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Reaping Return on Information Technology Investment: An Empirical Study

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Abstract

Since the amount spent on information technology (IT) keeps on increasing with time, senior management is rightly concerned with the evaluation of their capital investments in IT. However, despite significant progress in evaluating the productivity impacts from corporate investment in IT, the inability of traditional economic measures to fully account for intangible impacts has led to for calls for a more inclusive and comprehensive approach to measuring IT business value. This paper goes beyond the notion of improving evaluation based on measurement improvements and shows that there are limits to obtaining accurate benefit and cost figures. This paper is premised on the belief that IT investments do lead to increased business value. However, for an organization to experience such increased business value, efforts have to be made to control investments and heedfully take steps to leverage IT resources. Evaluation, therefore, has to take on a continuous characteristic. Amongst the issues discussed in this paper are the relationship between the comprehensiveness of IT investment evaluation and their effects on realized returns on IT investment by an organization, executives' perceptions about the various aspects of IT investment evaluation (costs, benefits, risks and evaluation methodology). In this study perceptual measures, as reported by IT managers, have been used to assess payoffs from IT investment. This provides an added advantage in that, unlike traditional economic measures, perceptual measures can be used to evaluate both tangible and intangible impacts. These measures include the importance and level of difficulty in measuring costs, benefits and risks and desirable features of a good IT evaluation methodology. To establish the relationship between extensiveness of IT investment evaluation and the returns on IT investment, causal model analysis has been done using structural equation modeling. The main finding is that increased attention to risks in IT investment evaluation leads to better investment control, which, in turn, results in a higher realized return on IT investment by the organization.

Keywords: information technology, evaluation, cost, benefit, risk

Introduction

There are two primary reasons why IT investment evaluation is important. Firstly, organizations are devoting high levels of resources on IT investments. Expenditure on IT investments represents a substantial element of capital expenditure despite the falling costs of IT. Moreover, actual spending levels are likely to be higher than those actually reported, given that the total organizational costs associated with IT investments (for example, staff training, organizational restructuring costs, employee time and so forth) are unlikely to be included in the reported costs. Secondly, along with increasing IT spending levels and global economic and competitive climate which organizations face today, concerns have been voiced over IT effectiveness measurement, cost justification and cost containment. As IT transforms organizations and its role moves from being a support to becoming a driver for change, the perspective employed for its evaluation

needs to be changed. According to Rau and Bye (2003) it is important to identify where and how IT can add value.

The purpose of this study is to synthesize the learning issues from the past research with the findings from this research to provide an enhanced model for IT investment evaluation. To meet that objective we studied the relationship between the measurement of IT value and the realized effectiveness of IT. Using past studies we developed a research model. We tested the model using data gathered through a survey. We showed that by complementing IT investment decision models with continuous evaluation higher returns on IT investment *can* be realized. In essence, our work is a framework for action as well as understanding the entire process of IT evaluation. The rest of the paper contains the following sections in sequence: literature review, research gaps, model development, research methodology, analysis, discussion and conclusion.

Literature Review

There is a considerable body of literature (Kohli and Devraj, 2003; Alpar and Kim, 1990; Barua et al. 1995; Blackler and Brown, 1988; Dos Santos, 1991, 1994; Strassman, 1985, 1990; Willcocks, 1994; Wiseman, 1984) that has addressed the issue of IT appraisal. The research evidence that appraisal of IT investments is a task which most organizations feel they have a responsibility to perform dates back to almost three decades (Carlson, 1974). Even though many of the benefits accruing from IS investments can be suitably analyzed using the traditional accountancy frameworks, non-tangible and non-financial benefits coupled with indirect costs associated with IT projects make the IT appraisal process complicated (Irani, 2002b). However, despite the existence of this wealth of literature, the research community appears to be no nearer a solution to many of the problems associated with IT appraisal.

