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Product line design and positioning using add-on services

Omkar D. Palsule-Desai [a,*], Devanath Tirupati [b], Janat Shah [c]

[a] Indian Institute of Management Indore, Block III, Ground Floor, Prabandh Shikhar, Rau Pithampur Road, Indore 453 331, India
[b] Indian Institute of Management Bangalore, Bangalore 560 076, India
[c] Indian Institute of Management Udaipur, Udaipur 313 001, India

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ABSTRACT

In this paper, we consider a generic product line design and positioning problem in the context of variety creation using a *core product* and *add-on services*. While the functional output of the core product is identical across the products, product variety is created using add-on services that do not alter the functionality of the core product. The motivation for our study comes from emerging for-profit private healthcare service providers in India. We consider two specific scenarios – simultaneous and sequential design – and focus on obtaining insights into the implications of the core product on design and positioning of add-on services. We show that for the core product cost below a threshold the firm does not cover the entire market. For the cost beyond another threshold, it does not introduce any product. The product quality increases in both the core product cost and the consumer valuation of the product relative to the cost of quality; however, the quality based distinction decreases (increases) in the cost parameters (product valuation). In the two-product sequential product design scenario, we show that both products are active only under certain situations. We derive conditions under which the second product has quality higher (lower) than that of the first product. When the firm initially enters the market with a product that corresponds to single product design scenario, we show that the firm introduces a lower quality product and increases profit by increasing the market share. By comparing our results in the two scenarios, we show that the gap between positive (and similarly negative) implications of the two scenarios decreases as the core product cost increases with respect to the cost of quality. In a duopoly setting, we also illustrate how the design and positioning of an incumbent's product impacts a new entrant's product. Our model and results may be seen as building blocks for obtaining managerial insights.

1. Introduction

Increasing product variety is a popular and well recognized strategy in marketing to increase demand and market share (see, Kotler, 2002). Using empirical evidences, Kekre and Srinivasan (1990) found that broader product lines result in significant market share benefits and increase in firms' profitability. With rapidly evolving technologies, capabilities of firms to produce a variety of the same product are increasing. Over the years, managing product variety has also become a source of competitive advantage for firms (Meyer and Lehnerd, 1997). However, Ramdas and Sawhney (2001) and Gourville and Soman (2005) observe that increasing product variety does not guarantee increase in long run profits, and in fact, it can worsen firms' competitiveness. Researchers have studied the product line design problem extensively in a variety of settings in manufacturing industries (e.g., Kim and Chhajed, 2000; Lacourbe, 2012); however, related issues in services settings have not been addressed adequately. It has been observed in many service industries that firms develop a portfolio of product/service (henceforth, referred to as product only) using a *core* product and *add-on* services. In this case, the functional output of each product variant is delivered by the core product that is common across all variants, and a variety of the product is created using add-on services that do not alter the functionality of the core product. Consumers self-select a particular variant of the product based on the utility derived net of its price. Accordingly, the firm's strategy of offering a variety of the product has implications for its profitability; however, the functionality of each variant is identical.[1]

* Corresponding author. Tel.: +91 731 2439567; fax: +91 731 2439800.
E-mail addresses: omkardpd@iimidr.ac.in (O.D. Palsule-Desai), devanath@iimb.ernet.in (D. Tirupati), janat.shah@iimu.ac.in (J. Shah).

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[1] In the existing literature, product functionality is considered as one of the various dimensions implied by generic *quality* parameter used for vertically differentiated products (see, e.g., Desai, 2001). Thereby, better is the product functionality, more is the quality. However, in view of our motivating examples we specifically distinguish between product functionality and other dimensions of

The motivation for our study presented in this paper comes from emerging for-profit private healthcare service providers in India. The past two decades have witnessed emergence of two kinds of hospitals providing specialty care. On one hand, there are hospitals – such as Aravind Eye Care, Narayana Hrudayalaya – that were established to serve consumers at the bottom of the pyramid, and over the years they have introduced specialized services targeting elite sections of the market. On the other hand, other hospitals – such as Apollo Hospitals, Fortis Healthcare – that started as super-specialty healthcare providers eventually introduced products that could be afforded by the lower segment of the market. In these hospitals, the core product, e.g., cataract or cardiac surgery, is provided under different packages – such as premium, regular, economy – with add-on services that do not compromise on functionality of the core product. (The context is described further in Section 2.) Similar examples can be found in manufacturing industries in which firms offer service components as add-on to products manufactured. For instance, Dell Inc. offers laptops with either a *limited* warranty scheme or with an *Accidental Damage Service* cover. iPads and iPhones are available with various App Store Gift Cards. Similarly, many automakers offer a variety of car maintenance programs. While our motivation comes from specific examples in India, the model and structural results are valid in other service settings too. For example, medical tourism in countries such as Canada, Israel, UAE, Singapore, the UK, etc. (see, Gahlinger, 2008), books, telecommunication services, etc.

