been a constantly expanding list of these new business initiatives, generally known by three-letter acronyms that claim to increase business success e.g., TQM, EDI, ABC. All initiatives broadly advocate a change in the business paradigm through continuous improvement, but each accomplishes continuous improvement differently (Gupta et al. 1997). For example, TQM emphasizes "doing the right things the first time"; JIT stresses lean manufacturing; ABC advocates activity-based performance measures; and EDI concentrates on productivity improvement through reduction of duplication of effort and increased communication.

Established initiatives of significant interest to the motor carrier industry are selected for investigation in this study. Initiatives studied include the technology based EDI and STS. Also included are alliances with competitors (AWC) and PWS, strategies involving enhanced clientele relationships. The advanced management and decision-making strategies total quality management (TQM), and business process re-engineering (BPR) are also included. The final measure is an initiative of particular interest to the accounting profession, activity-based costing (ABC).

Selection of Industry

Most research regarding new business initiatives has focused on the manufacturing segment of the economy. However, the major changes that manufacturing companies have experienced in recent years have also occurred in virtually all types of service organizations (Atkinson et al. 1995). Consequently, new business initiatives can be applied in all types of organizations (Rotch 1990; Tanju and Helmi 1991). Since non-

manufacturing activities represent the majority of the North American economy, there clearly is opportunity for research to focus on non-manufacturing settings, including transportation (Shields 1997).

Service companies differ from manufacturing companies in many ways. The most obvious difference is that they do not produce a product. They can produce no inventory in advance of the customer's need but generally deliver in real time directly to the customer (Atkinson et al. 1995). Less obviously, service companies have more direct contact with customers. Thus, in addition to price, service companies must be especially sensitive to the timeliness and the quality of the service they provide to their customers.

This study focuses on a single service industry: the motor carrier industry (SIC 4213). Restricting to a single industry reduces noise, increasing statistical power, and consequently provides a higher likelihood of identifying valid relationships. The motor carrier industry is selected because of 1) interest of the members of the industry in use of business initiatives that can potentially improve their competitive positions, and 2) the availability of detailed financial statement data for those members of the industry exceeding $5 million in annual revenues. Restricting to a narrow SIC selection helps to insure a high level of internal validity (Ahire et al. 1996). In addition, although one could argue that the focus on a single industry generally tends to make the results less generalizable than a study that crosses industries, the findings of this study have a wide appeal for the following reasons:

1. Within the motor carrier industry there are many distinct segments that use different technologies, warehousing methods, and labor force demographics. For example, a truckload bulk carrier may make point-to-point delivery in a

specialized truck without making use of warehousing, terminals, or break-bulk facilities, while an LTL carrier may have these all of these facilities, and make use of either union or non-union labor.

2. The motor carrier industry generates about 5% of the gross domestic product and hauls approximately 55 percent of all domestic freight volume. It has an economic impact on virtually every organization in every industry and governmental agency in the U.S. economy.
3. Transportation is a major component of business logistics and usually is the single largest cost element in the logistics function for companies. Each component of the logistics system is linked with, and influences, the operations of the other components (Tyndal 1990). Physical distribution costs range from 7.93% to 30% of sales (Davis 1991; Quillian 1991), and the management of logistics costs has become increasingly important due to their significant impact on product profitability, product pricing, customer profitability, and ultimately, corporate profitability (Tyndal 1990).

The Motor Carrier Industry

The motor carrier industry[1] plays a major role in the transportation of manufactured and food products because of its generally higher quality of service compared to other modes of transportation, e.g., rail, ship or barge. For this high-valued, time-sensitive traffic, the general service characteristics of motor carriers, including accessibility, speed,

[1] *Transportation*, 4th edition (Coyle, Bardi, and Novack 1994) has been freely used as resource in the discussion of the motor carrier industry.

reliability, frequency, and lower loss and damage rates have given motor carriers an advantage over other modes.

In 1995, the United States trucking industry (American Trucking Industry 1995):

Employed more than 9.3 million people,

Was comprised of more than 423,000 companies,

Generated $381 billion in gross revenues, approximately 5% of the gross domestic product,

Hauled 5.6 billion tons of freight, approximately 55 percent of all domestic freight volume,

Was the exclusive mode of supply of 77% of all communities,

Traveled more than 161 billion miles,

Operated more than 4.2 million medium and heavy trucks,

Purchased more than 4.1 billion gallons of gasoline and diesel fuel.

The industry is not homogenous, but can be partitioned into distinct segments. One important distinction is between less-than-truckload (LTL) and truckload (TL) carriers. LTL carriers provide service to shippers who tender shipments lower than the minimum truckload quantities, i.e., 500 to 15,000 pounds. Consequently, the LTL carrier must consolidate the numerous smaller shipments into truckload quantities for inter-city movement and disaggregate full truckloads at the destination city for delivery in smaller quantities. In contrast, the truckload carrier picks up a truckload and delivers the same truckload at destination.

Carriers may also be classified by the type of commodity they are authorized to haul. They may have the authority to transport general commodities or specialized commodities only. Specialized equipment carriers are carriers of goods requiring special handling, e.g., liquefied gases, frozen products, automobiles, or household goods. A specialized carrier is not permitted to transport other specialized commodities, or general commodities.

There is a significant difference between the types (TL versus LTL, and specialized versus general) carriers in terms of capital investment requirements. The LTL segment of the industry requires significant capital assets, including terminal facilities and complex computer and communications systems, a skilled work force, and a large sales organization to operate a network of terminals and freight handling equipment to consolidate and distribute freight (Harmatuck 1990). This network is generally not needed by the TL carrier. Specialized equipment carriers usually have larger investments in equipment and terminals than those transporting general freight.

Since deregulation in the 1970s, the industry has become highly competitive, largely because of 1) low entry costs in the TL and specialized carrier segments, and 2) increased competition with other modes of transport. Overall, the industry lacks the capital investment requirements, proprietary processes, technology, and territory and patent protection typical of many other industries. Therefore, trucking firms are not able to maintain their competitive position over extended periods of time without continuing improvements in efficiency and service.

LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

New business initiatives have found rapid and wide acceptance and there are ample anecdotal reports of benefits, e.g., General Electric. However, there still is not a significant body of empirical evidence to validate their alleged benefits. Evidence of the benefits of these systems is largely restricted to theoretical models and anecdotal information obtained from case studies[2] and often related by practitioners. Typically, empirical research has either 1) measured success or satisfaction with the initiatives rather than using measures of financial performance (McGowan and Klammer 1997; Shields 1995, Swenson 1995), or 2) failed to establish that financial performance is indeed improved (Dixon 1996; Balakrishnan et al. 1996; Engelkemeyer 1991; Boyd 1996; Biggart 1997; Dusseau 1996; Granzol and Gershon 1997). However, some recent studies have had limited success (Husan and Nanda 1995; Kaynak 1996; Easton and Jarrell 1995). These studies, their limitations and weaknesses, and the remedies implemented in the current study are discussed in succeeding paragraphs. A summary of the key characteristics and findings of each study along with those of this study is included as Table 3-1. Preceding this analysis, the importance of assessing initiatives through measures of financial performance is discussed.

Importance of Financial (vs. Non-Financial) Measures

Studying whether initiatives are viable requires evaluations of outcomes, namely performance measures (Grandzol and Gershon 1997). It is important to measure the success of new initiatives with measures of *financial* performance because 1) most technologies and investments are justified on the basis of their impact on financial and

[2] For examples, see Goyal and Deshmukh (1992) and Golhar and Stamm (1991) – JIT; Barnes (1991), Brimson (1991), Bruns and Kaplan (1987), and Harris (1990) – ABC; Dean (1996) and Romney (1995) –

accounting measures, not operational measures (Husan and Nanda 1995), and 2) financial performance measures are the only internally generated measures that *directly* reflect whether the company's strategy, implementation, and execution are generating wealth by contributing to firm value (Atkinson et al. (1995) as demonstrated by Edwards and Bell (1961) and Ohlson (1991, 1995).[3] For these reasons, even though impacts of initiatives are not easily quantified (Husan and Nanda 1995), financial performance measures are the ultimate measures of the efficacy of these initiatives and serve as dependent variables in this study.

Empirical Literature

In the last several years, researchers have made the first attempts to measure whether use of the initiatives JIT and TQM is in fact associated with financial performance. To date, no studies have empirically measured financial performance benefits obtained from using initiatives other than JIT or TQM. Nor have studies focused performance benefits from initiatives in the motor carrier industry. The existing studies of JIT and TQM have met with limited success. Balakrishnan et al. (1996) and Biggart (1997) found no significant overall return on investment (ROI, defined as three year average return on assets) response to JIT adoption through univariate testing with control groups, although Balachrishnan et al. found that firms without significant customer influence did benefit from adoption. Boyd (1996) found no definitive response to a variety of tests of levels of multiple performance variables. Engelkeyer (1991), Dixon

---

BPR; Sankar (1995) – TQM.

(1996), and Dusseau (1996) found no relationship between complex measures of TQM infusion and diffusion and financial performance. Grandzol and Gershon (1997) were unsuccessful in their attempt to link financial "quality", a construct consisting of measures of ROI, market share, and capital investment ratio, to latent constructs and endogenous dependent outcomes (although by fitting their structural model to their data, did find that financial quality is a function of continuous improvement -- a construct consisting of demonstrated non-financial improvements).

However, Huson and Nanda (1995) did find that JIT adopters have enhanced earnings per share after controlling for average industry unit costs, margins, turnover and employees per sales dollar. Kaynak (1996) found that "financial and market" performance were enhanced for firms using a combination of TQM and JIT purchasing. Easton and Jarrell (1995) found evidence that a very broadly defined TQM is associated with the variance between actual financial performance and that forecasted by Value-line analysts. Unfortunately, none of these studies included control for concurrent use of other initiatives or for previous financial performance and therefore the findings cannot be attributed specifically to single initiatives. In addition, Kaynak's measure of performance is not truly a measure of financial performance, but a combination of level and change variables measuring both financial and market factors (e.g., market share); and he relied on self-reported responses of potentially biased quality managers. Easton and Jarrell defined TQM in a manner that included initiatives and management practices other than TQM, and measured deviation from Value-Line forecast, which may or may not have

[3]Ohlson (1995) derives the value of the firm (P_t) as a function of its book value (y_t) plus the present value of expected future (to infinity) abnormal earnings (earnings (x_t) above cost of capital (r) times beginning book value): $P_t = y_t + \Sigma E_t [x_t - r\, y_{t-1}]_{t+\tau}$

incorporated subjective valuation of the initiative, rather than demonstrated improvement in financial performance.

Possible reasons for the limited success of most studies include:

1. Reliance on public sources of information to identify users and non-users; non-users are typically defined as companies where there is no *public* discussion of adoption of the initiative (Balachrishnan 1996; Biggart 1997; Husan and Nanda 1995). Consequently, some firms that adopt the initiative are probably incorrectly classified as non-adopters because of the lack of public release of implementation information, thereby biasing against finding a distinction between groups; in addition, public announcement of adoption is not a reliable measure of the primary determinant of the efficacy of the innovation, the extent of diffusion throughout the organization,
2. Inadequate sample size – attributable to the difficulty of identification of users that also release financial information (Dusseau 1996, sample size of 10; Balachrishnan 1996, 92 ; Engelkeyer 1991, 9; Biggart 1996, 85; Boyd 1996, 115),

Other limitations of previous studies include:

1. Reliance on responses furnished by potentially biased subjects to measure the variables of interest, primarily project managers and controllers (Dixon 1996; Shields 1995; Kaynak 1996; Easton and Jarrell 1995),
2. Failure to control for the effect of concurrent use of multiple initiatives (all previous studies), a potentially fatal limitation that is discussed in the next section.
3. Measurement of *level* of, rather than *change* in financial performance (Dixon 1996; Boyd 1996; Engelkeyer 1991; Kaynak 1996). Use of levels is a weakness in that

performance improvement after implementation of an initiative is not accurately captured by an attained level of performance if the level was very low before implementation; conversely, high performers may have attained their level before implementation of the initiative. "Levels" are a limitation in that statistical significance of the initiative gives no information as to whether the use of the initiative occurred concurrently with a *change* in performance.

4. Lack of control for the effects of mean reversion whereby top performing firms that implement initiatives have difficulty demonstrating improvement in financial performance. They must expend more effort to maintain their position rather than enhancing it. No study has controlled for this condition, although Biggert (1996) and Balachrishnan (1996) reduced its effect by comparing averaged periods of performance.[4] If poor performers tend to be the implementers of initiatives, mean reversion may be mis-interpreted as initiative efficacy.

Concurrent Use of Multiple Initiatives

Organizations are not restricted to using only one initiative at a time and are simultaneously exploring multiple programs such as TQM, BPR, and ABC (Kaplan 1993). These practices overlap and often complement each other. For example, Carr and Johansson (1995) note that BPR can and should be used to extend the gains in employee empowerment and teamwork under any TQM effort, and in case studies performed by Cooper et al. (1992), all five companies studied found ABC and TQM to be highly compatible and mutually beneficial.

Although there appears to be an association between use of the various initiatives, previous research has not controlled for possible statistical effects of this correlation, and consequently have not isolated the effect of a single initiative. Another issue concerning concurrent use of multiple initiatives is that there may be synergies (positive or negative) leading to various optimal combinations of factor inputs, i.e., initiatives (Capon et al. 1990). This study will test the initiatives both individually and together to determine if separate effects can be isolated and whether there are positive synergistic effects from use of more than one initiative.

Extensions of Research in the Current Study

This study addresses the weaknesses and limitations of prior research by 1) testing relatively large sample sizes of 332 and 191 respondents, 2) identifying users and specifically *non-users* of individual initiatives through a mail survey, and 3) identifying and controlling for the concurrent use of multiple initiatives and levels of prior performance in 4) measuring change in composite, archival measures of financial performance.

Research Questions and Hypotheses

The following research questions are investigated:

1. What is the level of use of various new initiatives in the trucking industry?

2. Is there an association between use of various initiatives?

---

[4] Use of a control group as in Balachrishnan (1996) will only ameliorate the noise created by this condition if the criteria for selection of the control group firms includes beginning of period performance as a criterion.

3. Is there an association between use of initiatives and improvement in financial performance?
4. Is use of multiple initiatives associated with a synergistic improvement in financial performance?

Although not tested through statistical inference, investigation of level of use of initiatives is included to emphasize the importance of this research to the motor carrier industry. Significant use is indicative of interest and importance to practitioners. While research has prescribed the benefits of initiatives for all types of companies (Atkinson et al. 1995; Rotch 1990), extent of use has not recently been documented for motor carriers.

The second research question, regarding the concurrent use of multiple initiatives has not yet been documented through large-scale cross-sectional studies. It is important to establish the level of concurrent use of initiatives. Obviously, if concurrent use is not common, it is difficult to measure synergistic benefits from concurrent use. In addition, low concurrent use would enhance the credibility of previous research that did not control for this condition. This discussion leads to Hypothesis 1 (alternate form):

H1: The likelihood of use of multiple initiatives exceeds the likelihood of use of one initiative.

The theories of diffusion of innovations (Kwon and Zmud 1987), transaction cost economics (Roberts and Silvester 1996), and information technology (Dixon 1996) suggest that organizations adopt an innovation such as ABC, TQM, or EDI to obtain benefits that directly or indirectly impact financial performance measures. In addition, the academic and practitioner literatures contain voluminous references to the potential benefits of each of these initiatives. However, no scientific, empirical evidence

unequivocally demonstrates that any of these initiatives individually improves financial performance.

Hypotheses H2 and H3 specifically address research questions three and four, the association between the individual initiatives and change in financial performance. H2 is the first step, the approach often used in previous research, to identify the change in financial performance associated with an initiative without regard for the simultaneous use of other initiatives:

H2: Without control for use of other initiatives or prior financial performance, there is a positive association between use of a business initiative and improvement in financial performance.

Each initiative is tested individually, without control for concurrent use of other initiatives. Significant results would indicate that the initiative is associated with change in financial performance, but, as noted by Wempe (1997) and Biggart (1997), interpretation is limited in that the variable may be a proxy for the effects of other concurrent initiatives or the synergistic effect of multiple initiatives.

Another potentially troublesome issue not addressed by H2 is, as Balakrishnan et al. (1996) noted in their discussion of JIT, a firm's pre-adoption operating efficiency will influence its ROI response to the increased efficiency of initiative adoption. Because it appears that there are continuing pressures that tend to pull the performance of firms towards the average[5] (Bernard 1994), higher performing companies may need to

[5] Previous research (DeBondt and Thaler 1987; Penmna 1991; Penman 1992) has documented the mean-reversion of earnings. ARIMA (p,d,q) models with mean-reverting characteristics have been shown to be descriptive of annual earnings series (Halsey 1996; see Finger, 1994 and Foster, 1986 for a discussion). Halsey (1996) successfully tested a model of earnings consisting of three components: 1) an underlying trend to capture the permanent component of earnings, 2) a transitory component to reflect irregular shocks,

implement business initiatives just to retain their advantage, rather than to show improvement. This condition causes problems in detecting the association of the initiatives with improved financial performance (Husan and Nanda 1995).[6] In addition, firms are generally unable to sustain extremely poor performance for an extended period of time, and must either improve their performance towards that of the mean, or go out of business, and thus cannot be included in this study. These conditions may effectively create a "collar" around the performance of the firm, a ceiling limiting the improvement of the top performers and a floor limiting the deterioration of the already poor performers, and resulting in a phenomenon with the statistical characteristics of mean-reversion.

Significance of the variable of interest could also result from lack of control for the effects of this "mean reversion". If below average performers tend to implement initiatives more than successful firms, an upward change in performance may be due to the pressures noted above that tend to pull the performance of firms towards the average rather than efficacy of the initiatives.

The testing of H2 is analogous to previous empirical research (e.g. Dixon 1996; Boyd 1996; Engelkeyer 1991; Husan and Nanda 1995; Balachrishnan 1996, Biggart 1997; Easton and Jarrell 1995) that tested the effect of one initiative without

---

and 3) a mean-reverting component. It is contended that use of initiatives provides a positive adjustment to the trend component.

[6] Another factor with similar statistical effects to the "mean reversion" identified above is the threat to internal validity frequently called "regression toward the mean" (RTM). Wolins (1982) contended that failing to compensate for RTM is the most persistent, complex, and insidious of all mistakes". In general, RTM occurs whenever two variables are not perfectly correlated. It is due to factors or elements unique to each of the variables and/or measurement errors. Observations at the extremes of one variable do so, in part, because of a rare combination of factors that is not expected to be repeated when the other variable or time period is being measured. In addition, random errors attenuate (lower) the correlation between two variables or between scores measures on the same variable at two points in time. It follows, that the greater the random errors, the greater the RTM (Pedhazur and Schmelkin 1991).

consideration of possible complementary effects associated with simultaneous use of other initiatives or levels of prior performance. H3 addresses these limitations by introducing control for both the significant use of other initiatives and the level of prior performance. This control separates the effects of the individual initiatives and measures the partial correlation contributed by each initiative apart from the potential confounding effects of mean-reversion.

H3: After control for concurrent use of other initiatives and prior level of performance, there is a positive association between use of an individual business initiative and improvement in financial performance.

H4 addresses research question four regarding the synergistic effect of multiple initiatives. It is quite possible that a combination of new technologies, BPR, TQM, and ABC leads to a synergy where the effects of the sum exceed the sum of the effects individually (conversely, it is possible that the effects of adding initiatives are reduced for each succeeding initiative). As described earlier the literature contains frequent references to possible synergy. To-date, no previous empirical research on financial performance has studied this possible synergy and its effect on financial performance. Previous testing (H2 and H3) has determined whether the addition of an initiative furnishes incremental effects on financial performance. Whether the effects are synergistic as theorized, or suffer from the principal of diminishing returns has yet to be explained. The preceding discussion leads to the following formal hypothesis:

H4: The financial performance of firms that use multiple initiatives has increased more than the increase associated with each initiative singly.

MODEL DEVELOPMENT -- RESEARCH DESIGN

This section contains a detailed description of the research model, its constructs and the hypothesized relationships between constructs. The section begins with a description of each of the variables contained in the research model and concludes with a description of the methodology and statistical analysis techniques. The following sections contain the results of the statistical analysis, and the limitations and conclusions of the research.

Variables and Hypothesized Relationships

Measures of Financial Performance

Financial performance measures indicate whether the company's strategy, implementation, and execution are contributing to bottom-line improvement. Typical financial goals have to do with profitability (Kaplan and Norton 1996). Testing improvement in financial performance poses significant measurement problems. For example, consider an obvious measure of financial performance, return on investment (ROI). Determining an appropriate methodology to measure ROI improvement is no minor issue. As Roberts and Silvester (1996) observe, numerous complications arise, including:

1. Determining the appropriate time period of study (does the profit improvement appear immediately, or by the end of some other period—for example one year, three years, or five years),

2. Modeling a company's "expected" profitability against which to compare realized profitability after an implementation,
3. Controlling for concurrent changes in the organization,
4. Controlling the length and breadth of implementation and integration of initiatives throughout the firm.

In selecting appropriate time periods to test, one must consider the offsetting effects of two factors: 1) previous research has posited (Shields 1995; Player and Keys 1995; Easton and Jarrell 1995) that profit improvements are expected to grow over time so a relatively long window is probably necessary to yield results (because the organization may still be in a learning process and also may incur "start-up" costs that temporarily reduce profitability.). For example, the literature has indicated that at least five years are needed to experience the positive effects of JIT adoption (Boyd 1996); and in his field studies of TQM users, Dusseau (1996) found non-statistical indications that performance began to improve after a minimum of eight years.

However, 2) a longer window increases the effect of non-initiative factors on financial performance. Although research suggests that a longer period is appropriate to obtain maximum benefits, most previous empirical studies have opted to use a relatively short window of one to four years for testing, presumably to mitigate the effect of intervening events, e.g., Kaynack used a one-year window, Balachrishnan (1996) and Biggart (1997) used three-year windows, and Husan and Nanda (1995) tested over four years. This study measures change in performance over five years, and provides sensitivity testing over the shorter three year period commonly tested in other studies.

In general, comparison of "expected profitability" requires either specification of control variables which describe the industry in which the firm operates, or alternatively the use of "industry mean-adjusted" measures. The underlying assumption is that firms in the same line of business share the same production technology, in terms of the production function, but cross-sectional variation between firms is created due to the use of differing management and control systems (Husan and Nanda 1995). In the current study, expected profitability is addressed through restricting the study to a single industry and controlling for differences in the three major segments of the industry and size of the individual firms. These restrictions allow comparison of the profitability of initiative users (72% of respondents) against that expected without use, proxied by the performance of equivalent non-users (28%). In addition, control for use of other initiatives separates the effects of individual initiatives and allows comparison of users of an individual initiative (6 to 30% of firms) to non-users of that initiative.

Concurrent changes in the organization are partially addressed through identifying and controlling for use of other initiatives and prior performance. Controlling for the moderating effects of length and breadth of implementation is addressed by inclusion of time since first use and the use of a 7-point Likert scale measuring extent of use.

Because differing operationalizations of return measures systematically affect regression coefficients of explanatory variables (Capon et al. 1990), multiple measures are used to increase internal (Simon and Burstein (1985) and external validity (Cook and Campbell 1979). The ratios selected for use in this study are change in return on investment (ROI) and, of particular interest to the motor carrier industry, change in operating ratio.

Return on investment (ROI). The most common investment center performance measure is return on investment (ROI) (Hilton 1994). ROI, defined as after tax net income scaled by total assets is generally accepted as a financial performance variable in empirical research. Six studies that recently attempted to measure improvement in financial performance resulting from the implementation of JIT (Balakrishnan et al. 1996; Biggart 1997; Boyd 1996) and TQM (Dixon 1996; Engelkeyer 1991; Easton and Jarrell 1995) have operationalized financial performance through the use of ROI as defined above. Furthermore, previous research shows a high correlation between ROI and other profitability measures (Prescott et al., 1986) and suggests that ROI can be more readily available in business units than other measures (Jacobson 1987).

Operating ratio (OR). The most standard measure of profitability in the trucking industry is the operation ratio (TTS 1996). The operating ratio measures the portion of operating revenue that goes to cover operating expenses:

$$\text{Operating Ratio} = \frac{\text{Operating Expenses}}{\text{Operating Revenues}} \text{ X } 100$$

Operating expenses are those expenses directly associated with the transportation of freight and exclude non-transportation expenses and interest costs. Operating revenues are the total operating revenues generated from freight transportation; non-transportation revenues are excluded. Motor carrier operating ratios usually range between 93 and 96. An indication of the importance placed on this ratio is that the operating ratio has often been used by motor carriers to support a rate increase before the ICC (the closer the ratio

is to 100, the more indicative of the possible need to raise rates to increase total revenues).

TTS Blue Book of Trucking Companies

Archival dependent variable information is obtained from the *TTS* database. The *TTS Blue Book of Trucking Companies* is published by Transportation Technical Services, Inc., New York (TTS), a sister company of the Central Analysis Bureau (CAB). CAB has assisted U.S. based insurance underwriters in financial analysis of motor carrier for over 55 years. The *Blue Book* reflects important data items from 2,100 U.S. motor carrier annual reports, plus state reported data. Other publications of TTS include *the Private Fleet Directory* (with profiles of 25,000 fleets), the *National Motor Carrier Directory* (22,000 carriers), the *TTS Blue Book Quarterly*, the *Mexican Motor Carrier Directory* (350 carriers), *Canadian Motor Carrier Directory* (1,800 carriers), the *TTS Contract Carrier & Routing Directory* (2,400 carriers), and the *Directory of Shippers* (9,000 shippers and 700 military installations).

The majority of *Blue Book* data is extracted from annual reports called Form M that carriers file with the Interstate Commerce Commission (ICC). This forms requires use of standardized accounts defined in the *Uniform System of Accounts for Motor Carriers of Property* published by the American Trucking Associations, Inc. *Blue Book* data does not represent industry totals because small carriers (revenues less than $3 million) are not required to file financial reports with the Interstate Commerce Commission. In addition, although some carriers may have grown to over $3 million in revenues, the ICC may have not officially reclassified them. Also, a few companies may have not filed reports by the publication deadline.

Independent and Control Variables

Variables of interest (AWC, PWS, EDI, ABC, TQM, BPR, STS). The variables of interest measure use of initiatives. Cross-sectional survey data are collected regarding the extent of use (diffusion) of initiatives at the survey date (mid-1997), and also the year that use began. The variables are developed from 7-point Likert scale responses to a survey item (III-3) introduced as "How much do you avoid or use the following competitive tactics to realize your competitive strategies?" In addition, respondents are asked the year of beginning of use of each initiative.

Realization of the expected relative advantages of an innovation occur as it is implemented on a wide-spread basis within, or diffused throughout an organization. Diffusion of an innovation takes time to effect. According to the theories of diffusion of innovation, diffusion of these initiatives should occur in an organization in a non-linear manner (Kwon and Zmud 1987). Rogers (1983) suggested that diffusion of an innovation occurs as in an S-shaped curve. As an organization moves up the S-curve, a greater number of individuals and units will have adopted the components of the innovation until a saturation point is reached on the upper plateau of the 'S'.

In this study, change in financial performance is measured over a fixed five year period of time, i.e., change from the end of fiscal year beginning in 1991 to 1996. Using fixed points in time allows control for macroeconomic and industry-specific factors that affect all firms equally. Some firms were already using, and presumably receiving financial benefit from initiatives at the beginning of the measurement period. Others began use during the period. To determine the change in performance attributable to each

initiative over the measurement period, allowance must be made for the period during which benefits could not have been received. A simple interaction between time and current diffusion would imply assumption of a linear, rather than a more appropriate S-shaped curve. Transformation of data to the form of the cumulative probability function of a normal distribution (cdf)[7] allows simulation of the hypothesized S-shaped curve of diffusion as demonstrated in Figure 3-1. Setting the mean of the probability distribution function (pdf) as five years and the standard deviation as two years allows assumption of a strongly sloping 'S' over the three to seven year interval and a plateau exceeding ten years that is consistent with prior research (Husan and Nanda 1995; Dusseau 1996). The measure of probable initiative efficacy is the weighted average diffusion percentage as simulated by the cdf. Accordingly, calculation of the variables of interest, the levels of diffusion of initiatives used the following algorithm:

$$DIFFusion_i = \%RELativeDIFFusion_i \text{ X extent of } USE_i \text{ in current year}$$

where

DIFF is the scaled diffusion of an initiative from beginning to end of test period

RELDIFF is the relative diffusion for a given period since implementation as modeled by the cdf with mean 5 years and standard deviation 2 years

USE is the seven-point measure of use of an initiative for a firm

[7] $1/(\sigma\sqrt{2\pi}) \int \exp[-1/2\sigma^2 (x-\mu)^2]$ where x = number of years since beginning of use of an initiative, $\mu = 5$ years and $\sigma = 2$ years.

For example, a firm that had implemented TQM in 1993 and was at a USE level of 6 at survey date would have been in use for 3 years and have a RELDIFF of 22%. Its DIFF for TQM would be 0.22 * 6 =1.32.

Control Variables

The implications of four control variables, firm SIZE and type of company (two variables – TL and LTL), and beginning LEVEL of performance are considered. SIZE and type have been demonstrated as important in previous work e.g., size -- Capon et. al. (1990), Fama and French (1992), and Bartov (1993); type of firm – Capon et al. (1990),Watts and Zimmerman (1986), Zmijewsli and Hagerman (1981) and Healy (1985) explaining cross-sectional variation in financial performance. Level of performance is included to provide control for the undesirable effects of "regression to the mean."

Company size (SIZE). The issue of company size is problematic. Anderson (1995a) concluded that implementation of initiatives is most likely to be disruptive if it occurs over a protracted period and disrupts familiar routines. Large, vertically integrated firms are more likely to have lengthy implementation processes that cause significant organizational disruption. However, Selto and Jasinski (1996) propose that, other than in some large companies that are well staffed, well trained, and well funded, there is not much evidence that ABC (and presumably other initiatives) are understood well enough to be designed or implemented successfully as a stand-alone system, let alone one that is integrated with strategy.

Although other research has failed to confirm that firm size moderates the relationship between JIT and nonfinancial performance measures (Inman and Mehra

1990; Manoochehri 1988; Gilbert 1990; Kaynak 1996), to forestall a missing variables issue, as in Kaynak (1996), sales is used to control for size. Because the research in the relationship between organization size and innovations suggests a curvilinear relationship (as size increases, innovation increases, but at a decreasing rate (Ettlie 1983; Kimberly and Evanisko 1981; Moch and Morse (1977), the firm size variable is measured as the natural logarithm of beginning of measurement period sales revenue.

Type of company (TL, LTL, specialized). Environmental variables, measured at the industry level, have a significant impact on firm performance (Capon et al. 1990). Georgantzas and Shapiro (1993) and Schroeder (1990) analytically demonstrate that industry type moderates the relationship between innovation and performance. The characteristics of the three types of service offered by carriers (TL, LTL, and specialized) in effect reflect three mini-industries. Because both financial performance and the efficacy of initiatives may vary with the type of service being offered, self-reported continuous variables measuring the percentage of total freight revenues attributable to each classification (TL and LTL, with specialized carrier the default) are included in the analysis (item I4 of the survey instrument). These variables provide control for differences in competitive environments, accounting practices, and other classification specific attributes that may impact performance.

Level of performance (LEVEL). As noted earlier, a firm's pre-adoption operating efficiency will influence its ROI response to the increased efficiency of initiative adoption. To control for the effects of mean reversion and survivor bias, beginning of test

period level of performance (ROI, or operating ratio) will be included as an independent variable. It is expected that the sign of the regression coefficient associated with this variable will be negative – performance will be drawn toward the mean – as demonstrated in Figure 3-2.

Survey Instrument and Procedures

The independent variable data (other than SIZE and LEVEL) used in this study are extracted from a 21-page instrument that is used to collect data intended for use both in this study and also for other in-depth analyses of the trucking industry. The instrument is based on a thorough review of prescriptive, conceptual, practitioner, and empirical motor carrier literature. Content validity is addressed by asking representatives of the trucking industry, industry experts, and a group of faculty experienced in management innovation and survey research to review the instrument for clarity and meaning. Modifications are made as appropriate.

