Activity Based Cost Estimation System for Product Lifecycle Using Object Oriented Programming

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ABSTRACT

The costs incurred during production, use, and disposal is mostly committed by early design decisions. Product designers started giving due consideration to life cycle cost implications of their design decisions. In this paper we developed a product lifecycle cost estimation system which can able to find the product lifecycle cost especially at early design stage in order to provide lifecycle cost information of a product efficiently and effectively to support decision makings. This system is built using object-oriented programming and linked to user interface. It is used to help designers for detailed cost information when needed at any stage of product development process. Activity based costing method is used to estimate the lifecycle cost through cost drivers of the product. Researchers presented and proposed cost estimation methods for one stage like manufacturing not all stages of lifecycle, certain manufacturing processes, specific category of products like machine parts and injection moulded part. A case study from local company is considered to validate the system for successful implementation. It is compared with the result of the same case study using concurrent cost module of DFMA software.

Keywords: Activity Based Costing, Cost Drivers, Data Base, Design for Concurrent Costing (DFC), Product Lifecycle Cost

1. INTRODUCTION

The manufacturing companies are facing ongoing challenges of high quality, low cost and in-time delivery of products in present scenario of competitive global market, dynamic and rapid changes of customer needs. Further, recycling and disposal after use is also gradually becoming responsibility of manufacturer due to global and domestic environment regulations. These challenges driving the manufacturing industry to change its traditional product development

DOI: 10.4018/jcrmm.2013010106
process to modern processes using concepts like concurrent engineering, product lifecycle management in their product development. Many companies started to consider the cost issues related to service and maintenance, environment impacts of their processes and products, recycling and disposal after use (MacDue, 1996). This trend leads most of the companies to show a keen interest in the lifecycle cost approach in product design rather than in a pure manufacturing related cost approach.

The lifecycle cost approach involves use of the product’s cost information to track and analyze the financial behaviours of activities associated with each phase of a product’s lifecycle. In this regard, properly choosing and applying a costing method to calculate product cost accurately plays an important role. The product manufacturing costs represent only a low proportion of the total cost. Non-manufacturing product costs such as plant overheads, distribution overheads have expanded greatly in the total cost. The product lifecycle cost is calculated with traditional costing methods, which focus on the costs of materials and labor rate but not estimating the real cost of a product (Duverlie, 1999).

In a series of papers, Boothroyd, and Dewhurst (1983 & 1984) presented models for calculating the cost of assembly of products using robots, automatic machines, and manual labor. These models formalized into computer programs. Dewhurst and Boothroyd developed a cost model which estimates the machine cost, mould base cost and cavity cost for establishing the manufacturing cost of injection moulded parts (Dewhurst, 1988). Keys, Balmer, and Creswell (1987) focused on cost modeling for printed wiring board assembly. They developed a simulation process to ensure the reliability of the manufacturing data to improve the cost model. Noble, and Tanchoco (1990) presented a conceptual framework for concurrent design and economic justification of systems that allows the decision maker to see the economic implications for different design alternatives based manufacturing cost of the product. Although the framework is useful, the model is based on traditional accounting concepts which are not very useful for accurate cost estimate. McIlhenny, Sethumadhave, Lee, and Keys (1993) developed a cost estimation model for parts by injection mould. It includes mould base and process cost, material cost and maintenance cost. Bruckner and Ehrlenspiel (1993) presented research data to build a tool for assisting the designers to achieve a cost-effective design of gear drive. Ong (1995) developed an activity based cost estimating system to help designers for estimating the manufacturing cost of a printed circuit board assembly at the early concept stage of design. Though the author claims the model is meant to be used at the conceptual phase of design, the data required for the evaluation will most probably not be available until the preliminary design stage.

Sheldon, Huang, and Perks (1993) proposed a framework for developing an intermediate cost database, which is established between the cost accounting system and Design for Concurrent Costing (DFC) systems. This system will analyze the cost information provided by a cost accounting system to establish the appropriate cost structures suitable for different groups of DFC users. Luong and Spedding (1995) described the development and implementation of a generic knowledge-based system to perform the functions of process planning, cost estimation and to recommend appropriate machining parameters for the hole making process. However, the system still lacks desirable features like interface to computer-aided design. Yang, Parsaei, Leep, and Wang (1998) proposed a manufacturing cost estimate system using an activity-based costing method. In their system, feature recognition and process generation techniques were used to transfer design information into manufacturing features and generate process plans.

Ou-Yang and Lin (1997) proposed an integrated framework to support a designer for analyzing the manufacturing cost of a part during its conceptual stage and cost estimation method based on the form features and their surface roughness. They consider only the machining processes. Shehab and Abdalla
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