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The effect of cost goal specificity and new product development process on cost reduction performance

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ABSTRACT

Many firms that compete based on the development of new and innovative products have begun to adopt concurrent new product development (NPD) processes in which product design phases occur in a non-linear and iterative manner. While concurrent NPD processes increase flexibility and reduce time-to-market as compared to traditional sequential processes, concurrency increases task uncertainty since the product design process begins before all important product features and specifications have been established. Such changes can result in costly redesign and rework. Prior research suggests target costing, where product design teams are assigned specific cost goals, is an effective method of controlling costs in sequential NPD. Even so, it is unclear whether target costing will improve cost reduction performance when combined with a concurrent NPD process due to increased task uncertainty. We examine experimentally the ability of product design groups to achieve specific or general cost reduction goals under simulated sequential or concurrent NPD. We predict and find that the nature of the NPD process moderates the effect of specific cost reduction goals on actual cost reduction performance. While specific cost goals result in higher reductions in product cost than general cost goals under a sequential NPD process, specific goals are no better than general goals in motivating design groups to reduce product cost under a concurrent NPD process; thus, we demonstrate boundary conditions on the usefulness of target costing as a cost control method.

Introduction

New product development (NPD) processes comprise several phases that typically include planning, concept design, product design and testing, and production start-up (Davila, 2000). These phases have traditionally been performed *sequentially* and in lock-step (Kalyaraman & Krishnan, 1997; Valle & Vazquez-Bustelo, 2009). Decisions about product features and specifications are identified and "frozen" before the actual design process begins (Hertenstein & Platt, 2000). In contrast, under concurrent NPD, design phases occur *simultaneously* and in a non-linear manner. Product specifications may unexpectedly change due to upstream decisions about product features that continue to occur even though downstream product design activity has already begun (Loch & Terwiesch, 1998; Mitchell & Nault, 2007). Thus, task uncertainty, defined by the number of exceptions and degree of improvisation required to complete internal tasks (Perrow, 1970), is higher under concurrent than under traditional sequential NPD (Mitchell & Nault, 2007).

An important and relatively unexplored issue is how firms control NPD costs when task uncertainty is high.

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Prior research suggests target costing is an effective cost management tool firms use during the NPD process (Booker, Drake, & Heitger, 2007; Cooper, 2002; Davila & Wouters, 2004; Dekker & Smidt, 2003; Everaert & Bruggeman, 2002). Target costs are specific cost goals calculated by subtracting a target profit from the product's market-driven sales price (Ax, Greve, & Nilsson, 2008). Setting and working toward target costs can provide significant cost savings in sequential NPD processes (Anderson & Sedatole, 1998; Cooper, 2002; Cooper & Slagmulder, 1999).[1] Concurrent processes, on the other hand, are inherently more uncertain than traditional sequential processes (Mitchell & Nault, 2007) and thus, we examine whether assigning specific cost goals (as would be the case under target costing) will also be effective in controlling costs under concurrent NPD. This issue is important given the recent widespread adoption of concurrent NPD processes in practice (Mitchell & Nault, 2007; Valle & Vazquez-Bustelo, 2009).

Hirst (1987) develops a theoretical proposition that task uncertainty will limit the effectiveness of specific cost goals (such as target costs) in directing effort and performance, although he does not test this proposition empirically. Essentially, Hirst (1987) argues that as task knowledge becomes less complete, task uncertainty increases and individuals are less able to identify the most effective ways to direct their effort towards improved performance when presented with specific goals. This effect is much less severe (or even nonexistent) under general ("do your best") goals. Therefore, based on the theory developed in Hirst (1987), we hypothesize that the nature of the design process (sequential or concurrent) will moderate the effectiveness of specific cost goals in motivating increased cost reduction by new product design groups. In particular, due to higher task uncertainty under a concurrent NPD process, specific cost reduction goals will be less effective in reducing product cost under concurrent relative to sequential NPD.

In our experiment, 186 participants are assigned to three-person product design groups and are required to redesign a small truck to meet new product specifications. The group's objective is to lower the truck's cost while achieving the stated functional/technical specifications.[2] Participants are students enrolled in MBA or other postgraduate executive education programs. To operationalize variations in specificity of cost goals, we assign a specific goal ("achieve a final product cost of $16,500") to half of the design groups and a general goal ("reduce costs as much as you can") to the others. We operationalize the sequential and concurrent design processes by varying the timing of information delivered to design groups regarding new product specifications. We simulate a more certain sequential process by informing design groups of all product specifications before they begin to redesign the product. To simulate a relatively less certain concurrent process, the design groups receive the same information in total as under the sequential process, but one third of the product specifications are provided at each of three different intervals during the work period and the design groups do not know when or if this new information will be received.

We find that the nature of the design process (concurrent or sequential NPD) moderates the relation between cost goal specificity and cost reduction performance. Groups assigned a specific cost goal reduced costs more than those assigned a general cost goal in the sequential NPD (low uncertainty) condition while cost reduction performance is no better under specific cost goals than under general ("do your best") cost goals in the concurrent NPD (high uncertainty) condition.

This paper makes several contributions to both research and practice. First, we answer the call by Davila and Wouters (2004) for additional research to better understand how cost management tools like target costing can help or hinder innovation given recent changes in the manufacturing environment and the management of the NPD process. Second, our findings suggest cost goal specificity and the firm's approach to the NPD process may jointly influence design teams' ability to reduce the cost of new and redesigned products. These results are important given recent popularity of concurrent NPD (Mitchell & Nault, 2007; Valle & Vazquez-Bustelo, 2009) in many organizations looking to reduce time-to-market for new products. As more firms adopt concurrent processes, it will be important to recognize that high task uncertainty may be a boundary condition on the effectiveness of target costing; hence developing alternate cost management tools that are effective in the uncertain concurrent NPD environment should be a priority for these organizations (Davila & Wouters, 2004).

The remainder of this paper is organized as follows. The next section reviews the literature and develops our hypothesis. We then describe the research design and results of hypothesis tests and finish with a discussion and suggestions for further research.

Literature review and hypothesis development

Target costing

Target costing is defined as a profit planning and cost management system used to support the development of new and redesigned products (Kee & Matherly, 2013). Cost targets are derived by deducting required profit margins from market prices and typically serve to control costs during the design stage of NPD (Ansari, Bell, & Okano, 2007). In practice, once a product's cost target is established, a team works to design a product that satisfies customer requirements at no higher than the target cost (Cooper & Slagmulder, 1999). In a target costing environment, design teams are instructed to not just "design a good component," but to instead "design the best component for a given amount of money" (Mihm, 2010, 1334).

Conditions under which target costing is adopted and reasons for its use have been examined extensively using

[1] While most prior research fails to distinguish sequential and concurrent NPD processes, Exhibit 2 in the review article of Hertenstein and Platt (2000) provides an example of a traditional sequential NPD process map studied in most of the prior accounting literature.

[2] The experimental task is modeled after a target costing exercise used internally by the Boeing Company (also described in detail in Everaert & Swenson, 2014). The truck's initial product cost was set at $20,000 for all design groups.