Large survey techniques are used to collect initiative use data for two reasons. First is the volume of available data. Collection of a sufficiently large data set enhances the power of any significant findings. A large data set also enhances the external validity of the findings in an area that is receiving a considerable amount of attention from both researchers and practitioners. Secondly, information regarding the use of initiatives from archival sources such as the *Wall Street Journal Index* is not complete and, in particular, only includes those companies that have publicly released information regarding use of initiatives (Husan and Nanda 1995). Therefore, use of archival information results in a

mix of unidentified users and non-users as controls, thereby weakening the power of statistical testing.

In addition to the questions relating to use of initiatives and control variables described previously, additional information is gathered in the questionnaire relating to the characteristics of the firms and respondents, and for use in future analysis. Most of the questions are either close-ended and ask the respondent to rate or assess on a seven-point Likert scale, e.g., anchored by 1 = "Almost Always Avoid" and 7 = or "Almost Always Use" or to furnish specific numerical information, e.g., TL percent of total freight revenue.

As recommended by Young (1996), procedures prescribed by Dillman (1978) are followed to maximize response rates. Specific steps taken to strengthen this study include 1) pre-calling to obtain name of the CEO and to verify the mailing address, 2) sending a preliminary letter and brief summary of the project, 3) pre-calling to ask if CEO had any questions, 4) including a personalized cover letter, 5) promising to send a summary of results and a Technical Report 6) promising confidentiality, 7) including a stamped, self-addressed envelope for reply, 8) mailing a reminder letter at three weeks past initial mailing, and 9) mailing a reminder post card after seven weeks.

Population and Sample

The initial population for this study consisted of the 2,002 firms that reported to the Interstate Commerce Commission and were included in the *1995 TTS Blue Book of Trucking Companies*. In order to focus on companies of sufficient size to have an established set of practices for conducting business, the population is limited to those

companies that had at least thirty employees or $5 million in gross revenues. Presumably, these firms have well-developed systems that measure performance accurately and are sophisticated enough to properly implement and use new business initiatives. This constraint reduced the population by 383 and, as shown in Table 3-2, substantially increased the mean and median size of the sample companies above the industry average. For example, the 1996 mean (median) revenue of the sample was $70,944,000 (27,666,000) vs. $36,891,000 (8,321,000) for the 1,818 firms in the 1996 TTS database.

From the remaining 1,619 companies, 1,100 are randomly selected for inclusion in the study. Of these, six are eliminated because they are Canadian companies, two are unable to be contacted by telephone or letter, nine have gone out of business, and fourteen withdrew or refused to cooperate upon initial contact. The remaining 1,069 firms comprise the final sample. 332 responses were received yielding a response rate of 31.1 percent. Because of their larger size, the 332 sample firms represent 18.3% of the firms in the TTS database but contributed from 31% (equity) to 51% (ton-miles) of the aggregated totals. Of the 332 responses, 27 had incomplete data, primarily missing year of beginning use of initiatives. TTS data is available for 191 of the remaining responses for both 1996 and 1991. Sample selection and response are summarized in Table 3-3.

The median response time is fifteen days. Non-response bias is tested by comparing the median responses of the early responders (less than fifteen days) to those of late responders for statistical difference in responses. This test is based on Oppenheim (1966), who found late survey respondents are similar to non-respondents. Two-sample t-tests (using Satterthwaite's (1946) approximation for the degrees of freedom when variances are unequal), Wilcoxon 2-sample signed rank tests (Hollander and Wolfe 1973) in cases

where the assumption of normality is violated (Shapiro and Wilk 1965), and Pearson chi-square tests of proportions (binary variables, Feinberg 1983) are performed on the raw data and on the transformed variables. The tests reveal significant differences ($p<.05$) on six of the ninety-six variables (49 variables each for three-year and five year samples), somewhat more than the five that would be expected by chance. Later respondents tend to be older, to have more industry experience and to be associated with smaller companies. These firms also exhibit a slightly higher use of BPR.

It is not suprising that the non-response bias tests reveal some differences. For example, a possible explanation for the slower responses by older and more experienced respondents representing smaller companies is that the range of their responsibilities precludes a fast response.

As presented in Table 3-4, the median industry, company, and position experience of the full sample of respondents is twenty-five, seventeen, and nine years, respectively. Respondents averag fifty years of age, and ninety-six percent are of the rank of controller or officer (70% President , Owner, or CEO). The extensive experience and high rank of the respondents lend considerable credibility to the survey responses. Other demographic information collected indicated that ninety five percent of the respondents are male, fifty-seven percent have earned a Bachelor's degree, and seven percent have obtained professional certification (generally CPA or JD). Fifty-three percent indicate expertise in management, with marketing (12%), accounting (10%), and logistics (9%) the other leading responses. There is little variation between the responses of the full sample (n=332) and five-year (n=191) sample, furnishing evidence that little generalizability is lost because of the lack of available financial data.

Research Models

Hypothesis 1 posits that there is a positive association between use of initiatives and is tested with a binomial test of the number of firms using multiple initiatives against the number using one initiative. This test is supplemented with correlation analysis. Statistically significant positive correlations would indicate that firms tend to concurrently use the significant pairs in tandem.

The remaining hypotheses are tested with pooled cross-sectional multiple regression analysis of all firms. Hypothesis H2 posits that financial performance is positively associated with the use of the individual business initiatives, without controlling for concurrent use of multiple initiatives or for prior level of performance.

This hypothesis is tested with a simple model whereby each performance measure is regressed against one initiative at a time, and is analogous to Balachrishnan (1996) and Husan and Nanda (1995), and Kaynak (1996). Firm SIZE and type (TL, LTL) are included as control variables. There are two sets of seven regressions (two performance measures X seven initiatives) for each model.

$$PERF = \alpha + \beta_1 DIFF + \beta_2 TL + \beta 3 LTL + \beta_4 SIZE + \beta_5 LEVEL(\text{Model 2 only}) \qquad (1)\ \&\ (2)$$

where

PERF is the vector of two dependent measures of change in financial performance (ROI and Operating Ratio (OR), measured for period t (1996) minus t-5 (1991), regressed one at a time

and where

	Expected Sign
DIFF = is the vector of 7-point Likert measures of initiative use scaled by time since beginning of use, regressed one at a time	+

SIZE = the natural log of freight revenue of the firm for the period t-5, ?

TL = the self-reported % of freight revenue that is general freight truckload, ?

LTL = the self-reported % of freight revenue that is general freight less than truckload, ?

LEVEL= level of PERF for period t-5 -

Using methodology employed by Cheng (1998), significance of the median t-statistic of the initiative variables would provide confirmation of H2. Conditional confirmation of H2 is claimed for those initiatives that are significant in at least one of the models at the α=0.05 level. It is expected that the testing of H2 will yield positive results for at least some of the initiatives. Positive results could indicate that the use of the initiative results in improvement in performance. Alternatively, 1) companies that are successful for other reasons are implementing the initiatives, 2), the tested initiative is a proxy for the use of another, highly correlated initiative, and this highly correlated combination of initiatives affects financial performance, or 3) initiative use is correlated with prior performance and serves as a proxy for mean-reversion. To address explanation 3, LEVEL of prior performance is added in Model (2) to test the effect of initiative correlation with prior performance.

H3 addresses limitations 2 and 3 discussed above. It states that there is an association between use of each initiative and financial performance, requires testing of all initiatives simultaneously in a single set of two multiple regressions (one for each performance measure):

$$PERF = \alpha + \beta_1 AWC + B_2 PWS + \beta_3 EDI + B_4 ABC + \beta_5 TQM + B_6 BPR + B_7 STS + \beta_8 TL + \beta_9 LTL + \beta_{10} SIZE + \beta_{11} LEVEL \quad (3)$$

where Expected sign

AWC = a 7-point Likert measure of firm use of alliances with competitors

scaled by time since beginning of use (DIFF for AWC) +

PWS = a 7-point Likert measure of firm use of partnerships with suppliers scaled by time since beginning of use (DIFF for PWS) +

EDI = a 7-point Likert measure of firm use of electronic data interchange scaled by time since beginning of use (DIFF for EDI) +

ABC = a 7-point Likert measure of firm use of activity-based costing scaled by time since beginning of use (DIFF for ABC) +

TQM = a 7-point Likert measure of firm use of total quality management scaled by time since beginning of use (DIFF for TQM) +

BPR = a 7-point Likert measure of firm use of business process reengineering scaled by time since beginning of use (DIFF for BPR) +

STS = a 7-point Likert measure of firm use of satellite tracking systems scaled by time since beginning of use (DIFF for STS) +

If the median t-statistic of the initiatives is significant H3 is confirmed. Conditional confirmation of the hypothesis is claimed for those initiatives that are significant at the α=0.05 level. This model eliminates many of the limitations of previous research as reflected in model (1). Positive results indicate either that 1) companies that are successful for other reasons are implementing the initiatives, 2) the use of the initiative results in improvement in performance.

H4 posits that financial performance is positively associated with the synergy created by the use of multiple initiatives. To ascertain which initiatives create synergy, interactions of those initiatives with the highest concurrent use (Table 3-13) are added to model 3.

$$PERF = \alpha + \beta_1 AWC + B_2 PWS + \beta_3 EDI + B_4 ABC + \beta_5 TQM + B_6 BPR + B_7 STS + \beta_8 TL + \beta_9 LTL + \beta_{10} SIZE + \beta_{11} LEVEL + B_{12} ABC*TQM + \beta_{13} PWS*ABC + \beta_{14} EDI*TQM + B_{15} PWS*TQM + B_{16} ASTS*TQM + \beta_{17} PPWS*STS + \beta_{18} EDI*ABC + B_{19} BPR*TQM + B_{20} ABC*STS \quad (4)$$

Significance of a positively signed interaction term indicates that there is a synergy created from concurrent use of the two tested initiatives, i.e., there is an association with improvement in financial performance over and above that of the sum of the effects of the initiatives used in isolation.

STATISTICAL ANALYSIS

Descriptive Statistics

In this section are presented descriptive statistics regarding 1) the firms responding to the survey, 2) the firms' degree of use of new business initiatives, 3) descriptive statistics relating to the dependent and control variables used in further statistical analysis, and 4) correlations between use of individual initiatives. Because the distributions presented generally lack normality, with a small number of large firms dominating the means, both means and medians are presented.

Descriptive statistics relating to the responding firms are presented in Table 3-5. During 1996, the median (mean) responding firm had revenue of $27,666,000 (70,944,000), assets of 11,796,000 (36,146,000), equity of 4,469,000 (12,660,000) and hauled 290,786 (576,990) ton-miles of freight in 1996. It had income of 396,000 (535.900) and a ROI of 3.4% (1.5%). The mean percentage of truckload (TL) freight was 51.5%, with LTL accounting for 10.2%, and specialized carriage the remaining 38.3%. 62.2% of the total employees were unionized, and the median (mean) firm employed 70 drivers (678), fifteen owner operators (84), and 105 (1,839) other employees. Fifty-five

percent of the firms considered themselves to be at least super-regional in scope, with only seven percent considering themselves local carriers. 95% of the firms were corporations, but only 9% were publicly traded.

The reduced sample, where data is available for testing five-year (191) improvement in financial performance is remarkably similar to the full sample of (332). The proportion of TL business is slightly lower and number of employees higher (consistent with a higher proportion of non-TL business), but in other respects, there is little difference in firms characteristics. The similarity provides evidence that there will be little threat of survivor bias.

Descriptive statistics relating to the dependent and control variables used in statistical testing are presented in Table 3-6. The median (mean) change in ROI (operating ratio) is a slightly negative 0.2% for the five year period, reflecting the recent decline in profitability of the industry. However, operating ratio improved slightly, decreasing by 1.21. Firms were experiencing increased financing costs and other "non-operating" costs which are reflected in ROI, but not operating ratio. The median level of performance for 1991 was a 7% ROI, and a 98.4 operating ratio. Because the sample included somewhat larger and less TL oriented firms, this negative performance could indicate reduced profitability for those segments.

Table 3-7 presents statistics relating to the use of new business initiatives of both the full and reduced samples. Medians of the initiatives are generally four or five on a seven-point scale, indicating moderate use, (AWC is the exception with a median of two). When the use variables are scaled by the s-curve measurement of time, median scores (DIFF) are generally under one (the theoretical maximum is seven for firms with use of

seven and time implemented of over ten years). Because some firms reported substantial use over an extended period of time, mean scores are higher, varying from slightly under one to approximately two. Consistent with prior discussion, there is little difference between the full and reduced samples.

As reported in Table 3-8, 71% (100%-28.6%) of the respondents indicate that their firm "mostly" or "almost always" uses at least one initiative. Mean and median initiative use is approximately two initiatives, with TQM (30%) and ABC (28%) the most often referenced. Only 21% of firms use a single initiative in isolation. There appear to be a balance of numbers of users and non-users (control firms), both overall and of initiatives individually to provide the contrast necessary for adequate statistical testing power.

Regression Diagnostics

Multiple regression analysis is used to test hypotheses 2 through 4. Although many of the correlations between use of initiatives are statistically significant, regression diagnostics reveal no serious problems with multi-collinearity. The maximum condition index of 36 is slightly higher than the ideal 30 recommended by Belsley et al. (1980), but the maximum variance inflation factors of individual regressions are generally approximately 1.3, and in no cases exceed 3, well below the threshold of concern of 5. White's (1980) chi-square test is used to test the null of correct model specification and homoskedasticity. In no cases is the null rejected at the 0.10 level of significance. Analysis of the Durbin-Watson statistics indicates no misspecification of variables.

Influential Data Points

Influential data points, generally outliers with extreme values of the dependent variable, are identified through analysis of the R-student residuals. Outliers are expected because extreme observations of ratios (ROI and operating ratio) occur frequently relative to typical levels or change variables. Influential data points are addressed through an iterative process whereby a regression is run, the observation with the largest R-student residual (exceeding '3') is identified, investigated, and eliminated, and the regression re-run. This process results in the elimination of eight observations (4.1%) from the 5-year ROI sample and three observations (1.6%) from the operating ratio sample. As discussed later in the paper, sensitivity testing is performed whereby the values of the depended variables of the deleted observations are Winsorized to the 5^{th} or 95^{th} percentile of the sample and reinserted into the regression with little effect on the results.

Hypothesis Testing

Hypothesis 1 posits that there is a positive association between use of initiatives and is tested with a binomial test of the number of firms from the full sample of 332 respondents using multiple initiatives (164) against the number using one initiative (71). The test yields a Z test statistic of 6.132^{8}, $p<.0001$, prompting confirmation of H1. The correlation matrices portraying the univariate relationships between initiatives are presented as Table 3-9. For the raw 7-point use data, 71.4% of the relationships are significant at the $\alpha=0.05$ level with a maximum of 0.44 for TQM and BPR, and all relationships are positive. For the time-scaled measure, 66.7% are significant and

positive. Again TQM and BPR exhibit the highest correlation at 0.38. These correlations, along with the binomial test results provide confirmation of H1 and provide support for the supposition that use of an initiative may serve as a proxy for use of others.

Hypothesis H2 posits that financial performance is positively associated with the use of the individual business initiatives, without controlling for concurrent use of multiple initiatives or previous level of performance. The results of testing model (1) are shown in Table 3-10. The median coefficient and t-statistic values of the seven initiatives tested are .016 and 2.976, respectively for ROI ($p<.001$), providing strong confirmation of H2. Six of the seven initiatives (AWC is the exception) tested are significantly positively associated with improvement in ROI at the $\alpha=0.05$ level. This result is consistent with expectations but can be explained as either resulting from efficacy of the tested initiative or the initiative serving as a proxy for the use of other initiatives or for some other missing variable.

The median coefficient and t-statistic for operating ratio against the initiatives are .375 and 1.097 ($p< 0.136$), providing no confirmation of H2. Somewhat suprisingly, although all signs are of the expected positive sign, the only ABC and BPR are significantly associated with improvement in operating ratio. While ROI is a composite measure of overall financial performance, Operating Ratio is a more limited ratio of the profit margin portion of the Dupont decomposition of ROI (ROI = Profit Margin X Asset Turnover). It appears that the power of the test to detect the association is reduced because the benefits of initiatives are spread over both components of ROI.

---

[8] $Z_{+,Right} = (S_+ - 0.5 - .5n)/.5\sqrt{n} = (164 - .5 - 117.5)/(.5*\sqrt{235}) = 6.132$ where S_+ is number of firms using more than 1 initiative and n = 332 total firms – 93 using no initiatives = 235 firms.

When previous level of performance is included in the ROI model, the median t-statistic is reduced from 2.976 to 2.033 ($p< 0.021$), t-statistics are reduced for all significant variables of interest (except operating ratio on AWC), BPR becomes insignificant, and TQM becomes significant only at the 0.10 level. The median t-statistic increases slightly from 1.097 to 1.188 ($p< 0.117$, and only BPR remains a marginally significant ($p<.082$) predictor of operating ratio. Level of performance is highly significant ($p<.0001$) and of the expected negative sign.

To further understand the impact of previous level of performance, exploratory regressions of the overall use of initiatives are run against the control variables TL, LTL, SIZE and LEVEL. Prior level of performance is significant ($t = -3.777$, $p<.0002$) and negatively signed. The firms that tended to use initiatives are those that were performing relatively poorly five years earlier. In other words, it appears that, in general, poor performers tend to implement initiatives to improve their performance, while top performers appear to be more satisfied with the status quo rather than adopting initiatives.

H3 states that there is an association between use of each initiative and financial performance and is tested with model (3) which incorporates control for use of other initiatives and previous level of performance into model (1). The results of these regressions are presented as Table 3-11. The median t-statistic of the seven initiatives is 1.624 ($p<.0522$), PWS, EDI, and STS are significant at the $\alpha=0.05$ level and ABC has a p-value of $<.053$, providing confirmation of H3. TQM and BPR, which had significance in Model (1) are no longer significant ($p<.68$). Their association with improvement in performance appears to have been due to the concurrent use of other initiatives.

None of the initiatives are significant predictors of change in operating ratio at the $\alpha = 0.10$ level, a result consistent with the findings of the testing of Hypothesis 2. Because of this lack of significance, operating ratio will not be included in further analysis. In summary, the most important finding is that, for the ROI model, four of the seven initiatives have a positive association with improvement in financial performance separate from the effect of other initiatives.

Because poor performers tend to be the implementers of initiatives, it is not necessarily expected that initiative users will exhibit higher current performance. While initiatives are associated with improvement, users may move upward toward the industry mean, rather than above it. To investigate, 1996 level of ROI is regressed on the seven initiative variables, SIZE, TL and LTL. As expected, fewer initiatives are associated with current level of performance. EDI and ABC are significant predictors at the $\alpha=0.05$ level, but PWS and STS are not significant at conventional levels.

H4 posits that financial performance is positively associated with the synergy created by the use of multiple initiatives. Prior to formal hypothesis testing, exploratory analysis is performed with four regressions whereby 5-year change in ROI is regressed against summary measures of initiative use and the control variables SIZE, TL, LTL and LEVEL. The results of these analyses are reported in Table 3-12. Measures of use of single initiatives are combined into single indices of overall initiative use. As recommended by Babbie (1990), in the absence of compelling reasons for differential weighting, the practices are weighted equally. First, the sum of the 7-point measures of initiative USE is calculated for each firm and regressed. Secondly, each initiative's USE

is interacted with its TIME since implementation, summed for each company, and regressed.

$$PERF = \alpha + \beta_1 \Sigma USE \text{ or } \Sigma USE*TIME + \beta_2 TYPE + \beta_3 SIZE + \beta_4 LEVEL \quad (5a, 5b)$$

where		Expected sign
ΣUSE	= the firm-specific sum of the 7-point measures of use of each initiative	+
ΣUSE*TIME	= the firm-specific sum of the 7-point measures of use of each initiative scaled by TIME since implementation	+

Both USE and USE*TIME are highly significant in their respective regressions ($p<.001$, $t=3.031$ for USE, increasing to 3.573 for USE*TIME).

For the third (fourth) exploratory analyses (models 5a and 5b), binary (discrete) measures are created for heavy initiative use. If use of an initiative is reported as "6" or "7" on a 7-point scale, then that initiative is classified as heavy use. If a firm is a heavy user of one initiative, the binary variable USE=1 is set to "1". If a firm is a heavy user of more than one initiative, binary (discrete) variable USE>1 is set to "1" (the number of initiatives in heavy use).

$$PERF = \alpha + \beta_1 USE{=}1 + \beta_2 USE{>}1 + \beta_3 TYPE + \beta_4 SIZE + \beta_5 LEVEL \quad (6a,6b)$$

where		Expected sign
USE=1	= 1 if a firm has heavy use (6 or 7) of one initiative, 0 otherwise	+
USE>1	= 1 (4a) or number of initiatives in heavy use (4b) if number of initiatives in heavy use >1, 0 otherwise	+

In both analyses, the USE=1 variable is marginally significant at the $\alpha = 0.10$ level while USE>1 is highly significant at $\alpha = 0.001$. The results of the four analyses show clearly that in general, increasing use of initiatives is associated with improvement in

financial performance. It appears that, in general, there is weak evidence that firms obtain benefit from a single initiative and there is strong evidence that firms obtain benefit from increasing use of initiatives.

However, there is no evidence of a general synergy created from use of multiple initiatives. In analysis 4b, the coefficient of USE=1 is larger (.0280) than USE>1 (.0173), opposite of what would occur if there is an overall synergy.

To formally identify which initiatives are associated with positive synergy (H4), interactions of the nine initiatives with the highest concurrent use (Table 3-13) are added to model 2 for dependent variable ROI. The results are reported in Table 3-14. The model is somewhat improved over model (3) with an adjusted R^2 of .6741 versus .6599. The median t-statistic of the seven initiatives is reduced slightly to 0.761 from the 1.624 obtained for model (3). PWS, EDI and ABC retain their positive signs and relative significance levels, but the t-statistic of STS is reduced 1.794 to .761, indicating that its contribution arises from concurrent use with other initiatives. Of the nine interaction terms, PWS*STS and EDI*ABC are significant at α=0.05 (.003 and .025). Therefore, it appears there is a positive synergy created from concurrent use of these pairs of initiatives. Lack of significance of other pairs does not show that concurrent use is harmful, rather it can be interpreted that concurrent use is either harmful or there are diminishing returns from concurrent use.

Sensitivity Tests

As additional checks on the specifications of the models, equations (1) through (6) are re-estimated using 1) an alternative measure for change in ROI (three-year rather than

five-year change), 2) size (log of total assets as a substitute for log of revenue), 3) prior level of performance (four quartile continuous variables rather than a single continuous variable), 4) Winsorized outliers re-inserted into the models, 5) a linear rather than S-shaped transformation of time since beginning of use, 6) interaction terms for all combinations of the set of individually significant initiatives rather than frequency of use, and 7) binary variables of individual initiative use rather than continuous, time transformed variables. All models, except the model making use of binary variables are generally robust to these alternative specifications, and the mean of the initiative t-statistics changes minimally except as noted below for the three year model.

Three-year Model

The power of the 3-year ROI change model is slightly higher than the 5-year model, probably because 1) the sample size is increased to 238 firms due to more complete data availability, and 2) there is less noise from non-initiative factors. The median of the initiative t-statistics increases from 1.624 to 1.888 ($p< 0.029$) in model (3), and from 0.817 to 1.373 ($p<.085$) in model (4), adding strength to the confirmation of H3. ABC is significant at $\alpha=0.05$ in both models (3) and (4), without and with interactions respectively, where in the five-year model, it is significant at $\alpha=0.053$ and 0.057. Consequently, the p-value of the model (4) ABC*STS interaction deteriorates from 0.025 to 0.075. In addition, in models 5a and 5b, the significance of the USE=1 variables increases to $\alpha=0.05$ from $\alpha=0.10$.

Prior Level of Performance.

To further investigate mean-reversion, a continuous variable is created for each quartile of firms based on their previous level of performance. Use of these four continuous prior level of ROI variables yields expected evidence that the "collar" effect noted earlier is much stronger above the 75th and below the 25th quartiles of the sample and is not significant between the 50th and 75th percentiles (at α=0.05) in all models. There appears to be a strong mean reversion for only the extreme values of the sample. Substitution of these variables reduces the significance of STS to 0.503 in model 2 (it maintains a p-value of 0.038 in the 3-year model).

Outliers.

Inclusion of Winsorized outliers reduces the adjusted R^2 of all regression by approximately twenty percent. ABC becomes significant at α=0.05 in model (3) rather than at 0.053; PWS significance reduces to .0668 from .025. In model (4), the interactive terms, EDI, and ABC maintain their significance, but PWS is significant only at α = .0868 rather than .051 and STS, which had not been significant at conventional levels, became significant at .0885.

Time

When a simple linear (multiplicative) interaction of time and use of initiatives is substituted in model (3) for the S-curve transformation of time and use, R^2 decreases slightly from .680 to .664. PWS, EDI, ABC and STS remain significant, but the p-value of PWS and STS drop to .068 and .087 respectively (from .046 and .032). ABC improves slightly from 0.053 to under 0.050. Although transformation of the variable of interest

through use of an S-curve adds some strength, the benefits obtained may not be worth the costs of adding complexity to the model.

Interactions

All possible interactions (including three and four way) of the initiatives PWS, EDI, ABC, and STS that are significant in model (3) are substituted into model (4). As reported for the original model, interactions of PWS with EDI and PWS with ABC are significant. No other interactions are significant.

Binary Variables of Interest

Binary variables for each initiative are set to "1" if firms are heavy users and "0" otherwise and substituted into model 3. Rather than four initiatives (PWS, EDI, ABC, and STS) with significance at $p<.053$, only PWS at $p< 0.009$ and STS ($<.052$) remain significant at conventional levels. It appears important to obtain the information necessary to create variables capable of reflecting level and time of initiative use.

Binomial Test of 3-year Sample

Finally, an alternative test of H1 is performed through a binomial test of the three-year sample. The Z-statistic of 5.502 is highly significant, consistent with statistic of 6.132 obtained in the primary test.

SUMMARY & CONCLUSIONS

This paper investigates the use of new business initiatives in the motor carrier industry and the association of those initiatives with improvement in financial performance. Knowledge of the efficacy and synergy of business initiatives is of significant interest to three communities: 1) the practitioner community (including accountants, managerial decision-makers, potential project leaders, professional associations, and consultants) using, promoting, instructing in the use of, or contemplating the implementation of initiatives, 2) researchers contributing to the substantial theoretical and limited empirical literature regarding these initiatives, and 3) educators who communicate the commonly believed benefits and instruct in the use of initiatives.

This study focused on a single industry. Restricting to a single industry reduces noise, thereby increasing statistical power, and consequently provides a higher likelihood of identifying valid relationships. Some of the initiatives of critical importance to the motor carrier industry, e.g., STS and EDI, may be of less importance to other industries. Other commonly used initiatives such as JIT are not addressed because of their limited application to the industry. Research investigating other industries would complement the findings of this study.

Information regarding initiative use is collected from a sample of 332 firms. Use of initiatives is common in the industry, with 72 percent of firms reporting that they are heavy users of at least one initiative. Most firms use multiple initiatives. Only 21 percent use a single initiative in isolation. In general, poor performers tend to implement more initiatives, presumably because they feel the need to improve performance, while top performers presumably are more satisfied with the status quo. Consequently, initiative

use is a better predictor of change in financial performance than it is of level of financial performance.[9]

Archival financial information obtained for 191 of these firms from the TTS database is used to regress 5-year change in ROI against initiative use. Because the current study has several advantages over prior research, the ability to detect an association between financial performance and initiative use is enhanced. Six of the seven initiatives tested are significantly positively associated with improvement in ROI in an approach analogous to that used in prior research. An important finding is that after control for previous level of performance and for use of other initiatives, Partnerships with Suppliers, EDI, Satellite Tracking Systems and ABC remain as significantly associated with ROI improvement. The positive findings regarding ABC are of particular interest to practicing and academic accountants because they are often the primary proponents and administrators of ABC and all previous evidence of ABC efficacy has been theoretical or anecdotal.

There is empirical evidence that some synergies are obtained from concurrent use of initiatives, specifically of Partnerships with Suppliers and Satellite Tracking Systems and of EDI with ABC. However, more research is needed to explain how this effect occurs. It is interesting to note that both sets of initiatives demonstrating synergy contain a technology-based initiative (STS and EDI). Possibly, in the current highly competitive

[9] Because poor performers tend to be the implementers of initiatives, it is not necessarily expected that initiative users will exhibit higher current performance. While initiatives are associated with improvement, users may only move upward toward the industry mean, rather than above it. To investigate, 1996 level of ROI is regressed on the seven initiative variables, SIZE, TL and LTL. As expected, fewer initiatives are associated with current level of performance. EDI and ABC are significant predictors at the α=0.05 level, but PWS and STS are not significant at conventional levels.

environment, those firms that are best able to adapt are those that can successfully blend technology and sophisticated management initiatives.

It is possible that the improvement in performance results more from the introspection and internal and external communication that occurs whenever an initiative is implemented rather than results achieved from the mechanical application of the initiative. The strongest results are obtained for initiatives that aid in external communication – EDI and PWS have significant direct effects in all tests and contribute to positive synergy. Research that investigates the conditions under which improvement occurs and that identifies the components of financial performance that are impacted by initiative use would be of benefit.

It is instructive to note that, to maintain their position, the best performing firms must implement solutions to counter the "collar" effect that pulls their performance towards the mean. Although cause cannot be directly inferred from this study, there is evidence that the use of initiatives can help to offset this effect. However, use of the initiatives is more widespread among below mean performers. Firms tend to wait unit their performance deteriorates before implementing solutions – "If it ain't broke, don't fix it." A more proactive approach may prevent their performance decline.