Farbey et al. (1992) have provided a useful set of objectives that are served by IT appraisal. These include (a) justification of investments; (b) enabling organizations to decide between competing projects, especially if capital rationing is an issue; (c) acting as a control mechanism over expenditure, benefits and the development and implementation of projects; and (d) acting as learning device enabling improved appraisal and systems development to take place in the future. However, as mentioned before, there are persistent problems with IT evaluation methods. Serafeimidis and Psoinos (1996) summarize them as follows

- no investment appraisal techniques tailored to IT investments
- the complexity of traditional accounting techniques
- the difficulties in measuring the business value of IT, dealing with tangibles and intangibles at the same time, identifying and 'quantifying' cause and effect relationships, and understanding human and organizational costs
- the lack of direct correlation between productivity and IT expenditure, lack of communication and understanding and lack of congruency with current IT development methodologies
- the narrow focus on the content of decision making

Zimmerman (1996) provides a comprehensive assessment of appraisal and evaluation tools and methodologies for IT (Appendix A). The majority of IS evaluation methodologies tend to respond to investment related difficulties (Serafeimidis and Psoinos, 1996) but fail to provide

direction for future investments that may have impact on realized value from such investments. Recent research (Benaroch, 2002; Schniederjans and Hamaker, 2003; Kearns, 2004) has attempted to address the decision modeling aspect of the IS evaluation problem. However, there are not many frameworks in IS literature that focus on process-related problems of IS investments and evaluation. Such problems fall under the rubric of risk estimation. Consequently, we have focused on benefits, costs as well as risks.

Research gaps

The growth of interest in measuring IT value has led to a variety of approaches and to studies of various industries, but to no conclusive results (Weill and Vitale, 1999). Various approaches and techniques have been proposed to assist organizations in evaluating IT investments. However, there's no completely successful measure available. The review of existing literature reveals that there is a discernable bias toward measurement in the IS evaluation techniques. Process-orientation is emerging as a complement to measurement orientation. We posit that IT evaluation is not a one-shot process but a continuous process. Consequently, a one-off evaluation exercise, that many of the methods connote, tends to defeat the purpose of the entire exercise. There are suggestions of such process-orientation in the practice of IT evaluation. Naveh and Halevy (1998), Cerpa and Verner (1998) and Kanungo (2003) suggest process-orientation in assessment and the notion of IT maturity respectively.

By far, the most important gap lies in the practice of IT evaluation. Though there are many studies reported in the IS literature that suggest use of IT appraisal techniques for the purpose of ex-ante IS investment evaluation (Ballantine & Stray, 1998, 1999; Arribas & Inchusta 1999; Anandarajan & Wen 1999), the focus again is on IT investment measurement than the process of IT investment measurement. While improving the IT investment measurement technique can improve the accuracy of measured costs and benefits, however, there is a limit to the level of accuracy or effort that can be associated with measuring costs, benefits and risks. Consequently, such measurement frameworks fail to help us in leveraging IT investments. From this standpoint, there is a need for a framework that recognizes this and responds to a situation that can very easily suffer from analysis paralysis.

Model development

Our research model incorporates costs, benefits, and risks associated with IT investments in an organization. These form the basis for IT investment control in the hands of the managers. Therefore, our research model incorporates both the measurement and practice standpoints. The multiple methods of IT evaluation (Appendix A) concentrate on different aspects and are based on different assumptions. A major assumption that differentiates most of the models has to do with whether any return on IT is possible or not. Differences in these assumptions have to do with identifying where the benefits of IT can be realistically measured. Some methods believe that IT benefits can be measured downstream (organizational performance) and indirectly (managerial effectiveness) while others tend to believe that such measures can be made more upstream (efficiency increases in organizational processes even at individual levels) and directly (cycle time reduction and work productivity). Consequently, these models emphasize different aspects and evaluation criteria. Three criteria that stand out in terms of evaluative importance are – costs, benefits and risks. Depending on the model(s) used, costs, benefits and risks are treated differently.

