

Dynamic Product Portfolio Management with Life Cycle Considerations

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In order to be profitable, companies have to continuously manage their portfolio of product lines. At the same time, demand for products varies across different life cycle stages. Disregarding these variations may result in high operational costs due to inadequate ordering decisions and revenue shortfalls. In a portfolio of product lines, the product life cycle acquires even more relevance because the upper and lower extremes of demand and revenue may occur simultaneously in multiple product lines and thus be magnified. Therefore, companies may want to smooth the overall levels of demand and revenue by actively managing their portfolio, properly timing product upgrade launches and adequately choosing the amount and timing of marketing support. This is particularly true for products with short life cycles such as high technology goods, consumer electronics, and fashion apparel, for which the life cycle is the main source of demand dynamics. When firms are financially constrained in making needed investments yet still have to manage multiple products through various life cycle stages, achieving optimal inventory, product launch and marketing support decisions becomes complex.

In this research, to understand how a company should combine these decisions to successfully coordinate its operations and finances, we propose a stylized model that combines three subjects : product portfolio management, product life cycle and financial constraints. The model aims to help dynamically manage a portfolio of product lines that probabilistically transition through various life cycle stages (introduction, growth, maturity, decline and end-of-life). For this, we develop a Markov decision process to find the optimal decisions depending on the actual composition of the portfolio. Products are characterized by varying operational cost parameters (procurement, holding, and lost sales) and can have specific life cycle characteristics. The evolution through the life cycle stages is impacted by both marketing support and product launch decisions. These decisions involve costs and impact the life cycle stages transitions. The inventory, launching and

marketing decisions and the related portfolio expenditures are bound by a financial constraint in the form of restricted working capital. The working capital is a constant level of cash and inventory held by the company, which is supposed to be decided a priori by the company. Therefore, in our model, companies can, within limits, actively manage their product portfolio to achieve more favorable demand realizations. In fact, product life cycle management acquires real meaning at the product portfolio level since harmonizing decisions can be made to smooth aggregated demand and thus income.

Applying our tool, several managerial insights can be provided. Firstly, the decisions regarding the launch timing, the marketing support and the WC level are complex and dynamic, justifying the use of a comprehensive model, including the complex and multiple trade-offs involved. Cautious and greedy policies lead to much lower profit. Secondly, product portfolios benefit greatly from joint management, which reduces the amount of WC used per product and increases the benefits per allocated WC. Thirdly, the optimal policy aims to reach a stable aggregate demand level and thus stable resource requirements, rather than temporarily reaching the highest aggregate demand level. Optimal decisions smooth not only aggregated demand levels but also cash flows and the length of time in and outside the market. This is important to ensure optimal use of resources and avoid high costs. Finally, portfolio composition is a strategic decision that can also be made with the help of the proposed portfolio management tool. The optimal composition depends closely on the characteristics of admitted product types.