Table 3-1
Empirical Research on Financial Performance and New Business Initiatives

Study	Journal/ Dissertation	Initiative	Primary Statistical Tools (3)	Sample Size	Dependent Variables: Measure (3)	Period	Levels/ Changes	Scale?	Type	Industry-Adjusted?	Archival/ Self-reported	Control Group	Control (8) for Previous Performance	Control for Other Initiatives	Other Controls
Dixon 1996	Dissertation Florida State	TQM	Princomp Regression	635	ROI (2)	NA	Levels	No	Continuous	No	Archival	No	No	No	No
Dusseau 1996	Dissertation	TQM	Regression (1)	5	FS	NA	Levels	Index	Continuous	Control (7)	Archival	Yes	No	No	No
	Missouri-Rolla	TQM	Plot	1	FS	NA	Levels	Index	Continuous	No	Archival	No	No		No
		TQM	Regression (1)	10	FS	12 Yr	Levels	Index	Continuous	Control (7)	Archival	Yes	No		No
Easton and Jarrell 1995	Working Paper Chicago	TQM	Regression	108 Pairs	ROA	1,2, 3-5avg	Changes	No	Continuous	Control (7)	Archival	Yes	N/A	No	No
Engelkeyer 1991	Dissertation Clemson	TQM	Princomp	9	ROI	Na	Levels	No	Continuous	No	Archival	No	No	No	No
Grandzol and Gershon 1997	American Society for Quality	TQM	LISREL	275	Finance Quality	NA	Changes	Scale	Continuous	No	Self	No	No	No	No
Balachrishnan et al. 1996	Accounting Review	JIT	Paired T	46 Pairs	ROI	3 years	Changes	No	Continuous	Control (7)	Archival	Yes	No	No	No
Biggart 1997	Dissertation Florida State	JIT	T, Sign	85	ROI	3 Years	Changes	No	Continuous	Yes	Archival	No	No	No	No
Boyd 1996	Dissertation Louisiana Tech	JIT	Regression	115	ROI, ROE	NA	Levels	No	Continuous	No	Archival	No	No	No	Time
Husan and Nanda 1995	JOM	JIT	3SLS	55	EPS	4 Years	Changes	No	Continuous	(6)	Archival	No	No	No	No
Kinney and Wempe 1998	Working Paper Texas A & M	JIT	Paired T, Sign	186 Pairs	ROI	0-3 Years	Changes	No	Continuous	Control (7)	Archival	Yes	No	No	No
Kaynak 1996	Dissertation North Texas	TQM/JIT (4)	Regression (Hierarchical)	214	Fin & Market Performance	1 Year	Composite (Both)	Scale	Continuous	Some	Self	No	No	No	Size, Type Time
Shields 1995	JMAR	ABC	Descriptive	143	Success	NA	NA	No	7-point	No	Self	No	N/A	No	No
			Correlation		Fin. Benefit	NA	NA	No	Binary	No	Self				
Swenson 1995	JMAR	ABC	Correlation	60	Satisfaction	Na	Levels	No	4-point	No	Self	No	N/A	No	No
Cagwin 1999 (Current Study)	Dissertation Arkansas	7 Initiatives	Regression	191-332	ROI	5 Yr 3 Yr	Changes	No	Continuous	Yes(6)	Archival	No	Yes	Yes	Size Type

1 = 2nd Order Regression
2 = Weighted average of four years weighted toward fourth year.
3 = Other methods or measures may have been used; disclosed are those that most closely pertain to this research
4 = JIT Purchasing
5 = Intersection of National Association of Purchasing Management and American Society for Quality Control
6 = Indirectly by including industry exogenous variables in prediction of endogenous variables
7= Control firms matched on industry and other criteria
8= Or include previous level of dependent variable in control group selection.
9= Study was of a single industry - for-hire motor freight
FS = Financial Strength, an index of liquidity, leverage and performance variables based on Kristy (1991)
JMAR = Journal of Management Accounting Research
JOM = Journal of Operations Management
? = Not disclosed in paper

Table 3-1
Empirical Research on Financial Performance and New Business Initiatives (Cont'd)

	Variables of Interest					
Study	**Measure**	**Respondents**	**Limits**	**Scale?**	**Results**	**Weaknesses & limitations**
Dixon 1996	Survey	QA/QC mgrs	ISO-9000	Scale	Inconclusive	Use of Levels; not industry-adjusted no controls
Dusseau 1996	Interview Interview NA	? ? ?	Miss Qual Award Case Study Public Baldrige	Scale NA NA	Inconclusive Inconclusive Inconclusive; Performance deteriorates in short-term, improves in long-term (5+ years)	Sample size
Easton and Jarrell 1995	Telephone Interview	QA Senior Mgr	Text/ValueLine Compustat	Tertiary	TQM positively associated with variance from analyst forecast	TQM definition very broad Control group weak
Engelkeyer 1991	Survey	Top ranking	Electronic Circuits	Scale	Inconclusive	Sample size; levels; no controls
Grandzol and Gershon 1997	Survey	Senior Site Managers	Navy Contractors	Scale	Continuous improvement = financial quality through operational quality	Data mining; definition of "financial quality"
Balachrishnan et al. 1996	Annual Report/10k	NA	< SICs	Binary	Inconclusive; firms with low customer concentration benefit	Binary independent; rely on public info;
Biggart 1997	Lexis/anecdotal	NA	Compustat, Users	Binary	Inconclusive	Binary independent, No controls
Boyd 1996	Survey	?	Compustat? 3 Industries	Scale	Inconclusive	Levels variables; no controls
Husan and Nanda 1995	WSJ Index Anecdotal	NA	Compustat	Binary	JIT positively associated	Control for other;control for pre-JIT performance; Emphasis on inventory
Kinney and Wempe 1996	Lexis MD&A Anecdotal	NA	Compustat	Binary	JIT positively associated	Control for other;control for pre-JIT performance;Rely on public info
Kaynak 1996	Survey	Quality Mgrs	NAPM, ASQM (5)	Scale	Together make a difference	Doesn't separate; self-reported; dependent measure not pure; period
Shields 1995	Survey	80% Controllers 100% Involved	ABC Users	NA	Diverse and Moderate 75% Yes; Correlation of .53 with success	Self-reported; vagueness of dependent
Swenson 1995	Interviews	Controllers, Managers	Users, Manufacturers	4-point	Higher satisfaction after ABC	Sample size; dependent variable
Cagwin 1999 (Current Study)	Survey	Top Mgmt	$5 million revenu or 30 employees	7-point & time	Several initiatives significant; some synergy; Controls necessary	Study restricted to trucking industry

1 = 2nd Order Regression
2 = Weighted average of four years weighted toward fourth year.
3 = Other methods or measures may have been used; disclosed are those that most closely pertain to this research
4 = JIT Purchasing
5 = Intersection of National Association of Purchasing Management and American Society for Quality Control
6 = Indirectly by including industry exogenous variables in prediction of endogenous variables
7= Control firms matched on industry and other criteria
8= Or include previous level of dependent variable in control group selection.
9= Study was of a single industry - for-hire motor freight
FS = Financial Strength, an index of liquidity, leverage and performance variables based on Kristy (1991)
JMAR = Journal of Management Accounting Research
JOM = Journal of Operations Management
? = Not disclosed in paper

Figure 3-1
S-Shaped Curve

Diffusion of an initiative takes place over time in the shape of an S-shaped curve
An S-shaped curve is appropriately modeled as a cumulative probability function (cdf)

Use Year	% Annual Relative Change in Diffusion (pdf)	RELDIFF % Relative Diffusion At End Of Year (cdf)
-1	0%	0%
0	1%	1%
1	3%	4%
2	6%	10%
3	12%	22%
4	18%	40%
5	20%	60%
6	18%	77%
7	12%	89%
8	6%	96%
9	3%	99%
10	1%	99%
11	0%	100%
12	0%	100%
13	0%	100%
14	0%	100%
15	0%	100%
16	0%	100%
17	0%	100%
18	0%	100%
19	0%	100%
20	0%	100%
Total	100%	
Mean (years)		5
Variance		4
Std. deviation		2

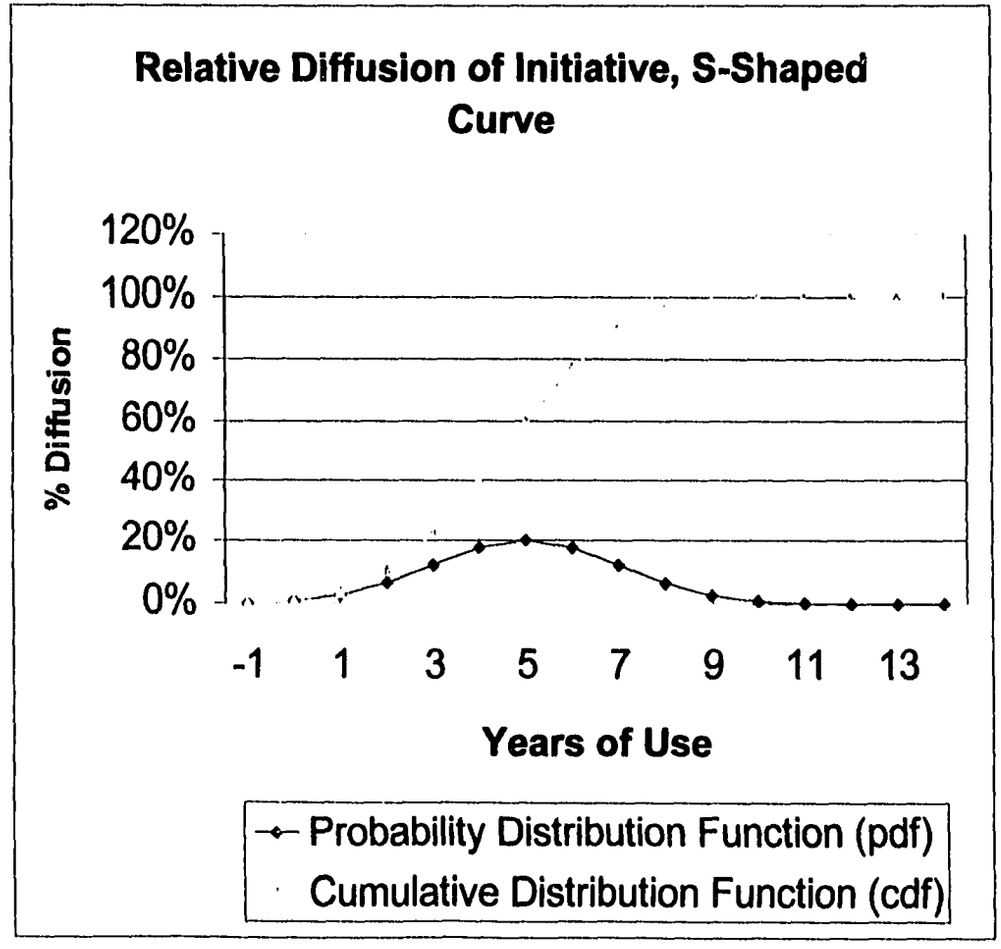


Figure 3-2
Sign of Coefficient of LEVEL Variable

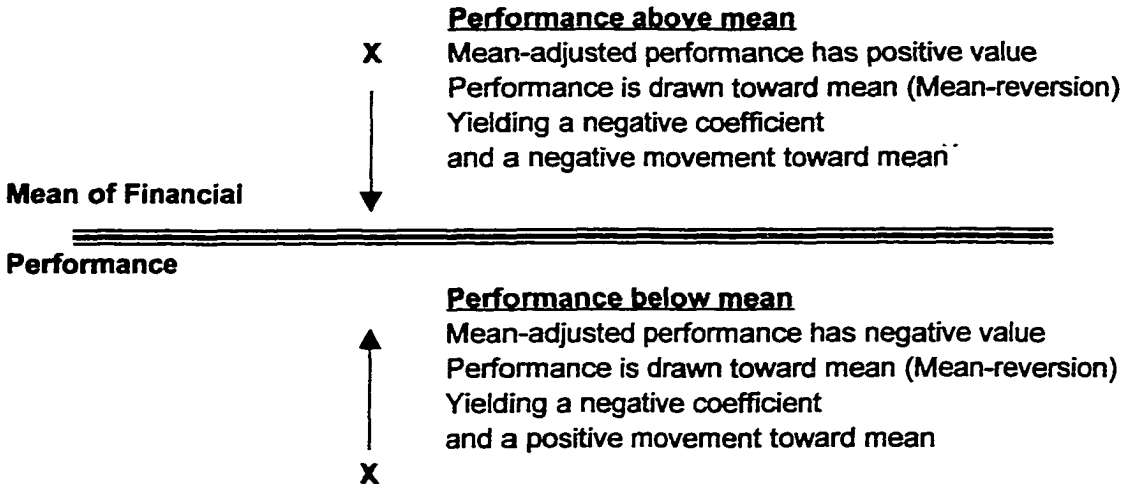


Table 3-2
Descriptive Statistics
Comparison of Responses to Industry Averages
(000s)

	All TTS Firms (n=1818)						Full Sample of Survey Responses (n=332)						Sample % of
	n	Mean	Median	Min	Max	Std. Dev.	n	Mean	Median	Min	Max	Std. Dev.	Total*
Revenue	1,818	36,891	8,321	83	11,951,947	318,326	332	70,944	27,666	1,942	2,052,121	172,387	35.1%
Net Income	1,818	536	97	(74,257)	291,347	7,672	332	536	396	(58,501)	34,557	6,187	18.3%
Assets	1,818	17,231	2,918	(1,673)	4,442,651	126,263	332	36,146	11,796	31	1,027,648	93,757	38.3%
Equity	1,818	7,405	1,074	(7,070)	2,953,213	77,207	332	12,660	4,469	(6,802)	280,102	28,950	31.2%
Ton-Miles (000)	2	207	61	0	16,076	739	0	577	291	2	16,076	1,230	50.8%

* Percentage of total TTS (industry) revenue, net income, etc., accounted for by responding firms.

Table 3-3
Summary of Sample

Initial Population		2,002	
Less: Firms with Less than Thirty Employees or $5million in Revenues		383	
Population of Interest		1,619	
Random Selection		1,100	
Less: Canadian Companies	6		
Undeliverable	2		
Out of Business	9		
Withdrew or Refused to Cooperate Upon Initial Contact	14	31	
Net Responses Possible		1,069	
Responses Received		332	
Response Rate			31.1%
Less: Year of beginning use of initiatives incomplete	27		
Data from 1991 unavailable	114	141	
Final Sample		191	

Table 3-4
Descriptive Statistics
Characteristics of Respondents

	Full Sample				Five Year Sample			
	n	Mean	Median	Std. Dev.	n	Mean	Median	Std. Dev.
Experience (Years)								
Industry	329	25.8	25	11.2	189	25.5	25	11.2
Company	328	18.8	17	11.6	189	18.7	17	11.8
Job	327	11.5	9	9.6	189	11.2	9	9.2
Age	325	49.4	50	9.4	188	49.4	49	9.8

Title	#	%	Cum. %	#	%	Cum. %
President/CEO/Owner/Chmn	227	69.6%	69.6%	135	72.2%	72.2%
VP/Officer	57	17.5%	87.1%	33	17.6%	89.8%
General Manager/VP & GM	23	7.1%	94.2%	12	6.4%	96.3%
Controller	6	1.8%	96.0%	2	1.1%	97.3%
Other	13	4.0%	100.0%	5	2.7%	100.0%
	326	100.0%		187	100.0%	

Education	#	%	Cum. %	#	%	Cum. %
Graduate Degree	45	13.8%	13.8%	25	13.3%	13.3%
Some Grad School	26	8.0%	21.8%	16	8.5%	21.8%
College Degree	115	35.3%	57.1%	68	36.2%	58.0%
Some College	94	28.8%	85.9%	55	29.3%	87.2%
High School or GED	40	12.3%	98.2%	21	11.2%	98.4%
Some High School	6	1.8%	100.0%	3	1.6%	100.0%
	326	100.0%		188	100.0%	

Certification	#	%	Cum. %	#	%	Cum. %
CPA	15	4.6%	4.6%	5	2.7%	2.7%
JD	5	1.5%	6.2%	3	1.6%	4.3%
CMC	3	0.9%	7.1%	2	1.1%	5.4%
CSP	1	0.3%	7.4%	0	0.0%	5.4%
None	301	92.6%	100.0%	175	94.6%	100.0%
	325	100.0%		185	100.0%	

Sex	#	%	Cum. %	#	%	Cum. %
Male	311	94.8%	94.8%	178	94.7%	94.7%
Female	17	5.2%	100.0%	10	5.3%	100.0%
	328	100.0%		188	100.0%	

Area of Expertise*	#	%	#	%
Accounting	45	9.8%	25	9.5%
Finance	30	6.6%	17	6.4%
Management	244	53.3%	141	53.4%
Engineering	8	1.7%	5	1.9%
Info Systems	5	1.1%	4	1.5%
Law	13	2.8%	8	3.0%
Logistics	40	8.7%	28	10.6%
Marketing	56	12.2%	27	10.2%
Other	17	3.7%	9	3.4%
	458	100.0%	264	100.0%

* More than One Response Was Possible

Table 3-5
Descriptive Statistics
Characteristics of Responding Firms - Full Sample vs Reduced Samples

	Full Sample					Five Year Sample				
	n	Gran	Mean	Median	Std. Dev.	n	Grand	Mean	Median	Std. Dev.
Size (000s)										
Revenue	332		70,944	27,666	172,387	191		84,587	28,020	219,728
Assets	332		36,146	11,796	93,757	191		44,691	11,598	120,120
Equity	332		12,660	4,469	28,950	191		15,226	4,522	35,913
Ton-Miles	297		576,990	290,786	1,229,846	170		629,788	276,988	1,537,699
Financial Performance (000s)										
Net Income	332		535.9	396.0	6,187.2	191		316.7	396.0	7,111.3
ROI	332	0.015	(0.151)	0.034	3.270	191	0.007	(0.217)	0.033	3.861
Operating Ratio (Self-Report)	273	94.0	94.8	95.6	5.76	164	94.0	94.9	96.0	6.0
Type (%)										
TL	332	51.5	51.3	50.0	44.4	191	45.6	44.9	20.0	44.9
LTL	332	10.2	13.4	0.0	29.5	191	11.6	15.5	0.0	32.2
Specialized	332	38.3	35.3	0.0	44.2	191	42.8	39.5	0.0	45.9
Employees										
Union %	318	62.2	10.1	0.0	27.6	182	65.6	11.6	0.0	28.9
Drivers	309		678	70	5,568	178		1,110	80	7,315
Other Employees	309		1,839	105	19,510	180		3,055	120	25,522
Owner Operators	321		84	15	263	184		110	19	332
Scope of Business			#	%	Cum. %			#	%	Cum. %
International			32	9.9%	9.9%			24	13.0%	13.0%
National			104	32.2%	42.1%			56	30.3%	43.2%
Super Regional			42	13.0%	55.1%			23	12.4%	55.7%
Regional			122	37.8%	92.9%			72	38.9%	94.6%
Local			23	7.1%	100.0%			10	5.4%	100.0%
			323	100.0%				185	100.0%	
Ownership Structure			#	%	Cum. %			#	%	Cum. %
Publicly Traded			27	8.7%	8.7%			22	12.4%	12.4%
Privately Held Corporation			252	81.3%	90.0%			143	80.3%	92.7%
Sole Proprietorship			17	5.5%	95.5%			6	3.4%	96.1%
Partnership			10	3.2%	98.7%			5	2.8%	98.9%
Other			4	1.3%	100.0%			2	1.1%	100.0%
			310	100.0%				178	100.0%	

Mean is mean of individual firm means which is greatly affected by outliers; grand mean is mean of overall sample

Table 3-6
Descriptive Statistics
Dependent and Control Variables

	n	Grand	Mean	Median	Min	Max	Std. Dev.
ROI							
PERFroi	191		0.008	(0.002)	(1.328)	0.646	0.205
Level, t-5	191		0.019	0.070	(0.631)	0.752	0.149
Operating Ratio							
PERFor	191		(1.143)	(1.210)	(27.100)	26.890	7.603
Level,t-5	191		98.345	98.400	75.200	119.500	5.526
Type (%)							
TL	191	45.6	44.9	20.0	0.0	100.0	44.9
LTL	191	11.6	15.5	0.0	0.0	100.0	32.2
Size							
LN (REV)	191		10.466	10.241	8.576	14.534	1.053
LN (ASSET)	191		9.565	9.359	7.095	13.843	1.298

Table 3-7
Descriptive Statistics
Characteristics of Responding Firms; Use of Initiatives
7-point Likert scale (1-7)

	Full Sample				Five Year Sample			
	n	Mean	Median	Std. Dev.	n	Mean	Median	Std. Dev.
Alliances with Competitors (AWC)	332	2.90	2	1.85	191	2.91	2	1.87
Partnerships with Suppliers (PWS)	332	4.25	5	1.75	191	4.31	5	1.69
Electronic Data Interchange (EDI)	332	4.24	5	1.77	191	4.37	5	1.74
Activity-Based Costing (ABC)	332	4.30	5	1.85	191	4.41	5	1.83
Total Quality Management (TQM)	332	4.42	5	1.81	191	4.57	5	1.75
Business Process Re-Engineering (BPR)	332	3.61	4	1.71	191	3.69	4	1.75
Satellite Tracking Systems (STS)	332	3.69	4	2.19	191	3.89	4	2.22
ALLIANCE *TIME	332	0.95	0.1	1.72	191	0.89	0.1	1.73
SUPPLIER *TIME	332	1.93	0.5	2.36	191	1.93	0.5	2.38
EDI*TIME	332	1.41	0.5	1.92	191	1.68	0.5	2.07
ABC*TIME	332	1.70	0.2	2.31	191	1.87	0.5	2.40
TQM*TIME	332	1.71	0.5	2.20	191	1.94	0.5	2.36
BPR*TIME	332	0.78	0.2	1.53	191	0.82	0.2	1.60
STS*TIME	332	0.88	0.2	1.78	191	1.14	0.2	1.99

Table 3-8
Use of Innovative Business Practices

Business Initiative	Full Sample Number Using	Full Sample Percent (n=332)	Five-Year Sample Number	Five-Year Sample Percent (n=191)
Alliances with Competitors (AWC)	20	6.0%	13	6.8%
Partnerships with Suppliers (PWS)	75	22.6%	40	20.9%
Electronic Data Interchange (EDI)	62	18.7%	42	22.0%
Activity-Based Costing (ABC)	92	27.7%	58	30.4%
Total Quality Management (TQM)	100	30.1%	60	31.4%
Business Process Reengineering (BPR)	38	11.4%	27	14.1%
Satellite Tracking Systems (STS)	87	26.2%	60	31.4%

Number of Initiatives in Significant Use	0	1	2	3	4	5	7	8	Total
Responses (Full Sample)	93	71	59	43	35	19	4	1	325
Responses (Five-Year Sample)	53	34	33	28	19	16	3	1	187
% (Total)	28.6%	21.8%	18.2%	13.2%	10.8%	5.8%	1.2%	0.3%	100.0%
% (Five-Year)	28.3%	18.2%	17.6%	15.0%	10.2%	8.6%	1.6%	0.5%	100.0%

	All Initiatives Full	All Initiatives 5-Year
Mean Number of Initiatives	1.90	2.06
Median	2	2

Significant Use is defined as a response of at least 6 on a 7-point scale ("Mostly Use or Almost Always Use")

Table 3-9

Correlation Matrix of New Business Initiatives

7-Point Likert Measures of Use (Lower Left of the Diagonal) and Use Interacted with Time (Upper Right)

(Spearman Correlations)

7-Point Likert Measures of Use

	Alliances	Supplier	EDI	ABC	TQM	BPR	STS
Alliances with Competitors (AWC)	1.00	**0.22**	0.01	**0.17**	0.02	0.06	0.00
Partnerships with Suppliers (PWS)	-0.09	1.00	**0.16**	**0.21**	**0.28**	**0.22**	**0.25**
Electronic Data Interchange (EDI)	0.03	**0.18**	1.00	**0.27**	**0.33**	**0.25**	**0.19**
Activity-Based Costing (ABC)	**0.19**	**0.29**	**0.26**	1.00	**0.32**	**0.39**	**0.16**
Total Quality Management (TQM)	0.02	**0.33**	**0.23**	**0.31**	1.00	**0.44**	**0.20**
Business Process Reengineering (BPR)	0.07	**0.20**	**0.22**	**0.32**	**0.38**	1.00	**0.30**
Satellite Tracking Systems (STS)	0.00	**0.20**	**0.22**	0.09	**0.18**	**0.32**	1.00

Bold and Underlined = significant at the .01 level
Bold = significant at the 0.05 level
Underlined = significant at the 0.10 level

	Use Measure			Use-Time Measure		
	Total Possible	Number	%	Total Possibl	Number	%
Significant at 1%	21	13	61.9%	21	12	57.1%
Significant at 5%	21	15	71.4%	21	14	66.7%
Significant at 10%	21	15	71.4%	21	14	66.7%

Table 3-10
Models 1& 2, Hypothesis 2
Regression of ROI on Individual Initiatives
with Control for Size and Type of Firm

MODEL 1

	5-year Change in ROI Initiative			5-year Change in Operating Ratio Initiative		
Initiative	Coefficient	T-stat	p-value	Coefficient	T-stat	p-value
Alliances with Competitors (AWC)	0.004	0.431	0.333	0.290	0.896	0.186
Partnerships with Suppliers (PWS)	0.020	3.840	**0.000**	0.171	0.748	0.233
Electonic Data Interchange (EDI)	0.023	3.660	**0.000**	0.330	1.246	0.107
Activity-Based Costing (ABC)	0.016	2.976	**0.002**	0.389	1.719	**0.048**
Total Quality Management (TQM)	0.011	1.952	**0.026**	0.225	0.978	0.165
Business Process Re-Engineering (BPR)	0.029	3.667	**0.000**	0.918	2.736	**0.003**
Satellite Tracking Systems (STS)	0.014	2.048	**0.021**	0.300	1.097	0.137
Mean of Initiatives	0.017	2.653	**0.004**	0.375	1.346	*0.089*
Median of Initiatives	0.016	2.976	**0.001**	0.300	1.097	0.136

LTL, TL and SIZE are generally negative and always insignificant and the 0.10.level.

MODEL 2

With Control for Previous Level of Peformance

	Coefficient	T-stat	p-value	Coefficient	T-stat	p-value
Alliances with Competitors (AWC)	0.000	-0.091	0.928	0.306	1.403	0.162
Partnerships with Suppliers (PWS)	0.009	2.822	**0.003**	0.016	0.108	0.457
Electonic Data Interchange (EDI)	0.011	2.860	**0.002**	0.210	1.188	0.118
Activity-Based Costing (ABC)	0.008	2.352	**0.010**	0.175	1.154	0.125
Total Quality Management (TQM)	0.004	1.307	*0.096*	0.157	1.025	0.153
Business Process Re-Engineering (BPR)	0.004	0.793	0.214	0.321	1.395	*0.082*
Satellite Tracking Systems (STS)	0.008	2.033	**0.022**	0.228	1.254	0.106
Mean of Initiatives	0.006	1.725	**0.042**	0.202	1.075	0.141
Median of Initiatives	0.008	2.033	**0.021**	0.210	1.188	0.117

LTL, TL and SIZE are generally negative and always insignificant and the 0.10.level.
Prior Performance (ROI or Operating Ratio) at t-5 is always negative and highly significant.

Bold = significant at the 0.05 level
Italicized = = significant at the 0.10 level

Table 3-11
Model 3, Hypothesis 3
Regression of ROI on All Initiatives

n=191

	5-Year Change in ROI			5-Year Change in Operating Ratio		
Model F	33.099			21.998		
Model p-value	0.0001			0.0001		
R2	0.6804			0.5789		
Adjusted R2	0.6599			0.5526		
Initiative	Coefficient	t-stat	p-value	Coefficient	t-stat	p-value
INTERCEPT	-0.0144	-0.177	0.860	3.7977	0.989	0.324
Alliances with Competitors (AWC)	-0.0033	-0.671	0.749	0.3057	1.335	0.092
Partnerships with Suppliers (PWS)	0.0072	**1.981**	**0.025**	0.0613	0.355	0.361
Electonic Data Interchange (EDI)	0.0091	**2.336**	**0.010**	0.1337	0.720	0.236
Activity-Based Costing (ABC)	0.0059	**1.624**	**0.053**	0.1751	1.017	0.155
Total Quality Management (TQM)	-0.0015	-0.420	0.663	-0.0514	-0.296	0.616
Business Process Re-Engineering (BPR)	-0.0023	-0.418	0.662	0.1616	0.637	0.263
Satellite Tracking Systems (STS)	0.0073	**1.794**	**0.037**	0.1749	0.926	0.178
SIZE	0.0019	0.253	0.801	-0.3943	-1.107	0.270
TL	-0.0001	-0.411	0.682	-0.0124	-1.431	0.154
LTL	-0.0003	-1.048	0.296	-0.0050	-0.401	0.689
LEVEL	-0.9154	**-16.368**	**0.000**	-0.9989	**-14.723**	**0.000**
Mean of Initiatives	0.0032	0.889	0.187	0.1373	0.671	0.251
Median of Initiatives	0.0059	1.624	*0.052*	0.1616	0.720	0.236

Bold = significant at the 0.05 level
Italicized = significant at the 0.10 level

Table 3-12
Models 5 & 6, Hypothesis 4
Regression of 5-year Change in ROI on Extent of Use of Initatives

	Model 5a Use>5			Model 5b USE*TIME				Model 6a Dummies for Use			Model 6b Number in Use		
Model F	68.481			70.478				57.505			56.897		
Model p-value	0.0001			0.0001				0.0001			0.0001		
R2	0.6592			0.6657				0.6622			0.6598		
Adjusted R2	0.6496			0.6562				0.6507			0.6482		
	Coefficient	t-stat	p-value	Coefficient	t-stat	oefficient	p-value	Coefficient	t-stat	p-value	Coefficient	t-stat	p-value
INTERCEPT	0.0400	0.507	0.613	0.0249	0.317	-0.0003	0.752	0.0326	0.413	0.680	0.0401	0.508	0.612
sum of 7-point USE	0.0166	**3.031**	**0.001**										
Sum of USE*TIME				0.0037	**3.573**	0.0052	**0.001**						
USE=1 initiative (dummy)								0.0338	*1.561*	*0.060*	0.0280	*1.324*	*0.094*
USE>1 initiative (dummy)								0.0596	**3.279**	**0.001**			
USE>1 (number in use)											0.0173	**3.073**	**0.001**
SIZE	-0.0019	-0.265	0.792	-0.0015	-0.208	-0.0053	0.836	-0.0021	-0.286	0.775	-0.0023	-0.310	0.757
TL	0.0000	-0.116	0.908	0.0000	-0.263	0.0000	0.793	0.0000	-0.125	0.901	0.0000	-0.147	0.883
LTL	-0.0003	-1.279	0.202	-0.0003	-1.364	-0.0002	0.174	-0.0003	-1.299	0.196	-0.0003	-1.224	0.223
LEVEL	-0.9333	**-17.054**	**0.000**	-0.9175	**-16.720**	-0.782	**0.000**	-0.9419	**-17.458**	**0.000**	-0.9320	**-16.980**	**0.000**

Bold = significant at the 0.05 level
Italicized = significant at the 0.10 level

Table 3-13
Concurrent Use of Two Initiatives

			Full Sample				5-Year Sample		
Rank	Combination		Using Both	Possible*	%	% Rank	Using Both	Possible*	%
1	ABC	TQM	49	92	53.3%	3	29	58	50.0%
2	PWS	ABC	34	75	45.3%	6	20	40	50.0%
3	EDI	TQM	33	62	53.2%	4	21	42	50.0%
4	PWS	TQM	31	75	41.3%	8	17	40	42.5%
5	TQM	STS	30	87	34.5%	14	22	60	36.7%
6	PWS	STS	29	75	38.7%	11	16	40	40.0%
7	EDI	ABC	28	62	45.2%	7	20	42	47.6%
8	TQM	BPR	26	38	68.4%	1	19	27	70.4%
9	ABC	STS	24	87	27.6%	17	18	58	31.0%
10	ABC	BPR	21	38	55.3%	2	15	27	55.6%
11	EDI	STS	21	62	33.9%	15	16	42	38.1%
12	PWS	EDI	17	62	27.4%	18	11	40	27.5%
13	EDI	BPR	15	38	39.5%	10	11	27	40.7%
14	BPR	STS	14	38	36.8%	12	13	27	48.1%
15	PWS	BPR	11	38	28.9%	16	7	27	25.9%
16	AWC	PWS	10	20	50.0%	5	7	13	53.8%
17	AWC	ABC	8	20	40.0%	9	7	13	53.8%
18	AWC	TQM	7	20	35.0%	13	5	13	38.5%
19	AWC	EDI	5	20	25.0%	19	4	13	30.8%
20	AWC	STS	5	20	25.0%	20	3	13	23.1%
21	AWC	BPR	3	20	15.0%	21	1	13	7.7%
			421	1049	40.1%		282	675	41.8%

*Smallest number of firms using the one of the two listed initiatives.

Table 3-14
Model 4, Hypothesis 4
Regression of 5-Year Change in ROI on Initiatives Including Interactions of Commonly Used Combinations of Initiatives

Model F	19.819
Model p-value	0.0001
R2	0.7099
Adjusted R2	0.6741

Variable	Coefficient	t-stat	p-value
Intercept	-0.0390	-0.485	0.629
Alliances with Competitors (AWC)	-0.0031	-0.597	0.725
Partnerships with Suppliers (PWS)	0.0074	***1.646***	***0.051***
Electonic Data Interchange (EDI)	0.0084	**1.968**	**0.025**
Activity-Based Costing (ABC)	0.0063	*1.587*	*0.057*
Total Quality Management (TQM)	0.0033	0.741	0.230
Business Process Re-Engineering (BPR)	-0.0024	-0.389	0.651
Satellite Tracking Systems (STS)	0.0035	0.761	0.224
ABC*TQM	-0.0530	-1.634	0.949
PWP*ABC	-0.0397	-1.141	0.873
EDI*TQM	-0.0181	-0.449	0.673
PWP*TQM	-0.0305	-0.806	0.790
STS*TQM	-0.0283	-0.835	0.798
PWP*STS	0.0957	**2.794**	**0.003**
EDI*ABC	0.0773	**1.981**	**0.025**
BPR*TQM	0.0024	0.072	0.471
ABC*STS	0.0055	0.158	0.437
SIZE	0.0040	0.534	0.594
TL	-0.0001	-0.518	0.605
LTL	-0.0002	-0.615	0.539
LEVEL	-0.9062	**-16.296**	**0.000**
Mean of Initiatives	0.0033	0.817	0.207
Mean of Interactions	0.0013	0.016	0.494
Median of Initiatives	0.0035	0.761	0.223
Median of Interactions	-0.0181	-0.449	0.673

Bold = significant at the 0.05 level
Italicized = significant at the 0.10 level

Chapter 4

The Association Between Activity-Based Costing and Improvement in Financial Performance: An Empirical Study

INTRODUCTION

In the 1990s, activity-based costing[1] (ABC) has been promoted as a basis for making strategic decisions (Kaplan and Norton 1992; Turney 1992) and improving profit performance (Cooper and Kaplan 1991b). In addition, as Kaplan (1990) predicted, ABC information is now widely used in organizations to assess continuous improvement and monitor process performance. Although ABC has found rapid and wide acceptance, there is significant diversity in opinions over the efficacy of ABC (McGowan and Klammer 1997) and a need for empirical research documenting the consequences of ABC implementation (McGowan 1998). Although managers stress that management accounting systems should pass a cost-benefit test (Foster and Young 1997), there still is not a significant body of empirical evidence to validate the alleged benefits of ABC (Shim and Stagliano 1997; McGowan and Klammer 1997).

