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Int. J. Production Economics 97 (2005) 210–226

international journal of
**production
economics**

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Estimating the cost of a new technology intensive automotive product: A case study approach

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Received 16 July 2003; accepted 20 August 2004

Available online 26 October 2004

Abstract

Estimating cost of new technology intensive products is very ad hoc within the automotive industry. There is a need to develop a systematic approach to the cost estimating, which will make the estimates more realistic. This research proposes a methodology that uses parametric, analogy and detailed estimating techniques to enable a cost to be built for an automotive powertrain product with a high content of new technology. The research defines a process for segregating new or emerging technologies from current technologies to enable the various costing techniques to be utilised. The cost drivers from an internal combustion engine's characteristics to facilitate a cost estimate for high-volume production are also presented. A process to enable a costing expert to either build an estimate for the new technology under analysis or use a comparator and then develop a variant for the new system is also discussed. Due to the open nature of the statement 'new technology', research is also conducted to provide a meaningful definition applicable to the automotive industry and this project.

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Keywords: Cost estimating; Cost engineering; Cost of new technology; Cost prediction; Automotive product cost

1. Introduction

The automotive, aerospace and defence industries often have to estimate the cost of a product

that contains significant amounts of new technology, and so requires considerable experience of previous projects, technology trends and new developments in other industry sectors. This paper presents a case study approach for the development of a cost model methodology that can be used to estimate the costs of a new technology-intensive product. The cost drivers involved in estimating the cost of these products are identified

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together with the need for expert judgement in the estimating process.

The paper is structured in 11 sections. Section 2 identifies relevant research in cost estimating and presents current practices within automotive and non-automotive sectors, especially focusing on new technology cost estimating processes. It is important to understand the nature of new technology; therefore Section 3 defines new technology and relates the definition to the automotive sector. The following section presents an overview of the methodology developed for the cost estimating. The methodology has three major steps: identification of new and 'carry-over' technologies, cost estimating both the parts and finally adjusting cost models due to the difference in sources of data used. The methodology is developed using a case study approach on power-train cost estimating. Once the 'carry-over' technology intensive parts are identified, the cost is estimated based on historical data (Section 5). Estimating the cost of the parts that are new technology based is trickier; it requires a comparative study with previous knowledge within other sectors (Section 6). The model developed as a result of the case study is fine adjusted to reflect the difference in time frame of the source data in Section 7. The methodology is then validated using two case studies, discussed in Sections 8 and 9. Discussion on the research methodology and results obtained are presented in Section 10, and finally the paper concludes in Section 11 and proposes future improvements to the cost models.

2. Related research and current practice

Activity-based costing, theory of constraints, feature-based costing, parametric costing and analogy are typical cost estimating and control techniques designed to provide more relevant information for evaluating the economic consequences of resource allocation decisions (Kee and Schmidt, 1998; Pugh, 1992; Shepperd and Scholfield, 1997; Myrtveit and Stensrud, 1999; Roy, 2003). Almost all literature on estimating future costs or technology (Rosenberg, 1998; Crawford et al., 1996; Roy et al., 1999) has been applied to

large civil engineering projects or low-volume aerospace projects, since these industries often rely on previously developed estimates to win new contracts. The Jet Propulsion Laboratory in the United States has developed a parametric costing model for future space projects that is based on very little historical data (Rosenberg, 1998). It was argued that using historical data and relationships failed to produce accurate estimates on which to base budgets (Crawford et al., 1996). The research presented in this paper suggests that unique cost drivers mean that each project needs to be estimated on its own merits. Several iterations of estimates also need to be conducted, each one in greater depth than the previous one. Cost control needs to use these estimates as the basis for decisions once the budget has been set. Moreover, management support during cost control allows accurate budgets to be achieved. However, a major problem involves the level of resources required to compile each stage of estimates during the conceptual phases and the following reconciliation between them.

In order to capture current practice within the automotive sector, a series of semi-structured interviews and telephone interviews were organised with cost estimators with three different companies, one of them is the industry leader in cost-estimating practices. It is observed, in the automotive sector different processes and procedures have been developed to help an activity achieve its commercial goal. For example, the Product Development System in one of the participating automotive companies determines how much a product can be sold for and then works back into system chunks and then into component level—although it fails to provide a costing function. The company uses activity-based techniques for estimating costs when the target and supplier quotes are disconnected. All information is stored in a database and so every cost driver can be traced to its original figure, which is based on real world data. Cost drivers can be defined as the portions of a system, end item, or service that have a large or major effect on the total work activity or output (Roy et al., 1999; Colmer, 2002; Roy et al., 2003). But the current practice does not support cost estimation of new technology

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