Journal of Purchasing & Supply Management ∎ (∎∎∎∎) ∎∎∎–∎∎∎

Contents lists available at ScienceDirect

Journal of Purchasing & Supply Management

journal homepage: www.elsevier.com/locate/pursup

Design for procurement: What procurement driven design initiatives result in environmental and economic performance improvement?

Barry Brewer *, Andrew N. Arnette

University of Wyoming, College of Business, 1000 E. University Ave., Laramie, WY 82071, United States

ARTICLE INFO

Article history:
Received 2 March 2016
Received in revised form
10 May 2016
Accepted 2 June 2016

Keywords:
New product development
Procurement
Sustainability
Performance
Survey
Regression

ABSTRACT

This study examines the role of procurement professionals in new product design. Specifically, it evaluates which factors play an important role in driving design for procurement (DFP) environmental and economic results. The factors early supplier involvement, standardization, lead time reduction, environmental sourcing, supply base maintenance, and core competence focused sourcing are regressed on diverse DFP performance outcomes. Data were collected via survey for a series of procurement focused items capturing the activities and characteristics for new product design and performance. Several major findings were supported through the analysis that enhance academic and managerial knowledge. Standardization positively impacted economic performance measures that focused on new product development and operational outcomes. Supply based maintenance was the strongest DFP initiative driving operational performance. Environmental sourcing positively affected all environmental performance measures, but was not related to economic performance.

1. Introduction

Sustainable competition for most firms requires a commitment to new product development (NPD) and innovation (Sjoerdsma and van Weele, 2015). Relying on today's products to generate tomorrow's revenue may work for basic commodities, but will result in disaster for products that rely on a greater amount of value-added manufacturing. To capture long-term revenues and sustainable competitive advantage, companies must commit to bring new products to market on a recurring basis. Carefully managing the creative process can result in product, and ultimately firm, success or failure.

NPD processes in firms vary significantly in terms of methods and functional involvement. They may be limited to R&D engineers and scientists that integrate cutting-edge technology into new products. Customer preferences today are more demanding and diverse. It is essential to understand what customers want (Holmes, 2016). Exceptional product form and function may be just enough to play in the market, but might not be enough to be the order winner. Customer concerns of total cost of ownership, long-term product support and environmental impact have placed additional requirements on new products. NPD processes must be able to design products with these diverse objectives in mind (Tracey and Neuhaus, 2013).

To address multi-objective product designs, some firms have responded with multi-functional NPD teams. These teams must include the technical experts that can integrate functions to build capabilities, but they must also include team members that can evaluate and incorporate product inputs, that understand how to move a design to the production line, that can plan for distribution, product support and recovery, and that know how design will be received by the market (Sobek et al., 1999). This new approach to product design opens the door for supply chain professionals to take a seat at the NPD table in the areas of procurement, manufacturing, and logistics.

A number of studies have focused on the role that procurement plays with respect to supplier integration and the overall supply chain framework (Droge et al., 2012; Nepal et al., 2012; Khan et al., 2012). However, a more holistic view of the role of procurement in NPD has been neglected, even though procurement is central to helping improve success for NPD projects (Eriksson, 2015). This paper focuses on the role that procurement professionals can play in NPD. Design for procurement (DFP) is a concept that procurement professionals apply to enhance procurement activities for the new product that will improve short-term NPD performance and long-term product performance in a sustainable manner to include economic and environmental concerns. This research focuses on procurement's role in design to answer the following research question: Do design for procurement decisions affect product economic and environmental performance outcomes? With this research we hope to begin filling in the gaps that exist and moving the conversation forward with respect to procurement in NPD.

* Corresponding author.
E-mail addresses: bbrewer4@uwyo.edu (B. Brewer), aarnette@uwyo.edu (A.N. Arnette).

http://dx.doi.org/10.1016/j.pursup.2016.06.003
1478-4092/

Please cite this article as: Brewer, B., Arnette, A.N., Design for procurement: What procurement driven design initiatives result in environmental and economic.... Journal of Purchasing and Supply Management (2016), http://dx.doi.org/10.1016/j.pursup.2016.06.003

We will attempt to answer this question by presenting the results of an empirical study of procurement professionals. In the following two sections, the extant literature on design for procurement and design factors that can be implemented by or that will affect procurement professionals on design teams is reviewed and hypotheses are developed utilizing contingency theory (CT). Section 4 details methodology and results, and Sections 5 and 6 discuss these results and consider the study's contributions, limitations, and future research.

2. Literature review and hypothesis development

2.1. Design for X (DFX)

DFP springs from the design for (DFX) literature. DFX are techniques employed in NPD to ensure that the design team factors specific design goals and initiatives into the NPD process that facilitate their achievement throughout the product life cycle. Examples of DFX areas include design for manufacturability, design for disassembly, design for recovery and reuse, design for quality, design for recyclability, and design for procurement. Recent research laid out several DFX themes where research falls short: the need for theoretical frameworks to guide DFX technique application; the dearth of empirical research on the contribution of DFX techniques and how they affect performance through greater collaboration in the NPD process (Arnette et al., 2014). Each of these items will be explored in this section and extended to address DFP.

