



A game theory-based model for product portfolio management in a competitive market

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ABSTRACT

In today's competitive markets, effective product portfolio is critical for manufacturers that offer several products. From manufacturers' perspective, the diversity must be maintained in a level in which the engineering costs do not exceed the acquired advantages of increased market share. On the other hand, product portfolio diversity is prominent for customers. In addition, manufacturers should always be careful about competitors activity. Therefore, we consider the problem of product portfolio management (PPM) in a competitive environment. This paper constructs a game theory-based mathematical model to deal with this new PPM problem. In this presented mathematical model, the PPM problem is formulated as a 2-person non-cooperative game with complete information. Each player has a set of strategies which correspond to the feasible product portfolios. Every payoff is determined by the procedure that considers the customer–engineering interaction in product portfolio planning, which aims to optimize product portfolio for a target market segment, and proposed a maximizing surplus share model for it. Therefore, obtaining the optimal product portfolio is determined by the Nash equilibrium point of this game. Finally, a numerical example is presented to demonstrate the feasibility of the approach.

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1. Introduction

Consumers, industrial managers, and sales and marketing people, all demand products that improve their lifestyles or to gain an edge over the competition. So, the products that presented by manufacturers in their product portfolios (or sets) are interesting for many people. But unlimited product variety is not a way to be successful; there has to be an optimum (Forza & Salvador, 2008; Kumar, Chen, & Simpson, 2009). It is true for most companies that the Pareto rule applies: 80% of the sales and/or profits come from 20% of the products (Gorchels, 2000). It is evident that a single product cannot fulfill the manufacturer needs and on the other hand, for diversity there exists limitation (Song & Kusiak, 2009).

In today's highly competitive environment, determining an optimal product portfolio is very important for the survival of a firm. Optimal product portfolio has received considerable attention, because the rates of failure of new product portfolio and their associated losses are very high (Business Week, 1993). The whole product portfolio decision is very crucial for the progress of a firm, because it is very costly and difficult to change (Kotler, 1997; Lilien, Kotler, & Moorthy, 1992; Urban & Hauser, 1993). The key

questions are, what the best product portfolio is, and how manufacturer can find it.

This type of decisions adheres to the general wisdom as suggested in the Boston Consulting Group's notion of product portfolio strategy (Henderson, 1970). The concept of product portfolio provides a useful synthesis of the analyses and judgments during the preliminary steps of the planning process, and is a provocative source of strategy alternatives (Day & George, 1977).

Product portfolio management (PPM) is a general business concept that analyze the production ability and market potential, simultaneously, and then determine the best set of products to offer, with the aim of manufacturer profit maximization (Dacko, 2008; McNally, Durmusoglu, Calantone, & Harmancioglu, 2009). PPM is developed to direct a product and its diversity including not only attributes, levels, and price's, but also analysis results, environmental component information, engineering requirements, manufacturing procedures, product performance information, and etc. (Cooper, Edgett, & Kleinschmidt, 1999). Therefore PPM has been classified as a combinatorial optimization problem. Each company strives for the optimality of its product offerings through various combinations of products (Kaul & Rao, 1995).

The PPM problem may develop from two perspectives: (I) For attract the opinion of customers in target markets. (II) For reduce the manufacture engineering costs. First is the problem of marketing managers, and second is the problem of producer. When both

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