Costs: It is a major managerial challenge to ascertain real costs in the realm of IT. Adopters of new IT tend to focus on costs (Ash and Burn, 2003). According to Ballantine et al (1996), identification of relevant costs, quantification of relevant costs, and identification of relevant opportunity costs constitute a major problem for the evaluators. Costs that are unidentified or miscalculated in the planning phase frequently account for a large number of IT project cost overruns (Federal CIO Council, 1999).

While hardware and software may decrease over time, hard to predict support and maintenance costs, business costs associated with making the transition to the new system, and other hidden costs can more than double the initial investment (Dempsey et al., 1999). Zimmerman calls this the *cost creep syndrome* associated with IT spending. According to Strassmann (1990), the implementation costs of training, software development, wiring, etc can range from 5:1 to 20:1 compared to the cost of hardware. Willcocks (1994) asserted that up to 40% of IT costs actually end up falling outside the traditional IT budget. Invariably, these costs are left out of the project evaluation/ budgeting phase. Studies by Ballantine et al. (1996), Fitzgerald (1998) and Vowler (1990) suggest that costs are often significantly underestimated and that in practice many projects suffer from serious cost overruns. One of the main reasons for this, according to Fitzgerald (1998), is the hidden nature of many IT costs. These costs are frequently underestimated or ignored. Once IT spending gets going, it is difficult for managers to stop and re-evaluate what they are spending on and what gains they are expecting. Of late, some of these costs have been conceptualized as social costs (Ryan et al., 2002)

Benefits: Seddon et al. (2002) report that a large proportion of IT initiatives are not rigorously evaluated for their benefits. When hard costs and benefits of efficiency systems can be quantified without great difficulty, a clear financial business case made for the investment Silk (1990). However, identification and quantification of relevant benefits is a major problem with the new sophisticated IT systems that aim to provide the organization with competitive advantage (Stanwick and Stanwick, 2002; Portar and Millar, 1985). Such strategic systems are becoming increasingly popular and present the major concern as well as the major difficulty. Payoffs from information systems like these are not controllable and depend upon other business functions beyond IT (Dempsey et al., 1999).

Studies by Ballantine et al. (1996), Vowler (1990) and Giaglis et al., (1999) indicate that organizations find it very difficult to evaluate IT investments; they use notional figures for assessing benefits. 66% of the organizations in his study were poor at measuring the benefits of IT to the business (Vowler, 1990). Lack of performance data is significant resulting in patchy evaluation practices and that investment in IT is often based on beliefs that benefits will accrue rather than any very great attempts to measure such benefits (Fitzgerald, 1998). Traditional investment appraisal techniques are no more accurate than a manager's 'gut feel' when it comes to measuring many of the benefits of IT systems (Coleman and Jamieson, 1994).

There are many problems in identifying the correlation between IT investments and their subsequent benefits. First, the impacts of modern IT are so wide-ranging, that very often organizations are simply unaware of what the benefits and the costs of a system might be. The benefits of IT investments are seldom attributable only to the technology of the newly implemented computer-based system. Secondly, much of IT has the character of infrastructure,

which is there to enable other applications. It is difficult to assign benefits to these investments, as the real benefits will come from the subsequent use of the applications that they will make possible. Lastly, many expected impacts from IT are very difficult to translate in terms of monetary value: these are the intangible costs and benefits. Consequently, the bulk of IT justifications usually depend on subjective assessments of intangible benefits.

Risks: While costs and benefits may eventually be calculated or assessed in some form, the evolving nature of IT often leads to new (desirable or undesirable) consequences. Some evaluation models do factor in risks (Wen et al., 1998). Risks are generally associated with the feasibility - attainability, points deserving review and critical success issues (Jiang and Klein, 2000) of the IT projects or programs and the consequent organizational payoffs. In the first instance, risks have to do with projects not finishing on time or costing more. In the latter case, managerial concerns have to do with ensuring that the promised payoffs do indeed take place.