The purpose of this study is to measure the improvement in financial performance that is associated with ABC use. The research instrument is a cross-sectional mail survey of 1,058 internal auditors, claimed (Tanju and Helmi 1991; Ray and Gupta 1992) to be knowledgeable and unbiased in the assessment of cost systems. Confirmatory factor

[1] The terms activity-based costing (ABC) and activity-based management (ABM) are sometimes used interchangeably. Strictly speaking, ABC refers only to the actual techniques for determining the costs of activities and outputs that those activities produce. Some researchers and practitioners prefer to use the term activity-based management (ABM) when they describe how the activity information is used to support

analysis and structural equation modeling (SEM) are used to test a model hypothesizing the conditions under which there is a positive association between a composite measure of the time-impacted use of ABC and a self-reported 5-point Likert measure of change in financial performance, a subsample of which is compared to actual reported financial performance. Control is provided for the moderating effects of concurrent use of other initiatives (e.g., TQM, JIT, etc.) and enabling conditions identified by prior researchers. Also provided are 1) tests of the association of improvement in financial performance with oucome measures of ABC efficacy -- satisfaction, success and financial benefit -- used in previous research (Shields 1995; Swenson 1995; Krumwiede 1996,1998b) and 2) a descriptive analysis of the use and interrelationships of use of ABC and other initiatives.

The study enhances previous research on ABC in five ways:

1) by using an unbiased, objective and knowledgeable source, internal auditors, to provide up-to-date measures of the extent of use of initiatives and the extent of concurrent use of multiple initiatives -- in contrast to prior research that has used respondents with a personal stake in ABC, such as controllers or ABC project managers, (e.g., Shields 1995; Swenson 1995; Krumwiede 1996, 1998b),
2) by overcoming a limitation of prior initiative research by specifically identifying non-users as control firms -- as opposed to testing without control firms (e.g., Swenson 1995; Shields 1995), or using a binary measure of implementation derived from archival sources, with selection of non-users as controls by default based on lack of

---

operating decisions. As in Swenson (1995), this study defines ABC very broadly to include activity-based costing and activity-based management.

public information regarding implementation (e.g., Balachrishnan 1996; Husan and Nanda 1995, Kinney and Wempe 1998),

3) by testing a specific measure of improvement in financial performance -- as opposed to unobservable general constructs such as perceptions of "success," "satisfaction," or "financial benefit,"

4) by testing a model synthesized from prior theoretical research, describing the conditions under which ABC should be successful, and,

5) by testing the association of the dependent variables satisfaction, success and financial benefit used in prior research modeling the determinants of success (Shields 1995; Swenson 1995; Krumwiede 1996, 1998b) with actual improvement in financial performance -- as suggested by Foster and Swenson (1997).

Findings include that 23 percent of firms report that they are significant users of ABC. The majority feel the implementation has been successful, worth implementing, and that the benefits exceed the cost. Positive synergies are obtained from concurrent use of initiatives with ABC. In addition, there is a positive association between ABC and improvement in ROI when implemented in complex and diverse firms, in environments where costs are relatively important, and when there are limited numbers of intra-company transactions to constrain benefits. There is also some indication that other enabling conditions (information technology sophistication, absence of excess capacity, and a competitive environment) affect the efficacy of ABC as expected and that some types of firms may obtain greater benefits. Finally, there is some evidence that measures of satisfaction with cost system, success of ABC, and financial benefit obtained from

ABC used in previous research (Shields 1995; Swenson 1995; Krumwiede 1996, 1998b) are predictors of improvement in financial performance.

Knowledge of the efficacy of ABC is of significant interest to three communities: 1) the practitioner community (including accountants, managerial decision-makers, potential project leaders, professional associations, and consultants) using, promoting, instructing in the use of, or contemplating the implementation of ABC, 2) researchers interested in the theoretical and empirical literature regarding ABC and other initiatives, and 3) educators who communicate the reputed benefits and instruct in the use of ABC.

The remainder of the paper is organized as follows. The next section relates background regarding ABC, situates this study in the context of past research. The following sections develop hypotheses, describe the methodology used including variable and model specification, sample selection and the survey instrument. Results, a summary and concluding remarks are presented in the final sections.

LITERATURE REVIEW

This study builds upon prior research 1) by modeling and documenting the benefits of ABC and 2) by measuring the improvement in financial performance achieved through the combined use of ABC and other business initiatives (TQM, JIT, etc.). Prior to review of the literature, a justification of use of financial performance measures is presented.

Importance of Financial (vs. Non-Financial) Performance Measures

Studying whether initiatives such as ABC are viable requires evaluations of outcomes, namely performance measures (Grandzol and Gershon 1997). It is important to measure the success of new initiative with measures of *financial* performance for two reasons: 1) most technologies and investments are justified on the basis of their impact on financial and accounting measures, not operational measures (Husan and Nanda 1995), and 2) financial performance measures are the only internally generated measures that *directly* reflect whether the company's strategy, implementation, and execution are generating wealth by contributing to firm value (Atkinson et al. 1995) as demonstrated by Edwards and Bell (1961) and Ohlson (1991, 1995).[2] Even though impacts of initiatives are not easily quantified (Husan and Nanda 1995), financial performance measures are the most important measures of the efficacy of these initiatives and serve as dependent variables in this study.

Activity-Based Costing (ABC)

ABC has received a great deal of attention as a cost management innovation that may provide more accurate product costs than traditional cost allocation methods (Drucker 1995; Turney and Stratton 1992; Cooper 1989; Johnson and Kaplan 1987). A review of the leading journals for practicing management accountants, *Management Accounting* and the *Journal of Cost Management* revealed that ABC accounted for 35 percent of the articles published over the period 1994-1996. Numerous proponents of ABC argue that its methods are necessary to trace overhead costs to cost objects, and thus

[2]Ohlson (1995) derives the value of the firm (P_t) as a function of its book value (y_t) plus the present value of expected future (to infinity) abnormal earnings (earnings (x_t) above cost of capital (r) times beginning book value): $P_t = y_t + \Sigma E_t [x_t - r\, y_{t-1}]_{t+\tau}$

properly account for batch and product-level costs (Cooper 1990), manufacturing complexity (Jones 1991), specialty product costs (Srinidhi 1992) and diverse business environments (Cooper and Kaplan 1988).[3] Many also recommend using ABC to support process improvement (Turney 1991) and to develop cost-effective product designs (Cooper and Turney 1989). Although ABC systems are most often associated with manufacturing companies, they can be applied in all types of organizations (Rotch 1990; Tanju and Helmi 1991).

The theories of diffusion of innovations (Kwon and Zmud 1987), transaction cost economics (Roberts and Silvester 1996), and information technology (Dixon 1996) suggest that organizations adopt an innovation such as ABC to obtain benefits that directly or indirectly impact financial performance measures. However, evidence of the benefits of ABC is largely restricted to theoretical models and anecdotal information obtained from case studies[4] and often related by practitioners. Empirical research on the efficacy of ABC has generally consisted of modeling the factors that lead to successful ABC systems (e.g., training, top management support) that rely on the potentially biased judgements of firm personnel that have a personal stake in that success (management accountants, accounting managers, controllers, and ABC facilitators or champions). Success is defined as use for decision making (Cotton 1993, Lukka and Granlund 1994, Innes and Mitchell 1995, Krumwiede 1996, 1998b), "satisfaction" with an ABC system

[3] An further indication of the theoretical acceptance of ABC comes from a 1996 survey by the Institute of Management Accountants (IMA) of companies that were upgrading their cost management systems. Some 49 percent of the companies surveyed were already using ABC-type systems (up from 41 percent from a similar survey in 1994). 54 percent of adopters were using ABC for decision making. Of the remaining 59 percent of the 1994 respondents that were using some method other than ABC for their cost management practices, almost one-third felt that they should be using ABC (IMA 1994). The respondents were members of the IMA Cost Management Group that consists of largely manufacturing companies.

[4] For examples, see Barnes (1991), Brimson (1991), Bruns and Kaplan (1987), and Harris (1990).

(McGowan and Klammer 1997) or cost system (Swenson 1995, Shields 1995), perceived "financial benefit"-- a dichotomous measure with no reference to the criteria of benefit (Shields 1995, Krumwiede 1996, 1998b), or other non-financial benefits (McGowan 1998). There has been no empirical evidence that demonstrates that ABC improves financial performance.

Other Initiatives

ABC is one of the set of new business initiatives including, for example, TQM (total quality management), JIT (just-in-time), BPR (business process reengineering), and FMS (flexible manufacturing systems). These managerial systems or system designs seem to be gaining an increasing foothold all over the industrialized/post industrial world (Granlund and Lukka 1998). In the last several years, researchers have made the first attempts to measure whether use of these initiatives is associated with financial performance, usually with limited success (see Table 4-1). Huson and Nanda (1995) find that JIT adopters have enhanced earnings per share after controlling for average industry unit costs, margins, turnover and employees per sales dollar. Kaynak (1996) finds that "financial and market" performance are enhanced for firms using both TQM and JIT purchasing. Easton and Jarrell (1995) find evidence that a very broadly defined TQM is associated with the variance between actual financial performance and that forecasted by Value-Line analysts. Kinney and Wempe (1998) report that JIT positively affects ROI in the three to four year period following JIT adoption.

Unfortunately, none of these studies include control for concurrent use of other initiatives and therefore the findings cannot be attributed specifically to single initiatives.

In addition, Kaynak's measure of performance is not truly a measure of financial performance, but a combination of level and change measures of financial and market factors (e.g., market share), and he relies on self-reported responses of potentially biased quality managers. Easton and Jarrell define TQM in a manner that includes initiatives and management practices other than TQM, and measure deviation from Value-Line forecast, which may or may not have incorporated subjective valuation of the initiative, rather than demonstrated improvement in financial performance. Husan and Nanda (1995) use a five-equation simultaneous equation that emphasizes JITs effect on inventory turnover and inventory turnover's effect on EPS, thereby ignoring JIT's effect on the level of non-inventory investment (Kinney and Wempe 1998). It is interesting to note that the virtually all of the effect identified by Kinney and Wempe (1998) occur in the year of "adoption," or as the authors state, the year of disclosure in MD&A.

Possible reasons for the limited success of most studies include:

1. Reliance on public sources of information to identify users and non-users. Non-users are typically defined as companies where there is no *public* discussion of adoption of the initiative (Balachrishnan 1996; Biggart 1997; Husan and Nanda 1995; Kinney and Wempe 1998). Consequently, many firms that adopt the initiative may be incorrectly classified as non-adopters because of the lack of public release of implementation information, thereby biasing against finding a distinction between groups; in addition, public announcement of adoption is not a reliable measure of the primary determinant of the efficacy of the innovation, the extent of diffusion throughout the organization,

2. Inadequate sample size because of the difficulty of identification of users that also release financial information (Dusseau 1996, sample size of 10; Balachrishnan 1996, 92; Biggart 1997, 85; Engelkeyer 1991, 9; Boyd 1996, 115).

Other limitations of previous studies include:

1. Reliance on responses furnished by potentially biased subjects to measure the variables of interest, primarily project managers and controllers (Dixon 1996; Shields 1995; Kaynak 1996; Easton and Jarrell 1995),
2. Failure to control for the effect of concurrent use of multiple initiatives.
3. Measurement of level, rather than change of financial performance (Dixon 1996; Boyd 1996; Engelkeyer 1991; Kaynak 1996). Use of levels is a weakness in that performance improvement after implementation is not accurately captured by an attained level of performance if the level was very low before implementation; conversely, high performers may have attained their level before implementation of the initiative. "Levels" are a limitation in that statistical significance of the initiative gives no information as to whether the use of the initiative occurred concurrently with a *change* in performance. Although an association between initiatives and levels of performance provides information regarding "best-practices," it provides no knowledge of the contribution of the initiative.

Extensions of Research in the Current Study

This study addresses the limitations of prior research on ABC and other initiatives by 1) testing a relatively large sample size of 204 firm business units (of 1.058 surveys mailed), 2) identifying users and specifically *non-users* of individual initiatives through

the survey, 3) using unbiased, objective and knowledgeable internal auditors rather than potentially biased controllers or project managers, 4) identifying and controlling for the concurrent use of multiple initiatives in 5) measuring change in a composite measure of financial performance.

HYPOTHESES

Direct Association of ABC with Change in Financial Performance

The arguments in support of ABC are generally based on the comparative advantage that firms can obtain from the superiority of information generated through ABC in comparison with that generated by traditional cost management systems. However, although ABC has strong theoretical underpinnings, Kaplan (1993) and other researchers caution practitioners that not every ABC system they design will benefit them. The issue of whether increasing use of ABC is directly associated with improvement in financial performance, without regard to firm and industry-specific environmental conditions has not been empirically tested, leading to the following hypothesis (in alternate form):

> **H1: There is a positive association between the extent of use of ABC and relative (compared to other firms in the industry) improvement in financial performance.**

Enabling Conditions Under Which ABC is Associated with Change in Financial Performance

Previous research (e.g., Pattison and Arendt 1994; Estrin et al. 1994; Cooper and Kaplan 1991a) has identified specific environmental conditions (complexity, competition, importance of costs, information system sophistication, presence of intra-company transactions and unused capacity) that affect the expectation of improvement from use of

ABC. Theory supports the proposition that, under appropriate enabling conditions, the improved costing of goods, activities and services leads to improved decision-making and therefore is associated with improved performance, leading to the following hypotheses (in alternate form):

H2a: The association between the extent of use of ABC and relative improvement in financial performance is positively impacted by the level of importance of costs.

H2b: The association between the extent of use of ABC and relative improvement in financial performance is positively impacted by the level of information technology sophistication.

H2c: The association between the extent of use of ABC and relative improvement in financial performance is positively impacted by the level of business unit complexity.

H2d: The association between the extent of use of ABC and relative improvement in financial performance is negatively impacted by the level of intra-company transactions.

H2e: The association between the extent of use of ABC and relative improvement in financial performance is negatively impacted by the level of unused capacity.

H2f: The association between the extent of use of ABC and relative improvement in financial performance is positively impacted by the level of competition.

Measures of ABC "Success" and Change in Financial Performance

Previous researchers (McGowen and Klammer 1997; Krunwiede 1996; Shields 1995; and Swenson 1995) have developed and tested theory regarding the determinants (e.g., top management support, training, use for decision-making, non-accounting ownership) of ABC "success." Success has been measured in various ways (Krumwiede 1998b). It has generally been operationalized by survey items specifically asking if

respondents believe that the system has been "successful" (Shields 1995), if they are "satisfied" with their cost systems (Swenson 1995), whether ABC has been "worth implementing" (Krumwiede 1996,1998b), or their level of satisfaction with the implementation of ABC (McGowan and Klammer 1997). Because the objective of ABC systems is usually to aid in decision-making and therefore improve financial performance, researchers have implicitly assumed that successful ABC systems lead to improved financial performance. However, the relationship between success and specific measures of financial performance has not been tested. In addition, in an examination of the effect of measuring ABC success in different ways, Foster and Swenson (1997) found pairwise correlations between success measures that were "sizably less than 1.00" (0.45 to 0.75). The current study tests the relationship of success with improvement in financial performance through the following hypothesis (in alternate form):

H3a: Relative (compared to other firms in the industry) improvement in financial performance of firms is positively associated with the level of "success" of ABC.

H3b: Relative (compared to other firms in the industry) improvement in financial performance of firms is positively associated with level of "satisfaction with the cost system."

H3c: Relative (compared to other firms in the industry) improvement in financial performance of firms is positively associated with the belief that ABC has been "worth implementing."

Rejection of the null hypotheses would provide evidence of the appropriateness of use of the construct "success" in ABC studies and would enhance the credibility of both this study and previous research by providing a tie between success and financial

performance. Inability to reject the null will cast doubt on the appropriateness of the use of success in measuring the viability of ABC.

MODEL DEVELOPMENT -- RESEARCH DESIGN

This section contains a detailed description of the primary research model, its constructs and the hypothesized relationships between constructs. The primary variable of interest is a construct derived from 19 measures of the use of ABC. These measures are transformed through a 6-point measure of time since beginning of use for decision-making to reflect the composite measure of general ABC efficacy that is used to identify the direct association between ABC and improvement in ROI (H1). This ABC measure is then interacted with an index of the use of other initiatives (TQM, JIT, etc.), constructs representing the enabling conditions that prior research posits facilitate the efficacy of ABC and the control variables SIZE and TYPE of firm. These final interactive measures reflect the probable efficacy of ABC in specific firm environmental situations (H2). The conceptual model is presented as Figure 4-1.

The section begins with a description of each of the variables contained in the research model and concludes with the hypothesized relationships between and among the variables. Capitalized terms are variables included in the research models (see Figure 4-1). The figure also includes the questionnaire items measuring each construct. The research instrument is included as Exhibit 1. Following this discussion of the primary model and variables used to test the first two hypotheses is a discussion of the model adaptations made to test H3.

Variables and Hypothesized Relationships

Most of the constructs used in this study are latent constructs composed of two or more manifest variables. Composite scores of multiple variables have the advantage of capturing more of a construct's multi-dimensionality than individual questions (Foster and Swenson 1997). Use of multi-item measures reduces the effect of random and measurement errors, and structural coefficients obtained are less biased than those obtained using manifest variables alone (Libby and Tan 1994).

Measures of Financial Performance

Financial performance measures indicate whether the company's strategy, implementation, and execution are contributing to bottom-line improvement. Typical financial goals have to do with profitability (Kaplan and Norton 1996). Testing financial performance poses significant measurement problems. For example, consider an obvious measure of financial performance, return on investment (ROI). Determining an appropriate methodology to measure ROI improvement is no minor issue. As Roberts and Silvester (1996) observe, numerous complications arise, including:

1. Determining the appropriate time period of study (does the profit improvement appear immediately, or by the end of some other period—for example one year, three years, or five years),
2. Modeling a company's "expected" profitability against which to compare realized profitability after an implementation,
3. Controlling for concurrent changes in the organization,
4. Controlling the length and breadth of implementation and integration of the initiative throughout the firm.

In selecting appropriate time periods to test, one must consider the offsetting effects of two factors: 1) previous research has posited (Shields 1995; Player and Keys 1995b; Easton and Jarrell 1995) that profit improvements are expected to grow over time so a relatively long window is probably necessary to yield results (because the organization may still be in a learning process and also may incur "start-up" costs that temporarily reduce profitability.). For example, the literature has indicated that at least five years are needed to experience the positive effects of JIT adoption (Boyd 1996); and in his field studies of TQM users, Dusseau (1996) found non-statistical indications that performance began to improve after a minimum of eight years.

However, 2) a longer window increases the effect of non-initiative factors on financial performance. Although research suggests that a longer period is appropriate to obtain maximum benefits, most previous empirical studies have opted to use a relatively short window of one to four years for testing, presumably to mitigate the effect of intervening events, (e.g., Kaynack used a one-year window, Balachrishnan (1996) and Biggart (1997) used three-year windows, Husan and Nanda (1995) tested over four years, and Kinney and Wempe (1998) tested over zero to three years).

Two measures of ROI are used to increase internal (Simon and Burstein 1985) and external (Cook and Campbell 1979) validity. Change in ROI is measured through a construct composed of three and five year manifest variables, with sensitivity testing provided over a five year period and the shorter three-year period commonly tested in other studies. In addition, time since beginning of use is a factor included in the index of expected ABC efficacy developed as the independent variable of interest.

In general, comparison of "expected profitability" requires either specification of control variables which describe the industry in which the firm operates, or alternatively the use of "industry mean-adjusted" measures. The underlying assumption is that firms in the same line of business share the same production technology, in terms of the production function, but cross-sectional variation between firms is created due to the use of differing management and control systems (Husan and Nanda 1995). As in Huson and Nanda (1995), Biggart (1997) and Balakrishnan (1996), comparison of expected profitability is addressed through mean-adjustment, specifically in this study by 1) obtaining industry mean-adjusted responses whereby respondents are asked the extent to which performance has improved "relative to other business units in your industry" and 2) as in Easton and Jarrell (1995) controlling for type of firm (manufacturing vs. non-manufacturing).

Concurrent changes in the organization are partially addressed through identifying and controlling for use of other initiatives. The moderating effect of length and breadth of implementation is accomplished by specifically identifying and incorporating time since implementation and the extent of use of ABC in the model.

To summarize the preceding discussion, the dependent variables, measures of improvement in financial performance are comprehensive, industry mean-adjusted change variables (gain scores), and are measured over three and five year windows. Control is provided for use of other initiatives and time and extent of use of ABC are incorporated in the model. The ratio selected for use in this study is change in return on investment (ROI).

Return on investment (ROI). The most common investment center performance measure is return on investment (ROI) (Hilton 1994). ROI is generally accepted as a financial performance variable in empirical research. Seven studies that recently attempted to measure improvement in financial performance resulting from the implementation of JIT (Balakrishnan et al. 1996; Biggart 1997; Boyd 1996) and TQM (Dixon 1996; Engelkeyer 1991; Easton and Jarrell 1995, Kinney and Wempe 1998) have operationalized financial performance through the use of ROI as defined above. Furthermore, previous research shows a high correlation between ROI and other profitability measures (Prescott et al. 1986) and suggests that ROI can be more readily available in business units than other measures (Jacobson 1987).

Industry mean-adjusted ROI is measured by the self-reported 5-point Likert response provided by company internal auditors to the survey questions "Over the last three (five) years, the ROI of your business unit has improved relative to other business units in your industry."

Self-reported vs. archival measures of performance. Much of the research regarding financial performance associated with initiatives has relied on self-reported measures of performance. However, as noted by Young (1996), a self-report of performance may have no clear connection to actual performance. Young (1996) reviewed ten years of management accounting research and could find no published studies that collected both self-reported and objective measures of performance, or even discussed the issue critically. Although internal auditors are unbiased and objective, some may consider the dependent measures used in this study to be more subjective than other

possible sources of information, i.e., databases containing data from audited financial statements.[5]

Therefore, to obtain information as to the efficacy of self-reported measures, a comparison of actual financial statement information as contained in Compustat and the self-reported measures collected in this study is performed. Fifty-four respondents reported company-wide information for firms included in the Compustat database. For those companies with complete information (ranging from 47 to 52 for an individual test), actual ROI, industry-adjusted by subtracting the median performance of the subject's primary 3-digit SIC code is compared with the applicable 5-point Likert scale survey instrument response. As shown in Table 4-2, the survey responses exhibit a high degree of reliability. Spearman correlation coefficients range from .71 for ROI change over five years to .78 for ROI change over three years. When the continuous measures obtained from Compustat are converted to ranks on the same basis as the survey responses, correlations are .76 for 5-year ROI change and .86 for 3-year ROI change. The majority (66.3 percent) of responses are identical, and 99 percent of responses are within one value (e.g., report "4" on the survey and compute "5" from Compustat data).[6]

Independent and Control Variables

[5]However, using archival data sources is not problem-free. For example, there are significant discrepancies in financial data between the COMPUSTAT and Value Line databases (Kern and Morris 1994) and SIC codes (limiting ability to compute accurate industry mean-adjusted variables) between CRSP and COMPUSTAT (Ong and Jensen 1994).

[6] Variances can occur for reasons other than lack of knowledge by the internal auditor. For example, choosing "4" (agree) vs. "5" (strongly agree) requires a value judgement that can vary between subjects. Also, subjects could be reporting their belief in "true" unobservable financial performance rather than reported financial performance.

Use of ABC (USE). Unless a system is used extensively, it seems unlikely that it can be significantly associated with financial benefit. One would expect the level of performance benefits received from an innovation to depend on the extent to which the innovation becomes incorporated into organizational subsystems. Shields (1995) found that ABC success is significantly correlated with several categories of use: performance measurement, activity analysis, product costing, and reengineering. He also found significant correlation of success with the percentage of costs processed through ABC.

Shields (1995) also found evidence that the degree of linkage between ABC and performance evaluation and compensation is an important factor for ABC success. Employees pay more attention to those measures of performance that affect their personal welfare. Banker and Datar (1987) demonstrated that lack of coordination between incentive systems and performance measures can wreak havoc with a firm's performance.

A study of ABC "best practices" firms (Swenson 1997) confirms that use for decision making and use for performance measurement are typical of best practice firms. Other researchers (Cotton 1993, Lukka and Granlund 1994, Innes and Mitchell 1995, Krumwiede 1996) have measured success with ABC as use for decision making and Foster and Swenson (1997) found that models incorporating use measures yield the highest explanatory power in ABC success determinant models.

Therefore, the construct USE is developed from the following 19 5-point Likert measures of three aspects of use.

1) breadth of use (diffusion) – operationalized by use of ABC by organizational FUNCTIONs (e.g., manufacturing engineering, top management). This construct contains seven items, see survey items F16a-g,

2) depth of use (infusion) – operationalized by use of ABC for specific APPLICations, activities and decisions (e.g., product costing and pricing decisions). This construct consists of nine items (F17a-i), and

3) the level of integration of ABC into firm strategic and performance EVALuation systems, a key determinant of the successful implementation of ABC identified by prior researchers. This construct consists of 3 items (F3, F6, F7). The survey items measuring this construct are adapted from Shields (1995), Swenson (1995), and Krumwiede (1996).

Time (TIME). Realization of the expected relative advantages of an innovation occur when it is implemented on a wide-spread basis within, or diffused throughout an organization. Diffusion of an innovation takes time to effect. For example, evidence suggests that plant-level implementation does not move in lock-step with corporate implementation (Swenson 1995). And, as Shields (1995) noted, companies often shift from using ABC for product costing to using it for process improvements. In addition, accounting data has a historical focus; the benefits from use of ABC may not be measurable for several years.

According to the theories of diffusion of innovation, diffusion of these initiatives is likely to occur in an organization in a non-linear manner (Kwon and Zmud 1987). Rogers (1983) suggests that diffusion of an innovation occurs in an S-shaped curve manner. As an organization moves up the S-curve, a greater number of individuals and units will have adopted the components of the innovation until a saturation point is reached on the upper plateau of the 'S.'

In this study, cross-sectional survey data are collected regarding the extent of use of ABC (diffusion) at the survey date (mid-1997), and also years since beginning of use. Change in financial performance is measured for two fixed points in time -- three years and five years. Using fixed points in time allows for control for macroeconomic and industry-specific factors that affect all firms equally. Some firms were already using, and presumably receiving financial benefit from initiatives at the beginning of the measurement period. Others began use during the period. To determine the change in performance attributable to each initiative over the measurement period, allowance must be made for the period during which benefits could not have been received. A simple interaction between time and current diffusion would imply assumption of a linear, rather than a more appropriate S-shaped curve. Transformation of data to the form of the cumulative probability function of a normal distribution (cdf)[7] allows simulation of the hypothesized S-shaped curve of diffusion as demonstrated in Figure 4-2. Setting the mean of the probability distribution function (pdf) as five years and the standard deviation as two years allows assumption of a strongly sloping 'S' over the three to seven year interval and a plateau exceeding ten years that is consistent with prior research (Husan and Nanda 1995; Dusseau 1996).

Composite variable of interest (ABC). The composite measure of probable ABC efficacy (ABC) used to test H1 and to interact with the ENABLERs to test H2 is constructed from the 19 individual measures of USE multiplied by TIME (diffusion percentage as simulated by the cdf). For example, if a business unit had reached a likert

[7] $1/(\sigma\sqrt{2\pi}) \int \exp[-1/2\sigma^2 (x-\mu)^2]$ where x = number of years since beginning of use of an initiative, $\mu = 5$

level of '4' for use of ABC for performance evaluation and had been using ABC for decision-making for 2-3 years, the observed measure of that component of USE would be the likert use measure times the average cumulative cdf (Figure 4-2) for 2 and 3 years, or 4 * (.10+.22)/2 = .64.

Other initiatives (INIT). Researchers (e.g., Anderson 1995a, Evans and Ashworth 1995, Cooper and Kaplan 1991a, Thorne and Gurd 1995, and Player and Keys 1995a) have often noted the association with and appropriateness of implementing ABC in conjunction with new manufacturing methods. The sense of their comments is that rather than being individually necessary and sufficient conditions for improvement, other business initiatives and ABC complement each other and together enhance the performance of the firm. (Additional weight to these arguments has been provided by a finding of Krumwiede's (1998a) ABC best practices study that all fifteen "best practice" firms had linked ABC to another improvement initiative).

Because ABC often provides more and better information about processes, ABC may tend to be most beneficial if other initiatives are employed concurrently. Put another way, rather than causing improvement in financial performance by itself, ABC enables firms to reap the benefits of the new practices; ABC is not sufficient, but enhances and may be necessary for success. Conversely, the other initiatives are necessary, but may not be sufficient.

Use of the practices TQM, JIT, BPR, CIM, JIT, FMS, theory of constraints (TOC) and Value Chain Analysis (VCA) have been combined into a single index in this study

---

years and $\sigma = 2$ years.

developed from binary responses to instrument item I12. As recommended by Babbie (1990), in the absence of compelling reasons for differential weighting, the practices are weighted equally.

Enabling conditions (ENABLERS). Prior research has suggested that the benefits of ABC are more readily realized under conditions of sophisticated information technology, complex firm processes, highly competitive environment, relatively high importance of costs, and relatively low volumes of intra-company transactions and unused capacity. Therefore, these variables are appropriately incorporated into a factor-analyzed model testing the efficacy of ABC. Further discussion of each variable is included below.

Information technology (INFO). Cooper (1988) suggests that ABC becomes more beneficial as the costs of measurement are reduced. One of the major costs of measurement is for routing information from where an activity occurs (the shop floor, engineering department, etc.) to the cost system. In addition, Reeve (1996) suggests that an integrated ABC system pre-supposes a relatively high level of INFO sophistication with extensive and flexible information stratification and real-time activity driver information. An information system providing detailed historical data and easy access to users may provide much of the driver information needed by ABC. The INFO variable is operationalized through the six items of Section D of the survey instrument. The items were developed based on Reeve (1996) as modified by Krumwiede (1996, 1998b). The expected sign of the coefficient is positive.

Complexity and diversity (COMPLEX). Some researchers have concluded that ABC may not be the answer for all companies (Pattison and Arendt 1994; Estrin et al. 1994). Generally, those companies who will not potentially benefit are those with simple processes and few products. Cooper (1988) postulated that the potential for cost distortions is a very important reason for ABC implementation and use. Previous studies have confirmed that ABC data are most likely to differ from traditional cost data in settings with high coordination and control costs, such as those with diverse products, processes, customer demands, or vendors (Foster and Gupta 1990; Cooper and Kaplan 1991a; Anderson 1995b; Banker et al. 1995).

Besides product diversity, other factors may lead to a higher potential for cost distortions include support diversity, process diversity, volume diversity, and high overhead costs (Estrin 1994; Cooper 1988). This complex construct is operationalized through a series of seven items developed by Estrin et al. (1994) and used by Krumwiede (1996, 1998b) that measure each type of complexity and diversity (Section E of the instrument). The expected sign of the coefficient is positive.

