The Role of Decoupling Points in Value Chain Management

Jan Olhager

Abstract All supply chains are not the same. A key factor that affects the design and management of a value chain is the position of the customer order decoupling point; some products are produced to order (e.g. configured to particular customer needs) while others are produced to stock (typically standard products). The customer order decoupling point (CODP) identifies the point in the material flow where the product is linked to a specific customer. This paper discusses the impact of having the decoupling point at different positions, and the distinguishing features for value chain operations upstream the decoupling point (i.e. towards the supplier) versus those downstream the decoupling point (i.e. towards the ultimate customer). Based on these differences, we explore the implication of the CODP on the modelling of value.

Keywords Decoupling point • Value • Value chain management

1 Introduction

In order to compete successfully, operations in any type of firm need to be strategically aligned to the market requirements. This concerns all aspects and operations of the value chain. The customer order decoupling point (CODP) is gaining attention as an important factor in the design and management 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 the value chain perspective, there is

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H. Jodlbauer et al. (eds.), *Modelling Value*, Contributions to Management Science,
DOI 10.1007/978-3-7908-2747-7_2,

typically one dominant CODP along the material flow of the value chain. 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 value 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 role of the CODP in value chain management. First, the related literature is reviewed. Then, some distinguishing features are summarized. These two sections serve to establish the fundamental differences between upstream and downstream operations relative to the CODP. Finally, we explore the implications of the CODP on the modelling of value.

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; cf. Sharman (1984) and Olhager (2003). 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; cf. Fig. 1. The CODP thus divides the operations stages that are forecast-driven (upstream of the CODP) from those that are customer order-driven (the CODP and downstream). The CODP is also the last point at which inventory is held (Sharman 1984). Thus, the inventory at the CODP is a strategic 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 activities downstream the CODP (Olhager 2003).

The literature on CODP is growing (Olhager 2010). 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

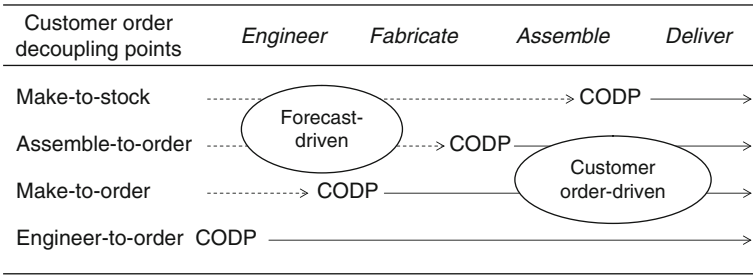

Fig. 1 Different customer order decoupling points (Based on Sharman 1984)

forecast-driven, whereas real customer orders dominate downstream. This has implications for many aspects of the manufacturing value chain. Areas that have been treated in the literature include operations strategy (Olhager and Östlund 1990; and Olhager 2003), logistics systems (Hoekstra and Romme 1992), manufacturing planning and production control (Giesberts and van der Tang 1992; Van der Vlist et al. 1997; and Olhager and Wikner 1998, 2000), manufacturing focus (Hallgren and Olhager 2006), and supply chain planning (Olhager 2010). Other papers have treated the CODP more generally for a certain area of application, such as the Finnish paper and pulp industry (Lehtonen 1999) and the Dutch food industry (van Donk 2001).

2.2 *Make-to-Stock Versus Make-to-Order*

From a material flow perspective, the four situations in Fig. 1 can be reduced to three, i.e. MTS, ATO, and MTO, since MTO fully includes ETO with respect to the material flow. MTS includes all options regarding keeping inventory in the distribution system; either at distributors, wholesalers or retailers. In all these environments, the product is produced to stock with respect to the form; however, they may differ in terms of time and space relative the ultimate customer. An individual plant may well have products in all categories. Different products being delivered in an ATO fashion do not necessarily have to have the CODP in the same position. What they have in common is that they have an internal CODP, which makes the internal value chain a mix of MTS and MTO; cf. Fig. 2.

Thus, there are two fundamental sections in a material flow: MTS and MTO. The choice of MTS versus MTO is typically a natural and clear-cut one in practice, and the differences and consequences are usually well understood by manufacturing and supply chain managers. For example, the specialty chemical firm Rohm and Haas separated the products into MTS and MTO categories based on demand volume and variability (D'Alessandro and Baveja 2000).

