Abstract

This paper explores how product variation in a quality-differentiated product line determines the overall success of a firm in the marketplace. For example, airlines provide multiple options (e.g. seat sizes, recliners, wifi and personal tv, etc.) in different aircrafts. We empirically investigate the impact of such variation under operational constraints.

Keywords: Product variety, quality differentiation, airline industry

Introduction

Airlines provide multiple quality products with large variation for the first, business, and economy classes. We empirically investigate the impact of the extent of this variety on a firm’s market success under operational constraints, such as limited capacity and resources. We investigate how airlines adopt different product variety strategy in terms of fundamental, peripheral, and intermediate variety. We find that the airlines reduced number of fundamental variations (variation of platforms; aircraft types), yet increased peripheral (classes) and intermediate variability (options driven by consumer choice) in order to meet demand.

Multiproduct firms frequently change their product lines. For example, in manufacturing 68% of the firms make a change in their product lines in the short-medium term. 12% of the 68%
added at least one product, 45% added and (also) dropped at least one product in their medium term decision. For example, the new iPhone5S offers three different memory capacities, and is considered as a higher quality product compared to the new iPhone5C.

According to Macduffie et al. (1996), manufacturing firms adopt the strategy of minimizing the variation in fundamental models to achieve economy of scale (this is called fundamental variety). Firms could offer large number of options (peripheral variety) that could be different without changing the core design in order to differentiate product for the consumers. Manufacturing firms try to minimize the complexity to achieve performance in a lean production practice of mass production plants. Yet, firms still need to consider variety that is driven by consumer choice (such as parts and options). For the manufacturers, company’s choice requires manufacturing plants to cope with a level of product mix complexity, in this study we want to know whether this practice exists in airlines. Airlines offer both tangible products and services with high customer contact. We want to know how such service firms deal with product line variety issues.

In the airline industry, service quality is different in each class: First class is very different from the Economy class. Meals and seat sizes are much different, too. Some airlines offer enclosed-suites for first class passengers; they even provide spa bathroom onboard. This adds up to the operational cost of having premium seats traded off with cabin space being used. On the other hand, we see occasionally some airlines stick with smaller first class seats and focus more on the economy class. In fact, success of product line decision depends largely on managing capacity. So the question being asked is: if higher cost of premium seats trades off with better customer satisfaction and limited resources, what should be an optimal product mix strategy?

Capacity constraint becomes extremely important and often characterizes product mix decisions. Firm decisions are limited by internal resources such as workforce, space, and capacity. Let’s compare two Airbus380s from two airlines: Korean Air and Emirates. A380s which considered as the largest 800 seats capacity offers two stories decks. Each airline decides on different seat configurations: Korean Air mixes 12 first class seats and 300 economy seats on the lower deck; the aircraft fits 94 business class seats. Emirates puts 14 enclosed-suites in the first class cabin and 76 flat-bed business class seats on the upper deck.
Another dimension of product variation is the number of cabin types. Cabin type options include first, business, premium economy, and economy classes and they differ in seat sizes, amenities and services.

Amenities that come with the seat package may also be different. If seats are equipped by personal tv, USB or laptop power outlet or wifi connection onboard, these would shape passengers inflight experience to another level. Hence, we consider these extra options as a separate dimension for product variations of airlines.

**Literature Review**

In the marketing and economics literatures, there has been great progress on understanding vertically differentiated product line design using analytical tools. Based on seminal works of Mussa and Rosen (1978), Moorthy (1984), Johnson and Myatt (2003), the literature suggests that for successful execution of the product line strategy, firms need to increase the “variation” or quality differentiation between their products or they need to delete the low-quality product from the product line all together.

The existing empirical research on product line design focused mainly on the impact of product line length on market performance. However, interestingly, the impact of differentiation within the products of the same firm was largely ignored. Moreover, there was no consideration of resource allocation issues in this line of literature.

Another stream of literature at the interface of operations and marketing simultaneously consider operational constraints together with product line issues. This literature has studied the effects of component commonality, production technology and capacity constraints among other things. This line of research is heavily dominated by analytical papers. It emphasizes the importance of considering operational capabilities at the product line design stage for a successful execution. However, the empirical investigation that looks at these issues is quite limited.

Empirical papers focus on the impact of increasing product variety on the operational outcomes (such as productivity performance), rather than the implications of specific operational choices (“variety”) on the successful the product line design. Literature did not identify the
micro-level differences between product options and product complexity in offering high quality product and low quality product, yet the findings were emphasized lean of mass production.

In our paper, we study relationships at the micro-level, focusing implications of specific operational choices on variety on market performance of the “service” or quasi-manufacturing firms.

**Background theory**

Our first hypothesis is based on the findings of Mussa and Rosen (1978); Moorthy (1984); and Johnson and Myatt (2003). *When marginal cost is increasing convexly in quality, analytical research suggests that segmentation strategy should be followed.* Firms should offer more variety. Remember that, they also suggest that for a successful execution, firms need to increase the relative differentiation between their high- and low- quality products (so more variety: more products, and they should be so different from each other). On the other hand, when the cost is concavely increasing, firms should only focus on offering a single product to the high-end segment.

In the operations literature, Yayla-Kullu et al. (2013) have analytically shown that when different types of products *consume different levels of resources, this becomes key when capacity is limited.* If the premium product consumes more resources than the low quality product, the premium product becomes too costly in terms of resource usage. Then, firms may be better off offering *more variety or focusing on the low quality segment.*

It is due to the nature of shared resource: high-fixed-cost/low-incremental-cost structure that forces the customers to choose the lowest price product. The price is likely inadequate to recover fixed costs, then the solution for the firm is to come up with product differentiation to shift customers’ willingness to pay for the product rather than choosing from the competitors. Airlines utilize price discrimination to achieve this. Our hypotheses will be set up to find how price discrimination (due to complex cost structure) interacts with consumer choices and how variety shapes the success of airlines.
Let’s take the three (plus one) dimension of airline product variety. If fundamental variety are platforms we see that airline utilizes many aircraft types with different in seat configurations. Aircraft types provide platform of airline operations. That brings us to the second dimension: cabin variety (first, business, economy, and premium economy). Consumer choices brought airline to be more specific in terms of offering seat options: choices are seat size, seat type (recliner, flat bed), inflight entertainment (personal tv), power and wifi connection. However, when we look at the variety dimensions, and slice them into small cubes, the total number of cubes are limited due to a strictly constrained capacity (e.g. cabin deck are limited in space; increase in first class seats will reduce available space to fit economy class seats etc.)

**Conclusions**

In this proceedings paper, we introduce our study on airlines’ product variety choices and their impact on the overall success of the firm. Full details of the methodology, results, and discussions can be found in the full length paper (Tansitpong and Yayla-Kullu, 2014).

We explore how operational decisions regarding a quality-differentiated product line determines the overall success of a multiproduct firm in the marketplace. Airlines provide multiple quality products with large variation at different prices for the first, business, and economy classes. We empirically investigate the impact of number of airline products under operational constraints, given limited capacity and resources. We find that optimal product line choice is dependent not only on price discrimination and cannibalization, but also resource constraints. If cost structure favors greater price discrimination, firms should offer product variety in order to perform well in the market. It is similar to the manufacturing organizations. Airlines, as representative of service firms, reduce number of fundamental variations, yet increased peripheral and intermediate variability in order to meet with customer demand.

**References**