Importance of costs (IMPORT). Even if ABC could substantially reduce product cost distortions, it will probably not be helpful unless a firm can use better cost information in its decision making. Besides the competitive environment, other factors affecting the decision usefulness of cost information include the firm's use of cost data in pricing decisions, cost reduction effort, need for special cost studies, strategic focus, and average profit margin (Estrin et al. 1994). Importance of costs is operationalized through

the six items of Section A adapted from Estrin et al. (1994) and used by Krumwiede (1996, 1998b). The expected sign of the coefficient is positive.

Intra-company transactions (INTRA). When companies have a large number of intra-company transactions, the financial performance of individual business units may be misleading because of transfer pricing methodology and constraints on decision making regarding source of supply and customer selection (Swenson 1995). Therefore, intra-company transactions is a potentially confounding variable to this study. It is expected to vary negatively with perceived benefit of ABC and is operationalized as the sum of two 5-point quantitative measures of percent of intra-company purchases and sales (items I10a and b).

Unused capacity (CAPAC). ABC theory predicts that unused capacity will be created in the resources supplied to handle the batch and product-sustaining activities by reductions in resource usage due to improvement or cost-reduction programs. If managers have acted to eliminate the unused capacities, then the effects can show up through lower costs of indirect resources supplied. If, however, the managers have not eliminated the unused capacity that has been created, then there is a significant cost of unused capacity, and the non-valued added costs identified by ABC may not translate to reduction of costs or improvement in profits (Kaplan 1993). Unused capacity is expected to be negatively associated with improvement in performance and is operationalized through a quantitative 5-point measure ranging from <50 percent through >90 percent (item I11).

Sixteen non-manufacturers did not complete this survey item; the overall mean response is used for missing data.

Competition (COMP). As competition increases, there is a greater chance that a competitor will exploit any costing errors made (for example, dropping an overcosted product with an unattractive profit margin after a competitor decides the product is worth pursuing). In addition, research by Alles (1990), Banker and Hughes (1991), and Banker and Potter (1991) shows that competitive situations where combinations of firms have significant market power (oligopoly) can lead to optimal, strategic costing systems that have more in common with traditional mark-ups than with ABC. Thus, more reliable cost information may be needed as competition increases (Cooper, 1988). Level of competition is operationalized through survey item A6 adapted from Swenson (1995). The expected sign of the coefficient is positive.

Control Variables. The implications of two control variables, business unit SIZE and TYPE of company are considered. These variables have been demonstrated as important in previous work, (e.g., size – Fama and French 1992, Bartov 1993; type of firm – Watts and Zimmerman 1986, Zmijewski and Hagerman 1981, and Healy 1985) explaining cross-sectional variation in financial performance.

Business unit size (SIZE). Theory proposes two conflicting effects for the interaction of firm size with ABC. Anderson (1995a) concluded that implementation is most likely to be disruptive if it occurs over a protracted period and disrupts familiar

routines. Large, vertically integrated firms are more likely to have lengthy implementation processes that cause significant organizational disruption. However, Selto and Jasinski (1996) propose that, other than in some large companies that are well staffed, well trained, and well funded, there is not much evidence that ABC is understood well enough to be designed or implemented successfully as a stand-alone system, let alone one that is integrated with strategy.

The combination of a time variable, and the inclusion of a firm size variable provide control for the organizational disruption anticipated by Anderson (1995a). Identification of breadth and depth of use of ABC, provides control for the small company resource problems noted by Selto and Jasinski (1996). Because the research in the relationship between organization size and innovations suggests a curvilinear relationship (as size increases, innovation increases, but at a decreasing rate (Ettlie 1983; Kimberly and Evanisko 1981; Moch and Morse 1977), the business unit size variable is measured as the natural logarithm of the mid-point of an 8-point self-reported sales category from a survey item adapted from Krumwiede (1996). The sign of the association is not predicted.

Type of company (TYPE). Environmental variables, measured at the industry level, have a significant impact on firm performance (Capon et al. 1990). Georgantzas and Shapiro (1993) and Schroeder (1990) analytically demonstrated that industry type moderates the relationship between innovation and performance. In this study, macro-economic differences between industries are controlled through the use of industry-adjusted dependent variables, eliminating the need to model a direct effect. Firm specific

conditions affecting ABC are measured through enabling condition variables. However, previous ABC researchers (e.g., Rotch 1990 and Cooper 1988, 1989) argue that the efficacy of initiatives may fundamentally differ between manufacturing and service companies. Therefore, a binary variable differentiates the 106 manufacturing firms from the 98 non-manufacturing firms and is interacted with ABC. Survey item I6 is adapted from Krumwiede (1996). No prediction is made as to the sign of the association.

SATISfaction, SUCCESS and financial BENEFIT.

The variables of interest in testing Hypotheses 3 relating to the association between ABC "success," and improvement in ROI are those developed by Swenson (1995), Shields (1995), and Krumwiede (1996, 1998b). As shown in Figure 4-3, model 1 is modified by replacing USE with the single item measures of SUCCESS (hypothesis 3a), SATISfaction (H3b) and financial BENEFIT (H3c). SATISfaction with cost system (survey item C1) and SUCCESS with ABC (H5) are 5-point measures while financial BENEFIT obtained from ABC (H4) is a 4-point response to the question "In your opinion, was ABC worth implementing?" with possible responses of "No," "Too early to tell," "Will be," and "Yes" scaled as 1 through 4 for testing.

Subjects

The firms studied are "for profit" firms that employ internal auditors who are members of the Institute of Internal Auditors (IIA). It is contended that these firms have well-developed systems that measure performance accurately and are sophisticated enough to properly implement and use new business initiatives.

As noted by Shields (1995), one of the limitations of research regarding efficacy of initiatives is that often (e.g., Dixon 1996; Shields 1995; Grandzol and Gershon 1997) implications have been weakened because findings have been based on the responses or information provided by potentially biased subjects, those responsible for design, implementation, and operation of the innovation.[8] For example, McGowan and Klammer (1997) and Foster and Swenson (1997) found that perceptions of ABC vary depending on the role of the individuals involved – specifically preparers reported more favorable attitudes toward ABC than users, with project leaders or champions reporting the most favorable.

The current study mitigates this limitation of prior research through the utilization of unbiased internal auditors as subjects. The *Statements of Responsibilities in Internal Auditing* (1990), and Section 100 of the *Standards of Practice for Internal Auditors* (IIA 1995) require that internal auditors be independent of the activities they audit. "Independence permits internal auditors to render impartial and unbiased judgments" (Standards, Section 100.01). In addition to their independence and objectivity, internal auditors are appropriate subjects because they are knowledgeable, possess varied talents and expertise, and have access to relevant information (Tatikonda and Tatikonda 1993; Stoner and Werner 1995).

On the practical side, another consideration is that subjects need to have an interest in the project, and a willingness to complete the survey instrument accurately. According

[8] As with other studies, because this research relies on self-reported data, it is potentially subject to reporting biases and measurement error called common-method bias (Johnson et al. 1995). However, Miller and Roth (1994) suggest that care in the selection of respondents can contribute to overcoming common-method bias. The selection of unbiased, objective and knowledgeable internal auditors eliminates most, if not all potential effects from common-method bias that may be present in other research.

to the literature, internal auditors have an interest in initiatives that can improve firm performance (Sawyer 1993; Tanju and Helmi 1991).

In summary, this study extends prior research by providing a unique and ideal pool of subjects, contributing to construct validity[9] and enhancing the external validity[10] of previous findings. Internal auditors are ideal subjects for the study of business initiatives because they are unbiased, knowledgeable, and interested respondents.

Population and Sampling Procedures

The population of subject firms is limited because many firms do not employ internal auditors. In addition, internal auditors employed in the banking industry often have highly specialized responsibilities, limiting their exposure to new business initiatives, and are therefore omitted from the sample. Another issue arises because the primary interest of this study is to measure the association of ABC with improvement in financial performance, measured as improved profitability. Non-profit organizations do not measure improved financial performance as improvement in profitability, and internal auditors employed by these organizations are not appropriate subjects for this study. Therefore, the sample consists of the population of those practicing members of ten geographically diverse U.S. chapters of the Institute of Internal Auditors (IIA)[11] where

[9] Construct validity, the ability of the studies to measure what they purport to measure, is threatened by mono-operation bias. The solution to this problem is to vary the subjects of the treatment (Cook and Campbell 1979).

[10] To increase external validity, a researcher can replicate in various settings and at different times (Cook and Campbell 1979).

[11] The IIA serves as the internal auditing profession's authority on significant issues affecting internal auditors, and is the only organization dedicated solely to the advancement of the internal auditor and the profession on a world-wide basis. The IIA is the world's leader in research and educational issues for internal auditors and is the standards-setting body for the profession. It has approximately 53,000 members in 196 local chapters, national institutes and audit clubs in more than 100 countries (IIA 1996, 1997).

information is available to the researcher, who are not employed in the banking industry, or by governmental or nonprofit organizations. Sample size is further limited to five randomly drawn subjects per organization.[12] A mail survey with a second mailing to non-respondents is used to collect information. As shown in Table 4-3, IIA members of the Chicago (59 responses) and Houston (52) chapters represent 54 percent of the total of 204 responses.

The questionnaire is distributed to 1,058 internal auditing professionals. This sample is reduced by 68 that were returned unopened because of incorrect address or change of employment with no forwarding address. In addition, as presented in Table 4-4, 28 uncompleted or partially completed surveys were returned because the subjects are not knowledgeable about their company's systems, company policies against response to surveys, or other reasons, leaving an adjusted sample size of 962. Of 204 usable responses, 137 are from the first and 67 from the second mailings yielding a response rate of 21.2 percent. Sixty-five responses (31.8 percent) indicate some use of ABC. The remaining 139 respondents serve as a non-using control group.

There is no test to ensure that non-response bias does not exist (Krumwiede 1998b). Two separate procedures are performed to help assess the possibility of bias. As in Gosselin (1997) and Krumwiede (1998b), a "reason for non-response" section is included at the bottom of the transmittal letter. As shown in Table 4-4, the majority returning this section indicated that their company does not use cost allocation methods, has a policy against responding to surveys, or the respondent is no longer employed at the firm.

[12] In six instances, there were multiple responses from the same business unit. Differences were minor, and responses were combined into a single observation by averaging scores.

Non-response bias is further tested by comparing the median responses of the first mailing to those of the second mailing for statistical difference in responses. This test is based on Oppenheim (1966), who found late survey respondents are similar to non-respondents. Wilcoxon 2-sample signed rank tests (Hollander and Wolfe 1973) and Pearson chi-square tests of proportions (Feinberg 1983) on the raw data and on the additive indexes reveal significant differences ($p<.05$) on five of the 75 variables tested 6.7 percent, slightly more than one would be expect by chance. Second mailing respondents tend to report at a somewhat higher level of aggregation (e.g., company vs. division; median 4.82 vs. 4.29 – $p<.0385$), have less tendency to be manufacturers (.42 vs. .57– $p<.044$), to be less likely to use CIM (.10 vs. .22 – $p<.047$), and to be less satisfied with their business unit cost (3.20 vs. 2.91 – $p<041$) and performance measurement (3.18 vs. 2.87 – $p<.033$) systems. It is not suprising that the test reveals some differences. For example, a possible explanation for slower responses by internal auditors with country or company-wide responsibilities is that they tend to travel more often, and are thus likely to have delayed responses.

Sample Size Considerations

For effective analysis, the sample covariance matrix must be reasonably stable and approximate the pattern of covariances in the population. In general, ceteris paribus, the larger the sample size the more likely this will be the case. Guadagnoli and Velicer (1988) reviewed the literature on sample size considerations in factor analysis and principal components analysis and conducted an extensive Monte Carlo study on sample size effects. Consistent with other Monte Carlo studies, they found no support for often

used rules of thumb based on respondents-to-variables criteria (e.g., 5:1). As quoted from Jaccard and Wan (1996):

> "The most important factors influencing the stability of the sample covariance matrix were the absolute sample size and the magnitudes of the path coefficients from the latent constructs to the observed indicators (referred to as "saturation"). When such standardized path coefficients were low (i.e., near 0.40), sample size was quite important. At moderate to high saturation levels (e.g., standardized path coefficients of 0.60 to 0.80), once a certain sample size was achieved, further improvement in stability were small with increasing N. When saturation was high (standardized path coefficients of .80), sample sizes as low as 50 performed well, even when the number of variables in the covariance matrix was large."

Jaccard and Wan then recommend a sample size of 75-100 in conditions of high saturation, and 150 for moderate saturation levels. The saturation levels obtained in this study are "high" for 76 percent of the multi-item variables used to test H1 and H2 and "moderate" to "high" or "high" for 80 percent of those used to test H3. These levels are adequate to expect a stable covariance matrix.

As a check, a sensitivity test is performed whereby the 19 ABC manifest variables are reduced to six, reducing the number of manifest variables to 25 and increasing the sample size/variable ratio to 8:1 from 5:1. Results are not impacted.

Survey Instrument

Data are extracted from a 96 item instrument. As in Kaynak (1996), Shields (1995); Swenson (1995), Grandzol and Gershon (1997), McGowan and Klammer (1997), and (1996, 1998b) the instrument is constructed (both dependent and independent variable information is collected at the same level) so that analysis can be conducted at the appropriate level of knowledge (plant, division, region, subsidiary, country, or entire

company) of the individual respondents, thereby reducing measurement error and measurement problems associated with differing levels of ABC use in different segments of firms. As described in the variable descriptions, many survey items are adapted from previous research.

Large survey techniques are used to collect initiative use data for two reasons. First is the volume of available data. Collection of a sufficiently large data set enhances the power of any significant findings. A large data set also enhances the external validity of the findings in an area that is receiving a considerable amount of attention from both researchers and practitioners. Secondly, information regarding the use of initiatives from archival sources such as the *Wall Street Journal Index* is not complete and, in particular, only includes those companies that have publicly released information regarding use of initiatives (Husan and Nanda 1995). Therefore, use of archival information results in a mix of unidentified users and non-users as controls, thereby weakening the power of statistical testing.

In addition to the questions relating to use of initiatives, financial performance and enabling and control variables described previously, additional information is gathered in the questionnaire relating to the characteristics of the users of initiatives, and for use in future analysis. Most of the questions are close-ended and ask the respondent to rate or assess on a five-point Likert scale, anchored by 1 = "Strongly Disagree" and 5 = or "Strongly Agree."

As recommended by Young (1996), procedures prescribed by Dillman (1978) for maximizing response rates are followed. Specific steps taken to strengthen this study include 1) using a second mailing, 2) promising confidentiality of responses, 3) including

deadline dates for reply, 4) including personalized cover letters, 5) including a postage-paid, self-addressed envelope for reply, and 6) promising to send a summary of results on request. Content validity is addressed by asking a group of faculty experienced in management innovation and survey research to review the instrument for clarity and meaning. Modifications were made as appropriate. The survey instrument is included as Exhibit I.

Models Tested

As noted by Shields (1997), there is an opportunity to improve survey research by providing simultaneous test of measurement reliability and structural relations (i.e., hypothesis testing) by using structural equation models. In this study, the hypothesis that ABC is associated with improvement in financial performance, is tested by confirming the theorized structural model with structural equations modeling (SEM) using LISREL8 (Joreskog and Sorbom 1993). Confirmatory factor analysis, discriminant analysis and reliability testing are used to validate the individual constructs. To model the change in financial performance associated with ABC, the analysis is run with variables based on the conceptual model shown in Figure 4-1 and discussed in other sections of the paper. The measure of USE of ABC is composed of FUNCTIONs using, APPLICations, and use for performance EVALuation. This measure is tranformed with TIME since implementation, and interacted with an index of use of other INITiatives and measures of enabling conditions measuring levels of information technology (INFO), COMPLEXity and diversity, IMPORTance of costs, INTRA-company transactions, and COMPetition and the control variables SIZE and TYPE of company. The purpose of these interactions

is to reflect that ABC, by itself, may not improve financial performance in all situations. Other INITiatives and the enabling and control variables (other than TYPE) are then included in the model as independent variables with theorized direct effects in addition to the indirect effects described above. Hypothesis 1 is rejected if the path between ABC and cgange in ROI has statistical significance. Hypothesis 2 is rejected for those tests where a significant path between exists between the interaction term and the financial performance variable.

Methodology similar to that used to test hypothesis 1 and 2 is also used to test hypothesis 3 relating to alternate measures of the efficacy of ABC. Model 1 is modified by replacing USE with the single item measures of SUCCESS (hypothesis 3a), SATISfaction (H3b) and financial BENEFIT (H3c) described previously. Because the measures reflect results obtained from ABC under firm specific conditions rather than use of ABC, no interactions with enablers or control variables are necessary.

Reliability and Validity

An instrument is useful only if it is statistically reliable and valid. Therefore, it is important to establish reliability and validity of the test instrument. Content validity is a subjective measure, and is claimed to be thoroughly backed by the literature as well as the opinion of experts and pre-test subjects.

Construct and convergent validity are individually established through confirmatory factor analysis (CFA). CFA is similar to exploratory factor analysis except that the hypotheses that form constraints are embedded in the analysis. In this case the constraints include hypothesizing the number of factors and the nature of the relationship among the

factors. To conduct CFA, a measurement model consisting of a collection of constructs, each defined according to a weighted linear combination of the items, is first specified. The covariance matrix of the items (sample matrix) is then computed. Based on the specifications of the measurement model, factor loadings are selected by minimizing a fitting function that measures the differences between the generated matrix and the sample matrix (Long 1983). The generated matrix is a covariance matrix created by selecting various factor loadings and taking into account the specifcations of the measurement model (Ahire, Golhar and Waller 1996).

Construct validity is evaluated by establishing unidimensionality through CFA of the measurement items of each of the six factors and establishing uniqueness of the factors through discriminant analysis.[13] Unidimensionality is a necessary condition for reliability analysis and construct validation (Anderson and Gerbing1991). Items in a unidimensional scale estimate one single construct. In the absence of unidimensionality, a single number cannot be used to represent the value of a scale (Venkatraman1989).

Convergent validity is the extent to which varying approaches to construct measurement yield the same results (Campbell and Fiske 1959). Each item in the scale can be viewed as a different approach to measuring the construct. Convergent validity is established through a Bentler-Bonett (1980) normed fit index (NFI) obtained from confirmatory factor analysis.

[13]A traditional approach to scale refinement includes identification of factors through exploratory, rather than confirmatory, factor analysis on the item responses to identify major factors according to item-factor loadings. This approach has major limitations because factors may consist of items that correlate with one another only statistically, and which may not have a practically valid identity or exhibit unidimensionality. (Ahire, Golhar and Waller 1996). Recent research (e.g., Germain, Drodge, and Daugherty 1994, Kumar, Scheer and Steenkamp 1995 and Ahire, Golhar and Waller 1996) has increasingly preferred the confirmatory factor analysis approach due to its conceptual strengths.

Reliability refers to the degree of dependability and stability of an instrument (Gatewood and Field 1990). It reflects the instrument's ability to consistently yield the same responses (Flynn, Schroeder and Sakakibara 1994). Reliability of the instrument is determined by the internal consistency method through use of Cronbach's Alpha.

STATISTICAL ANALYSIS

Descriptive Statistics

In this section are presented descriptive statistics regarding the firms responding to the survey, their cost management systems, and the degree of use of new business initiatives. First general background information is presented (Tables 4-5 and 4-6). Fifty percent of the respondents report for their entire company, with the remainder spread among plant, division, group, subsidiary, and country business units. 46.6 percent report that their business unit revenues exceed $1 billion, while, as is not suprising for firms employing internal auditors, only seventeen report for business units with revenues under $50 million. Manufacturing firms constitute 52 percent of the responses.

As reported in Table 4-7, all but 45 (22.1 percent) of the respondents indicate that their business unit is significantly using at least one business initiative. The median firm is using two practices (range from zero to six) with JIT and TQM the most often referenced at 46 percent. Manufacturers have more mean use (2.56 vs. 1.32) than non-manufacturers and companies over $1 billion in revenues have higher use than smaller companies (2.2 vs. 1.5). Discounting the purely manufacturing initiatives CIM and FMS, the difference in use between manufacturers and non-manufacturers reduces to 2.06 initiatives vs. 1.32 initiatives.

Forty-seven respondents, 23percent, reported that they are significant users of ABC. Another 18 respondents indicated that they are implementing ABC, but that the system is not yet in significant use. This rate is somewhat lower than prior research (Shim and Stagliano 1997; Geishecker 1996), who found that 27 percent to 44 percent of respondent were using ABC.[14] Higher use is reported by manufacturers than non-manufacturers (31.1 percent vs. 14.3 percent), and large business units (41 percent). Significant ABC users generally also are users of other initiatives (mean of 2.2 other initiatives). Only seven of 47 ABC firms are using ABC in isolation. As reported in Table 4-8, the distributions of responses to questions relating to satisfaction with existing systems are generally bimodal, centered on 2 and 4, indicating that most respondents are either moderately satisfied or dissatisfied with their systems. ABC users generally appear to have higher satisfaction than non-users with their firms' cost and performance measurement systems (generally 60-70 percent vs. 40 percent) and a higher level of information technology (INFO) sophistication. Also, significant ABC users express more agreement than non-users that the quality of their cost systems is excellent (48 percent vs. 28 percent). This result is consistent with prior research that generally shows that the majority of users (ABC and non-ABC) are dissatisfied with their systems (Geishecker 1996). Internal auditors are most satisfied with the quantity of data available (78 percent), and most dissatisfied with user-friendly capability (54 percent) and that operating data is updated "real-time" (51 percent).

Significant users (Table 4-9) tend to use ABC in several applications, with, as expected, cost reduction and product costing the highest uses (4.37 and 4.13 out of 5

[14] Prior research has generally been sample from a population consisting exclusively of manufacturers, a

respectively). The majority, 34 have been using ABC for decision-making for over two years, 74 percent feel the implementation had been successful, 67 percent feel that the implementation has been worth implementing, and 65 percent that the benefits exceed the cost. The correlation of SUCCESS with BENEFIT is 0.60, statistically significant and consistent with that found by Shields (1995) of 0.53.

The correlation matrix portraying the univariate relationships between new business initiatives is presented as Table 4-10. For the full sample, thirty-nine percent of the relationships are significant at the α=0.05 level, and all significant relationships are positive except that of Business Process Reengineering (BPR) and the Theory of Constraints (TOC). JIT exhibits the strongest relationship with other initiatives, with significant correlations between it and all other relationships except TOC. ABC is significantly correlated with JIT at the α=0.05 level, and BPR at α=0.10. Somewhat suprisingly, the relationships are qualitatively similar for the partition including manufacturing firms only.

Content Validity and Reliability

Confirmatory factor analysis is used to test the unidimensionality of each of the six multi-item constructs FUNCTION, APPLIC, EVAL, INFO, COMPLEX, IMPORT. To use confirmatory factor analysis for verifying unidimensionality, a measurement model is specified for each construct. Individual items constituting the construct are examined to see how closely they represent the same construct. One indicator of fit is the chi-square statistic. However, this statistic is sensitive to sample size and violations of the

---

likely explanation for the lower use of ABC found in this study.

assumptions of multivariate normality (Bentler 1983; Joreskog and Sorbom 1989), which can lead to rejections of the model even when the fit is reasonable. A good fitting model may be indicated when the ratio of χ^2 to the degrees of freedom is less than two (Tabachnick and Fidell 1996). Therefore, it is useful to supplement the analysis with other indicators of fit. A goodness of fit index (GFI) of 0.90 or higher for the model suggests that there is no evidence of a lack of unidimensionality (Joreskog and Sorbum 1989), and an adjusted goodness of fit index (AGFI) of 0.80 and a root-mean-square residual (RMR) under 0.10 are generally regarded as indications of good fit (Libby and Tan 1994).

The χ^2 statistics, and GFI, AGFI, and RMR indices for the six constructs are reported in Table 4-12. After deletion of five of 37 survey items, chi-square tests that the models fit the data are not rejected ($p<.01$), and all GFI and AGFI values are above 0.90 and 0.80 respectively, indicating that there is no evidence of a lack of unidimensionality.

A scale exhibits discriminant validity if its constituent items estimate only one construct (Bagozzi and Phillips 1991). It is possible that an item in one scale could be reflecting the value of a construct of another scale. This usually results in an over-estimation of correlation among constructs. Therefore, scales should be tested for discriminant validity using a chi-square difference test (Ahire et al. 1996). A set of confirmatory factor analyses is run on each multi-item pair of scales, first allowing for correlation between the two constructs and then fixing the correlation between the two scales at one. A statistical significant difference in chi-square statistics ($p< 0.01$) demonstrates that the two constructs under consideration are distinct (Venkatraman 1989). For the six multi-item scales in the instrument, a total of fifteen discriminant

validity checks are run. The three ABC scales (FUNCTION, APPLIC AND EVAL) fail to yield statistically significant chi-square differences (the χ^2 difference is under two). Therefore, after confirming unidimensionality, the nineteen variables from those constructs are combined into a single construct (ABC) for testing.

An NFI value of 0.90 or above demonstrates strong convergent validity (Tabachnick and Fidell 1996). The NFI values for all of the constructs are reported in Table 4-12. All of the scales had values over 0.90, demonstrating strong convergent validity.

Reliability refers to the degree of dependability, consistency or stability of a scale (Gatewood and Field 1990). Cronbach's coefficient alpha (α) (Cronbach 1951) is a widely used measure of scale reliability. In exploratory research an alpha above 0.50 is considered satisfactory (Nunnally 1978). The Cronbach's alpha values for each construct are shown in Table 4-11. All of the scales have acceptable reliability.

Causal Models

The causal models are tested with structural equation modeling (SEM). A measurement model is specified that relates the observed variables to the latent variables. In addition, a structural model relates the latent variables to each other. Both the measurement model and the structural model are simultaneously estimated by the LISREL 8 program. Factor loadings and structural coefficients are obtained using the maximum likelihood estimation method. Estimation involves finding the values of the coefficients that produce an estimated covariance matrix that is a s close as possible to the sample covariance structure of the manifest variables (Libby and Tan 1994).

For each of the six constructs (latent variables) discussed in the previous section, several survey items are used as indicators. Using multiple items reduces the effect of random and measurement errors, and the structural coefficients obtained are less biased than those obtained using manifest variables alone (Libby and Tan 1994). In addition, INTRA and INIT are additive indexes constructed from two and eight survey items respectively, and CAPAC, COMP, SIZE, and TYPE are single item measures.

Prior to formal hypothesis testing a construct composed of the two ROI variables is regressed against constructs for ABC use, other initiative use, size, a composite construct composed of the six enablers, and an interaction variable composed of ABC, Other initiatives and enablers. Survey items are weighted equally within constructs and constructs are weighted equally within composite constructs. This model is a rough approximation of the primary model that is tested (Figure 4-1) but does not include the refinements and advantages obtained from use of structural equation modeling. However, it does yield information regarding the overall efficacy of the enablers that is not obtained with the LISREL model. The regression model is:

$$ROI = \alpha + \beta_1 ABC + \beta_2 INIT + \beta_3 ENABLE + \beta_4 ABC*INIT*ENABLE + \beta_1 SIZE$$

Where		Expected Sign
ROI	= the average of five point measures of industry-adjusted improvement of ROI over three and five years	+
ABC	= the average of 19 five point Likert measure of ABC use	+
INIT	= the sum of eight binary measure of significant initiative use	+
ENABLE	= the average of six measures of enabling variables which in turn are composed of the average of individual survey items	?
ABC*INIT*ENABLE	= an interaction term	+

SIZE = the log of the mid-point of a five point Likert sales category ?

The results of this regression are presented as Table 4-13. Use of other initiatives is significant at the $\alpha = 0.05$ level, and the interactive term is significant at 0.081.There appears to be an overall effect of enabling variables and use of initiatives combined with ABC. It is noteworthy that this effect is not present when ABC is dropped from the interaction term. The contrast between effects with and without inclusion of ABC is an indicator of probable efficacy of the use of ABC under favorable enabling conditions.

Hypothesis Testing

The purpose of the first two hypotheses is to test whether ABC is directly associated with improvement in ROI (H1) and to identify the enabling conditions under which ABC results in an improvement ROI (H2).

To perform these tests, the conceptual model presented as Figure 4-1 is modified to that shown in Figure 4-4, which also reports the results of testing. Product terms are created for the interactions between each of the enabling variables, other initiatives, size and ABC. Positive significance of the ABC variable would indicate a direct effect on change in performance, regardless of environmental conditions. Positive significance of a product term indicates that ABC is positively associated with an improvement in performance when used in the environment described by the product term.

The fit of the model is good: $\chi^2(1017df) = 911$, $p<0.99$, GFI = 0.96, AGFI = 0.92, RMR = 0.075. Many of the variables have significant direct effects: INFOrmation technology, IMPORTance of costs, SIZE and other INITiatives have positive effects and number of INTRA-company transactions and COMPetitive environment have negative

direct effects at the 0.05 level. ABC (positive), COMPLEXity (positive) and unused CAPACity (negative) are not significant at conventional levels. However, the effect of ABC, although positive, is not significant ($p < .3483$). There is no direct affect associated with use of ABC and H1 is not rejected.

More importantly, the interactions of ABC with COMPLEXity ($p < .012$) and other INITiatives ($p < .030$) are positive and significant and H2 is confirmed for those conditions. ABC*IMPORT and ABC*INTRA are significant at 0.10 ($p < 0.097$ and $p < 0.079$). SIZE is also marginally significant ($p < 0.093$). Although not significant at conventional levels, the signs of the other enabling variable interactions, ABC*COMPetition (positive) and ABC*CAPACity (negative) are as expected. It is very possible that use of a larger sample size would have increased statistical power sufficient to result in significance. Also, results for ABC*CAPAC may be weakened because it appears that non-manufacturers had difficulty in assessing capacity utilization.

The results of the three tests of H3 are presented in Table 4-14. As expected with use of single item variables of interest, model fit is not as good as that of previous model, with χ^2 generally approaching three times degrees of freedom rather than the desired two. GFIs range in the lower 0.80s and AGFIs in the upper 0.70s, although the RMR for all three models are under 0.08. Variable significance is consistent for the three models and with direct effects of the model used to test H1 and H2. INFOrmation technology, IMPORTance of costs (except against SATISfaction) and other INITiatives are positive and significant at 0.05. Unused CAPACity and COMPetitive environment are negative and significant. SATISfaction ($p < .104$), SUCCESS ($p < .059$), and financial BENEFIT ($p < 0.174$), are positively signed and SUCCESS is marginally significant. Although no

firm statistical conclusions can be reached regarding H3, it appears that the variables are relatively good proxies for improvement in performance associated with use of ABC.

Sensitivity Analysis

The programming strategy used to test H2 is to form product terms between the ABC construct and the enabling variables and then use these product terms as indicators of a latent interaction variable. A potential problem with this approach is that the measurement error for a given product indicator must be a function of the measurement error of the component parts of the product terms (Jaccard and Wan 1996). Joreskog and Yang (1996) developed an approach to addressing this problem that requires formation of four new matrices and the imposition of nine constraints per product term. Thus, the primary sensitivity test is to modify the model by incorporating the recommendations of Jorreskog and Yang. The resulting model requires estimation of a number of parameters larger than the sample size, resulting in unstable parameters. However, the parameters and t-statistics derived are nearly identical to those previously reported. All variables retain their signs and significance levels are stable within 0.05 and 0.10 boundaries.

As additional checks on the specifications of the models, the analysis is re-estimated with 1) limited and 2) substantial error correlation allowed between the independent manifest variables, 3) restriction of the error correlation of the dependent variables 4) change in ROI over separate three and five year periods rather than a construct derived from the combination of the two periods, 5) all correlations between the latent constructs allowed rather than only those statistically significant at the 0.10 level, 6) a direct effect of industry type on change in ROI (even though the ROI variable is

industry-adjusted), 6) a reduction the number of manifest ABC variables from 19 to six (H1 and H2 model only), and 7) for the exploratory regression analysis, change in ROI measured over separate three and five year periods. Although there is some change in fit statistics of the models, with the exception of models allowing substantial fitting of correlated errors of the manifest variables there is little change in the significance levels of the independent variables. Further description of the sensitivity testing is included below.

