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The role of the customer order decoupling point in production and supply chain management

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ABSTRACT

In order to compete successfully, operations in any type of firm need to be strategically aligned to the market requirements. This concerns both manufacturing and supply chain operations. The customer order decoupling point (CODP) is getting increasing attention as an important input to the design of manufacturing operations as well as supply chains. This paper investigates the impact of the position and role of the CODP on issues of concern for production and supply chain management. The focus is on the design and strategic planning aspects of the supply chain, and the design of manufacturing planning and control systems. The paper proposes a dual design approach for production and supply chain planning systems; one type of system for operations upstream the CODP and another type of system for downstream operations in order to fully support the characteristics and objectives of each respective part of the supply chain.

1. Introduction

In order to compete successfully, operations in any type of firm need to be strategically aligned to the market requirements. The motivation for this research is that companies are showing increasing interest in incorporating the customer order decoupling point (CODP) as an important input to the strategic design of manufacturing operations as well as supply chains. The CODP is the point in the material flow where the product is tied to a specific customer order; the basic choices being make-to-stock, assemble-to-order, make-to-order, and engineer-to-order. As a rule, the CODP coincides with the most important stock point, from where the customer order process starts. From a supply chain perspective, there is typically one dominant CODP along the entire supply chain flow. From a company perspective, the CODP can be positioned inside their manufacturing operations or it can be positioned at the suppliers (first tier or even further upstream in the supply chain), at the interface with the supplier (raw material inventory), at the border towards the customers (at some finished goods inventory), or even further downstream in the supply chain.

This paper investigates the impact of the position and role of the customer order decoupling point on production and supply chain management. Issues that will be dealt with include the design and planning of manufacturing and supply chain operations. The purpose of the paper is to explore and develop a framework for an integrated perspective on production and supply chain management based on the CODP. The development of the framework in this paper is based on three types of research sources: a review of the related literature, a case study, and the results from an empirical survey of 128 Swedish manufacturing firms.

First, a review is provided on the related literature on the customer order decoupling point and issues related to production and supply chain management that can be interpreted from a CODP perspective. Secondly, the case study and the survey results are presented. Then, the framework is presented and motivated.

2. Related literature

2.1. The customer order decoupling point

The CODP is traditionally defined as the point in the value chain for a product, where the product is linked to a specific customer order. Sometimes the CODP is called the order penetration point [1,2]. Different manufacturing situations such as make-to-stock (MTS), assemble-to-order (ATO), make-to-order (MTO) and engineer-to-order (ETO) all relate to different positions of the CODP. The different situations are related to the ability of manufacturing operations to accommodate product customization or a wide product range; cf. Fig. 1. Thereby, the CODP divides the material flow that is forecast-driven (upstream of the CODP) from the flow that is customer order-driven (downstream the CODP).

The CODP is the point where product specifications get frozen in most cases, and more important, it is the last point at which inventory is held [1]. Thus, the inventory at the CODP is a strategic

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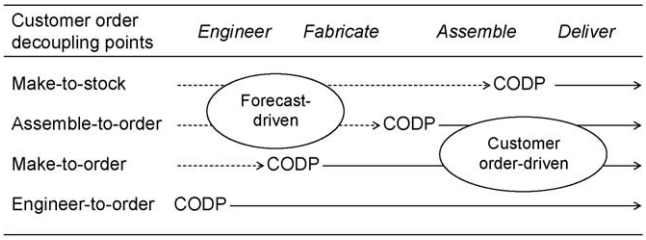

Fig. 1. Different customer order decoupling points (based on Sharman, 1984 [1]).

stock point since delivery promises are based on the stock availability at the CODP and the lead times and capacity availability for the customer order-driven operations downstream the CODP [2]. The literature explicitly discussing the CODP is growing, dealing with both manufacturing and supply chain operations. In [3], the CODP is considered a major factor in designing an integrated push-pull manufacturing strategy. More recent contributions are found in [4–13]. There is a strong consensus among the literature on CODP in that the operations upstream are significantly different than those downstream, based on the fact that the upstream material flow is forecast-driven, whereas real customer orders dominate downstream. Publications primarily from the Cardiff group [7,8,10] distinguished between lean and agile supply chains. This literature acknowledges the CODP as the divider between lean and agile operations in manufacturing or supply chains. A lean supply chain should be applied upstream the CODP, while an agile supply chain would be more suitable for downstream operations. This is the core idea of the "leagility" approach.