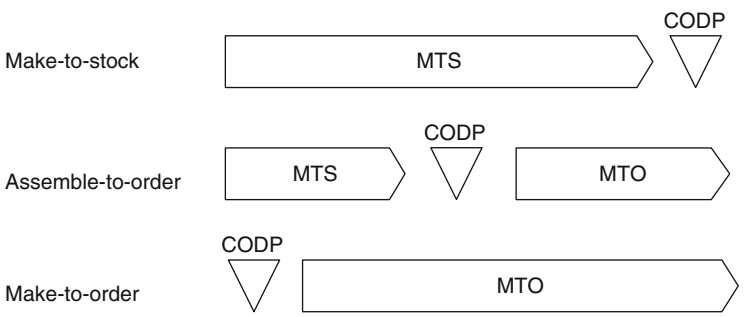

Fig. 2 The CODP partitions the process into MTS upstream and MTO downstream

The Berry and Hill (1992) model for linking manufacturing planning and control approaches to market and product characteristics explicitly uses MTS, ATO, and MTO as choices for the master planning level. MTO should be selected for special products with wide range and low individual product volume per period, and MTS for standard products with predetermined and narrow range and high volume per period (Berry and Hill 1992). This framework has been tested empirically in Olhager and Selldin (2007), and product range was found to be a significant driver of the positioning of the CODP, with a subsequent significant impact on product mix flexibility performance.

The impact of e-business on manufacturing strategy decisions was explored by Olhager and Rudberg (2003), in a study of seven Swedish manufacturing companies. The results showed that e-business interfaces with customers were beneficial to MTO operations in terms of improved delivery lead time and cost performance. However, it had little impact on MTS operations, since the product is already produced and is available for delivery to the customer.

2.3 *Lean Versus Agile*

One literature stream, initiated by research by the Cardiff group (e.g. Naylor et al. 1999; Mason-Jones et al. 2000; and Aitken et al. 2002), distinguishes between lean and agile supply chains using 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. The distinction between lean and agile has been tested empirically concerning drivers and performance outcomes (Hallgren and Olhager 2009). They found that lean is associated with a cost leadership strategy and cost performance, while agile is associated with a differentiation strategy and flexibility performance. Another aspect of the "leagile" approach is the recognition of an information decoupling point (Mason-Jones and Towill 1999). The underlying rationale is that the feedback of market information does not necessarily have to stop at the (material flow related) CODP, but can be forwarded further upstream to provide advance planning information. Still, in practice, the information and material decoupling points most often coincide.

2.4 *Related Models*

The product-process matrix by Hayes and Wheelwright (1984) can be complemented by the CODP. Low volume, low standardization, one-of-a-kind products need to be produced in an ETO/MTO fashion focussing on flexibility and quality, and the CODP position gradually shifts to the finished goods inventory

(possibly extended to include distribution inventories) for high-volume, high standardization, commodity products focussing on dependability and cost at the other end of the product characteristics continuum.

The product profiling concept developed by Hill (2000) can also be related to CODP positions. According to the product profile table (Hill 2000), standard products with very narrow range win orders on price, wherefore the key manufacturing task is to provide low-cost production (i.e. applicable to MTS operations and upstream a CODP), whereas special products in wide range win orders based on delivery speed and unique design capability, wherefore manufacturing has to meet specifications and delivery schedules, which requires high flexibility (i.e. applicable to MTO operations and downstream a CODP).

The model by Fisher (1997) for choosing the right supply chain for products includes a distinction between two product types and two supply chain types. He made a distinction between functional and innovative products, and between physically efficient and market responsive supply chains. 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. This model has been tested empirically (Selldin and Olhager 2007), finding some support for this model. It should be noted that the products that are considered in this model are business-to-consumer products that are made to stock. Still, the core ideas of this model can be related to the CODP, such that the characteristics of the physically efficient supply chain can be considered applicable to operations upstream the CODP, while the characteristics of the market-responsive supply chain can be considered useful for downstream operations (Olhager et al. 2006).

Another related model is the supply chain operations reference (SCOR) model (Supply Chain Council 2008). The three basic processes – source, make, and deliver – in the SCOR model are differentiated for make-to-stock, make-to-order, and engineer-to-order products. Thus, the SCOR model acknowledges that the position of the customer order decoupling point has an impact on the design of operations processes.

3 Distinguishing Features

Based on the review of the related literature we can conclude that there are indeed substantial differences between operations and activities upstream the CODP and those downstream the CODP. In Table 1, we summarize some key aspects of what distinguishes the operations upstream the CODP from those downstream.