Correlated Errors of Independent Variables

When correlated errors of the manifest independent variables are estimated, t-statistics of all variables tend to increase. If a large number of correlations are estimated, the interaction terms and SUCCESS and SATISfaction variables become significant at $\alpha = 0.05$. However, in the absence of an error theory to explain these correlations, no inference can be made from these results.

Uncorrelated Errors of Dependent Variables

Correlated errors are expected for the dependent variables ROI3 and ROI5 . ROI is an estimate that contains measurement error for several reasons: 1) accounting income and assets are estimates and are imperfect measures -- they are subject to timing issues and are not comprehensive (for example intellectual capital is accounted for very imprecisely), 2) firms do not always apply GAAP precisely, 3) GAAP allows many judgements, and 4) firms can make discretionary choice to manage earnings. Therefore the results have been reported with correlated error terms of the dependent variables.

When the errors between ROI3 and ROI5 are not allowed to correlate significance levels of the independent variables are generally weakened somewhat. Although signs remain as expected, ABC* Importance of Costs and ABC*SIZE lose their significance ($p < 0.176$ and $p < 0.142$ vs. $p < 0.097$ and $p < 0.093$). ABC*INIT also loses some significance ($p < 0.054$ vs. $p < 0.030$). However, even with this additional restriction, the models furnish evidence of the efficacy of ABC under specific environmental conditions.

Other Sensitivity Tests

The other tests yielded little additional information. Type is never significant at conventional levels and modification to the permitted correlations of the latent construct matrix had minimal effect. For the three-year change in ROI model, importance of costs becomes significant at the 0.05 level when satisfaction is the dependent variable (rather than the $p < 0.097$ for the reported model).

SUMMARY & DISCUSSION

This paper investigates the improvement in financial performance that is associated with ABC use and the enabling conditions, including concurrent use with other initiatives, under which benefits are obtained.

Information regarding initiative use is collected from a sample of 204 firm business units. Use of initiatives is common, with 78 percent of firms reporting that they are significant users of at least one initiative. A substantial minority, 23 percent reported that they are significant users of ABC, with another nine percent in the process of

implementation. Only seven of the 47 significant ABC users are using ABC in isolation, apart from other initiatives.

Significant users tend to use ABC in several applications, with cost reduction and product costing the highest use. The majority have been using ABC for decision-making for over two years, 74 percent felt the implementation has been successful, 67 percent feel that the implementation has been worth implementing, and 65 percent feel that the benefits exceed the cost.

Confirmatory factor analysis and structural equation modeling (SEM) are used to test a model hypothesizing the conditions under which there is a positive association between a composite measure of the use of ABC and change in financial performance. Control is provided for the moderating effects of concurrent use of other initiatives and enabling conditions derived from prior research.

The first finding is that positive synergies are obtained from concurrent use of initiatives with ABC. This finding is consistent with statements by researchers that management accounting systems are meant to be efficient in supporting firms' operational effectiveness (Granlund and Lukka 1998; Cooper 1995; Porter 1996; Granlund 1997). A primary purpose of initiatives is to improve this effectiveness and ABC is contributing in this regard. However, more research is needed to explain how this effect occurs. Research that identifies the components of financial performance that are impacted by initiative use would be of benefit.

The second finding provides evidence supporting previous analytical and theoretical research regarding the conditions favorable to obtaining benefits from ABC. There is a positive association between ABC and improvement in ROI when implemented in

complex and diverse firms, in environments where costs are relatively important, and when there are limited numbers of intra-company transactions to constrain benefits. These positive findings regarding ABC are of particular interest to practicing and academic accountants because they are often the primary proponents and administrators of ABC and all previous evidence of ABC efficacy has been theoretical or anecdotal.

There is some indication that other enabling conditions (information technology sophistication, absence of excess capacity, and a competitive environment) affect the efficacy of ABC as expected and that some types of firms may obtain greater benefits. All signs of coefficients are as expected, leading one to suspect that statistical power could be an issue. It is possible that these enabling conditions do positively enhance the use of ABC and that the effect could be confirmed through methods that allow increased statistical power (e.g., larger sample size, multi-item measures of capacity utilization and competitive environment, partitioning of industry membership more finely). Although, it is difficult to obtain both large sample sizes and the volume of information necessary to adequately measure the constructs of interest, the subject is of significant importance to pursue. Further research is also required to explain the increased efficacy of ABC in smaller business units.

Finally, there is some evidence that measures of satisfaction with cost system, success of ABC, and financial benefit obtained from ABC used in previous research (Shields 1995; Swenson 1995; Krumwiede 1996, 1998b) are predictors of improvement in financial performance. This finding is an important step toward completing the link between identification of the conditions factors affecting the success of ABC

implementation to documenting the efficacy of ABC as a tool aiding profit-maximizing firms in attaining their goals.

This research adds to the limited body of empirical business initiative research and contributes to the development of the theory of ABC in four ways. The first contribution is to provide the first cross-sectional empirical evidence confirming the assertions made by advocates concerning the benefits of ABC. Second, this study eliminates a significant limitation of previous research regarding business initiatives, i.e., the lack of control for simultaneous use of multiple initiatives. Third, in this study a model explaining ABC efficacy is synthesized from previous research. Fourth, the study enhances the credibility of previous research by using unbiased and objective internal auditors as respondents, and providing confirming evidence regarding the efficacy of the construct "success."

Table 4-1
Empirical Research on Financial Performance and New Business Initiatives

Study	Journal/ Dissertation	Initiative	Primary Statistical Tools (3)	Sample Size	Dependent Variables: Measure (3)	Period	Levels/ Changes	Scale?	Type	Industry-Adjusted?	Archival/ Self-reported	Control Group	Control (8) for Previous Performance	Control for Other Initiatives	Other Controls
Dixon 1996	Dissertation Florida State	TQM	Princomp Regression	635	ROI (2)	NA	Levels	No	Continuous	No	Archival	No	No	No	No
Dusseau 1996	Dissertation Missouri-Rolla	TQM	Regression (1)	5	FS	NA	Levels	Index	Continuous	Control (7)	Archival	Yes	No	No	No
		TQM	Plot	1	FS	NA	Levels	Index	Continuous	No	Archival	No	No		No
		TQM	Regression (1)	10	FS	12 Yr	Levels	Index	Continuous	Control (7)	Archival	Yes	No		No
Easton and Jarrell 1995	Working Paper Chicago	TQM	Regression	108 Pairs	ROA	1,2, 3-5avg	Changes	No	Continuous	Control (7)	Archival	Yes	N/A	No	No
Engelkeyer 1991	Dissertation Clemson	TQM	Princomp	9	ROI	Na	Levels	No	Continuous	No	Archival	No	No	No	No
Grandzol and Gershon 1997	American Society for Quality	TQM	LISREL	275	Finance Quality	NA	Changes	Scale	Continuous	No	Self	No	No	No	No
Balachrishnan et al. 1996	Accounting Review	JIT	Paired T	46 Pairs	ROI	3 years	Changes	No	Continuous	Control (7)	Archival	Yes	No	No	No
Biggart 1997	Dissertation Florida State	JIT	T, Sign	85	ROI	3 Years	Changes	No	Continuous	Yes	Archival	No	No	No	No
Boyd 1996	Dissertation Louisiana Tech	JIT	Regression	115	ROI, ROE	NA	Levels	No	Continuous	No	Archival	No	No	No	Time
Husan and Nanda 1995	JOM	JIT	3SLS	55	EPS	4 Years	Changes	No	Continuous	(6)	Archival	No	No	No	No
Kinney and Wempe 1998	Working Paper Texas A & M	JIT	Paired T, Sign	186 Pairs	ROI	0-3 Years	Changes	No	Continuous	Control (7)	Archival	Yes	No	No	No
Kaynak 1996	Dissertation North Texas	TQM/JIT (4)	Regression (Hierarchical)	214	Fin & Marke Performance	1 Year	Composit (Both)	Scale	Continuous	Some	Self	No	No	No	Size, Type Time
Shields 1995	JMAR	ABC	Descriptive	143	Success	NA	NA	No	7-point	No	Self	No	N/A	No	No
			Correlation		Fin. Benefit	NA	NA	No	Binary	No	Self				
Swenson 1995	JMAR	ABC	Correlation	60	Satisfaction	Na	Levels	No	4-point	No	Self	No	N/A	No	No
Cagwin 1999 (Current Study)	Dissertation Arkansas	7 Initiatives	Regression	191-332	ROI	5 Yr 3 Yr	Changes	No	Continuous	Yes(8)	Archival	No	Yes	Yes	Size Type

1 = 2nd Order Regression
2 = Weighted average of four years weighted toward fourth year.
3 = Other methods or measures may have been used; disclosed are those that most closely pertain to this research
4 = JIT Purchasing
5 = Intersection of National Association of Purchasing Management and American Society for Quality Control
6 = Indirectly by including industry exogenous variables in prediction of endogenous variables
7= Control firms matched on industry and other criteria
8= Or include previous level of dependent variable in control group selection.
9= Study was of a single industry - for-hire motor freight
FS = Financial Strength, an index of liquidity, leverage and performance variables based on Kristy (1991)
JMAR = Journal of Management Accounting Research
JOM = Journal of Operations Management
? = Not disclosed in paper

Table 4-1
Empirical Research on Financial Performance and New Business Initiatives (Cont'd)

	Variables of Interest					
Study	**Measure**	**Respondents**	**Limits**	**Scale?**	**Results**	**Weaknesses & limitations**
Dixon 1998	Survey	QA/QC mgrs	ISO-9000	Scale	Inconclusive	Use of Levels; not industry-adjusted no controls
Dusseau 1998	Interview Interview NA	? ? ?	Miss Qual Award Case Study Public Baldrige	Scale NA NA	Inconclusive Inconclusive Inconclusive; Performance deteriorates	Sample size
Easton and Jarrell 1995	Telephone Interview	QA Senior Mgr	Text/ValueLine Compustat	Tertiary	TQM positively associated with variance from analyst forecast	TQM definition very broad Control group weak
Engelkeyer 1991	Survey	Top ranking	Electronic Circuits	Scale	Inconclusive	Sample size; levels; no controls
Grandzol and Gershon 1997	Survey	Senior Site Managers	Navy Contractors	Scale	Continuous improvement = financial quality through operational quality	Data mining; definition of "financial quality"
Balachrishnan et al. 1996	Annual Report/10k	NA	< SICs	Binary	Inconclusive; firms with low customer concentration benefit	Binary independent; rely on public info;
Biggart 1997	Lexis/anecdotal	NA	Compustat, Users	Binary	Inconclusive	Binary independent, No controls
Boyd 1998	Survey	?	Compustat? 3 Industries	Scale	Inconclusive	Levels variables; no controls
Husan and Nanda 1995	WSJ Index Anecdotal	NA	Compustat	Binary	JIT positively associated	Control for other;control for pre-JIT performance; Emphasis on inventory
Kinney and Wempe 1998	Lexis MD&A Anecdotal	NA	Compustat	Binary	JIT positively associated	Control for other;control for pre-JIT performance;Rely on public info
Kaynak 1998	Survey	Quality Mgrs	NAPM, ASQM (5)	Scale	Together make a difference	Doesn't separate; self-reported; dependent measure not pure; period
Shields 1995	Survey	80% Controllers 100% Involved	ABC Users	NA	Diverse and Moderate 75% Yes; Correlation of .53 with success	Self-reported; vagueness of dependent
Swenson 1995	Interviews	Controllers, Managers	Users, Manufacturers	4-point	Higher satisfaction after ABC	Sample size; dependent variable
Cegwin 1999 (Current Study)	Survey	Top Mgmt	$5 million revenu or 30 employees	7-point & time	Several initiatives significant; some synergy; Controls necessary	Study restricted to trucking industry

1 = 2nd Order Regression
2 = Weighted average of four years weighted toward fourth year.
3 = Other methods or measures may have been used; disclosed are those that most closely pertain to this research
4 = JIT Purchasing
5 = Intersection of National Association of Purchasing Management and American Society for Quality Control
6 = Indirectly by including industry exogenous variables in prediction of endogenous variables
7= Control firms matched on industry and other criteria
8= Or include previous level of dependent variable in control group selection.
9= Study was of a single industry - for-hire motor freight
FS = Financial Strength, an index of liquidity, leverage and performance variables based on Kristy (1991)
JMAR = Journal of Management Accounting Research
JOM = Journal of Operations Management
? = Not disclosed in paper

Figure 4-1
H1: Association of ABC with Improved Financial Performance

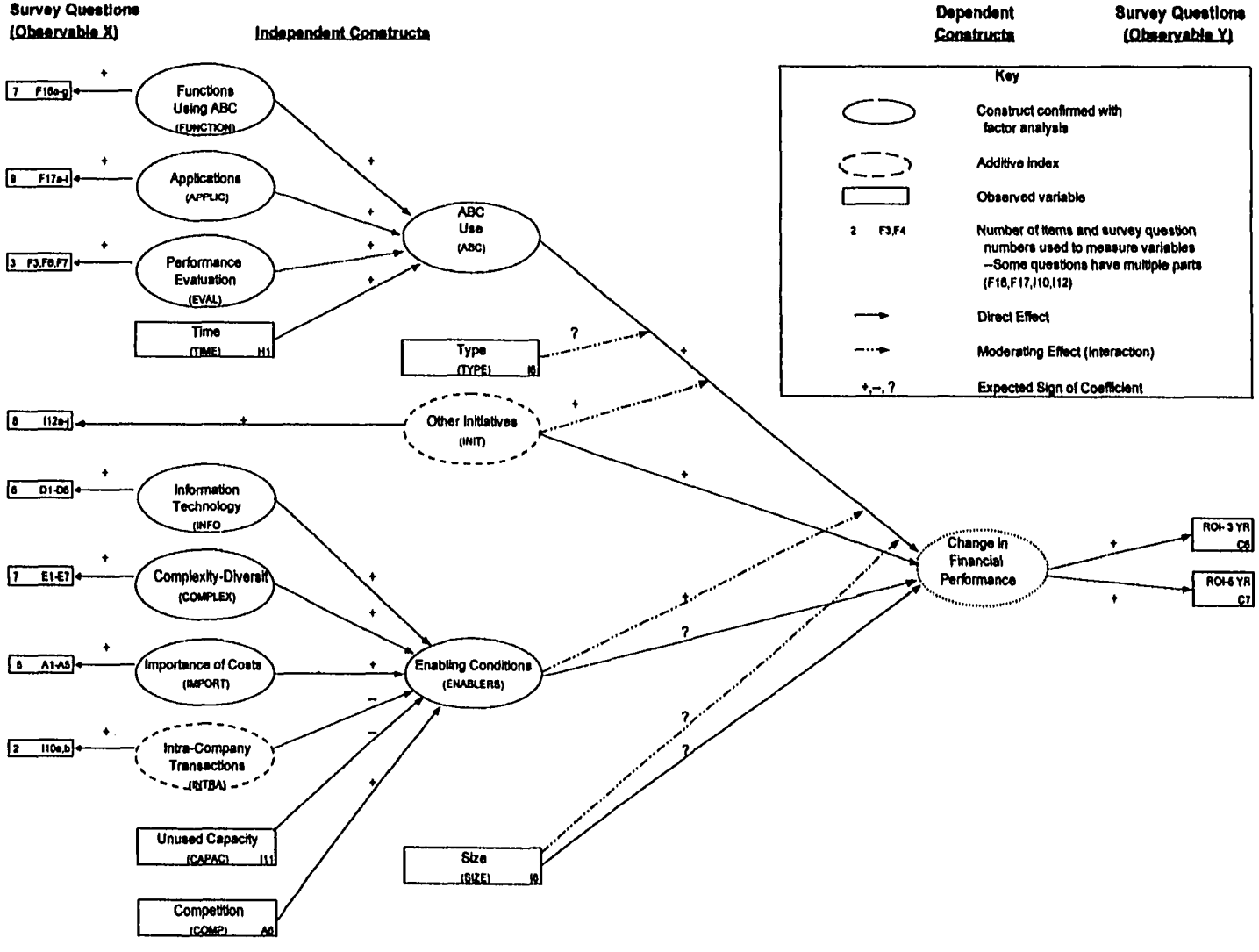


Table 4-2
Correlations of Self-Reported Dependent Measures with Actual Reported (Compustat) Performance Measures Adjusted for Industry Performance (3-Digit)

		Likert Dependent Measure with Continuous Measure		Likert Dependent Measure with Ranked Measure	
Measure	n	Pearson	Spearman	Pearson	Spearman
ROI Change - 3 Years	51	0.77	0.78	0.86	0.86
ROI Change - 5 Years	47	0.62	0.71	0.75	0.76

Likert Dependent Measure with Ranked Compustat Measure

		Ranks Identical		Ranks Differ by 1		Ranks Differ by>1	
	n	Number	%	Number	%	Number	%
ROI Change - 3 Years	51	37	72.5%	14	27.5%	0	0.0%
ROI Change - 5 Years	47	28	59.6%	18	38.3%	1	2.1%
	98	65	66.3%	32	32.7%	1	1.0%

Subject firms actual reported performance is adjusted by the median performance of firms in the subject firm's primary 3-digit SIC code

The number of industry firms ranges from 4(SICs 376 and 799) to 226 (SIC 131).

Compustat firms are ranked 1-5 with the equivalent number of individual ranks as the dependent variable.

Figure 4-2
S-Shaped Curve

Diffusion of an initiative takes place over time in the shape of an S-shaped curve
An S-shaped curve is appropriately modeled as a cumulative probability function (cdf)

Use Year	% Annual Relative Change In Diffusion (pdf)	RELDIFF % Relative Diffusion At End Of Year (cdf)
-1	0%	0%
0	1%	1%
1	3%	4%
2	6%	10%
3	12%	22%
4	18%	40%
5	20%	60%
6	18%	77%
7	12%	89%
8	6%	96%
9	3%	99%
10	1%	99%
11	0%	100%
12	0%	100%
13	0%	100%
14	0%	100%
15	0%	100%
16	0%	100%
17	0%	100%
18	0%	100%
19	0%	100%
20	0%	100%
Total	100%	
Mean (years)		5
Variance		4
Std. deviation		2

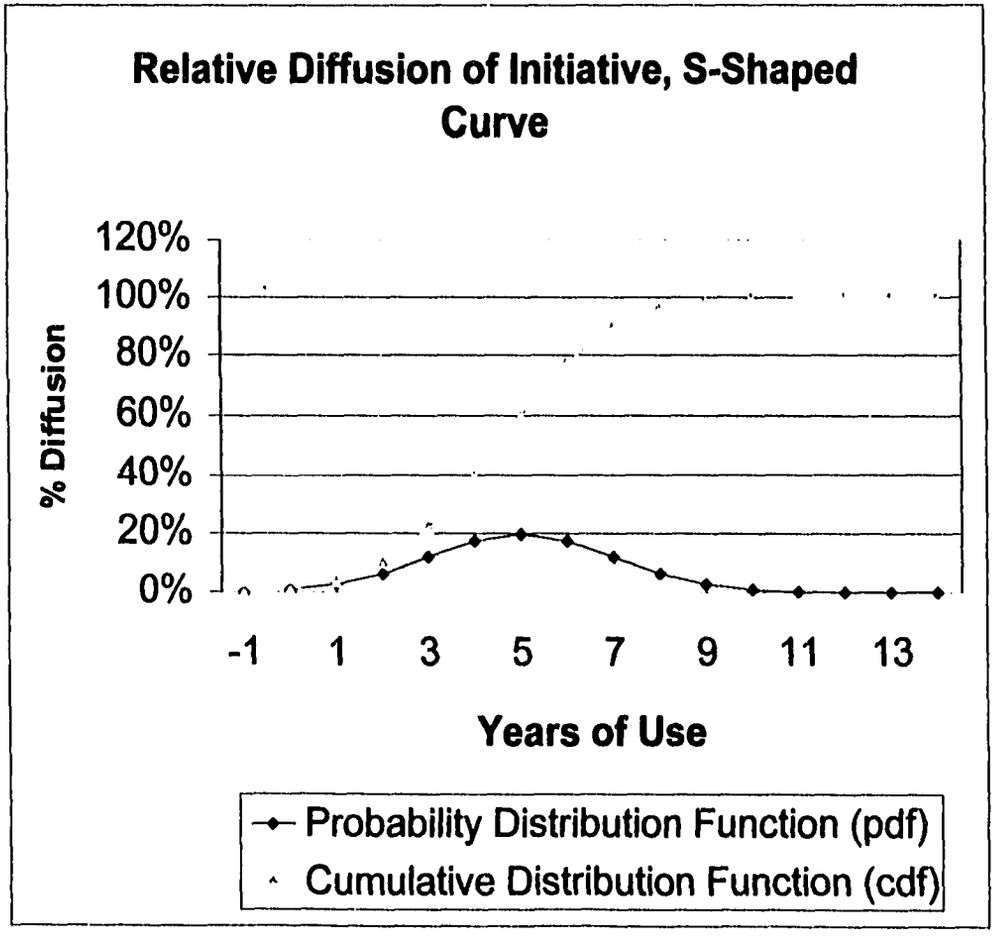


Figure 4-3
H2: Association of "SUCCESS" with Improved Financial Performance

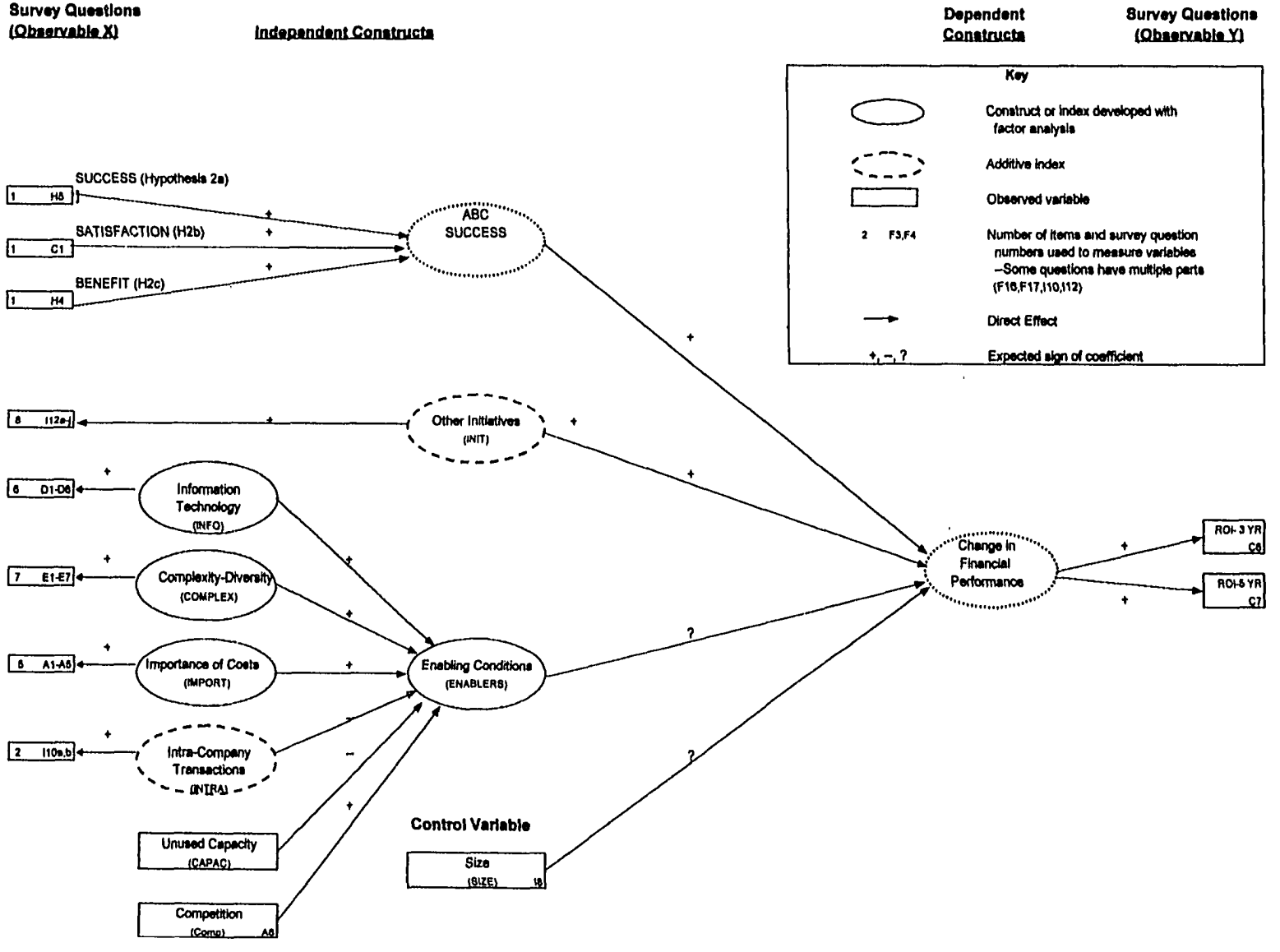


Table 4-3
Institute of Internal Auditors (IIA) Chapters

		Responses				
Chapter Name	Number Mailed	First Mailing	Second Mailing	Total	Percent Returned	Percent of Total
Albuqurque, New Mexico	8	0	2	2	25.0%	1.0%
Chicago, Illinois	240	44	15	59	24.6%	28.9%
Dallas, Texas	237	25	17	42	17.7%	20.6%
Fort Worth, Texas	61	12	2	14	23.0%	6.9%
Houston, Texas	316	32	20	52	16.5%	25.5%
Long Island, New York	44	8	2	10	22.7%	4.9%
Miami, Florida	89	10	7	17	19.1%	8.3%
Northeast Pennsylvania	12	0	1	1	8.3%	0.5%
Santa Fe, New Mexico	1	0	0	0	0.0%	0.0%
Tampa, Florida	50	6	1	7	14.0%	3.4%
	1,058	137	67	204		100.0%

Table 4-4
Summary of Sample

Questionnaires Mailed		1,058
Less: Undeliverable		68
Net Questionnaires Delivered		990
Less: Incomplete Responses:		
Company does not use cost allocation methods	12	
Company policy against responding to surveys	6	
Respondent is consultant	1	
Respondent is no longer employed at subject firm	7	
Respondent is not knowledgeable about cost systems*	2	28
Net Responses Possible		962
Responses Received		
First Mailing	137	
Second Mailing	67	204
Response Rate		21.2%

* Generally because the position is extremely specialized such as railroad rate auditor.

Table 4-5
Descriptive Statistics
Number of Respondents By Size Within Business Unit

n=204

		Annual Revenue									
Survey Items	Business Unit	Under $5 Million	$5-20M	$21-50M	$51-100M	$101-500M	$501M-$1	$1B-$5B	Over $5Billion	Total	%
1,18	Plant	0	2	0	2	3	4	2	0	13	6.4%
	Division	0	2	1	2	8	5	12	5	35	17.2%
	Group	2	0	0	0	4	1	7	4	18	8.8%
	Subsidiary	0	2	0	4	6	5	4	4	25	12.3%
	Country	0	0	3	0	2	0	0	6	11	5.4%
	Company	1	3	1	6	17	23	25	26	102	50.0%
	Total	3	9	5	14	40	38	50	45	204	100.0%
	%	1.5%	4.4%	2.5%	6.9%	19.6%	18.6%	24.5%	22.1%		

Table 4-6
Descriptive Statistics
Number of Respondents By Size Within Industry
n=204

Survey Items	Industry	Annual Revenue: Under $5 Million	$5-20M	$21-50M	$51-100M	$101-500M	$501M-$1	$1B-$5B	Over $5Billion	Total	%
I6,I8	Manufacturing	1	2	0	8	22	23	28	22	106	52.0%
	Financial Services	0	0	2	0	0	2	7	5	16	7.8%
	Wholesale/Retail	0	2	1	1	4	1	2	0	11	5.4%
	Transportation	0	0	0	0	5	2	1	6	14	6.9%
	Utilities	0	0	0	1	4	6	4	5	20	9.8%
	Other Services	0	4	1	0	0	1	2	1	9	4.4%
	Other	2	1	1	4	5	3	6	6	28	13.7%
	Total	3	9	5	14	40	38	50	45	204	100.0%
	%	1.5%	4.4%	2.5%	6.9%	19.6%	18.6%	24.5%	22.1%	#####	

Table 4-7
Use of Innovative Business Practices

n=204

Survey Item	Business Initiative	Number Using	Percent of Total	Manufacturers Number	Manufacturers Percent (n=106)	Non-Manufacturers Number	Non-Manufacturers Percent (n=98)	Percent of Users with $1 Billion Revenues*
I12	Activity-Based Costing (ABC)	47	23.0%	33	31.1%	14	14.3%	40.4%
	Total Quality Management (TQM)	94	46.1%	65	61.3%	29	29.6%	58.5%
	Just-in-Time (JIT)	95	46.6%	66	62.3%	29	29.6%	56.8%
	Computer-integrated Manufacturing (CIM)	37	18.1%	37	34.9%	0	0.0%	54.1%
	Business Process Reengineering (BPR)	79	38.7%	42	39.6%	37	37.8%	49.4%
	Value Chain Analysis (VCA)	23	11.3%	16	15.1%	7	7.1%	43.5%
	Flexible Manufacturing Systems (FMS)	16	7.8%	16	15.1%	0	0.0%	68.8%
	Theory of Constraints (TOC)	9	4.4%	6	5.7%	3	3.1%	66.7%

Number of Initiatives in Use	0	1	2	3	4	5	6	7	Total
Responses (Total)	45	45	34	47	23	6	4	0	204
Responses (Manufacturing)	14	19	12	30	21	6	4	0	106
Responses (Non-Manufacturing)	31	26	22	17	2	0	0	0	98
% (Total)	22.1%	22.1%	16.7%	23.0%	11.3%	2.9%	2.0%	0.0%	100.0%
% (Manufacturing)	13.2%	17.9%	11.3%	28.3%	19.8%	5.7%	3.8%	0.0%	100.0%
% (Non-Manufacturing)	31.6%	26.5%	22.4%	17.3%	2.0%	0.0%	0.0%	0.0%	100.0%

	All Initiatives			Omitting Purely Manufacturing Initiatives**		
	Total	Manuf.	Non-Manuf.	Total	Manuf.	Non-Manuf.
Mean Number of Initiatives	1.96	2.56	1.32	1.70	2.06	1.32
Median	2	3	1	2	2	1

Responses to question "Check if the following is used to a significant extent in your business unit."

Table 4-8
Current Cost Management & Information Technology Systems

n=204

Survey Item		All Firms n=204			Significant ABC Users n=47			Some ABC Use n=65			No ABC Use n=139		
		Mean	1-2	4-5	Mean	1-2	4-5	Mean	1-2	4-5	Mean	1-2	4-5
C1	Satisfaction with existing cost methodology	3.10	37%	47%	3.39	24%	67%	3.22	31%	58%	3.05	40%	42%
C2	Satisfaction with performance measurement	3.08	37%	45%	3.35	33%	61%	3.22	35%	52%	3.01	38%	42%
C3	Satisfaction with cost reduction information	3.15	36%	47%	3.70	22%	70%	3.52	28%	65%	2.98	40%	39%
D1	Integration of information systems	3.04	41%	49%	3.30	11%	74%	3.40	34%	55%	2.97	44%	46%
D2	User-friendly query capability	2.74	54%	32%	3.20	41%	48%	3.06	45%	43%	2.59	58%	27%
D3	Detailed sales & operating data available	3.85	10%	78%	3.85	11%	83%	3.86	9%	82%	3.85	11%	76%
D4	Multiple views of cost & performance data	3.40	28%	59%	3.50	24%	67%	3.48	26%	66%	3.36	29%	55%
D5	Operating data updated "real time"	2.82	51%	35%	3.24	33%	52%	3.20	37%	52%	2.64	58%	27%
D6	Quality of cost system is excellent	2.70	51%	28%	3.02	46%	48%	2.88	51%	40%	2.62	51%	23%

1=Strongly Disagree to 5=Strongly Agree with Statement

Table 4-9
Use of ABC- Significant Users
n=47

Q	Application	---Extent of Use--- 1	2	3	4	5	Mean	Number of Responses Median	4&5	Percent
F17	Product Costing	0	4	5	18	19	4.13	4	37	78.7%
	Cost Reduction	0	0	2	25	19	4.37	4	44	93.6%
	Pricing Decisions	0	9	12	11	14	3.65	4	25	53.2%
	Product Mix Decisions	0	8	7	18	13	3.78	4	31	66.0%
	Determine Customer Profit	0	6	10	22	8	3.70	4	30	63.8%
	Budgeting	0	6	8	22	10	3.78	4	32	68.1%
	As an Off-Line Analytic To	0	2	15	20	9	3.70	4	29	61.7%
	Outsourcing Decisions	0	10	11	19	6	3.46	4	25	53.2%
	Performance Measuremen	0	7	6	24	9	3.76	4	33	70.2%

		Number of Years ≤1	1-2	2-3	3-4	4-5	>5
	Time Since						
H1a	Implementation of ABC	4	9	7	13	5	9
H1b	Use for Decision-making	7	13	9	9	4	5

H4 **ABC Has Been Worth Implementing?**

Value	Number	Percent
Yes	31	67.4%
Will Be	4	8.7%
Too Early to Tell	11	23.9%
No	1	2.2%

H5 **ABC Has Been Successful?**			**F15 Benefit > Cost?**	
Value	Number	Percent	Number	Percent
Strongly Agree	9	19.1%	13	27.7%
Agree	25	53.2%	17	36.2%
No Opinion	8	17.0%	12	25.5%
Disagree	3	6.4%	4	8.5%
Strongly Disagree	2	4.3%	1	2.1%

* 65 respondents indicated some use of ABC.
47 respondents indicated use to a significant extent in decision-making.