The identification and the consequent management of risks is important because, both costs and benefits are difficult to identify and assess. However, the assessment of risk, allows management to plan ahead in case (Lyytinen and Keil, 2000). Like costs and benefits, risks too lend themselves to multiple views (Jiang and Klein, 1999). Accounting for risks encourages managers to learn new skills before the risky outcomes actualize. Risk analyses also help expand the process to include behavioral, structural and strategic issues into consideration in order to mitigate risks (Ho and Pike, 1998). This flexibility in the implementation and management of information systems approach is necessary if information systems have to enable organizational flexibility and agility. Bosworth and Jobome (1999) advance the notion of an optimal stopping rule for R&D projects that may not pay off. Information system projects share many similarities with R&D projects and we believe that most information system projects do not have the option of "getting it right the second time." Recent work (Li and Johnson, 2002; Kim and Sanders, 2002), on integrating real option theory to IT investment decisions, recognizes this dimension. Consequently, risk analysis builds into the evaluation process, the ability for the organization to reorient, reorganize, re-plan, and rework in case plans go awry. This in itself would reduce the risk of failure or under-achievement of goals. An IT investment could involve multiple risks and there could be multiple ways to manage the investments by using or creating different options. From this standpoint, better management of IT investments risks will help to optimally manage and leverage IT investments.

Thus, based on the discussion above, it is logical to expect that IT investment evaluation methodology will have an impact on how costs, benefits, and risks associated with any IT investments are assessed. We posit the following hypotheses with respect to the evaluation methodologies and costs, benefits, and risks.

H1: More extensive the IT investment evaluation methodology, better will be the measurement of costs.

H2: More extensive the IT investment evaluation methodology, better will be the measurement of benefits.

H3: More extensive the IT investment evaluation methodology, better will be the evaluation of risks.

Investment control: Investment controls are managerial actions that are used to stabilize IT projects or programs once they have been initiated. Specifically, investment controls constitute of a set of actions that has to do with measuring individual, project, process and functional performance, taking actions to ensure original goals are met, and changing goals, if necessary. Generally, investments tend to connote a one-time event that has more to do with spending a large sum of money. However, when it comes to information systems, investments have to do with hardware, software, processes, human resource development, and many other expenditure items. In many instances, the investment in alternate resources like time and people becomes crucial. Moreover, investing in people, processes and technology becomes a continuous affair. This is one of the many reasons why returns on such continuous and / or intermittent inputs are hard to determine. Dirk (1994) identifies the problems while quantifying the costs and benefits of an information system investment in advance. Dirk (1994) further points out that changes in future cash flows resulting from IS cannot be determined exactly. From this standpoint, since there is a higher degree of uncertainty associated with IT benefits, control checks are required at every stage of IT investments to leverage their value. An extreme example of such investment controls could be given for a troubled project, which can be either abandoned or provided with substantial refunding to keep it alive after re-establishing costs, benefits and risks (Irani, 2002). Investment controls are premised on the belief that benefits, costs and risks associated with any IT project are uncertain. Therefore, controlled investments are likely to provide managers in organizations a way to contain their IT investments and leverage the value of the investments already made. The effectiveness of such investment controls depends on the initial estimates of benefits, costs and risks which in turn are based on the IS evaluation methodology. The majority of investment control decisions consequent to the initial cost, benefit, and risk assessments tend to be incremental and course correcting in nature. Therefore, the following set of hypotheses is posited:

H4: More extensive the measurement of costs, the better will be the Investment control.
H5: More extensive the measurement of benefits, the better will be the Investment control.
H6: More extensive the evaluation of risks, the better will be the Investment control.

Return on IT (ROIT): Investment controls are a set of managerial actions that are taken to improve the probability that the investments in IT payoff. In many ways, the quality of managerial actions determines the outcome of a series of investments in IT. It is generally true that aspects that get management attention tend to perform better than those that do not. In that sense the very act of measuring something improves its performance. The idea is that the use of formal evaluation methodologies that provide a meaningful basis for managerial action should result in more successful IT projects, increased and more effective use of such information systems, and consequently increased business value. Varghese (2003) argues for establishing a process and identifying responsibility across the organization to extract returns from the investments made in IT. This leads us to posit or last hypothesis:

H7: The better the planning and control, the higher is the realized return on IT investment.

