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Ramp-Up Management as an Approach to Mitigating Instability in the Adaptation of Solution Spaces in High-Variety Business Environments

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Abstract

In today's markets companies are oftentimes forced to offer a broad product variety, so that they can meet the individual requirements of their customers. Being confronted with such high-variety business environments, suppliers need to practice "solution space development," i.e. understanding the customers' idiosyncratic needs and deriving a suitable set of product variants from this knowledge. The diversification of customer demand must not lead to an ill-considered proliferation of variants in a firm's product offering, but any reconsideration of an existing product portfolio has to be done in a careful and purposeful manner: offering limitless choice is economically unfeasible and product variety should only be offered for those product attributes along which customer needs diverge and that can be aligned with the existing product architecture. However, due to unexpected changes in customer preferences, technical turbulences or faulty interpretations of the manufacturer during the development of the initial product offering, an adaptation of the existing solution space of product variants might become necessary at any given time. Whenever such a misfit between the existing product offering and the current customer demand occurs, firms are forced to introduce new product variants to the market. Such an addition of product variants may disrupt the available manufacturing system and cause significant instabilities in the respective value creation processes. This paper investigates whether the implementation of ramp-up management can mitigate the negative effects of this instability.

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1. Introduction

In many markets a recent trend of increasing heterogeneity of customer needs can be observed [1]. In response to such a diversification of the customer demand, companies are oftentimes forced to offer a broad product variety, so that they can meet the individual requirements of their customers [2]. Being confronted with such high-variety business environments, suppliers of industrial goods need to establish new business models that are capable of dealing with high levels of heterogeneity, such as mass customisation [3, 4]. Existing research claims that such a transition towards a high-variety product strategy requires far-reaching changes in the organisational structure of a firm [3-7]. In order to be able to cope with this transition companies have to develop certain

strategic capabilities across all parts of the value creation process in order to align their activities with the heterogeneous needs of the customers [7].

One capability that is described in literature as a potential key factor for establishing such a high-variety business model is termed "solution space development" (SSD), i.e. understanding the customers' idiosyncratic needs and deriving a suitable set of product variants from this knowledge [7]. The diversification of customer demand must not lead to an ill-considered proliferation of variants in a firm's product offering, but any reconsideration of an existing product portfolio has to be done in a careful and purposeful manner: offering limitless choice is economically unfeasible [4] and product variety should only be offered for those product

attributes along which customer needs diverge and that can be aligned with the existing product architecture [7-10]. The importance of solution space development becomes apparent in the cost implications that may result from shortcomings in the development of a suitable product offering: excessive variety causes unnecessary costs of maintenance for each unwanted product option that is kept available [11]. On the other hand, firms will suffer from missed sales opportunities for all product options that have been excluded from the product offering despite existing customer demand [12].

However, due to unexpected changes in customer preferences, technical turbulences or faulty interpretations of the manufacturer during the development of the initial product offering, an adaptation of the existing solution space of product variants might become necessary at any given time [13, 14]. Whenever such a misfit between the existing product offering and the current customer demand occurs, firms are forced to introduce new product variants to the market. Such an addition of product variants may disrupt the available manufacturing system and cause significant instabilities in the respective production processes [15]. This paper shows that ramp-up management can serve as a suitable approach to mitigating the negative effects of instability that have been induced by rearranging the solution space in a high-variety business environment. Furthermore, recommendations will be made concerning a suitable organisational set-up of ramp-up management in such business environments.

2. Developing High-Variety Solution Spaces

Naturally, every company has to make decisions concerning its respective product offering. However, this task is characterised by a much higher level of uncertainty and decision complexity, if the product domain at hand is of a rather heterogeneous and volatile nature. Subsequently, the level of product variety that customers demand in a specific market, can be regarded as an indicator for the task complexity of solution space development and its implications for ramp-up management.

2.1. The Role of Product Variety

Recently, the need for high-variety product offerings seems to be of growing importance. Customer needs have become increasingly heterogeneous and the demand for a broader variety of goods and services that is capable of meeting these heterogeneous customer needs is strongly increasing [1]. This shift in the customer demand structure leads to significant increases in product variety across many different industries. A recent study of ROLAND BERGER STRATEGY CONSULTANTS [16], for example, shows the development of product lifecycles and product variety in five major industries, namely automotive, chemicals, fast-moving consumer goods (FMCG), machinery and pharmaceuticals. According to the study's results product variety in these industries has more than doubled within the past 15 years. Thereby, the FMCG industry faces the lowest increases (+62%) and the chemicals industry is confronted with the most drastic development

(+213%). The remaining industries show similar developments of product variety: automotive (+70%), machinery (+116%), pharmaceuticals (+123%) [16].

In the light of this development, it becomes apparent that firms need to adapt organisationally to these high-variety business environments by establishing standardised mechanisms for the delineation of suitable product offerings and the execution of the respective production ramp-ups. However, even though product variety has increased so drastically, STICH [17] claims that there is no existing research on ramp-up management that specifically takes the interplay between product variety and ramp-up stability into account [17]. Considering the importance of ramp-up management in the automotive industry (a sector that is obviously highly impacted by increasing levels of product variety) [17-20], the lack of research concerning the impact of high-variety products on ramp-up management comes as a surprise. With regard to the development of a suitable product offering, however, managers can benefit from research on the strategic approach of mass customisation. This specific strategy is designed for the implementation in high-variety business environments and, thus, has certain recommendations concerning solution space development readily available.

2.2. The Solution Space Development Capability

In the context of mass customisation, the task of selecting an appropriate product offering is called solution space development and SALVADOR ET AL. [7] define it as "identify[ing] the product attributes along which customer needs diverge." The result of solution space development should be a "choice menu" of product features or product attributes that customers can choose from in order to customise products that meet their individual customer needs [8]. This also corresponds with the argumentation put forward by VON HIPPEL [9], who regards the solution space as the freedom of choice that the manufacturer's production system allows the customers. Subsequently, for the further course of this paper, we define the solution space as the sum of all available product variants in a company's product offering.

However, the development of a solution space in markets with high levels of heterogeneity has to be clearly distinguished from product portfolio decisions in the context of more homogeneous business settings [4]: as mass production aims at reaching as many customers as possible with standardised products, manufacturers have to develop products that address *common needs* among all targeted users. In product domains with high customer need heterogeneity, on the contrary, firms need to identify those product attributes along which customer *needs diverge* the most [7]. These product attributes can then be used as a starting point for the generation of product variety for mass customisation that truly adds value for the customers [21].

The definition of a suitable solution space requires certain external and internal considerations: externally, the company has to develop a comprehensive understanding of the

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