

Integrating design metrics within the early supplier selection process

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Abstract

It has been found from the contemporary research in the fields of supply chain management and concurrent engineering that significant benefits can be achieved if suppliers are involved in product development. However, recent investigations in manufacturing industries have revealed that early supplier involvement in the design process is not widely practiced. One issue is the lack of an appropriate customer–supplier interface to assess the suitability of suppliers with reference to design criteria. This paper proposes a mechanism for evaluating supplier involvement during product development. The assessment tool includes four types of distinctive indices to measure supplier involvement in the design process, namely: Satisfaction Index, Flexibility Index, Risk Index, and Confidence Index. These indices measure the extent to which both the customer requirements and the supplier capabilities match or mismatch and therefore reflect the potential or risk of signing a project contract. The proposed methodology is discussed within a multinational telecommunications company and preliminary analysis indicates that the approach provides an effective mechanism for selecting suppliers involved in the product development process.

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1. Introduction

Over the last decade, shortened product life cycles, the globalisation of markets and the rapid rate of technological change have led to an increased focus on the product development process. Competitive pressures are forcing companies to consider strategies which reduce costs and compress time between each stage of the value chain (Batchelor, 1997). In such a competitive environment, suppliers are an increasingly important resource for customers. This is further emphasised by the fact that on a worldwide basis purchases account for over 50 percent of the cost of goods sold. At the same time, suppliers have a large and direct impact on the cost, quality, technology and time-to-market of new products. Effective integration of suppliers into the value chain is an important factor for customers in achieving the necessary improvements to remain competitive. Linked to these changes is the trend towards companies adopting more collaborative relations

with their key suppliers. Companies are now pursuing more intensive and interactive relationships with their suppliers, collaborating in new product development, integrating key business processes and cross-functional information sharing on a range of issues (McIvor et al., 1997).

This article focuses on the product development process and in evaluating potential suppliers who would be involved in making design decisions. Firstly, an overview of the changes that have taken place in relation to the supply chain and the product development process will be described. Secondly, examples of supplier involvement in product development will be outlined along with the potential benefits. Thirdly, a supplier evaluation tool is proposed to assist in operationalising the assessment of suppliers against design criteria. Finally, case study data is presented illustrating the application of the selection methodology.

2. Literature review

During the past 15 years, there has been a significant trend for firms and public organisations to externalise a

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wide range of functions that formerly might have been carried out in-house. Increasingly, business organisations are concentrating on core activities and outsourcing other functions to external suppliers (Sislian and Satir, 2000). This ranges from major manufacturers increasing the proportion of components and sub-assemblies designed by suppliers to the contracting out of functions such as computer services, R&D and accountancy. There are a number of reasons for this trend, including rising global competition, more rapid technical change and the need for the faster development of products with higher quality and reliability. It is virtually impossible for any one firm to possess all the technical expertise needed to develop a complex product. This means that organisations have to focus on their core competencies and for other activities to draw on the best expertise available worldwide. Thus, the traditional pattern of the large, vertically integrated business, is being replaced by one consisting of complex networks of collaborating organisations, and chains of buyers and suppliers (Roy and Potter, 1996).

In this new industrial structure, the design and development of complex engineering products is one of the activities that is being devolved back along the supply chain. The extent to which this occurs varies, with some manufacturers devolving most engineering design and development work to external suppliers. In other cases, there is often a mixed situation, in which the design of sub-assemblies and components are devolved to suppliers, or where in-house designers work closely with their suppliers to ensure that components of the required performance and quality are developed. It is therefore apparent that in this new structure, design and development not only has to be managed within one large organisation, but it also involves managing relationships between many companies in an extensive chain of buyers and suppliers (Bidault et al., 1998; Dowlatshahi, 1998).

Firms in many industries are facing increased global competition and are operating in markets that demand more frequent innovation and higher quality. These firms are looking for ways to decrease product development times and, at the same time, improve quality and reduce product cost. A large body of literature now exists which has identified new product development as a core process that has a major role to play in achieving success in the global economy. Researchers have produced a number of studies, identifying a wide range of variables critical to successful product development. Brown and Eisenhardt (1995) provide a summary of the key variables from the literature, which include:

- Team composition, team organisation of work and group processes (Katz and Allen, 1985; Clark and Fujimoto, 1991).
- Project leadership and senior management support (Dougherty, 1990).
- Product concept effectiveness (Handfield, 1994).
- Marketing issues (Rothwell et al., 1974).

- Supplier and customer integration (Clark and Fujimoto, 1991).

With regard to the latter category, a significant degree of effort has investigated how companies that incorporate a user's perspective in new product decisions have more successful products (von Hippel, 1988). This has been further extended, particularly through the work of the IMP group, to consider successful product development as an interaction process between customer and supplier (Biemans, 1992), also referred to as the network approach. The 1997 Industrial Marketing Management special issue on relationship marketing included a review of changes in the nature of supplier relationships with a shift from a transactional to a relational-oriented approach (Sheth and Sharma, 1997). This is further supported by Araujo et al. (1999) who describes supplier relationships from the perspective of four different interfaces based on how a focal customer can access its suppliers' resources. These interfaces affect the efficiency of operational processes and the degree of innovation. In the context of product development, which involves significant design input from a supplier, these authors would suggest the need for an interactive interface involving open-ended dialogue based on how the buyer and supplier can join their knowledge of user and producer contexts and develop the specifications together.

There are many examples of suppliers having an input to product development. For example, Cadillac, has supplier representatives on 75 percent of their development teams. Xerox, has included suppliers in partnership since the early 1980s and, Boeing, co-locate suppliers in their manufacturing facilities (O'Neal, 1993).

More specifically, Twigg (1998) investigated the design process in the UK automotive industry and identified supplier involvement during several phases of product development:

- At concept stage, for example, design houses and engineering consultancies contribute design expertise to styling, or suppliers of body components may provide manufacturing advice to model stylists, where manufacturing finish might influence aesthetics.
- During detail engineering stage, multinational component system suppliers may take responsibility for proprietary parts, or others may provide black box designed parts. Material producers also have a role to play in design, with regard to the properties of new materials or their application in novel ways, which may require specialist input to the design process.
- For the process engineering stage, manufacturing knowledge is essential. Toolmakers, equipment manufacturers, raw material suppliers, or process specialists (such as casting or plastic injection moulding) all have an important role to play.

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