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5-24-2013

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Recommended Citation
Tu, Yu-Ju; Shaw, Michael; and Subramanyam, Ramanath, "IT Portfolio Cost Control and Risk/Return Performance" (2013). *MWAIS 2013 Proceedings*. 2.
http://aisel.aisnet.org/mwais2013/2

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IT Portfolio Cost Control and Risk/Return Performance

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ABSTRACT

We examine how the cost control strategy at portfolio-level can influence the risk/return performance of IT investment. We view a portfolio of IT initiatives as our IT investment target, and use the optimality of IT investment choice to measure the performance. By employing a method of combining computational modeling with simulation, we show that even if a firm takes the strategy of largely reducing the cost for its IT initiative portfolio, it still can have a chance of about 29% to capture a high-risk-high-return IT investment. This finding implicates that, even when facing a very limited budget, a firm would still be able to achieve a better investment performance by carefully selecting its IT initiative portfolio.

Keywords

IT portfolio, IT investment, IT governance

INTRODUCTION

IT investment often means a profound loophole in firms. After the passage of the Sarbanes-Oxley Act, firms are forced to take more fiscal accountability to their shareholders and thus seek for more effective ways to govern their IT investment. As a result, many firms consider adopting a portfolio approach to managing their IT investments, as managing a portfolio of financial assets (Jeffery and Leliveld, 2004).

From anecdotal evidence in business press, we observe that the control of portfolio cost is a conventional means to govern IT investment. Particularly, in a highly uncertain environment, many firms would decide to tighten their IT investment budgets. For example, Computer Weekly (2009) indicates that, because of the economic downturn, most UK firms slash IT investment. Gartner (2013) reported that a lower-than-expected global IT spending growth is predictable in 2013, because the uncertain economic prospect has caused a global IT investment reduction amounting to billions of USD. The related research, however, has been very scant in prior IS literature. Accordingly, we wonder how a firm's cost control strategy at portfolio-level will influence a firm's IT investment performance.

In this paper, we specifically examine how the cost control strategy at portfolio-level can influence the risk/return performance of IT investment. We view a set of IT initiatives as a portfolio as well as our IT investment target. We use the optimality of IT investment choice to measure the IT investment performance, and we consider two common investment profiles: low-risk-low-return and high-risk-high-return. We expect that the IT investment choice will have a strong impact on the investment efficiency and thus in turn influence a firm's IT investment performance.

Our research method is computational modeling and experiment, and our experimental IT initiative data come from the Monte Carlo simulation approach on the basis of real-world data. First, we develop an optimization model to select a best set of IT initiatives for simulating a firm's IT investment choice (IT initiative portfolio selection model). Next, we design scenarios for simulating a firm's small/large portfolio cost reduction strategies (i.e., slightly/largely tightening investment budget limits). We then conduct experiments to compare the choice optimality from the two common investment profiles.

Our findings show that a small portfolio cost reduction strategy can have a chance of 98.6% to generate optimal portfolio choices for low-risk-low-return IT investment, and a chance of 100% to generate optimal portfolio choices for high-risk-high-return IT investment. A large portfolio cost reduction strategy can have a chance of about 29% to capture optimal portfolio choice for high-risk-high-return IT investment, and a chance of about 93% for low-risk-low-return IT investment.

We organize the remainder of this paper as follows. In section 2, we review the related literature. In section 3, we outline our research methodology including a proposed decision support model for IT initiative selection, our computational experiment

design, and data simulation approach. In section 4, we show our experiment results and summarize the findings. In section 5, we discuss the implications and conclude this paper with contributions.

LITERATURE REVIEW

In prior IS literature, the factors that influence IT investment performance at firm level have been little known. A series of empirical findings indicate that IT investment performance varies across firms (Kauffman and Weill, 1989; Brynjolfsson and Hitt, 1996; Melville, Kraemer, and Gurbaxani, 2004; Matthew, 2006). After the passage of the Sarbanes-Oxley Act, many firms seek for more effective ways to manage their IT investments. Since then, IT portfolio management (ITPM) has increasingly captured the attention of IT practitioners. An IT portfolio is a set of IT assets that share comparable investment characteristics. IT portfolio management aims to manage an IT portfolio similar to a financial portfolio in order to improve the investment performance by balancing risk and return of the portfolio (Jeffery and Leliveld, 2004; Kumar et al., 2008; Cho and Shaw, 2009)

In practice, most IT investments are IT initiatives (or projects) and thus IT initiative portfolio is very critical to a firm's IT investment performance. Moreover, we observe that many firms use a top-down strategy and depend on adjusting the total cost (budget) of IT portfolio to govern their IT investments. So far, however, the research in prior IS literature has seldom investigate how a firm's cost control strategy at portfolio-level will influence a firm's IT investment performance.