Table 4-10
Correlation Matrix of New Business Initiatives
Manufacturers, n=106, to the Lower Left of the Diagonal
All Firms, n=204, to the upper Right
(Spearman Correlations)

	ABC	JIT	CIM	BPR	VCA	FMS	TQC	TQM
Activity-Based Costing (ABC)	1.000	**0.202**	-0.041	0.125	0.030	-0.027	-0.059	0.090
Just-In-Time (JIT)	**0.252**	1.000	**0.249**	**0.267**	**0.164**	**0.276**	0.087	**0.340**
Computer Integrated Manufacturing (CIM)	-0.058	**0.241**	1.000	0.018	0.074	**0.147**	0.023	0.126
Business Process Reengineering (BPR)	0.126	**0.273**	0.074	1.000	0.130	0.030	**-0.171**	**0.254**
Value Chain Analysis (VCA)	0.056	**0.234**	0.040	0.052	1.000	**0.300**	**0.301**	0.044
Flexible Manufacturing Systems (FMS)	-0.004	**0.229**	0.129	-0.093	**0.349**	1.000	**0.295**	-0.014
Theory of Constraints (TOC)	-0.049	0.115	0.002	-0.019	**0.467**	**0.428**	1.000	-0.055
Total Quality Management (TQM)	0.174	**0.313**	0.049	**0.485**	-0.081	-0.069	-0.130	1.000

Bold = significant at the 0.05 level
Underlined = significant at the 0.10 level

	Total	Full Sample		Manufacturers	
	Possible	Number	%	Number	%
Significant at 5%	28	11	39.3%	10	35.7%
Significant at 10%	28	14	50.0%	11	39.3%

	JIT	CIM	BPR	VCA	FMS	TQC	TQM
Number Significantly Using ABC (47 firms) with	30	7	23	6	3	1	25
Percent	63.8%	14.9%	48.9%	12.8%	6.4%	2.1%	53.2%

		Number of Initiatives						
	Mean	0	1	2	3	4	5	6
Number Significantly Using ABC with	2.2	7	6	17	10	4	2	1
Percent		14.9%	12.8%	36.2%	21.3%	8.5%	4.3%	2.1%

Table 4-11
Construct Unidimensionality and Reliability

Construct	Description	Instrument Items	Number of Items Original	Deleted	Chi-Square /degrees of freedom	p-value	Goodness of Fit Index (GFI)*	Adjusted Goodness of Fit Index (AGFI)**	Root Mean Square Residual (RMR)***	Bentler-Bonnett Coefficient (NFI)****	Cronbach Alpha (Alpha)*****
FUNCTION	Functions Using ABC	F16a-g	7	0	2.96/7	0.89	0.99	0.95	0.026	0.99	0.90
APPLIC	Applications ABC Used For	F17a-l	9	0	16.60/19	0.62	0.95	0.88	0.044	0.96	0.92
EVAL	Use for Performance Evaluation	F3,6,7	3	0	2.23/1	0.14	0.98	0.87	0.027	0.98	0.87
INFO	Information Technology Sophisti	D1-D6	6	1	3.93/4	0.42	0.99	0.97	0.016	0.99	0.84
COMPLEX	Complexity-Diversity	E1-E7	7	2	1.81/4	0.77	1.00	0.99	0.012	0.99	0.79
IMPORT	Importance of Costs	A1-A5	5	2	10.71/1	0.00	0.97	0.80	0.082	0.91	0.54
			37	5							
ABC	All ABC variables		19	0	131.99/12	0.36	0.94	0.91	0.012	0.98	0.94

*GFI value of 0.90 suggests that there is no lack of unidimensionality (Joreskog and Sorbom 1989)

**AGFI value of 0.80 indicates a good fitting model (Tabachnick and Fidell 1996)

***RMR value of under 0.10 indicates a good fitting model (Tabachnick and Fidell 1996)

****NFI value of 0.90 suggests strong convergent validity (Tabachnick and Fidell 1996)

***** Alpha value of 0.50 indicates acceptable reliability (Nunnally 1978)

Table 4-12
Exploratory Multiple Regression Analysis of Overall Effect of Enabling Conditions on Improvement in Performance

n=204

Model F	6.666
Model p-value	0.0001
R square	0.1441
Adjusted R square	0.1225

Variable	Parameter Estimate	Standardized Parameter Estimate	Standard Error	T-statistic	p-value
Intercept	1.018	0.000	0.950	1.072	0.285
ABC	(0.038)	(0.064)	0.066	(0.576)	0.565
Other INITiatives	0.152	0.221	0.056	2.697	**0.004**
ENABLErs	0.235	0.096	0.171	1.372	0.172
ABC*INIT*ENABLE	0.009	0.175	0.007	1.405	*0.081*
SIZE	0.049	0.105	0.322	1.532	0.127

Bold = Significant at the 0.05 level
Italicized = Significant at the 0.10 level

Intercept and Size tested with two-tailed test; Other variables with one-tailed tests

Figure 4-4

H1: Association of ABC with Improved Financial Performance as Tested

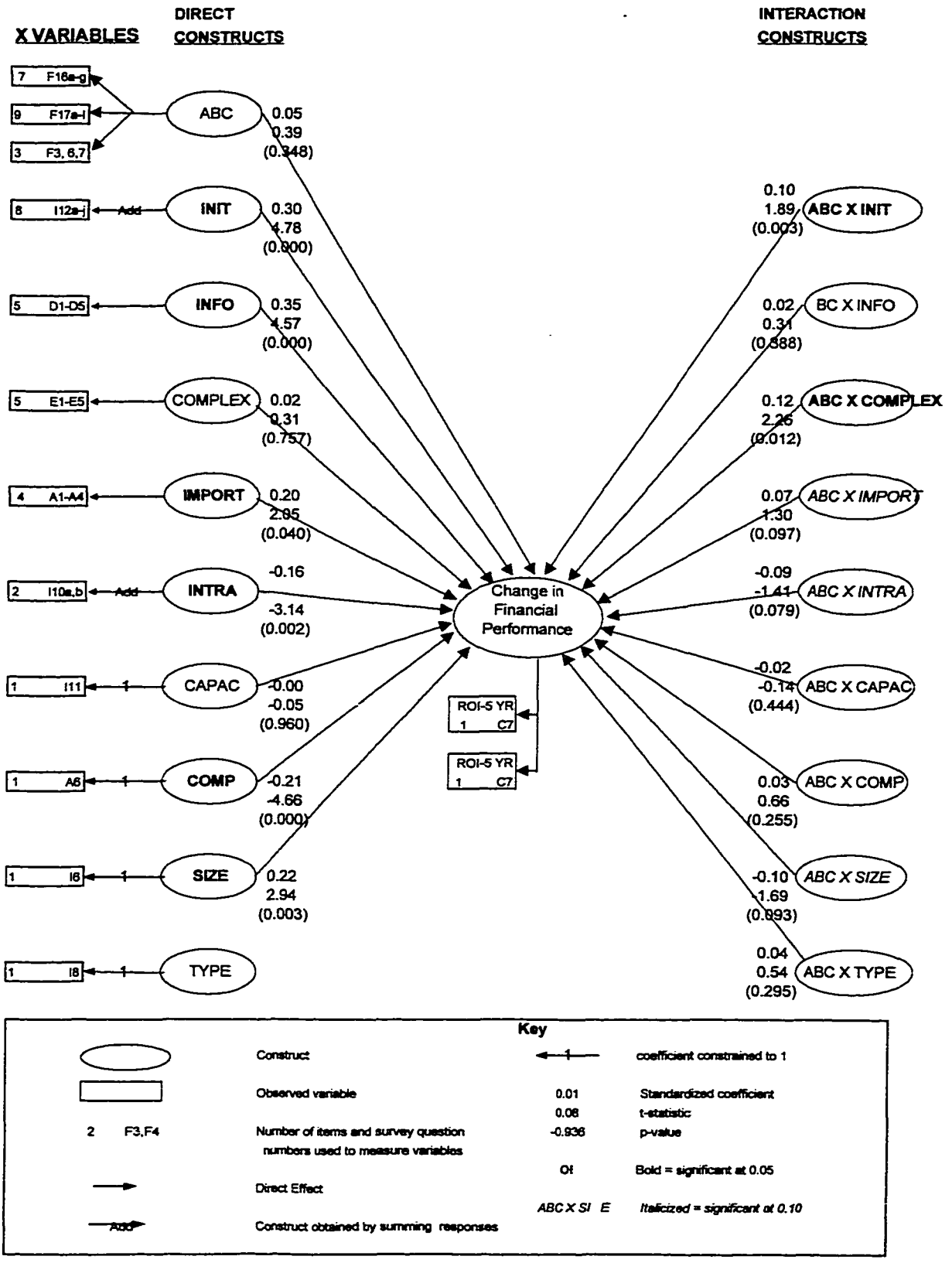


Table 4-13
LISREL Models of ROI on ABC and Success with Control for Enabling Conditions

n=204

ABC Construct	Chi-Square	Degrees of Freedom	p-value	GFI	AGFI	RMR	R2
SATISfaction	552	175	0.00	0.82	0.76	0.078	0.35
SUCCESS	524	173	0.00	0.83	0.77	0.078	0.35
BENEFIT	517	172	0.00	0.83	0.77	0.077	0.35

	--------SATISfaction-------			----------SUCCESS----------			-----Financial BENEFIT-----		
	Coefficient	t-statistic	p-value*	Coefficient	t-statistic	p-value*	Coefficient	t-statistic	p-value*
ABC	0.09	1.26	0.104	0.11	*1.59*	*0.059*	0.06	0.94	0.174
IT	0.27	**3.08**	**0.002**	0.27	**3.24**	**0.001**	0.29	**3.39**	**0.001**
COMPLEX	0.12	1.53	0.126	0.07	0.81	0.418	0.08	0.95	0.166
IMPORTANCE	0.15	0.15	0.136	0.23	**2.41**	**0.016**	0.26	**2.34**	**0.001**
CAPACITY	0.01	0.83	0.302	0.01	0.20	0.841	0.01	0.23	0.826
OI	0.32	**5.24**	**0.000**	0.29	**4.72**	**0.000**	0.30	**4.76**	**0.000**
INTRACO	(0.17)	**0.01**	**0.006**	(0.16)	**(2.76)**	**0.006**	(0.16)	**(2.72)**	**0.007**
COMPETE	(0.27)	**(4.11)**	**0.001**	(0.32)	**(4.86)**	**0.000**	(0.31)	**(4.69)**	**0.000**
SIZE	0.12	**0.12**	**0.042**	0.11	*1.84*	*0.066*	0.11	*1.87*	*0.061*

* One-tailed test except for SIZE

Chapter 5

Summary and Conclusions

The primary purpose of this dissertation is to measure the improvement in financial performance that is associated with use of new business initiatives such as JIT, TQM, and ABC. Knowledge of the efficacy and synergy of business initiatives is of interest to three communities: 1) the practitioner community (including accountants, managerial decision-makers, potential project leaders, professional associations, and consultants) using, promoting, instructing in the use of, or contemplating the implementation of initiatives, 2) researchers interested in the theoretical and empirical literature regarding these initiatives, and 3) educators who communicate the commonly believed benefits and instruct in the use of initiatives.

The investigation makes use of two distinct data sources and is organized into three areas of inquiry that telescope from the general to the specific in an attempt to reach a conclusion as to the efficacy of initiatives. The dissertation is structured into three separate, self-contained studies, rather than a single manuscript.

Initiative Use

Descriptive findings include that use of initiatives is common and consistent for both the cross-industry and motor carrier industry samples with 78 percent and 72 percent, respectively, of firms reporting that they are significant users of at least one initiative. Most firms use multiple initiatives concurrently and only 22 percent (21 percent) use a single initiative in isolation. In the motor carrier industry, poor performers

tend to implement more initiatives, possibly because they feel a greater need to improve performance, while top performers may be more satisfied with the status quo.[1]

For the cross-industry sample, a substantial minority, 23 percent, reported that they are significant users of ABC, with another nine percent in the process of implementation. Only seven of the 47 significant ABC users are using ABC in isolation, apart from other initiatives. Significant users tend to use ABC in several applications, with cost reduction and product costing the highest use. The majority have been using ABC for decision-making for over two years, 74 percent felt the implementation has been successful, 67 percent feel that the implementation has been worth implementing, and 65 percent feel that the benefits exceed the cost.

Summary of the Studies and Results

The first study, "The Association between Use of Business Innovations and Improvement in Financial Performance," is presented in Chapter 2. This study contains regression analyses of the association between the use of the initiatives (measured with dichotomous variables) and change in financial performance, operationalized as self-reported industry-adjusted five year change in ROI. Data is obtained through a cross-sectional mail survey of 1,058 internal auditors. ABC, TQM, CIM, VCA, and FMS are significantly associated with ROI improvement for the manufacturing segment of the sample. Interactions between initiatives are included as additional explanatory terms to identify synergies between use of multiple initiatives. Concurrent use of JIT with TQM, JIT with CIM, BPR with TQM, and JIT with ABC in manufacturing obtain statistical

[1] Information is not available from the cross-industry sample to test this assertion.

significance. This study enhances previous research by identifying specific initiatives that contribute to improvement in financial performance, provides an objective source, internal auditors, and is the first study to control for implementation of multiple initiatives and to include synergistic effects in a model.

Chapter 3 contains the second study, "The Association between Use of New Business Initiatives and Financial Performance: Evidence from the Motor Carrier Industry." This study makes use of the model developed in the first, cross-industry study to isolate the effects of new initiatives in a single service industry, the motor carrier industry. Enhancements include a more refined, 7-point Likert measure of use of each initiative, time (years) since beginning of use of the initiative, actual financial statement performance data as a dependent variable, and control for prior level of financial performance. Findings include that Partnerships with Suppliers, EDI, Satellite Tracking Systems and ABC are significantly associated with ROI improvement in the industry. Concurrent use of Partnerships with Suppliers and Satellite Tracking Systems and of EDI with ABC generate a positive synergy.

An in depth study of a single initiative, ABC, is the focus of the third study, "The Association between ABC and Financial Performance," presented in Chapter 4. Its purpose is to develop and test a comprehensive structural model that incorporates factors that have been postulated by previous researchers to affect the efficacy of ABC, including use of other initiatives, complexity, information system sophistication, importance of costs, the competitive environment, and the existence of intra-company transactions and unused capacity. This study also contributes a composite, continuous measure of ABC diffusion (and hypothesized efficacy). As in the first study, data is obtained from a mail

survey of internal auditors. The factors are multi-item measures validated with confirmatory factor analysis, discriminant analysis, and reliability testing. The first finding is that positive synergies are obtained from concurrent use of other initiatives with ABC. The second finding provides evidence supporting previous analytical and theoretical research regarding the conditions favorable to obtaining benefits from ABC. There is a positive association between ABC and improvement in ROI when ABC is used in relatively complex and diverse firms, in environments where costs are relatively important, and when there are limited numbers of intra-company transactions to constrain benefits. In addition, the signs of the coefficients of the remaining enabling conditions (information technology sophistication, absence of excess capacity, and a competitive environment) are as hypothesized, providing some indication that they affect the efficacy of ABC. Also manufacturers may tend to obtain greater benefits than non-manufacturers.

In a separate test, measures of "successful" ABC systems are substituted into the model to determine their association with improvement in financial performance. There is some evidence that measures of "satisfaction" with cost system, "success" of ABC, and "financial benefit" obtained from ABC that have been used in prior research are predictors of improvement in financial performance. This finding is an important step toward completing the link between identification of the conditions factors affecting the success of ABC implementation and documenting the efficacy of ABC as a tool aiding profit-maximizing firms in attaining their goals.

Conclusions and Recommendations for Further Research

In summary, there is empirical evidence that, in both manufacturing and in a specific service industry, initiative use is associated with improvement in financial performance. It is also possible that initiatives are effective in service industries other than motor carriers. Obtaining the information necessary to construct a stronger measure of initiative use than binary variables (e.g., as for motor carriers in Chapter 3) may allow detection the effect.

Specific enabling conditions that positively affect the efficacy of ABC are identified. It is also possible that the remaining enabling conditions also positively enhance the use of ABC and that the effect could be confirmed through methods that allow increased statistical power (e.g., larger sample size, multi-item measures of capacity utilization and competitive environment, partitioning of industry membership more finely). Further research is also needed to explain the increased efficacy of ABC in smaller business units.

The improvements in performance identified in this dissertation may result more from the introspection and internal and external communication that occurs whenever an initiative is implemented rather than results achieved from the mechanical application of the initiative. For example, in the motor carrier industry the strongest results are obtained for initiatives that aid in external communication – EDI and PWS have significant direct effects in all tests and contribute to positive synergy. Research that investigates the conditions under which improvement occurs would be of benefit.

There is consistent empirical evidence from all three studies that some synergies are obtained from concurrent use of initiatives. However, more research is needed to explain

how this effect occurs. Future research could identify the components of financial performance that are impacted by initiative use..

Contributions

This dissertation extends the use of inductive empirical methodology into research on technological change. It contributes to the development of the theory of new business initiatives in five ways. The first and most important contribution is to provide empirical evidence on the assertions made by advocates concerning the benefits of the initiatives. Second, synergistic benefits obtained from concurrent use of multiple initiatives are identified. Third, this study eliminates a significant limitation of previous research, i.e., the lack of control for simultaneous use of multiple initiatives. Fourth, the study enhances the credibility of previous research by using unbiased and objective internal auditors as respondents and providing confirming evidence regarding the efficacy of the construct "success" in ABC research. Fifth, a model explaining ABC efficacy is synthesized from previous research.

Taken together, these three studies provide a significant extension of research into the efficacy of new business initiatives. The studies detect a positive association between initiative use and improved financial performance across manufacturing industries, within a specific service industry, and also provide a model for further advances in empirical testing of these initiatives. The positive findings regarding ABC are of particular interest to practicing and academic accountants because they are often the primary proponents and administrators of ABC and all previous evidence of ABC efficacy has been theoretical or anecdotal.

Bibliography

Ahire, S. L., D. Y. Golhar, and M. A. Waller. 1996 Development and Validation of TQM Implementation Constructs. *Decision Sciences (*Winter): 23-56.

Alles, M. 1990. A Strategic Model of Costing. Working Paper. Stanford University.

Alles, M., S. Datar, and R. Sarkar. 1997. Control and Quality in Empowered Work Settings: Model and Empirical Analysis. Working Paper (April).

American Trucking Associations, Inc. 1990. *Annual Report of Motor Carrier Financial and Operating Statistics.* Washington, D.C.: American Trucking Associations, Inc.

Anderson, J., and D. Gerbing. 1991. Predicting the Performance of Measures in a Confirmatory Factor Analysis with a Pretest Assessment of their Substantive Validities. *Journal of Applied Psychology* 76 (5): 732-740.

Anderson, S. W. 1995a. A Framework for Assessing Cost Management System Changes: The Case of Activity-Based Costing Implementation at General Motors, 1986-1993. *Journal of Management Accounting Research* (Fall): 1-51.

Anderson, S. W. 1995b. Measuring the Impact of Product Mix Heterogeneity on Manufacturing Overhead Cost. *The Accounting Review* (3rd Qtr.): 363-388.

Ansari, A., and B. Modaress. 1987. The Potential Benefits of Just-In-Time Purchasing for U.S. Manufacturing. *Production and Inventory Management Journal* 2: 30-35.

Ansari, A., and B. Modaress. 1988. JIT Purchasing as a Quality and Productivity Centre. *International Journal of Production Research* 26(1): 19-26.

Atkinson, A. A., R. D. Banker, R. S. Kaplan, and S. M. Young. 1995. *Management Accounting.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Babbie, E. 1990. *Survey Research Methods* (2nd ed.). Belmont, CA: Wadsworth Publishing Company.

Bagozzi, R. P., Y. Yi, and L. W. Phillips. 1991. Assessing Construct Validity in Organizational Research. *Administrative Science Quarterly* 36: 421-458.

Balakrishnan, R., T. J. Linsmeier, and M. Venkatachalam. 1996. Financial Benefits from JIT Adoption: Effects of Customer Concentration and Cost Structure. *The Accounting Review* (April): 183-205.

Banker, R. D., and S. M. Datar. 1987. Accounting for Labor Productivity in Manufacturing Operations: An Application. *In Accounting and Management -- Field*

Study Perspectives, edited by W. Bruns and R. S. Kaplan. Boston, MA: Harvard Business School Press: 169-203.

Banker, R. D., and J. Hughes. 1991. Activity-Based Costing and Equilibrium Pricing. Working Paper. University of Minnesota.

Banker, R. D., and G. Potter. 1991. Economic Comparisons of Single Cost Driver and ABC Systems. Working Paper. University of Minnesota.

Banker, R. D., G. Potter, and R. G. Schroeder. 1995. An Empirical Analysis of Manufacturing Overhead Cost Drivers. *Journal of Accounting and Economics* 19 (1): 115-137.

Barnes, F. C. 1991. Ies Can Improve Management Decisions Using Activity-Based Costing. *Industrial Engineering* (September): 44-50.

Bartov, E. 1993. The Timing of Asset Sales and Earnings Manipulation. *The Accounting Review* (October): 840-855.

Bentler, M. 1983. Some Contributions of Efficient Statistics in Structural Models: Specification and Estimation of Moment Structures. *Psychometrica*: 493-517.

Bentler, P. M., and D.G. Bonett. 1980. *Significance Tests and Goodness of Fit in the Analysis of Covariance Structures*. Psychological Bulletin 88: 588-606.

Bernard, V. L. 1994. Accounting-Based Valuation Methods, Determinants of Market-to-Book Ratios, and Implications for Financial Statements Analysis. Working Paper: Michigan Business School.

Biggart, T. 1997. *The Effects of Just-in-Time System Adoption of Firm Performance.* 1997. Dissertation: Florida State University.

Brinker, B. J. 1997. Big Changes, New Publications, and the Theory of Constraints. *Journal of Cost Management* (January/February): 4-5.

Boyd, D. T. III. 1996. *An Analysis of Publicly Available Performance Measures of Companies Adopting JIT.* Dissertation: Louisiana Tech University.

Brimson, J. A. 1991. *Activity Costing, An Activity-Based Costing Approach.* New York: John Wiley & Sons, Inc.

Bruns, W. J. and R. S. Kaplan. 1987. *Accounting & Management Field Study Perspectives*. Boston, MA: Harvard Business School Press.

Campbell, D. T., and D. W. Fiske. 1959. Convergent and Discriminant Validation by the Multitrait-multimethod Matrix. Psychological Bulletin 56 (1): 81-105.

Capon, N., J. U. Farley, and S. Hoenig. 1988. Determinants of Financial Performance: A Meta-analysis. *Management Science* 36: 1143-1159.

Capon, N., J. U. Farley, and S. Hoenig. 1990. Determinants of Financial Performance: A Meta-analysis. *Management Science* 36: 1143-1159.

Carr, D. K., and H. J. Johansson. 1995. *Best Practices in Reengineering: What Works and What Doesn't in the Reengineering Process*. New York: McGraw-Hill, Inc.

Cheng, C. S. A. 1998. Empirical Validity of All-Inclusive Income: An Investigation of Volatility of Aggregated and Disaggregated Income Line Items and their Explanatory Power for Returns. Working Paper: University of Houston.

Cook, T. D., and D. T. Campbell. 1979. *Quasi-Experimentation: Design & Analysis Issues for Field Settings*. Boston, MA: Houghton-Mifflin.

Cooper, R. 1988. The Rise of Activity-Based Costing -- Part Two: When Do I Need an Activity-Based System? *Journal of Cost Management* (Fall): 41-48.

Cooper, R. 1989a. The Rise of Activity-Based Costing -- Part Three: How Many Cost Drivers Do You Need and How do You Select Them? *Journal of Cost Management* (Winter): 34-46.

Cooper, R. 1989b. You Need a New Cost System When .... *Harvard Business Review* (January/February): 77-82.

Cooper, R., R. S. Kaplan, L. Maisel, and R. Oehm. 1992. *Implementing Activity-Based Management: Moving from Analysis to Action:* Montvale, NJ: Institute of Management Accountants.

Cooper, R. 1990. Cost Classification in Unit-Based and Activity-Based Manufacturing Cost Systems. *Journal of Cost Management* (Fall): 4-14.

Cooper, R., and R. S. Kaplan. 1988. Measure Costs Right: Make the Right Decisions. *Harvard Business Review* (September/October): 96-105.

Cooper, R., and R. S. Kaplan. 1991a. *The Design of Cost Management Systems: Text, Cases, and Readings*. Englewood Cliffs, NJ: Prentice Hall.

Cooper, R., and R. S. Kaplan. 1991b. Profit Priorities from Activity-Based Costing. *Harvard Business Review* (May/June): 130-135.

Cooper, R., and P. B. Turney. 1989. *Hewlett-Packard: The Roseville Network Division*. Boston, MA: Harvard Business School (Case #9-189-117).

Cooper, W., K. Sinha, and K. Sullivan. 1995. Accounting for Complexity in Costing High Technology Manufacturing. *European Journal of Operational Research* 85 (2): 316-326.

Cotton, W. D. J. 1993. Activity-Based Costing in New Zealand. Working Paper. SUNY at Genesco.

Coyle, J. J., E. J. Bardi, and C. J. Langley. 1989. *Management of Business Logistics: Competitive Positioning for the 1990s*. Oakbrook, IL: Council of Logistics Management.

Cronbach, L. 1951. Coefficient Alpha and the Internal Structure of Tests. *Psychometrica* 16: 297-334.

David, J. S. 1996. An Empirical Analysis of REA Accounting Systems, Productivity, and Perceptions of Competitive Advantage. Working Paper, Arizona State University.

Davis, H. W. 1991. Physical Distribution Costs – 1991, In *Annual Conference Proceedings of the Council of Logistics Management.* Oak Brook, IL: CLM, 357-364.

DeBondt, W.F.M., and R. Thaler. 1985. Does the Stock Market Overreact? *The Journal of Finance*(July): 793-805.

Dillman, D. A.1978. *Mail and Telephone Surveys: The Total Design Method.* New York: John Wiley & Sons.

Dion, P. A., P. M. Banting, and L. M. Hasey. 1990. The Impact of JIT on Industrial Marketers. *Industrial Marketing Management* 19(1): 41-46.

Dixon, J. M. 1996. *Total Quality Management in ISO-9000 Registered Organizations: An Empirical Examination of the Critical Characteristics Associated with Levels of Financial Performance.* Dissertation: Florida State University.

Drucker, P. F. 1995. The Information Executives Truly Need. *Harvard Business Review* (January-February): 55-63.

Dusseau, S. P. 1996. *An Analysis of the Relationship between Financial Performance and Total Quality Management Implementation.* Dissertation: University of Missouri-Rolla.

Easton, G. S., and S. L. Jarrell. 1995. The Effects of Total Quality Management on Corporate Performance: An Empirical Investigation. Working Paper. University of Chicago.

Edwards, E. O., and P. W. Bell. 1961. *The Theory and Measurement of Business Income.* Los Angeles, CA: University of California Press.

Elliot, R. K. 1992. The Third Wave Breaks on the Shores of Accounting. *Accounting Horizons* (June): 61-85.

Engelkemeyer, S. W. 1991. *An Empirical Study of Total Quality Management Practices in U.S. Manufacturing Firms.* Dissertation: Clemson University.

Estrin, T. L., J. Kantor, and D. Albers. 1994. Is ABC Suitable for Your Company? *Management Accounting* (April): 40-45.

Ettlie, J. E. 1983. Organizational Policy and Innovation Among Suppliers to the Food Processing Sector. *Academy of Management Journal* 35: 795-827.

Evans, H., and G. Ashworth. 1995. Activity-Based Management: Moving Beyond Adolescence. *Management Accounting-London* (December): 26-30.

Fama, E.F., and K.R. French. 1988. Permanent and Temporary Components of Stock Prices. *Journal of Political Economy* 96: 246-273.

Fama, E., and K. French. 1992. The Cross-section of Expected Stock Returns. *The Journal of Finance* (June): 427-465.

Feigenbaum, A. V. 1986. Quality: The Strategic Business Imperative. *Quality Progress* (February): 26-30.

Feinberg, S. 1983. *The Analysis of Cross-Classified Categorical Data.* Cambridge, MA: MIT Press.

Finger, C. A. 1994. The Ability of Earnings to Predict Future Earnings and Cash Flow. *Journal of Accounting Research* (Autumn: 210-223).

Fliedner, G., and R. Vokurka. 1997. Agility: The Next Competitive Weapon. *APICS—The Performance Advantage* (January): 56-59.

Flynn, B. B., R. G. Schroeder, and S. Sakakibara. 1994. A Framework for Quality Management Research and an Associated Instrument. *Journal of Operations Management* 11: 339-366.

Foster, G. 1986. *Financial Statement Analysis.* Newark, NJ: Prentiss-Hall.

Foster, G., and M. Gupta. 1990. Manufacturing Overhead Cost Driver Analysis. *Journal of Accounting and Economics* 12: 309-337.

Foster, G., and D. W. Swenson. 1997. Measuring the Success of Activity-Based Cost Management and Its Determinants. Journal of Management Accounting Research 9: 109-141.

Foster, G., and S. M. Young. 1997. Frontiers of Management Accounting Research. *Journal of Management Accounting Research* 9: 63-77.

Frazier, G., R. Speckman, and C. O'Neal. 1988. Just-In-Time Relationships in Industrial Markets. *Journal of Marketing* 52(4): 52-67.

Gatewood, R. D., and H. S. Field. 1990. *Human Resource Selection* (2nd ed.). Chicago IL: The Dryden Press.

Geishecker, M. L. 1996. New Technologies Support ABC. *Management Accounting* (March): 42-48.

Georgantzas, N. C., and H. J. Shapiro. 1993. Viable Theoretical Forms of Synchronous Production Innovation. *Journal of Operations Management* 11: 161-183.

Germain, R., C. Drodge, and P. J. Daugherty. 1994. The Effect of Just-In-Time Selling of Organizational Structure: An Empirical Investigation. *Journal of Marketing Research* 31: 471-483.

Gilbert, J. P. 1990. The State of JIT Implementation and Development in the USA. *International Journal of Production Research* 28: 1099-1109.

Golhar, D. Y. and C. L. Stamm. 1991. The Just-in-Time Philosophy: A Literature Review. *International Journal of Production Research* 29 (No.4): 657-676.

Gosselin, M. 1997. The Effect of Strategy and Organizational Structure on the Adoption and Implementation of Activity-Based Costing. *Accounting, Organizations and Society* 22 (2): 105-122.

Goyal, S. K., and S. G. Deshmukh. 1992. A Critique of the Literature on Just-in-Time Manufacturing. *International Journal of Operations and Production Management* (January): 18-28.