The overarching research question for our research is “to what extent does investment control leverage the relationship between evaluation of information technology investment decision and the realized return on information technology investment?” Based on the above dimensions and variable constructs identified from the literature review, we proposed the research model shown in Figure 1.

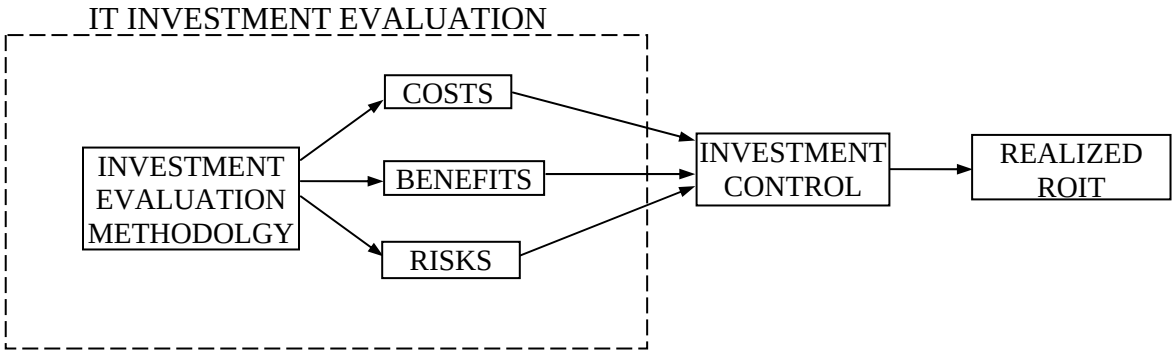

Figure 1. Research model

Research Methodology

Measures of IT investment evaluation, investment control and return on IT investment have been identified. The determination of these measures is problematic because of lack of consensus in defining and measuring such measures. Researchers have difficulty in agreeing as to what actually constitutes IT investment evaluation and return on IT investment. However, from an in-depth study of the literature it can be concluded that a good investment evaluation would comprise a comprehensive evaluation of the costs, benefits and risks using an investment methodology that is tailor made for IT investments. Such a methodology takes into consideration all the above stated aspects and involves a mix of quantitative analysis and informed judgement. Since it difficult to obtain data about return on IT investments, we follow the suggestion of Tallon et al (1999) by using executives' perceptions as a substitute of numerical figures of return on IT investment.

Using survey data this research empirically tests a theoretical model specifying the effect of comprehensiveness of IT investment evaluation on investment control and realized return on IT investment. The empirical test using data collected using a questionnaire survey began with a confirmatory analysis of the model. This stage of analysis specified the independent and dependent variables included in the model. The model was then analyzed using structured equation analysis as a means of investigating the causal effect of the independent variables on the dependent variables. On completion of this phase of model analysis, a determination was made regarding the significance, magnitude, and direction of the relationships between the independent and dependent variables. The exogenous variable is the investment evaluation methodology while the endogenous variables include costs, benefits, risks, investment control, and realized ROIT. The variables used in the study include costs, benefits, risks, features of methodology, investment control and realized return on IT investment. The respondents were CIOs and heads of IT functions.

Data gathered in previous step were used to test the research model using structured equation modeling. The software package used for Structured equation modeling is Amos Version 4.

Analysis

A total of 180 questionnaires were distributed out of which a total of 42 valid and usable responses were received. It was observed from the frequency distributions of the manifest

variables that the distributions sufficiently close to normal distribution and thus suffice the criteria for statistical analysis. After testing the variables for normality we used structured equation modeling (SEM) to test the validity of our research model. Our initial research model (initial model) is shown in Figure 2. The measurement model was trivial in our case because we used direct measures for the constructs and all the variables were manifest. What was important for us was to test whether the structural model was valid since the dyadic relations in that model were all derived from the existing body of literature.

