Investment Selection in Complex Multinational Projects

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ABSTRACT

Project executives believe complex multinational investment selection is complicated because there are many criteria to evaluate and the decision-making theories are difficult to implement in practice. The 2008 global recession has forced companies to rebalance existing programs and products. Thus, project selection is not merely a go/no-go decision for a single project but instead it is a multiple-criteria factor analysis of multiple new proposals – and whether to continue existing projects. Different selection approaches can produce opposite outcomes when applied to the same situation. Qualitative techniques such as managerial preferences or Delphi consensus building are subjective. Objective quantitative methods such as Markov analysis, linear programming and search heuristics are grounded on rigorous calculus theory, but they produce a single result (not priorities). Also, quantitative techniques may omit important managerial insight. This study demonstrates how qualitative and quantitative selection techniques can be combined for complex multinational investment decision making at a Virginia-USA-based coal mine company that generates electricity.

Keywords: Multinational Complex Projects, Mixed Method Multi-Criteria Decision Making, Payoff Tables

INTRODUCTION

Project portfolio selection is a decision-making theory that facilitates the evaluation of ‘complex’ choices to provide a prioritized list of feasible alternatives. These problems may involve dilemmas such as: determining optimal resource allocation subject to constraints in operations, creating financial investment strategies in unpredictable markets, or selecting the best project(s) from a large pool of proposals competing for the same limited funds. Project selection is pervasive because people with accountability want to make profitable and ethical decisions. Project selection is also cross disciplinary as it is applied across industries and functions.

There are numerous techniques in the broad family of project selection methods to choose from. For instance, in the literature, there were 152 project selection topics explained in an operations research-management science handbook (Cochran, Cox, Keskinocak, Kharouf, & Smith, 2011). Obviously the first challenge in project selection is to locate an appropriate technique that matches the business goals, situation and available data.

Project selection techniques are important to understand because the methods and their results impact organization profitability. Different project selection techniques can result in opposite decisions even when applied to the same situation. For example, qualitative project selection techniques such as brainstorming or hierarchical decision making are subjective.
processes that may depend more on intuitive knowledge and personality/mood of the decision makers rather than parameters. Qualitative approaches can result in tied-choices.

In the quantitative category of project selection techniques, linear/mathematical programming and optimal solution search heuristics are objective algorithms but since these rely entirely on input data using statistical simulations and/or calculus theory, they can overlook practical limitations or synergistic opportunities. Whereas linear programming can be used to analyze multiple constraints with numerous decision variables – it produces only one optimal result: the objective function. This becomes a problem if the first choice fails requiring a second option or additional alternatives.

Furthermore, a recent survey of best practices indicated that different project selection mechanisms are associated with different performance measures (Müller, Martinsuo, & Blomquist, 2008), which implies the techniques should be matched with the situational data/context. Certain techniques are better suited for specific disciplines, industries, or business cycle stages (such as selecting which new cars to manufacture versus which stocks to purchase for an investment pool).

In summary, the general family of project selection techniques includes numerous methods to facilitate complex decision making. However, their applications vary widely, and selecting an inappropriate tool for the task could lead to bad choices. Therefore, decision makers should be aware a range of qualitative to quantitative project selection techniques are available (including sources to research these), and how they can be integrated to objectively prioritize the alternatives. To that end, this paper applies both qualitative and quantitative portfolio selection techniques to an energy creation case study to demonstrate their integration.

**LITERATURE REVIEW**

Portfolios have different meanings across disciplines. In finance they refer to investments of stocks, bonds, treasury bills, and so on (Mills & Patterson, 2009). In new product development (Cooper & Edgett, 2008; McNally, Durmusoglu, Calantone, & Harmancioglu, 2009) and strategic business planning, portfolios are considered to be limited-duration projects or longer-term programs (PMI, 2008). Human resource recruiting and development has been analyzed as portfolios in terms of competencies and learning abilities (Ngwenyama, Guergachi, & McLaren, 2007). In fact teacher portfolios and student learning portfolios are contemporary formative assessment mechanisms found in higher education (Strang, 2010a).

**Selection and Mathematical Programming**

The definition of project selection varies by discipline and industry. It is generally accepted that the term project selection originated in the finance industry (Xidonas & Psarras, 2009), as ‘portfolio selection’ grounded in Markowitz’s (1952) integration of economic and statistical principles for selecting the best investments (based on the mean-variance of beta risk and yield regression estimates). It is apparent that portfolio selection methods draw heavily on statistical and mathematical programming theories. Lin, Hoffman and Duncan (2009) proposed an extension to Markowitz’s mean-variance portfolio selection technique by using performance attribution analysis wherein they created multi-criteria weights from equity returns and risks using z-scores of equity return standard deviations (as well as using net present value analysis of cash flow timing to weight the stock investment attractiveness).

On the other hand, many researchers have gone in the other conceptual direction by integrating financial portfolio selection techniques into linear and nonlinear programming models (Xidonas & Psarras, 2009). As a case in point, Goldfarb and Iyengar (2003) extended the Capital Asset Pricing Model (CAPM) using a combination of statistical principles, vector algebra, sensitivity analysis, and mathematical programming for optimization. Chen and Askin (2009) employed net present value with integer programming to the selection of projects.
The Online Effect: Transitioning from the Legacy Help Desk to the Online Task Management System
www.igi-global.com/article/online-effect-transitioning-legacy-help/3172?camid=4v1a