Chapter 10
Costing Systems for Decision Making under Uncertainty Using Probabilistic Models

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ABSTRACT

One measure of organizations' performance is the cost of products, as this may indicate the level of efficiency and contribute to define the business strategy of the firm. Nevertheless, companies face an increasingly fast-changing environment where the variability in processes, products, technology, prices, among other variables affect the performance of the organization. Particularly, given such changing environment, product and service costs may be changing over time. In this context, deterministic models for costing systems might be inappropriate. Thus, this chapter proposes a model for calculating costs which considers the variability of endogenous and exogenous cost variables. It uses the logic of a Two-Stage costing model and Monte Carlo Simulation. The proposed model may allow to some extent to predict the risk associated with the variability in costs and support the necessary steps which should be taken to better manage such risk, whether from the point of view of processes rationalization and of cost management.

INTRODUCTION

Many firms are interested in determining costs more accurately in order to support decision making and firm's strategy as well as to improve the quality of their efficiency indicators and increase profitability (A. Gunasekaran & Sarhadi, 1998). Thus, models of product costing should reflect business and production processes and the firm's cost structure as accurate as possible. However, organizations' internal and external circumstances are changing rapidly (Alnestig & Segerstedt, 1996). In this context, where endogenous and exogenous variables vary, cost behavior might be not fully understood if old-fashion costing models are used.

The globalization of markets and operations has been pushing the managers of twenty first century firms to develop new and more sophisticated tools for various managerial functions that include marketing, design, engineering, production, finance, human resources and accounting (Angappa Gunasekaran & Kobu, 2007). All this to meet the goal of the organization which is increase value to its shareholders. The ability of a company to compete effectively on the increasingly competitive global market is influenced to a large extent by the cost as well as the quality of its products as well as the ability to bring products onto the market in a timely manner (Asiedu & Gu, 1998). The knowledge on costs and the use of appropriate costing models is fundamental to do it efficiently. Accurate cost estimation is important for the performance of organizations considering that overestimation may result in non-competitive prices and losses in market share, whereas underestimation may represent negative margins and consequently financial losses (Goh, Newnes, Mileham, McMahon, & Saravi, 2010). For Stenzel & Stenzel (2003) cost is an outflow of resources, whether in cash, as payable, rendered services or as a trade or barter that is consciously made with the expectation of a benefit to the organization in terms of goods, property, or services acquired. Good cost estimation has a direct bearing on the performance and effectiveness of a business enterprise because overestimation can result in loss of business and goodwill in the market, whereas underestimation may lead toward financial losses to the enterprise. Because of this sensitive and crucial role in an organization, cost estimation has been a key agenda for managerial policies and business decisions (Niazi, Dai, Balabani, & Seneviratne, 2006).

Whether an organization sells a product or provides a service, managers must understand how revenue and costs behave, or risk losing control. Indeed, the cost accounting information system is indispensable to make decisions with a strategic formulation, for research and development, budgeting, production planning and pricing, among others (Horngren, Datar, & Rajan, 2012).

Nevertheless, like the value of economic goods, the value of a management accounting system depends on its costs and benefits for the organization. The benefit of the management accounting system rests on the system's ability to make the transmission of information which will help reach wise economic decisions and on the contribution of the system for the motivation of users to aim and strive for organizational objectives or goals (Horngren, 2004). The cost management system, as part of the management accounting system, is no exception.

Nevertheless, the data used in costing systems are uncertain due to a heavy dependence on parameter estimation. This primarily exists because gathering the necessary information to generate product costs is an expensive process. Since costing systems data are historically based and often estimated, the true values of the data are uncertain, and the input data are likely to be imprecise. Given that, the true value of each data parameter may never be known. Thus, it is important to acknowledge and handle the uncertainty within costing systems and cost models. This will allow the system user to acknowledge that the system results are not certain and potentially gain the ability to improve decisions supported in the system output by accounting for the inherent risk (Nachtmann & Needy, 2003).

Uncertainty can be defined as a state that exist when an individual defines himself as engaging in directed behavior based upon less than complete knowledge of (a) his existing relationship with the surrounding environment, (b) conditional and functional relationships between his behavior and environmental variables which may explain the occurrence of a future self-environment relation and (c) the place of future self-environment relations within the longer time frame of a self-environment relations hierarchy (Downey & Slocum, 1975). On the other hand, in a situation under risk the decision maker knows the probabilities for the occurrence of various states (Zimmermann, 2000).Several methods have been designed for handling uncertainty in mathematical models. The Monte Carlo simulation and fuzzy

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