METHODOLOGY

Our research method is computational modeling and experiment. In prior IS literature, such a method is often adopted when the sufficient empirical data for a research are not available (Green at al., 2010; Nan, 2011; Piramuthu and Shaw, 1998; Sikora and Shaw, 1988; Tu et al., 2009). We aim to use the method to observe the relationship between a firm's small/large portfolio cost reduction strategies and the frequencies of generating optimal IT initiative portfolio choices for low-risk-low-return/high-risk-high-return IT investments. Our experimental IT initiative data come from the Monte Carlo simulation approach on the basis of real-world data. Specifically, we collect a set of strategic IT initiatives (IT investment business cases) from a large insurance company in Midwest area, and then use them as the seed to initialize our Monte Carlo simulation.

The proposed IT initiative portfolio selection model

This model is for maximizing the return of a set of selected IT initiatives, given the IT investment risk and budget limits.

$$\text{Max } V(P) = \sum_{i=1}^{n} v_i x_i \tag{1}$$

Subject to:

$$V(P) = \sum_{i=1}^{n} v_i x_i \geq V_0 \tag{2}$$

$$R(P) = \sum_{i=1}^{n} r_i x_i \leq R_0 \tag{3}$$

$$C(P) = \sum_{i=1}^{n} c_i x_i \leq C_0 \tag{4}$$

Variable	Definition
$V(P)$	The total return of a portfolio choice P (a selected set of IT initiatives)
$R(P)$	The total risk of a portfolio choice P (a selected set of IT initiatives)
$C(P)$	The total cost of a portfolio choice P (a selected set of IT initiatives)
x_i	IT initiative decision variable ($x_i = 1$: selected; $x_i = 0$: not selected)
v_i	The NPV of IT initiative i
c_i	The monetary cost of IT initiative i
r_i	The risk score of IT initiative i
C_0	The budget limit for the selected set of IT initiatives
V_0	The expected total NPV for the selected set of IT initiatives
R_0	The risk limit for the selected set of IT initiatives

Definitions of Mathematical Notation in the Model

Computational experiment and data simulation

We employ a 2x2 experiment design that includes the low-risk-low-return/high-risk-high-return IT investment expectations, and the small/large portfolio cost reduction scenarios. Specifically, we use the risk/return ratio of the selected IT initiatives to differentiate between the low-risk-low-return and high-risk-high-return IT investments. The expected ratio for low-risk-low-return IT investment is 25% of the risk/return baseline ratio, and the expected ratio for high-risk-high-return is 75% of it. We derive this baseline ratio by computing the risk/return ratio in the case that the IT investment choice is composed of the overall IT initiatives[1]. Similarly, we define that the low portfolio cost reduction strategy is to adjust the cost of the selected set of IT initiatives to the 75% of the baseline cost, and the large portfolio cost reduction strategy is to adjust the selected set of IT initiatives to the 25% of the baseline cost; we derive the baseline cost by computing (aggregating) the cost of the IT investment choice that is composed of the overall IT initiatives.

For each scenario, we run 1000 data sets in 10 experimental iterations (100 data sets per iteration). In each data set, there are 50 IT initiatives with NPV, cost, and risk attribute values. We use the Gaussian distribution to randomly propagate the attribute values (simulated data). Specifically, we adopt the real-world data to generate the mean and standard deviation for initializing the data simulation; the mean and standard deviation for simulating NPV value is \$2,000,000 and \$2,600,000; for cost value is \$2,000,000 and \$200,000; for risk is 50 and 30 (scoring approach from the lowest risk:1 to the highest risk:100). In other words, these numbers are calculated on the basis of the collected set of strategic IT initiatives. Next, with the simulated data, we use a personal computer (Intel Duo 2.8G CPU with 8GB RAM) to run Lingo to implement the computational experiment.

RESULT

The performance result under each scenario is shown in table 1. The result is the number in each table field that represents the frequency of deriving the optimal choice for selecting a best set of IT initiatives (per 100 data sets). The overall average frequencies and their standard deviations (in the parentheses) are listed in the bottom line.

[1] Before any selection, the overall IT initiatives can actually be taken as a baseline portfolio with the highest investment value, risk, and cost.

