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A Multi-Objective, Multi-Criteria Approach for Evaluating IT Investments: Results from Two Case Studies

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ABSTRACT

While information technology investments have the potential for providing competitive advantage, actual returns on such investments have varied widely and a majority of CEOs rank IT investments as disappointing. Numerous methods exist for investment evaluation, but traditional methods do not adequately account for the intangible benefits that characterize strategic investments and lack other features of portfolio selection. This paper describes a model based upon the analytic hierarchy process, combined with integer programming, to overcome the deficiencies associated with traditional approaches to economic evaluation of IT investments. It also presents results of two case studies in which the model was used successfully and important contextual factors were observed. The multi-objective, multi-criteria approach was found to reflect both tangible and intangible benefits, link the investment to business strategies, increase management participation in the evaluation process, and provide important features of portfolio selection.

Keywords: information technology investments; analytic hierarchy process; strategic information systems planning

INTRODUCTION

American Airlines' apocryphal success with the Sabre System heralded the potential of IT as a source of strategic benefits (Hammer, 1991). While the competitive advantages from superior IT investments are widely recognized, actual returns received on IT investments vary widely and the IT productivity paradox has international recognition (Brynjolfsson & Hitt, 1998; Dewan & Kraemer, 1998; Santos & Sussman, 2000). A majority of CEOs admit to having funded IT investments that were economically infeasible but express confidence about the future ability of IT to provide strategic advantages (COMPASS, 1998, 1999). While most companies submit IT-based applications to some form of economic feasibility analysis, the numerous objective measures used in practice provide little relationship to the strategic direction of the firm (Liberatore, Monahan, & Stout, 1992). Moreover, despite recog-

nition of the importance of qualitative benefits, economic analysis of IT returns relies primarily on quantitative measures (Powell, 1992). At least one author concludes that the productivity paradox may result from a bias towards quantitative measures in MIS research (Chan, 2000).

Traditional approaches to capital budgeting have not proven useful in the economic evaluation of IT-based investments. Single criteria techniques, such as discounted cash flow (DCF) and cost/benefit analysis, are biased towards the tangible benefits that can be more easily identified and quantified. Calculations of IRR or net present value may ignore the "soft", qualitative benefits of IT applications or build them into the model so creatively as to devalue the results. Traditional approaches can penalize investments with valuable soft benefits, so often present in strategic applications. Hence, proper evaluation of IT-based investments requires a method that reliably measures all benefits in a consistent manner that is understood and supported by management.

Maximizing returns from IT investments also requires a total portfolio planning approach that cannot be accomplished by valuing each investment individually. In reality, some investments are mutually exclusive, other investments have mutual dependencies, and some investments should not be combined due to the total risk.

Applying both objective and subjective judgments to numerous projects, across multiple criteria, in a consistent manner is an imposing challenge for IT management. At the same time, it is becoming increasingly important that just such an approach be adopted to maximize the return on IT investments.

Combined with integer programming, the Analytic Hierarchy Process (AHP) supports a multi-objective, multi-criteria (MOMC) approach that addresses several issues hindering the success of IT investments. An MOMC approach, for example, can improve the alignment of the information systems plan with organizational goals. AHP has a wide variety of applications in industry and government (Zahedi, 1986; Vargas, 1990). IBM has called it "an extraordinarily powerful decision-making tool," (Saaty, 1994). AHP has multiple indicators of success, allows for broad evaluative participation, and specification of criteria that are strongly related to organizational strategies. More importantly, AHP has been used to counter political issues, engage management in the process of ISP planning, and provide a highly visible evaluation process that supports commitment. While research has reported on the use of AHP and integer programming as a ranking mechanism, the approach has not actually been tested on ranking IT investments in practice.

The purpose of this paper is to demonstrate the MOMC approach to IT investment analysis using a methodology that, heretofore, has not been demonstrated in practice. This paper first demonstrates the applicability of the proposed model using an illustrative example of five information systems projects. Next, it reports on the results of two case studies in which the model was successfully applied. Finally, facilitators and inhibitors and generalizable findings derived from the cases are presented.

THE IT INVESTMENT DECISION

Despite intensive research, there is little persuasive evidence that investment in IT positively impacts the financial position of the firm or increases productivity (Brynjolfsson & Hitt, 1995). For example, Sircar et al. (2000) could not find a rela-