Grandzol, J. R., and M. Gershon. 1997. Which TQM Practices Really Matter: An Empirical Investigation. *Quality Management Journal* 4 (4): 43-59.

Granlund, M. 1997. The Challenge of Management Accounting Change. Doctoral Manuscript, Turku School of Economics and Business Administration.

Granland, M., and K. Lukka. 1998. It's a Small World of Management Accounting Practices. *Journal of Management Accounting Research* 10: 151-179.

Guadagnoli, E., and W. F. Velicer. 1988. *Relation of Sample Size to the Stability of Component Patterns*. Psychological Bulletin 103: 265-275.

Gupta, M., S. Baxendale, and K. McNamara. 1997. Integrating TOC and ABCM in a Health Care Company. *Journal of Cost Management* (July/August): 23-?

Halsey, R. F. 1996. Trends and Cycles in Earnings and Implications for Prices. Dissertation: University of Wisconsin-Madison.

Harmatuck, D. J., 1990. Motor Carrier Cost Function Comparisons. *Transportation Journal* (Summer): 31-46.

Harris, E. 1990. The Impact of JIT Production on Product Costing Information Systems. *Production and Inventory Management Journal* (1st Qtr): 44-48.

Healy, P. M. 1985. The Effect of Bonus Schemes on Accounting Decisions. *Journal of Accounting and Economics* (April): 85-107.

Henry, D. 1998. GE's Welch Sees Opportunity in Asia Crisis. *USA Today* (February 27): 8B

Hilton, R. W. 1994. *Managerial Accounting* (2nd ed.) New York: McGraw-Hill, Inc.

Hollander, M., and D. Wolfe. 1973. *Nonparametric Statistical Methods.* New York: Cambridge University Press.

Hooks, K., L. Rabello, and T. Velasco. 1995. An Expert System Framework for a CIM Based Quality Inspection System. *Computers and Industrial Engineering* (September): 159-163.

Huson, M., and D. Nanda. 1995. The Impact of Just-In-Time Manufacturing on Firm Performance. *Journal of Operations Management* (January): 5-14.

Im, J. H., and S. M. Lee. 1989. Implementation of JIT Systems in US Manufacturing Firms. *International Journal of Operations and Production Management* (January): 5-14.

Innes, J., and F. Mitchell. 1995. A Survey of Activity-Based Costing in the U.K.'s Largest Companies. *Management Accounting Research* (June): 137-153.

Inman, R. A., and S. Mehra. 1990. The Transferability of Just-In-Time Concepts to American Small Businesses. *Interfaces* 20 (2): 30-37.

Institute of Internal Auditors. 1990. *Statement of Responsibilities of Internal Auditing.* Altamonte Springs, FL: The Institute of Internal Auditors.

Institute of Internal Auditors. 1995. *Standards for the Professional Practice of Internal Auditing.* Altamonte Springs, FL: The Institute of Internal Auditors.

Institute of Internal Auditors Research Foundation. 1996. *Independence and Objectivity: The Intricate Responsibility for the Internal Auditor.* http://www.rutgers.edu/Accounting/raw/iia/priority/htm. Altamonte Springs, FL: The Institute of Internal Auditors Research Foundation.

Institute of Internal Auditors. 1997. *Michael J. Barrett Doctoral Dissertaion Grant* (Application Information). Altamonte Springs, FL: The Institute of Internal Auditors.

Institute of Management Accountants, Cost Management Group. 1994. 4th Annual Activity-Based Cost Management Survey Results. *Cost Management Update* (February): 1-4.

Jaccard, J., and C. K. Wan. 1996. *LISREL Approaches to Interaction Effects in Multiple Regression.* Thousand Oaks, CA: Sage Publications, Inc.

Jacobson, R. 1987. The Validity of ROI as a Measure of Business Performance. *The American Economic Review* 77: 470-478.

Johns, G.1994. How Often Were You Absent? A Review of Self-reported Absence Data. *Journal of Applied Psychology* (August): 574-591.

Johnson, E. N., K. B. Walker, and E. Westergaard. 1995. Supplier Concentration and Pricing of Audit Services in New Zealand. Auditing: A Journal of Practice & Theory (Fall): 74-89.

Johnson, H. T., and R. S. Kaplan. 1987. *Relevance Lost: The Rise and Fall of Management Accounting.* Boston, MA: Harvard Business School Press.

Jones, L. F. 1991. Product Costing at Caterpillar. *Management Accounting* (February): 34-42.

Joreskog, K. G., and D. Sorbom. 1989. *LISREL 7: A Guide to the Program and Application (2nd ed.)* Chicago, IL: Scientific Software, Inc.

Joreskog, K. G., and D. Sorbom. 1993. *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language.* Chicago, IL: Scientific Software, Inc.

Joreskog, K. G., and F. Yang. 1996. Non-Linear Structural Equation Models: The Kenny-Judd Model with Interaction Effects. In G. Marcoulides and R. Schumacker (Eds), *Adavanced Structural Equation Modeling* (57-88). Hillside, NJ: Lawrence Erlbaum.

Kaplan, R. S. 1986. Accounting Lag: The Obsolescence of Accounting Systems. *California Management Review* (Winter): 174-199.

Kaplan, R. S. 1990. The Four-Stage Model of Cost System Design. *Management Accounting* (February): 22-29.

Kaplan, R. S. 1993. Research Opportunities in Management Accounting. Journal of Management Accounting Research (Fall): 1-14.

Kaplan, R. S., and D. P. Norton. 1992. The Balanced Scorecard - Measure that Drive Performance. *Harvard Business Review* (January/February): 71-79.

Kaplan, R. S., and D. P. Norton. 1996. Strategic Learning and the Balanced Scorecard. *Strategy and Leadership* (September/October).

Kaynak, H. 1996. *The Relationship between Just-in-Time Purchasing and Total Quality Management and Their Effects on the Performance of Firms Operating in the U.S.: An Empirical Investigation.* Dissertation: University of North Texas.

Kern, B. B., and M. H. Morris. 1994. Differences in the COMPUSTAT and Expanded *Value Line* Data Bases and the Potential Impact on Empirical Research. *The Accounting Review* 69: 274-284.

Kimberly, J. R., and M. J. Evanisko. 1981. Organizational Innovation: The Influence of Individual, Organizational and Contextual Factors on Hospital Adoption of Technological and Administrative Innovations. *Academy of Management Journal* 24: 689-713.

Kinney, M. R., and W. F. Wempe. 1998. Further Evidence on the Extent and Origins of JIT's Profitability Effects. Working Paper, Texas A&M University.

Krumwiede, K. R. 1996. *An Empirical Examination of Factors Affecting the Adoption and Infusion of Activity-Based Costing.* Dissertation. University of Tennessee.

Krumwiede, K. R. 1998a. ABC Why It's Tried and How It Succeeds. *Management Accounting* (April): 38-38.

Krumwiede, K. R. 1998b. The Implementation Stages of Activity-Based Costing and the Impact of Contextual and Organizational Factors. Journal of Management Accounting Research 10: 239-277.

Kumar, N., L. Scheer, and J. Steenkamp. 1995. The Effects of Supplier Fairness on Vulnerable Resellers. *Journal of Marketing Research* 32: 54-65.

Kwon, T. H., and R. W Zmud. 1987. Unifying the Fragmented Models of Information Systems and Implementation. In *Critical Issues in Information Systems Research*, edited by R. J. Boland and R. Hirscheim. New York: John Wiley & Sons.

Leisenring, J. L., and L. T. Johnson. 1994. Accounting Research: On the Relevance of Research to Practice. *Accounting Horizons* (December): 74-79.

Libby, R., and H. Tan. 1994. Modeling the Determinants of Audit Expertise. *Accounting. Organizations and Society*. Vol. 19 (8): 701-716.

Long, J. 1983. *Confirmatory Factor Analysis*. Beverly hills CA: Sage Publications.

Lukka, K. and M. Granlund. 1994. Cost Accounting Practice in Finland. Working Paper, Turku School of Economics and Business Administration, Finland.

Manoochehri, G. H. 1988. JIT for Small Manufacturers. *Journal of Small Business Management* 26 (4): 22-30.

McGowan, A. S. 1998. Perceived Benefits of ABCM Implementation. *Accounting Horizons* (March): 31-50.

McGowan, A. S, and T. P. Klammer. 1997. Satisfaction with Activity-Based Cost Management Implementation. *Journal of Management Accounting Research* 9: 217-237.

Milgrom, R., and J. Roberts. 1990. The Economics of Modern Manufacturing: Technology, Strategy, and Organization. *American Economic Review* (June): 511-528.

Miller, J. G., and A. V. Roth. 1994. A Taxonomy of Manufacturing Strategies. *Management Science* 40: 285-304.

Moch, M. K., and E. V. Morse. 1977. Size, Centralizations and Organizational Adoption of Innovations. *American Sociological Review* 42: 716-725.

Nunnaly, J. 1978. *Psychometric Theory*. New York: McGraw Hill.

Ohlson, J. 1991. Earnings, Book Values, and Dividends in Securities Valuation. Working Paper. Columbia University.

Ohlson, J. A. 1995. Earnings, Book Values, and Dividends in Security Valuation. *Contemporary Accounting Research* (Spring).

Ong, B. S., and T. D. Jensen. 1994. SICs and Industry-Level Data in Marketing: Problems and Ramifications. *American Business Review:* 37-46.

Oppenheim, A. N. 1966. *Questionnaire Design and Attitude Measurement*. London: Heinemann.

Pattison, D. D., and C. G. Arendt. 1994. Activity-Based Costing: It Doesn't Work All the Time. *Management Accounting* (April): 55-61.

Pedhazur, E. J. 1992. *Multiple Regression in Behavioral Research,* 2nd edition. Fort Worth TX: Holt, Rinehart and Winston, Inc.

Penman, S. H. 1991. An Evaluation of Accounting Rate of Return. *Journal of Accounting, Auditing and Finance*: 233-255.

Penman, S. H. 1992. The Articulation of Price-Earnings Ratios and Market-To-Book Ratios and the Evaluation of Growth. Working Paper: University of California at Berkley.

Player, R. S., and D. E. Keys. 1995a. Lessons from the ABM Battlefield: Getting Off to the Right Start. *Journal of Cost Management* (Spring): 26-38.

Player, R. S., and D. E. Keys. 1995b. Lessons from the ABM Battlefield: Moving from Pilot to Mainstream. *Journal of Cost Management* (Fall): 31-41.

Porter, M. 1996. What is Strategy? *Harvard Business Review* 74: 61-78.

Prescott, J. E., A. K. Kohli, and N. Venkatraman. 1986. The Market Share-Profitability Relationship: An Empirical Assessment of Major Assertions and Contradictions. *Strategic Management Journal* 7: 377-394.

Rafii, F. and L. P. Carr. 1997. Why Major Change Programs Fail: An Integrative Analysis. *Journal of Cost Management* (January/February): 41-45.

Ray, M. R., and P. P. Gupta. 1992. Activity-Based Costing. *Internal Auditor* (December): 45-51.

Reeve, J. M. 1996. Projects, Models, and Systems -- Where is ABM Headed? Jounal of Cost Management 10 (2): 5-15.

Roberts, M. W., and K. J. Silvester. 1996. Why ABC Failed and How It May Yet Succeed. *Journal of Cost Management* (Winter): 23-35.

Rogers, E. M. 1983. *Diffusion of Innovations*, 3rd Edition. New York: The Free Press.

Romney, M. 1995. Business Process Reengineering. *Internal Auditor* (June): 24-29.

Rotch, W. 1990. Activity-Based Costing in Service Industries. *Journal of Cost Management* (Summer): 4-14.

Sankar, M. 1995. *Self-Assessment Using the Baldrige Criteria*. Milwaukee, WI: ASQC Professional Technical Development.

Satterthwaite, F. W. 1946. An Approximate Distribution of Estimates of Variance Components. *Biometrics Bulletin* 2: 770-114.

Sawyer, L. B. 1983. *Elements of Management-oriented Auditing.* Altamonte Springs FL: The Institute of Internal Auditors. 7.

Schroeder, D. M. 1990. A Dynamic Perspective on the Impact of Process Innovation upon Competitive Strategies. *Strategic Management Journal* 11: 25-41.

Selto, F. H., and D. W. Jasinski. 1996. A Story with a Moral. *Management Accounting* (March): 37-40.

Shapiro, S. S., and M. B. Wilk. 1965. An Analysis of Variance Test for Normality (complete samples). *Biometrica* 52: 591-611.

Shepard, N. 1995. The Bridge to Continuous Improvement. *CMA Magazine* (March): 29-32.

Shields, M. D. 1995. An Empirical Analysis of Firms' Implementation Experiences with Activity-Based Costing. *Journal of Management Accounting Research* (Fall): 148-166.

Shields, M. D. 1997. Research in Management Accounting by North Americans in the 1980s. *Journal of Management Accounting Research* 9: 4-61.

Shim, E., and A. J. Stagliano. 1997. A Survey of U.S. Manufacturers on Implementation of ABC. *Journal of Cost Management* (March/April): 39-41.

Simon, J. L., and P. Burstein. 1985. *Basic Research Methods in Social Science.* New York: McGraw-Hill.

Srinidhi, B. 1992. The Hidden Costs of Specialty Products. *Journal of Management Accounting Research* (Fall): 198-208.

Stoner, J. A. F., and F. M. Werner. 1995. *Internal Audit and Innovation.* Morristown NJ: Financial Executives Research Foundation.

Sullivan, W. G., and R. S. Sawhney. Cost Management Practices - Can Industrial Engineering Contribute? 1989. *1989 AIIE Conference Proceedings.* Atlanta, GA: Institute of Industrial Engineers.

Swenson, D. 1995. The Benefits of Activity-Based Cost Management to the Manufacturing Industry. *Journal of Management Accounting Research* (Fall): 167-180.

Swenson, D. 1997. Best Practices in Activity-Based Management. *Journal of Cost Management.* (November/December): 6-14.

Tabachnick, B. G., and L. S. Fidell. 1996. *Using Multivariate Statistics (3rd ed.)*. New York: HarperCollins College Publishers.

Tanju, D. W. and M. Helmi. 1991. ABCs for Internal Auditors. *Internal Auditor* (December): 33-37.

Tatikonda, L. U., and R. J. Tatikonda. 1993. Overhead Cost Containment. *Internal Auditor* (February): 51-55.

Thorne, H., and B. Gurd. 1995. Some Human Aspects of Implementing Activity-Based Management. *Journal of Cost Management* (Fall): 50-57.

Transportation Technical Services, Inc. (TTS). 1996. *TTS Blue Book of Trucking Companies 1996-1997*. New York: Transportation Technical Services, Inc.

Turney, P. B. B. 1991. How Activity-Based Costing Helps Reduce Cost. *Journal of Cost Management* (Winter): 29-35.

Turney, P. B. B. 1992. *Common Cents: The ABC Performance Breakthrough*. Hillsborough, OR: Cost Technology.

Turney, P. B. B., and A. J. Stratton. 1992. Using ABC to Support Continuous Improvement. *Management Accounting* (September): 46-50.

Tyndal, G. R. 1990. Logistics Costs and Service Levels, in Barry J. Brinker, ed., *Emerging Practices in Cost Management*. Boston, MA: Warren, Gorham, & Lamont.

Venkatraman, N. 1989. Strategic Orientation of business Enterprises: The Construct, Dimensionality and Measurement. *Management Science* 35 (8): 942-962.

Watts, R., and J. Zimmerman. 1986. *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Wempe, W. F. 1997. *Production Technology Choice and Earnings Management Incentives and Strategies: The Case of Just-in-Time*. Dissertation Proposal, Texas A & M University (November).

White, H. 1980. A Heteroscedasticity-consistent Covariance Matrix Estimator and a Direct Test for Heteroscedasticity. *Econometrica* 48: 817-838.

Wolins, L. 1982. *Research Mistakes in the Social and Behavioral Sciences*. Ames, IA: Iowa State University Press.

Young, S. M. 1996. Survey Research in Management Accounting: A Critical Assessment. In *Research Methods in Accounting: Issues and Debates*, A. J. Richardson (Ed.). CGA Canada Research Foundation.

Young, S. M., and J. Davis. 1989. Factories of the Past and of the Future: The Implications of Robotics on Workers and Accounting Systems. In *Critical Accounting*, edited by D. Cooper and T. Hopper, 85-106. London: MacMillan.

Young, S. M., and F. H. Selto. 1991. New Manufacturing Practices and Cost Management: A Review of the Literature and Directions for Research. *Journal of Accounting Literature* 10: 265-298.

Zmijewski., and R. L. Hagerman. 1981. An Income Strategy Approach to the Positive Theory of Accounting Setting/Choice. *Journal of Accounting and Economics* (March): 129-149.

Exhibit 1

CONFIDENTIAL QUESTIONNAIRE FOR THE STUDY OF ACTIVITY-BASED COSTING

The following questions relate to your business unit's cost management practices and the involvement of internal auditing in these practices. I recognize that some of the information in this survey may be sensitive, but I assure you that the data will only be used in the aggregate to statistically compare various types of organizations that have participated in the study. Your responses will be kept confidential. Please answer the questions based on your business unit. A business unit may be an entire company, a group, a division, plant, or a country.

When you have completed the questionnaire, please put it in the enclosed postage-paid envelope, and return it to me within ten days.

Please answer the questions below by circling the correct replies or by filling in information.

1. Are you answering this questionnaire in terms of your (Please answer in terms of the **highest** level in which you feel confident of your answers):

Plant Division Group Subsidiary Country Whole Company Other_____

Please indicate (circle) the extent to which you agree with the following statements.

A. *Regarding the use of cost data within your business unit:*	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. Product costs must be accurate to compete in your markets.....	1	2	3	4	5
2. Cost data are important because of your cost reduction efforts...	1	2	3	4	5
3. Cost data are an important factor in pricing decisions.....	1	2	3	4	5
4. The business unit performs many special cost studies.....	1	2	3	4	5
5. Capital expenditures are based on "strategic reasons" instead of cost issues.....	1	2	3	4	5
6. Price competition in your industry is intense.....	1	2	3	4	5

B. Re*garding the use of quality initiatives within your business unit:*	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. Your business unit is committed to a quality improvement program.....	1	2	3	4	5
2. Management actively supports your quality program.....	1	2	3	4	5
3. Quality-related training is provided for all employees.....	1	2	3	4	5
4. Your suppliers are required to maintain minimum quality standards.....	1	2	3	4	5

C. Regarding the performance of your cost system and business unit:	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. You are satisfied with your business unit's methodology for calculating product and service costs.....	1	2	3	4	5
2. You are satisfied with your business unit's performance measurement systems.....	1	2	3	4	5
3. You are satisfied with your business unit's ability to provide information to aid in cost reduction efforts.....	1	2	3	4	5
4. Over the last three years, the sales of your business unit have improved relative to other business units in your industry.	1	2	3	4	5
5. Over the last five years, the sales of your business unit have improved relative to other business units in your industry....	1	2	3	4	5
6. Over the last three years, the ROI of my business unit has improved relative to other business units in your industry....	1	2	3	4	5
7. Over the last five years, the ROI of my business unit has improved relative to other business units in your industry....	1	2	3	4	5

Exhibit 1 (cont'd)

D. *Regarding your business unit's information technology:*	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. The business unit's information systems (e.g., sales, manufacturing, etc.) are integrated with each other	1	2	3	4	5
2. The information system offers user-friendly query capability	1	2	3	4	5
3. The past year's detailed sales and operating data are available	1	2	3	4	5
4. Many perspectives of cost and performance data are available	1	2	3	4	5
5. Operating data are updated "real time"	1	2	3	4	5
6. The quality of your cost management system is excellent	1	2	3	4	5

E. *Regarding the complexity of operations within your business unit*	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. There are major differences in lot sizes between products	1	2	3	4	5
2. There are major differences in volumes between products	1	2	3	4	5
3. Over time, there are major changes in volumes within products.	1	2	3	4	5
4. Costs of support departments are similar for each product	1	2	3	4	5
5. Product lines are diverse	1	2	3	4	5
6. Within product lines, products require similar processes to design, manufacture and distribute	1	2	3	4	5
7. There are frequent changes to your products, services, and processes	1	2	3	4	5

If your business unit is implementing or using activity-based costing (ABC), please answer Sections F through H; if not, skip to Section I. Activity-Based Costing (ABC) is defined as assigning indirect costs to individual activities or processes (rather than departmental) cost pools; then tracing costs to users of activities (products, customers, etc.) based on multiple cost drivers.

F. *Regarding the dynamics and use of ABC in your business unit:*	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. ABC receives active support from top management	1	2	3	4	5
2. Management has provided adequate resources to ABC efforts.	1	2	3	4	5
3. ABC is tied to the competitive strategies of the business unit.	1	2	3	4	5
4. Non-accounting depts show personal ownership of ABC	1	2	3	4	5
5. The implementation team was (is) cross-functional	1	2	3	4	5
6. ABC is linked to evaluations of non-accounting personnel	1	2	3	4	5
7. ABC is linked to compensation of non-accounting personnel	1	2	3	4	5
8. There has been consensus about the objectives of ABC	1	2	3	4	5
9. Adequate training was provided for designing ABC	1	2	3	4	5
10. Adequate training was provided for implementing ABC	1	2	3	4	5
11. Adequate training was provided for using ABC	1	2	3	4	5
12. ABC is integrated into operating information systems	1	2	3	4	5
13. ABC is integrated into accounting systems	1	2	3	4	5
14. ABC is strongly linked to our competitive strategy	1	2	3	4	5
15. The benefit of ABC has exceeded the cost	1	2	3	4	5
16. The following functions routinely use the ABC information for decision-making					
a. Design engineering	1	2	3	4	5
b. Manufacturing engineering	1	2	3	4	5
c. Production management	1	2	3	4	5
d. Plant manager	1	2	3	4	5
e. Top management	1	2	3	4	5
f. Marketing	1	2	3	4	5
g. Corporate finance	1	2	3	4	5

Exhibit 1 (Cont'd)

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
17. ABC is consistently used for the following purposes					
a. Product costing	1	2	3	4	5
b. Cost management	1	2	3	4	5
c. Pricing decisions	1	2	3	4	5
d. Product mix decisions	1	2	3	4	5
e. Determine customer profitability	1	2	3	4	5
f. Budgeting	1	2	3	4	5
g. As an off-line analytic tool	1	2	3	4	5
h. Outsourcing decisions	1	2	3	4	5
i. Performance measurement	1	2	3	4	5
j. Other/Comments_____					

G. *Regarding Internal Auditing's involvement in ABC:*	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
1. There was significant internal audit involvement:					
a. before ABC, documenting the advantages/disadvantages or costs/benefits of ABC compared to the prior system	1	2	3	4	5
b. during design of the ABC system	1	2	3	4	5
c. during implementation of the ABC system	1	2	3	4	5
d. auditing the supporting documentation to substantiate the decision-making process during initial implementation	1	2	3	4	5
e. during development of the performance evaluation system.	1	2	3	4	5
2. There is a significant ongoing level of IA involvement in the:					
a. audit of cost drivers	1	2	3	4	5
b. audit of treatment of common costs	1	2	3	4	5
c. audit of non-financial performance metrics	1	2	3	4	5
d. audit of value added by ABC	1	2	3	4	5
e. audit of tracking of waste indicators	1	2	3	4	5
f. identification of ways to eliminate waste and reduce costs	1	2	3	4	5
g. comparing cost of ABC with value added in terms of:					
1. net cost savings	1	2	3	4	5
2. customer satisfaction	1	2	3	4	5
3. increased productivity	1	2	3	4	5

H. *General questions:*

1. How long since your business unit began:

a. the implementation of ABC?	<1yr	1-2yr	2-3yr	3-4yr	4-5y r	>5yr
b. using ABC to aid in decision making?	<1yr	1-2yr	2-3yr	3-4yr	4-5y r	>5yr
c. implementation of quality program?	<1yr	1-2yr	2-3yr	3-4yr	4-5y r	>5yr

2. What percent would you estimate your **sales** have increased or decreased since you began using ABC?_____% increase_____% decrease No change

3. What percent would you estimate your **profits** have increased or decreased since you began using ABC? _____% increase____% decrease_No change

4. In your opinion, was ABC worth implementing? Yes No Will be Too early to tell
Please comment

_____

_____

_____

Exhibit 1 (Cont'd)

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
5. Overall your ABC initiative has been successful.....	1	2	3	4	5

Please comment:_____

_____

_____

_____

_____

I. *General questions regarding your business unit:*

6. Please indicate your type of business:

☐Manufacturing ☐Wholesale/Retail ☐Government ☐Financial Services
☐Transportation ☐Utilities ☐Other Services_____
☐Other _____

7. Main Product(s)/service(s) or SIC industry code(s) of your business unit: _____

8. Current annual sales revenue for business unit:

☐ Under $5 Million ☐ $5-20M ☐ $21-50M ☐ $51-100M
☐ $101-500M ☐ $501M-$1 Billion ☐ $1-5Billion ☐ $5 Billion+

9. How many auditors are employed in your internal audit department? _____

10. What percent of the following are to another business unit of your company?

a. Your sales ☐ <10% ☐ 10-25% ☐ 25-50% ☐ > 50%
b. Your purchases ☐ <10% ☐ 10-25% ☐ 25-50% ☐ > 50%

11. At what percent of capacity does your business unit usually operate?

☐ <50% ☐ 50-65% ☐ 65-80% ☐ 80-90% ☐ >90%

12. Check if the following is used to a significant extent in your business unit:

☐ a. Activity-Based Costing (ABC) ☐ b. Just-in-Time (JIT)
☐ c. Computer-integrated manufacturing (CIM) ☐ d. Business Process Engineering
☐ f. Value Chain Analysis ☐ g. Flexible Manufacturing Systems
☐ h. Theory of Constraints (TOC) ☐ i. Total Quality Management (TQM)
☐ j. Lean Manufacturing techniques ☐ j. Other (describe)_____

Please comment on any refinements that can be made to the survey (questions needed, unnecessary, or those that should be changed):

_____

_____

_____

_____

_____

THANK YOU FOR PARTICIPATING!

Please return your survey to:

Douglass Cagwin
PO Box xxx
University of Arkansas
Fayetteville, AR, 72701

NEW BUSINESS INITIATIVES AND FINANCIAL PERFORMANCE

Abstract of dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

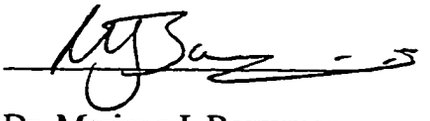
By

DOUGLASS CAGWIN, B.B.A., M.Acc.
Iowa State University, 1993
University of Arkansas, 1996

May 1999
University of Arkansas

This abstract is approved by:

Dissertation Director:



Dr. Marinus J. Bouwman

New Business Initiatives and Financial Performance

Abstract: This dissertation examines the relationship of improvement in financial performance with use of new business initiatives such as JIT, TQM, and ABC. The investigation is organized into three areas of inquiry that telescope from the general to the specific to reach a conclusion regarding the efficacy of initiatives.

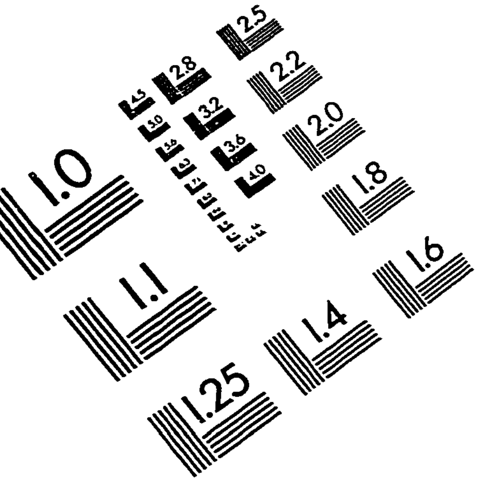
The first two studies contain regression analyses of the association between the use of the initiatives and change in industry mean-adjusted ROI. The third study develops and test a comprehensive structural model that incorporates factors postulated by previous researchers to affect the efficacy of ABC. Data are obtained through a cross-sectional mail survey of 1,058 internal auditors for the first and third studies, and of 1,100 motor carriers for the second.

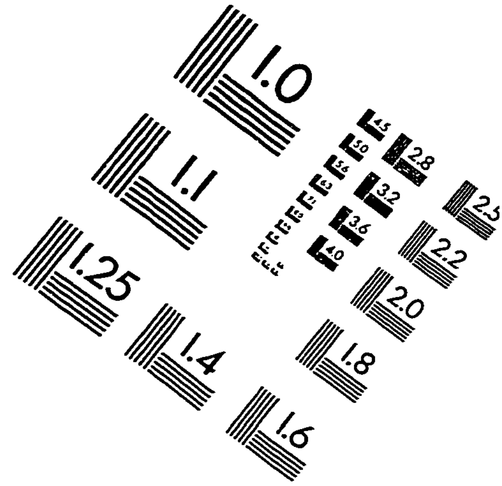
Use of initiatives is common and consistent across both samples with 78 percent and 72 percent, respectively, of firms reporting that they are significant users of at least one initiative. Most firms use multiple initiatives concurrently and only 22 percent (21 percent) use a single initiative in isolation

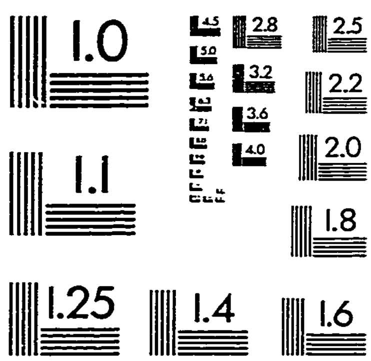
There is empirical evidence that initiative use is associated with improvement in financial performance. Findings include that ABC, TQM, CIM, Value Chain Analysis, and Flexible Manufacturing Systems are significantly associated with ROI improvement for manufacturers. Concurrent use of JIT with TQM, JIT with CIM, BPR with TQM, and JIT with ABC in manufacturing create a positive synergy. Partnerships with Suppliers (PWS), EDI, Satellite Tracking Systems (STS) and ABC are significantly associated with ROI improvement in the motor carrier industry. Concurrent use of PWS with STS and of EDI with ABC generate a positive synergy.

The third study concludes that positive synergies are obtained from concurrent use of other initiatives with ABC. There is a positive association between ABC and improvement in ROI when implemented in complex and diverse firms, in environments where costs are relatively important, and when there are limited numbers of intra-company transactions to constrain benefits. Finally, there is evidence that the measures "satisfaction" with cost system, "success" of ABC, and "financial benefit" obtained from ABC that have been used in previous research are predictors of improvement in financial performance.

IMAGE EVALUATION TEST TARGET (QA-3)

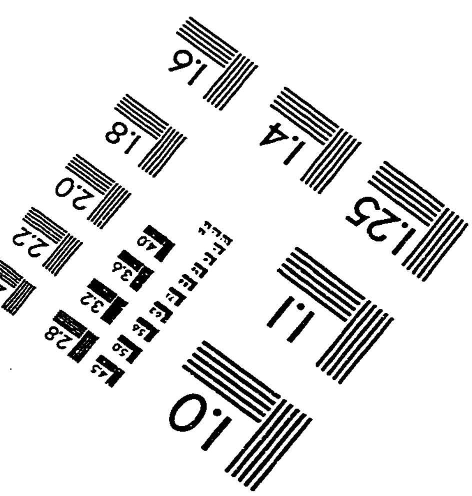


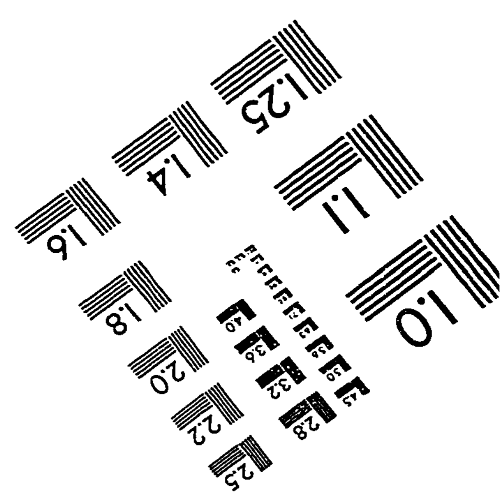




150mm

6″





APPLIED IMAGE, Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989