	High-Risk-High-Return IT investment		Low-Risk-Low-Return IT investment	
	Small Cost Reduction	Large Cost Reduction	Small Cost Reduction	Large Cost Reduction
Iteration 1	1.00	0.28	0.97	0.92
Iteration 2	1.00	0.25	0.98	0.92
Iteration 3	1.00	0.3	0.99	0.91
Iteration 4	1.00	0.29	0.98	0.94
Iteration 5	1.00	0.25	0.97	0.89
Iteration 6	1.00	0.24	1.00	0.97
Iteration 7	1.00	0.31	1.00	0.96
Iteration 8	1.00	0.27	0.98	0.92
Iteration 9	1.00	0.34	1.00	0.94
Iteration 10	1.00	0.35	0.99	0.93
Sub Avg.(Std.)	1.000 (0.000)	0.288 (0.037)	0.986 (0.011)	0.93 (0.023)

Table 1. Experiment Results: The Optimal IT Investment Choice Frequency

Summary of Findings

On the basis of the experiment result in table 1, we can further summarize our findings as follows: a small portfolio cost reduction strategy can have a chance of 98.6% (i.e., frequency=0.986) to generate optimal portfolio choices for low-risk-low-return IT investment, and a chance of 100% (i.e., frequency=1.000) to generate optimal portfolio choices for high-risk-high-return IT investment. A large portfolio cost reduction strategy can have a chance of about 29% (i.e., frequency=0.288) to capture optimal portfolio choice for high-risk-high-return IT investment, and a chance of about 93% (i.e., frequency=0.93) for low-risk-low-return IT investment.

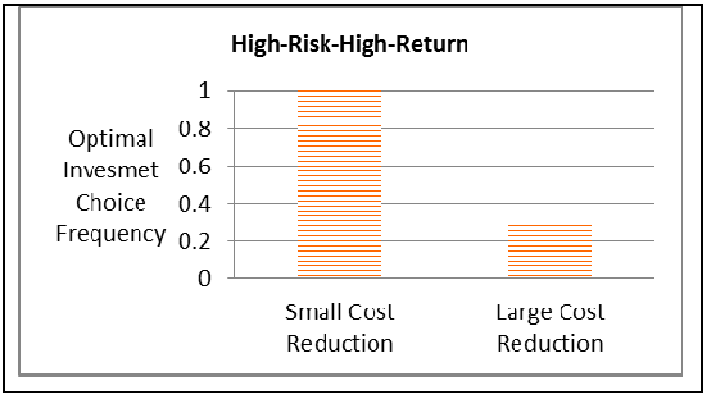

Figure 1. The Effectiveness of Portfolio Cost Reduction Strategies for a High-Risk-High Return IT Investment

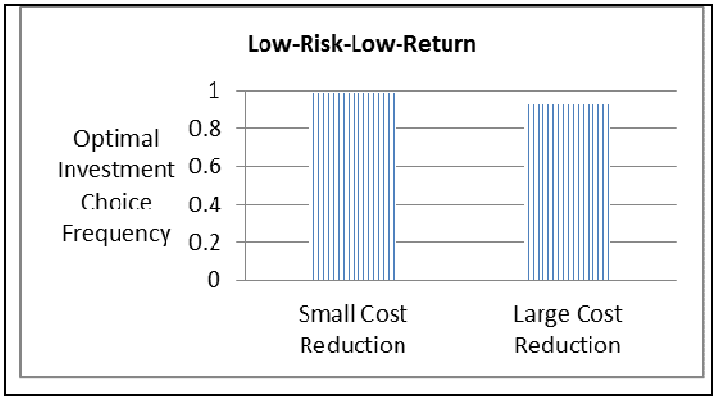

Figure 2. The Effectiveness of Portfolio Cost Reduction Strategies for a Low-Risk-Low-Return IT Investment

DISCUSSION AND CONCLUSION

Strictly speaking, the area of IT governance and portfolio management is still in its early development stage. For example, considerable firms still tend to adopt traditional ranking approaches to select a set of "best" IT initiatives, rather than use a portfolio approach to select a best set of IT initiatives. Moreover, financial portfolio theories often can hardly translate into the IT portfolio context in a firm. For example, according to the modern portfolio theory (Markowitz, 1959) in finance area, the cost of a financial stock portfolio (i.e., the portfolio's investment budget) can seldom influence the risk/return investment performance.

In this paper, our findings show how the cost reduction of an IT initiative portfolio will influence the investment performance and there is an asymmetry existing between the IT initiative portfolio cost and its risk/return investment performance in firm. This implicates that a firm's budget control strategy can play an important role in a firm's IT investment performance and it has not been well investigated in the empirical research of prior IS literature. The other implication is that, even when facing a very limited budget, a firm would still be able to achieve a better investment performance if it can carefully examine and select its IT initiative portfolio choice (i.e., the best set of IT initiatives). In our experiment, a firm still can have a chance of about 29% to capture a high-risk-high-return IT investment when largely reducing the cost for its IT initiative portfolio.

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