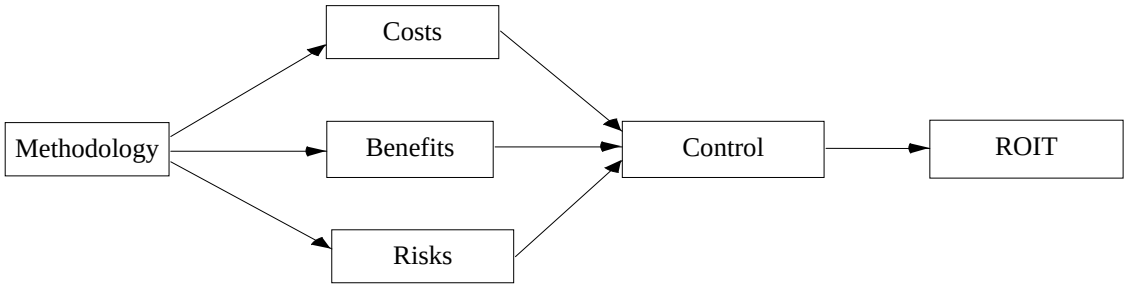

Figure 2. The initial research model

The revised models (Revised model 1 and Revised Model 2) have been modified based on the high values of modification indices shown in the output of the models. The modification indices higher than 4.00 have been selected to modify the models. The modification indices for the models and the mechanics for the modification are shown in Appendix B.

Modification from Initial Model to revised model 1: In the initial model the modification indices for covariances between error4 and error5 (=17.520), error3 and error4 (=12.683), error 3 and error 5 (=22.653), and error2 and error1 (=6.406) are greater than 4. Error4 represents the variability in benefits that is not due to variation in methodology. Similarly error3 and error5 represent the variability in costs and risks respectively that is not due to variation in methodology. Therefore, we can expect a positive correlation between error3, error4 and error5 which is also shown in the positive value of the par change (0.009, 0.011 and 0.013 for covariance between error4 and error5, error3 and error4 and error3 and error5 respectively). Therefore, error4 and error5, error3 and error4 and error3 and error5 have been correlated. Similarly error1 (which indicates the variability in control not explained by variation in costs, benefits and risks) and error2 (which indicates the variability in ROIT not explained by variation in control) are not positively correlated which is again substantiated by a negative par change (-0.059), and hence, they have also been correlated. The revised model 1 is an improvement over initial model, which is indicated by improvement in chi-square to degrees of freedom ratio.

Modification from revised model 1 to revised model 2: The modification index for covariance between error2 and error4 is 9.443 for revised model 1, which is significantly high. Therefore, errro2 and error4 were correlated to arrive at the revised model 2. The fitness of the revised model 2 is very good. But, it is difficult to explain the relationship between error2 and error5. Moreover, in this model the path coefficients for the path between costs and control is negative which is not explainable. The path coefficient for the path between benefits and control is also very low. Therefore, this model though an improvement over revised model 1, cannot be explained theoretically and is therefore not acceptable.

Modification from revised model 1 to revised model 3: The critical ratio for difference between parameters par 1 and par2 (representing path between costs and control and benefits and control respectively) is very small (=0.574). Therefore, we can put a constraint that path coefficients for costs→control and benefits→control are same. These results in a model modification as is shown in improved Chi-squared value to degrees of freedom ration and improved fit indices. The final model is shown in Figure 3. The critical ratio (C.R) for all the paths in the final model (as shown in Table 1) are significantly more than 1.96.

Maximum Likelihood Estimates (for final model)

Regression Weights:	**Estimate**	**S.E.**	**C.R.**
Costs <---------- Methodology	0.233	0.014	16.983
Benefits <------- Methodology	0.148	0.009	15.894
Risks <---------- Methodology	0.128	0.011	11.712
Control <-------------- Costs	0.542	0.115	4.702
Control <----------- Benefits	0.542	0.115	4.702
Control <-------------- Risks	3.245	0.326	9.943
ROIT <--------------- control	1.179	0.077	15.292