Most DFX research presumes that the implementation of design considerations during NPD will enhance product or process performance. However, a rigorous application of theory that provides conceptual definitions, domain limitations, theoretical relationships, and theory predictions (Wacker, 1998) is not found in DFX research. Theoretical frameworks have not been developed that incorporate the nature of the product, design goals, intended use, product strategy, market conditions, environmental and social conditions, and relevant business processes. These frameworks should facilitate DFX use "in many instances by explaining the who, what, when, where, how and why certain phenomena will occur" (Wacker, 1998).

Additionally, there is a lack of empirical testing for many key DFX techniques (Deshpande, 2012; Arnette et al., 2014). Creating and utilizing testable theoretical frameworks can provide the ability for data to be collected and analyzed to better understand if, and how, these design approaches can help deliver the desired performance results. This can help move discussions from the conceptual realm into a theory-based addition to the supply chain body of knowledge and to practical guidance based on tested concepts, principles, and frameworks.

2.2. Design for procurement (DFP)

DFP falls under the broader umbrella of design for supply chain that includes design for logistics and design for reverse logistics (Arnette et al., 2014). Design for supply chain can be viewed as being "concerned with designing the product while taking into account the impact on the performance and success of the supply chain" (Sharifi et al., 2006) and DFP the subordinate design initiative that focuses on the upstream supply chain. The underlying theme is to design a product with input from procurement that establishes a supply base that is responsive to the objectives and measures that would support product success. A framework for DFP was proposed based on a workshop with procurement industry professionals and academic experts that could improve value chains and facilitate the concurrent engineering process (Pulkkinen et al., 2012). However, the framework is only a proposal and lacks empirical testing. DFP research centers on suppliers' roles in product design, with case studies that indicate many problems could be avoided if suppliers were considered, or integral, in the design process. Similar research has looked at the impact of design on manufacturability, cost, lead time, and the ability to satisfy demand (Gokhan et al., 2010). DFP structure and guidelines are limited and have not been joined with the procurement related NPD research.

This more general NPD research examines the relationship between product design and supply chain design. However, the product design considerations do not contain the detail found in DFX approaches. Additionally, it focuses more on the contributions of external parties in the supply chain, without exploring internal procurement roles. Some examples of this research follow. Droge et al.'s (2012) empirical study with an Adaptive Structuration Theory lens found that supplier and customer integration provides benefit in terms of product and process modularity and positively impacts performance. Nepal et al.'s (2012) multi-objective optimization framework for matched product architecture strategy to supply chain design to determine supply chain member compatibility. Additionally, the research emphasizes the role of supply chain performance complementing technical and design performance on the overall success of the product in the marketplace. Khan et al.'s (2012) case study of a fast-growing UK fashion firm found that supply chain and product design alignment increases supply chain competitive advantage, resilience, and responsiveness. Other research examined earlier supplier involvement (ESI) and its impact on lead time, cost, or delivery (Handfield et al., 1999; Petersen, et al., 2003). The research on procurement's role in NPD is largely focused on the facilitation of ESI, often at the expense of other benefits that can lead to successful NPD (Eriksson, 2015). DFP provides procurement managers more tools for NPD engagement and the potential for broader impact. This research fuses the two fields of DFP research and procurement based supply chain research by examining the tie of design initiatives in the areas of lead time reduction, standardization, core competence focused sourcing, ESI, maintaining existing supply bases, and environmental sourcing to product performance.

2.3. Contingency theory (CT)

We employ contingency theory in this paper to make sense of DFP constructs within broader business and new product development environments. Contingency theory (CT) informs the use of design decisions; based on organizational and environmental conditions, to achieve an improved result (Ginsberg and Venkatraman, 1985). To select the appropriate decision, CT application pulls data from the market and industry, the expected product lifecycle, and the perceived level of environmental uncertainty (Porter, 1979). This data is used to create a process that drives organizational structure and systems. Success implementing the first two CT steps (context and configuration) should yield the desired performance (Doty et al., 1993; Ginsberg and Venkatraman, 1985). For DFP, firms are successful after achieving fit or congruency with configuration (structure and strategic factors) and context (Scott, 2003; Doty et al., 1993). We use contingency theory to build hypotheses that link DFP decisions or activities with expected performance outcomes.

Contingency theory has been used to study NPD in the past (Souder et al., 1998), and more recently has been used to focus on NPD with respect to modularization (Magnusson and Pasche, 2014), innovation (Duin et al., 2014), and most relevant to this research, procurement and supplier involvement (Yan and Nair, 2015). Therefore our use of CT is in congruent with recent research in NPD.

Please cite this article as: Brewer, B., Arnette, A.N., Design for procurement: What procurement driven design initiatives result in environmental and economic.... Journal of Purchasing and Supply Management (2016), http://dx.doi.org/10.1016/j.pursup.2016.06.003