Table 1 Distinguishing features of operations and activities upstream versus downstream the CODP (Based on Hallgren and Olhager 2006)

Features	MTS and upstream the CODP	MTO and downstream the CODP
Product characteristics	Standard components, high volumes, predictable demand	Customised, high variety, wide range, unpredictable demand
Order winners	Price	Delivery speed, flexibility
Qualifiers	Quality, delivery reliability	Quality, delivery reliability
Supply chain design	Physically efficient	Market responsive
Lean versus agile	Lean	Agile
Manufacturing task	Provide low cost manufacturing, maintain high stock availability at the CODP	Manufacture to customer specification, achieve short and reliable lead times
Key properties	Productivity	Flexibility
Improvement priorities	Cost reduction	Lead time reduction

4 Implications of the CODP on the Modelling of Value

4.1 Value Perceptions

In general, the customer value function is based on the perception of a variety of criteria related to the competitive capabilities of the value offering firm. Many criteria are manufacturing-based, but other criteria may be included.

$$\text{Value} = \text{f}(\text{Q},\ \text{D},\ \text{P},\ \text{F},\ \text{X}),$$

where Q = quality (conformance to specifications), D = delivery (speed and reliability), P = price, F = flexibility (volume, product mix, and design – in support of customization and product range), and X = other aspects. Other non-manufacturing related aspects may include design, brand, image, etc.

In MTS environments, price is typically the dominant criteria and acts as a major order winner. Quality and delivery are typical market qualifiers, while flexibility typically is not required at all. Using bold to denote order winner, and italics to denote qualifiers, the value perception of MTS operations can be depicted as:

$$\text{Value}\ (\text{MTS}) = \text{f}(Q, D,\ \mathbf{P},\ \text{F},\ \text{X}),$$

In MTO environments, the important competitive criteria are typically based on quality, delivery and flexibility. The order winner is typically related to some aspect of flexibility, while quality and delivery are typical market qualifiers. Price may be a qualifier, but for some products price is not really the issue. Delivery speed may appear as part of the order winning criteria. Non-manufacturing related aspects may also contribute to order winning or qualifying.

$$\text{Value (MTO)} = \text{f}(Q, D, \text{P}, \mathbf{F}, X),$$

Thus, the perception of what creates value is very different for MTS and MTO products in general.

4.2 Deployment of Perceived Value

The value perception differences between MTS and MTO products must be taken into account when designing and managing value chains. In particular, the perceived value is different on the two sides of the CODP. Consequently, the deployment of the value perception in the market is only relevant to the CODP. Upstream the CODP, the value has to be related to MTS products, for which MTO-based value perceptions are not valid. This is illustrated in Fig. 3.

4.3 The Impact of Profit Margin

A key aspect of the value perception for the manufacturer is the profit margin of the products sold to the market. A low margin corresponds to a competitive market place with many competitors, which is common for mature products that typically are produced to stock. On the other hand, a high margin is more typical for products that are customized or where the product range is wide, offering the customer a

