A Service-Oriented Approach for the Optimal Product/Service Design Business Process

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ABSTRACT

The optimal product design is an NP-hard marketing optimization problem, in which a firm aims at the maximization of its market share or profit. A manager that deals with the problem has to decide on a number of issues, such as how to simulate the consumer choice process, which optimization algorithm to apply, and how to model the competitors’ retaliatory moves. The existing information systems fail to provide the decision maker with the unique blend of techniques and resources required by the problem. In order to follow the way that marketing managers comprehend the optimal product process, in this paper the problem is broken down into distinct services, each one of them maps into a basic feature (simulation, optimization, competition analysis, etc.). All services are aggregated to a marketing decision support system by a service oriented architecture, achieving this way a decision-makers friendly environment, since the marketing managers are able to get a solution without the need to transfer data and parameters from one software to another, and without the need to coordinate manually the whole process.

Keywords: Business Processes, Marketing, Optimization, Product/Service Design, Service Oriented Architecture

INTRODUCTION

In today’s highly competitive environment new product design and development constitutes one of the most critical success factors for every company. Developing and launching new products or services enables firms to increase market shares and profits. However such procedures are risky and costly to implement, requiring large investments in money, effort, and time. The high rates at which new products fail make the product design the most important stage in the new product development process. In the product design stage the manager can assess the product’s penetration to the market using simulation models and algorithms. The
Optimal Product Design problem constitutes an NP-hard combinatorial optimization problem (Kohli & Krishnamurti, 1989) in quantitative marketing for more than thirty years, which is usually formulated in the context of Conjoint Analysis (Tsafarakis & Matsatsinis, 2010). The customer preferences concerning the different product/service attributes are estimated with the use of Conjoint Analysis, and optimization algorithms are used for finding the products’ configuration that will maximize the firm’s market share or profits. Different optimization algorithms have been applied to the problem the most important being Dynamic Programming (Kohli & Sukumar, 1990), Beam Search (Nair, Thakur, & Wen, 1995), Genetic Algorithms (Alexouda & Paparrizos, 2001; Balakrishnan, Gupta, & Jacob, 2004; Balakrishnan & Jacob, 1996; Steiner & Hruschka, 2003), Lagrangian relaxation with branch and bound (Camm, Cochran, Curry, & Kannan, 2006) and Particle Swarm Optimization (Tsafarakis, Marinakis, & Matsatsinis, 2011). The Optimal Product Design is a problem of high complexity, since the decision makers have to make a number of critical choices, such as which model to apply for simulating the customer product selection process, which optimization algorithm to use, and how to model the potential retaliatory moves from the competitive firms. In this context, several information systems have been developed for supporting managers in such a tricky procedure that requires a unique blend of resources and techniques. However, none of the existing systems incorporates the possible competitive reactions, or employs a market simulation model for the consumer choice process.

In this paper we present a novel system for the Optimal Product Design problem, which provides a flexible interaction with managers, allows for separation of duties, and enables a fast response scheme among its different modules. The proposed system incorporates all the necessary processes within a service oriented architecture. The rest of the paper is organized into six sections as follows: next a brief description of the optimal product design problem. Then, we review the related approaches and discuss their limitations. The business logic is modularized next. Each service is then described. Details for the system implementation are presented next. Finally, an overview of the main conclusions of the study, while its limitations are addressed and future research areas are suggested.

THE OPTIMAL PRODUCT DESIGN PROBLEM

In the optimal product design problem a company designs a product or service the introduction of which to the market will optimize a strategic goal of the firm, such as maximization of market share or profit. Each product consists of a number of attributes that usually take discrete values (levels). For example, an Internet Banking Service consists of the attributes Economical Advantages, Security, Help in Use, and Communication, with corresponding levels (30% discount on operations, 30% discount on commissions, 50% expense reduction), (insurance, SMS confirmation, SMS stand-by option), (CD Rom, free telephone help, help on-line), (newsletter, electronic show-case) (Corain et al., 2005). A customer is assumed to implicitly assign a value to each attribute level according to his/her preferences. This value is called part-worth, and is estimated through the application of Conjoint Analysis to each customer. The utility that a customer expects to obtain from a certain product is given by the linear additive combination of the part-worths that correspond to the product’s attributes. The customer product selection process is simulated with the use of choice models, which convert the utilities to choice probabilities (market shares) for each product. The choice models are used in the objective function of an optimization algorithm which finds the product’s configuration (i.e., combination of attribute levels) that maximizes the firm’s objective. If the market is considered to be static then the competitive firms will not respond to the introduction of the new product,
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