Navigating the New Product Process from Strategic Viewpoint

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Abstract. Resource scarcity is a major difficulty facing firms that engage in new product development (NPD) projects. In order to understand how resource allocation strategies affect NPD performance and which strategy is the best alternative, we construct a research and development (R&D) process model using system dynamics. Moreover, resource allocation strategies are categorized into two types: design-stage-first strategy and manufacturing-stage-first strategy, and several important indicators of performance evaluation are defined. We then use simulation to test the relationships between resource allocation strategy and various NPD performance measures. The most important finding from simulation results is that a firm should allocate its resources into early development stage first in order to obtain superior R&D performance.

Keywords: New product development, System dynamics, Resource allocation strategy.

1 Introduction

It is widely agreed that the development of new products is of increasing importance to profitability and competitiveness in many industries. Over the past twenty years several studies have examined the determinants of new product success and identified many factors that distinguish successful products from unsuccessful ones.

Spivey et al. (1997) suggests that various resources can strongly influence new product development (NPD), but few articles deeply explore how to allocate resources in the NPD process to improve project effectiveness and efficiency. The predominant view about resource allocation in the NPD process focuses on investigating resources that are input into each development activity in successful or unsuccessful projects (Booz-Allen and Hamilton, 1982; Souder, 1987; Cooper and Kleninschmidt, 1988). However, previous research has not yet been able to conclude that more resource put in specific stages will increase the odds of success due to the difficulty in classifying the causality issue. Therefore, which resource allocation strategy is better for the NPD is still unclear. Most importantly, how the resource strategy contributes to NPD performance has not been fully explored.
Despite the breadth and depth of the product development literature, it must be noted that NPD is a complex and dynamic process that involves external R&D workload and internal R&D defects/failures. The final development results would be affected by the interactions of various variables. To capture this complexity, we used a system dynamics approach instead of a survey approach to construct and assess a simulation model which characterizes an NPD system with highly complex internal and external dynamics. Longitudinal results obtained in the study provide managers with more meaningful guidelines on critical R&D resource-allocation decision than do conventional cross-sectional results.

The main objective of this research is to examine the relationship between resource allocation strategy and NPD performance. We identify two types of resource allocation strategies: design-stage-first and manufacturing-stage-first strategies based on the priority of different development stages in resource allocation. This study makes several contributions. First, we successfully build an R&D model with cause-effect loops using system dynamics. Second, we justify experimentally and quantitatively performance differences of various resource allocation configurations. An important practical implication of the results is that a firm should allocate its resources into early development stage first, which will result in efficient completion rate and rework rate, lower defect rate, and higher project completion rate.

The rest of the article is organized as follows. In section 2 we review the literature on the NPD process, R&D resource types, resource allocation in the NPD process, and NPD performances. Then, we present our proposed NPD system dynamics model in section 3. Followed are findings about the effect of resource allocation strategy on NPD performance. We discuss the limitations and contributions of this study along with its implications for future research and managerial practices in section 5.

2 Literature Review

2.1 New Product Development Process

A number of researchers have proposed an NPD process mainly from technical viewpoint, or marketing viewpoint, or combination of them (Cooper, 1980; Cooper and Kleinschmidt, 1986; Cooper, 1994; Kuczmarski, 1992; Crawford, 1994; Ulrich and Eppinger, 1995; McGrath, 1996; Tzokas et al., 2004; Prasnikar and Skerlj, 2006). For example, Ulrich and Eppinger (1995) presented a generic development process with five phases. These phases are concept development, system-level design, detail design, testing and refinement, and production ramp-up, some primarily stressed on marketing viewpoint. Tzokas et al. (2004) contended that the quest for success in NPD requires management to navigate complex processes. In their study, the development stages of the NPD process include the generation of new product ideas, the development of an initial product concept, an assessment of its business attractiveness, the actual development of the product, testing it within the market, and the actual launch of the product in the marketplace. Rochford and Rudelius (1997) suggested an NPD process that consists of idea generation, initial screening, preliminary market analysis, preliminary technical analysis,