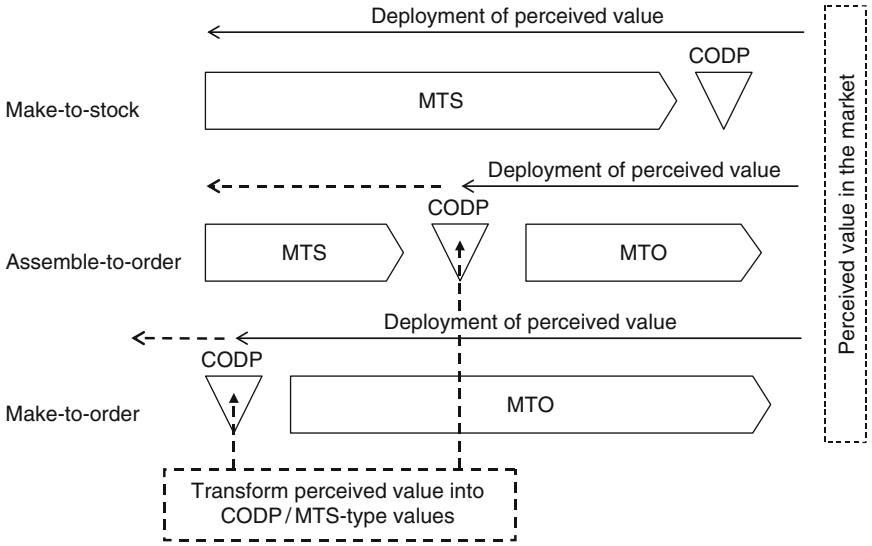

Fig. 3 Deployment of perceived value with respect to the position of the CODP

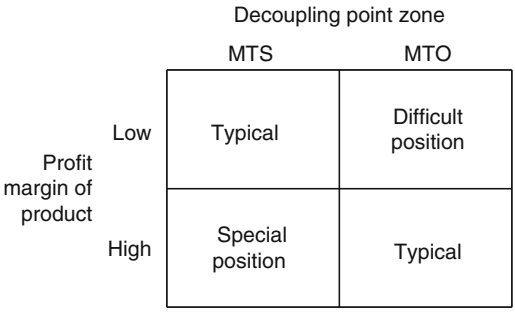

Fig. 4 Differences in profit margin with respect to the CODP

wider choice. Figure 4 illustrates the common relationships between profit margin and the CODP. Even though the figure depicts the relationships for end products in MTS and MTO operations, the results can be translated into operations upstream and downstream the CODP. Consequently, the profit margin of components and items upstream the CODP is typically low (since these have sufficiently high volumes to allow for being produced to stock), while parts and end products downstream the CODP have higher profit margins (since these include some element of customization).

Figure 4 includes two "untypical" positions that are possible in practice. In particular, the special position of high profit margin in MTS operations is possible for products where value is built largely on product innovation, design or brand name. Examples of such products are pharmaceuticals, fashion clothes, and some luxury items. The last quadrant with low profit margin in MTO operations is a difficult position. Since MTO operations often have some excess capacity to deal with unstable demand, the profit margin can easily be wiped out if demand is not sufficient with respect to the capacity level. This may be case for some sub-contractors that rely heavily on a steady stream of orders from their customers in order to stay profitable.

The profit margin is indicative of the relationship between value (for the customer), price and cost (for the manufacturer). For a competitive product the following relationship must hold:

$$\text{Value} > \text{price} > \text{cost}.$$

If price exceeds the value perceived by the customer, he or she will go elsewhere. If cost exceeds the price, the manufacturer will most likely go out of business in due course. In low-margin operations, the focus is to make sure that the margin stays positive, and avoid unnecessary costs. In high-margin operations, the manufacturer continuously strives to keep the margin or improve it, by product innovation, product design or building the brand name. Figure 5 illustrates these relationships.

MTS operations are typically cost-conscious, having to focus on cost control and measure cost performance to maintain the profit margin (small, but positive). MTO

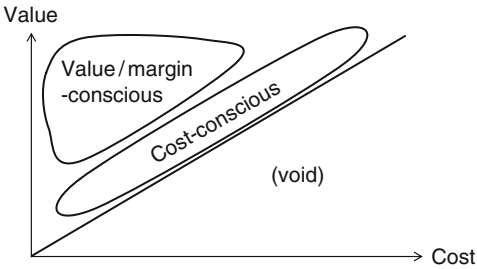

Fig. 5 Different types of focus with respect to the relationships among value, price and cost

Table 2 Some value-related aspects relative to the CODP

Aspect	MTS and upstream the CODP	MTO and downstream the CODP
Value added	Low	High
Profit focus	Cost performance	Margin/value contribution
Profitability generation	Through cost reduction	Through margins and sales
Pricing model	"Cost plus" (restricted by market price)	Value-based
Operational problem	Cost control	Market supply

operations have a wider scope of options in creating new complementary value-cost relationships.

4.4 Some Implications of CODP on the Modelling of Value

Based on the exploratory discussion of the value concept in MTS versus MTO operations it can be concluded that there are substantial differences. In Table 2, some key aspects are summarized that distinguishes the operations upstream the CODP from those downstream.

5 Concluding Remarks

This paper investigated the role of the CODP for value chain management. The CODP has a key role in developing and managing value chains in that value chain operations upstream the CODP perceive value differently than those downstream the CODP. As a consequence, the two parts around the CODP should be designed and managed differently in order to support the value creation at each respective stage.

These results are generally applicable to value chain operations. For firms where there is only one type of decoupling situation, i.e. only MTO or only MTS, the firm

can apply a single approach for the value chain. However, most firms tend to have a mix of MTO and MTS products, wherefore different approaches have to be applied for different parts of the firm. Also, in ATO situations the two types of approaches need to be applied to different parts of the value chain for a single product line. The fact that the entire value chain is not aligned towards one goal (i.e. the competitive priorities of the ultimate consumer) is not a dilemma per se. The important issue is to fit the approach to the task of each respective material flow – both upstream and downstream the CODP.

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http://www.springer.com/978-3-7908-2746-0

Modelling Value
Selected Papers of the 1st International Conference on
Value Chain Management
Jodlbauer, H.; Olhager, J.; Schonberger, R.J. (Eds.)
2012, XXI, 418 p., Hardcover
ISBN: 978-3-7908-2746-0
A product of Physica-Verlag Heidelberg