2.2. Managerial differentiation with respect to manufacturing planning and control

The models for linking market characteristics to the design of manufacturing planning and control (MPC) systems can basically be reduced to one, first presented Berry and Hill in [14], and later included in [15,16]. This model is concerned with three hierarchical planning levels: master planning (make-to-order, MTO; assemble-to-order, ATO; make-to-stock, MTS), material planning (time-phased vs. rate-based), and shop floor control (MRP-type vs. JIT-type; i.e. material requirements planning vs. just-in-time). The fourth level in a manufacturing resource planning (MRPII) system structure is sales and operations planning, which was added to the Berry and Hill framework by [17], concerned with the choice of planning strategy (chase vs. level, or potential mixes thereof; cf. [2]).

The attributes linking market and product characteristics to the planning and control system are basically the same at all levels, i.e. product type, product range and individual product volume per period [14,18]. Firms with high-volume standardized products are assumed to utilize a level planning strategy, make-to-stock, rate-based, and pull approaches, whereas firms with many low-volume, customized products are expected to choose a chase planning strategy, make-to-order, time-phased, and push approaches [2,14–17]. In ATO environments these choices are applicable to different sections of the production system or the supply chain, with respect to the position of the CODP; cf. the leagility literature, implying that lean principles are applied upstream the CODP while agile principles are applied downstream. Volumes are typically sufficiently high before the CODP to make level/MTS/rate-based/pull possible, whereas chase/MTO/time-phased/push is typically required after the CODP due to customized features and low volumes per product. The applicability of Kanban and MRP to different manufacturing environments is supported in [19], stating that "overall, pull systems, such as Kanban, may work well when the demand variability is low" and that MRP is a logical choice for "a firm producing a wide range of custom products in small batches using a make-to-order policy". They further suggested that a careful choice of the MPC system to fit the manufacturing environment will help improve the overall performance of the firm. The results of an empirical study of 211 high performing plants in seven countries show that lean principles are significantly associated with high levels of cost performance, while agile principles are better aligned with flexibility performance [20]. This result supports the perception that lean approaches are preferable upstream the CODP and agile approaches downstream.

2.3. Managerial differentiation with respect to supply chain design

Fisher presented a framework for choosing the right supply chain for products in [21]. He made a distinction between physically efficient and market-responsive supply chains. Products are categorised as either functional or innovative and should be matched to the proper supply chain delivery system. Functional products characterized by, e.g. a steady demand pattern and long product life cycles should be managed in a physically efficient supply chain that focuses on cost minimization and high utilization of resources, whereas innovative products with demand volatility and short life cycles should be transformed through a market-responsive supply chain that has extra capacity, capability of market demand information processing, and that is more flexible. Thus, this model suggested that certain product characteristics require a specific type of supply chain design, while other choices lead to mismatches. The model has attracted considerable attention by both practitioners and researchers. Other researchers have proposed models that build upon the model by Fisher, such as in [22–24]. The characteristics of the physically efficient supply chain are applicable to operations upstream the CODP, whereas the characteristics of the market-responsive supply chain are useful for downstream operations. Another perspective on supply chain management with relevance to the CODP is the supply chain operations reference (SCOR) model [25]. The SCOR model differentiates the three basic processes source, make, and deliver with respect to make-to-stock, make-to-order, and engineer-to-order products. Thus, the SCOR model acknowledges that the position of the decoupling point has an impact on the design of operations processes.

3. Case study

The case company is operating in the telecommunication industry, and manufactures microwave radio solutions for applications in telecom networks. The case study is concerned with the major product line. The informants to the case study are two supply chain coordinators, one market coordinator, one manager from operational procurement and production logistics. A detailed account of the case study and methodology is provided in [26]. There are approximately 1000 variants of the main product line offered to the marketplace. With all auxiliary equipment such as antennas and power supply, the number of possible configurations of complete microwave radio systems is over one million. In the upstream stages of the production, the number of variants is much more limited. The overall supply chain focus of the firm is to respond quickly to unpredictable demand. The sales and operations planning function manages the mix of forecasting for upstream operations and suppliers and of customized orders for the final production stages.

The main internal and external value streams are depicted in Fig. 2. Suppliers deliver printed circuits, components and modules. Components are surface mounted on printed circuit boards and modules are finalised into multi-chip modules and supplied to the