The examples mentioned above can be characterized by a product line developed using a *core product* and *add-on services*. In this context, the firm's product line design problem focuses on determining the number of product variants and their positioning. Positioning of product variants implies relative quality and price levels of all variants. We model and analyze this problem for two specific scenarios: simultaneous and sequential design. In the former scenario, the quality and price levels for all products are determined jointly. In sequential design scenario, they are determined in sequence of the products, i.e., quality and price levels for the subsequent products are determined relative to the already existing products. Besides characterizing the optimal solution to the problem, we develop structural results to derive key managerial insights. Our results show that there exists a threshold level for the core product cost below which the optimal strategy for the firm is to cover the entire market. There also exists another threshold beyond which the firm does not produce any variety of the product. The optimal product quality level increases as both the core product cost and the consumer valuation of the product increase relative to the cost of quality. Some of the implications of our structural results are also quite unique. For example, in the multi-product scenario, we show that products in the product line are increasingly identical when the firm's cost parameters are larger. On the contrary, the products are increasingly distinguishable when the product valuation for the consumers is higher. In a sequential product design case with two products, we show that when the firm's product design and positioning decisions are *arbitrary* to begin with, there exist situations in which the firm introduces a new variety of quality level higher (similarly lower) than the existing variety. In this case, we also show that the two products are active in the market only under certain situations. In a special case of the sequential product design in which the firm's product design and positioning decisions are optimal at each stage, we show that the optimal strategy for the firm is to introduce a lower quality product following the first product and increase its profit by increasing the market share.

(*footnote continued*)
quality. Thereby, the products in our model can be vertically differentiated on the basis of a generic quality parameter; however, they all deliver the same functional output.

The remainder of the paper is organized as follows. In Section 2, we describe our problem context, and in Section 3, we present an overview of the related literature. We develop the model in Section 4, and present our analyses and results in Sections 6 and 7. To bring out the implications of simultaneous and sequential design scenarios, we compare the firm's optimal decisions in both scenarios in Section 8. Section 9 reflects on a duopoly competitive setting based on our motivating examples. In Section 10, we mention key findings of the paper and conclude the paper. Proofs are relegated to appendix.

2. Problem description

The motivation for our study comes from the product line design and positioning problems faced by some of the private sector hospitals in India. The past two decades have witnessed emergence of two kinds of hospitals providing specialty care. On one hand, there are hospitals such as Arvind Eye (AE) and Narayana Hridayalaya (NH) that were established with the objective of providing affordable and quality healthcare to the masses by primarily serving the consumers at the bottom of the pyramid (see, Shah and Murthy, 2004; Khanna et al., 2005). Khanna et al. (2005) describe this approach as "Wal-Martization of healthcare". Over the years, in keeping with the reputation for their quality services and increasing popularity of medical tourism, AE and NH attained self-sustainability by exploring many avenues to attract consumers with high affordability from not only the western countries but also the Indian middle class that has been growing in its size, income levels and quality consciousness. These hospitals enhanced their market-reach by expanding the product portfolio without compromising on the quality of the basic services, i.e., surgeries. As described in Khanna et al. (2005), both AE and NH adopted a hybrid strategy to cater to both ends of the pyramid. In particular, they attracted consumers of high affordability by the virtue of reputation for their product quality and attracted consumers of low affordability via reasonable pricing.

Unlike AE and NH, Apollo Hospitals (AH) and Fortis Healthcare (FH) established themselves for consumers at the high end of the economic pyramid (see, Oberhozer-Gee et al., 2007). They attracted people from everywhere to India for super-specialty healthcare by providing first-world healthcare at emerging-market prices. However, due to capacity under-utilization in the existing systems and the scope for growing with the Indian middle class, alike AE and NH, both AH and FH expanded their product portfolio by introducing variants of the existing products. Accordingly, while the target consumer segments and the mission of the two kinds of hospitals are distinct, their strategies to attract consumers in the respective segments and the managerial problems arising out of this are identical as described below.

Each of the above mentioned hospitals offers a menu of products that are identical in the basic medical treatment but distinct in supporting healthcare. The number of variants of supporting healthcare, their content (quality) and pricing decisions essentially depend on market characteristics and the hospital's cost structure. For example, at NH open heart surgery is offered under premium, regular and economy categories; and angioplasty is offered only under premium and regular categories (see Khanna et al., 2005). Nevertheless, the functional outcome of the surgery in each product variant (or simply, product) is the same which is evident from the fact that the surgery is performed by the same set of doctors.

While a number of examples similar to our motivating example can be found in the service sector, manufacturing industries offering services as add-on to the manufactured products also demonstrate similar characteristics. For instance, the features considered in our problem are similar to those experienced by manufacturing firms