Standardized Regression Weights:	Estimate
Costs <---------- Methodology	0.936
Benefits <------- Methodology	0.928
Risks <---------- Methodology	0.877
control <-------------- Costs	0.193
control <----------- Benefits	0.124
control <-------------- Risks	0.678
ROIT <--------------- control	0.978

Table 1. Path coefficients for final model

Therefore, the relationships (path coefficients) are statistically significantly (i.e. different from zero at 0.05 level). Therefore, the following links in the model hold:

- Better the IT investment evaluation methodology, more extensive will be the measurement of costs, measurement of benefits and the evaluation of risks.
- More extensive the measurement of costs, the better will be the investment control.
- More extensive the measurement of benefits, the better will be the Investment control.
- More extensive the evaluation of risks, the better will be the Investment control.
- The better the planning and control, the higher is the realized return on IT investment.

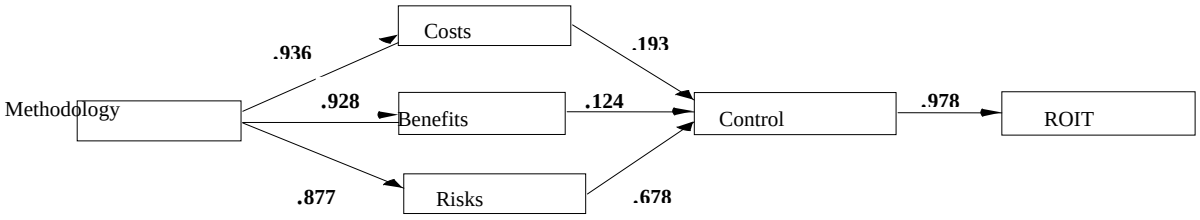

Figure 3. The final model

Therefore, our response to the overarching research question is that a more comprehensive IT investment evaluation does lead to a higher ROIT when investments controls are in place.
Our results indicate that the choice of the model chosen to assess IT effectiveness determines in a very large measure the quality of the measure of the benefits, costs and risks. But benefits and

costs do not influence investment controls as much as risks do. The assessment of risks significantly influences the investment controls.

Discussion

There is an important managerial lesson here for practitioners. Whether an organization measures costs or benefits, an organization has to incur certain minimal costs. Many of such costs can be estimated and assessed without necessarily having to employ sophisticated models and methodologies. Seddon et al. (2002) provide a possible explanation of such findings by arguing that in some circumstances IT evaluation can seem much more valuable to an organization than usual, so evaluation increases. However they also argue that there must also be times when, for cost-benefit reasons, it is rational not to evaluate IT investments. Organizations can use their internal and external estimates to decide on a conceptual cap on costs (whether capital or operating). Benefits have the same problem of measurement. However, most organizations do know what to expect and even what magnitude to expect. In the case of benefits, a minimum expectation needs to be set. These maximum and minimum levels can change with time and they are indicative in nature. Costs and benefits tend to be similar across organizations. However, an organization's ability to anticipate and manage risks, allows it to control for cost escalations and benefit slippages. Therefore, managers must continually strive to recalibrate benefits, costs and risks.

The main implication is that while good IT decisions could end up in undesirable and low-payoff organizational outcomes, maintaining a process perspective allows IT managers and users to salvage even a sub-optimal IT investment decision into one that provides demonstrable IT value to the organization. This finding will allow IT managers and users to understand the importance of transitioning from project and decision-oriented view to a process and continuous improvement view.

That benefits and costs are difficult to identify and express has been well accepted and better approaches are evolving. Almost all costs and benefits associated with IT investments that get identified change over time. As the survey shows few organizations are able to comprehensively identify them and even fewer are able to express them in monetary terms. In the survey the benefit that was found most difficult to identify and then quantify was the formation of intellectual capital as a result of IT. Expanded services/products, costs savings and enhanced work environment have been found out to be the benefits that are somewhat or mostly identified and measured. Intellectual capital was found out to be the most difficult benefit to be quantified followed by enhanced work environment. Expanded products/services and cost savings are in general the benefits that are perceived more important by the executives as they are the ones used to justify investment.

