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Activity-based costing and process modeling for cost-conscious product design: A case study in a manufacturing company

Katja Tornberg*, Miikka Jämsen, Jari Paranko

Industrial Management, Tampere University of Technology, P.O. Box 541, 33101 Tampere, Finland

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Abstract

The most effective way to control costs is to design them out of the products. However, cost data is rarely available for product designers in a usable form. The aim of this study was to investigate the possibilities of activity-based costing and the modeling of design, purchasing and manufacturing processes in providing useful cost information for product designers. The hypothesis was that activity-based costing and process modeling might provide an effective tool for the evaluation of different design options. The study was conducted in a large Finnish manufacturing company. First, the most costly items of one product's sub-assembly were studied in order to identify the activities needed to produce the items and to calculate their activity-based costs. Second, the processes, in other words the activity chains, were modeled with graphic flowcharts from product design, purchasing, and manufacturing departments. Finally, the applicability of activity-based cost information and process models to product designing practices was tested. The results of the study suggested that activity-based costing and process modeling provide a good starting point in heading toward more cost-conscious design. This way the designers learn the relationships between the activities performed in the organization and their associated costs. The development of a parametric cost estimation model based on activity-based costing and process modeling provides a challenge for future research.

Keywords: Activity-based management; Cost management; Product design; Process modeling

1. Introduction

1.1. Product design and cost accounting

The important role of product development in cost management is undeniable. However, the need for cost information in product development has not been sufficiently met. Problems include both the content as well as the form of information.

Uusi-Rauva and Paranko [1] examined the present state of cost accounting from a designer's point of view in four Finnish manufacturing companies. During the study both accounting professionals (information producers) and managers of designers (users of information) were interviewed. As a result 11 improvement opportunities were presented, of which two are presented here.

First, cost information should be better combined with product structure and business process activities. Second, designers need reliable information on a product's total costs. It is common for designers to get information only on a product's direct costs. However, the decisions made on product design also affect indirect costs [2].

Cost accounting should help product development to design products that carry the lowest

* Corresponding author.

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possible total costs while also taking into consideration other important design criteria. Cooper and Turney [3] have argued that activity-based costing provides cost information on each of the company's production processes so that the costs of different designs can be compared. According to them, activity-based costing (ABC) puts product costs "on the backs" of the engineers [3]. Consequently, companies develop ABC systems to provide more relevant economic information for product designers [4].

1.2. Definitions

A number of writers [5–9], have provided definitions for a business process. According to Laakso a business process is a structured, measured set of activities and flows that use necessary resources of the organization to provide a specified output for a particular customer [10].

Smart et al. [11] offer a general process classification framework. The framework is helpful in specifying the business processes as well as in determining the process boundaries. In this classification, the main process classes are the operating, support, and managing processes. The operating processes are defined as the cross-functional and value-adding chains having a direct customer interface. The four main operating processes are product development, sales and marketing, order fulfillment, and customer service. Furthermore, parts of the main operating processes can be divided into subprocesses. For example, a production process can be seen as a part of the order fulfillment process. In addition to production, the order fulfillment process includes several other activities, such as customer inquiry, proposal, contract, assembly, delivery, installation and invoicing [10].

The objective of process modeling is to help companies to improve their business process understanding. A qualitative model that provides a graphical interpretation of the process captures the structure of a business process. The objective of qualitative process modeling is to visualize the process and to achieve a commonly agreed view of the process structure. Graphical process presentation facilitates communication between people and helps in developing a common conceptual model of what goes on in the studied process [10].

The graphical process models (Fig. 1) are formatted into horizontal bands to illustrate where an activity is performed and by whom. This way the involvement of various constituents of the overall process can be isolated. The process goes simultaneously from left to right and from the top down. The activities are presented with a rectangle and the branches of the process are presented with a diamond. A shadow under a rectangle indicates that an activity consists of several sub-processes. In this way the process model becomes a hierarchical entity.

A quantitative analysis of quality, cost or time may be done after the process structure is visualized. The quantitative process modeling is a vital part of the in-depth process understanding. It identifies problem areas and helps to make improvement decisions based on more solid information [10]. In fact, quantitative process modeling may in our case be seen as equivalent to activity-based costing. This results from the fact that the activities of an ABC model and the process steps of a qualitative process model may be defined as identical. In summary, qualitative process

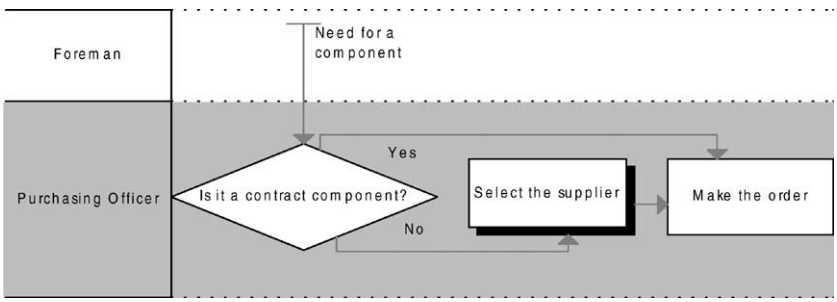

Fig. 1. An example of a graphical process model.