Relatively easily identifiable and measurable costs like hardware, software and infrastructure costs, etc are measured more extensively than the lesser visible and consequently difficult to identify and measure costs such as opportunity costs, transition costs, complexity costs, etc which are either hardly measured or not measured at all. The easily recognizable costs are the ones that are perceived by the executives as more important to be measured, as they are perceived to constituting a major proportion of the IT budgets. Labor costs are not properly accounted as it is usually kept out of traditional IT budgets. Amongst the risks strategic risks,

technology risks and project management risks are the ones that are more extensively identified and evaluated. Some of the reasons for such an approach include the thrust being given to the alignment of the organization's strategy and its IT strategy, rapid pace of technological changes, and large number of time and costs overruns in IT projects respectively.

The managerial implication of our final model is that organizations need to move from concentrating primarily on evaluation to shifting the emphasis on achieving the goals. The low path coefficients from "costs" and "benefits" to "control" show that there are diminishing returns for management to concentrate their efforts on benefits and costs only. Once meaningful costs and benefits have been identified, they should be disaggregated to allow for meaningful measurement. A one-time measurement approach suffers from obvious weaknesses. Consequently, repeated measurements are required. The idea is much like the one followed in software costing – where the initial estimate is very difficult and not reliable. However, over time, repeated estimations lead to some convergence. Unlike software costing, where parametric estimation is possible, organizations do not consider IT as their core competence and would rightly not like to see too many IT projects in progress at any point in time.

A prime example of the need for such a shift can be provided by citing the failure of packaged software. The major advantage that packaged software promise to organizations is that the cost would not be deterministic and so would the benefits. Moreover, since coding would be minimal, the implementation time would be shortened. However, many such implementations failed either because the organization did not make the strategic choices to configure the systems and procedures or the implementation process spun out of business control (Buckhout et al., 2000). Almost all IT investment decisions that require non-trivial evaluations tend to be strategic in nature. This means that a significant amount of monetary inputs is required and once committed to a certain path, backtracking or major deviations would be very expensive.

Conclusion

This study shows that the less tangible dimensions of the IT benefits and costs make evaluation of IT investments difficult. This does not mean however that IT evaluation cannot or should not be done. Costs, benefits and risks should be as comprehensively evaluated for IT investments as possible. Following that, better control, as a part of continuous evaluation, is a critical feedback function. Control over IT investments or spending is essential in the wake of the so-called 'cost creep syndrome of IT investments' and our inability to isolate or accurately estimate the benefits of IT. This improved control process also enables a check on cost creep and encourages the need to continuously strive for benefits – thereby resulting in higher returns.

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Appendix A: List of appraisal and evaluation tools for IT (Zimmerman, 1996)
Capital investment appraisal techniques (CIAT); IT Effectiveness Framework; IT Efficiency Framework; Performance Measures for IT; Productivity Measures for IT; Enhanced Cost-Benefit Analysis; Information Economics Model; Activity-Based Costing; Integrated Performance Measurement; Information System Success Categories; Value Management Framework; Earned Value; The Balanced Scorecard; Oracle CB-90 Methodology; Investment Appraisal Model; Option Pricing Model; Prudential Project Appraisal Method; Quality engineering; Return-On-Management Model.

Appendix B: Models for the research

Models	Modification Indices		
Initial model	**Covariances:**	M.I.	Par Change
	error5 <----------> error4	17.520	0.009
	error3 <----------> error4	12.683	0.011
	error3 <----------> error5	22.653	0.013
	error2 <----------> error4	5.430	-0.028
	error2 <----------> error1	6.406	-0.059
	Regression Weights:	M.I.	Par Change
	Benefits <---------- Risks	4.032	0.128
	ROIT <---------- Costs	4.144	0.427
Revised model 1	**Covariances:**	M.I.	Par Change
	error2 <----------> error4	9.443	-0.020
Revised model 2	**None**		
Revised model 3	**Covariances:**	M.I.	Par Change
	error2 <----------> error4	10.204	-0.021