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# Differentiating manufacturing focus

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# Differentiating manufacturing focus

## Abstract

In order for a manufacturing firm to be competitive, by supporting the market requirements through the manufacturing function, manufacturing should focus on a narrow set of tasks. Focused manufacturing is concerned with the perspectives when designing a manufacturing facility, be it a factory, plant or plant-within-a-plant. Traditionally, focus has been on the product, the process, or the manufacturing task based on competitive priorities (order winners and qualifiers). So far, the literature implies that a certain facility should have but only one focus. In this paper, we present a framework that differentiates focus with respect to different parts of the manufacturing value chain. The point, around which focus needs to be differentiated is the customer order decoupling point. We associate alternative types of focus relative the customer order decoupling point, separating the upstream and downstream parts, and create a framework for choosing focus and how to differentiate manufacturing focus.

*Keywords:* Manufacturing strategy; Manufacturing focus; Customer order decoupling point; Productivity; Flexibility; Make-to-order; Make-to-stock

## 1. Introduction

A factory cannot perform well in every yardstick were the exact words of Skinner in 1974. A similar note is made by Hill and Duke-Woolley (1983) stating that a manufacturing process cannot provide for all aspects of competitiveness at the same time. One suggested solution to this problem is focusing the efforts towards for example a narrower range of products or segments of the entire market. By reducing the scope of an organisation the activities are limited to accomplish a manageable and consistent set of tasks (Skinner 1974). Focusing concentrates expertise and promotes superior performance in a narrower range (Lee 1992), meaning that a facility that focuses on a narrow set of products, market, customers *etc.* is likely to outperform those that attempt satisfying multiple markets with several

1  
2 different products. Hitherto, the literature argues that focusing provides better opportunities to exploit  
3  
4 any given market, thus making the area interesting from a research perspective. Still the literature is  
5  
6 quite limited on the subject, especially definitional work. A common factor is that an organisation  
7  
8 should have only one focus area, be it product, process or the manufacturing task. Even though the  
9  
10 focused factory literature is one of the cornerstones in manufacturing strategy literature few attempts  
11  
12 have been made in guiding managers in choosing focus area or focus criterion. The positioning of the  
13  
14 customer order decoupling point (CODP) is another area that receives increasing attention in the  
15  
16 manufacturing strategy literature. The characteristics upstream and downstream the CODP in a  
17  
18 manufacturing system differ significantly wherefore the parts should be managed differently (Olhager  
19  
20 2003). In this paper, we investigate the concept of focus relative the CODP. We also investigate  
21  
22 whether the characteristics upstream differ enough from the characteristics downstream to justify  
23  
24 applying different foci to operations upstream versus downstream the CODP. In doing so we challenge  
25  
26 the common notion that facilities should have one single focus. The remainder of this paper is  
27  
28 organized as follows. First, we make an exposition of the literature on manufacturing focus, and on the  
29  
30 customer order decoupling point. We then combine these two concepts to investigate how they are  
31  
32 interrelated. As a result, we present a framework for differentiating manufacturing focus relative to the  
33  
34 customer order decoupling point. Also we propose a methodology for taking the CODP into  
35  
36 consideration when identifying and applying manufacturing focus. Finally, conclusions and managerial  
37  
38 implications are discussed.  
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47

## 48 **2. Manufacturing focus**

49  
50 The focused factory literature drawing on Skinner's early work is still one of the cornerstones in the  
51  
52 manufacturing strategy literature. Although most authors presume an understanding of the concept, a  
53  
54 few efforts have been made to define manufacturing focus. Richardson *et al.* (1985) defines focus as  
55  
56 "the extent to which a consistent set of parameters in the firm's mission is both selected and given  
57  
58 importance relative to other parameters" (p. 20). Another definition given by Hill and Duke-Woolley  
59  
60 (1983) expresses that the determination of strategic focus concerns "making a consistent and explicit

1  
2 choice of the extent to which aspects such as delivery speed, delivery reliability, quality, cost and  
3  
4 product development are provided for by the manufacturing system” (p. 118). One of the most  
5  
6 comprehensive and precise definition in the literature is given by Pesch (1996) who via a Delphi-study  
7  
8 defined manufacturing focus as follows; “The focused factory is a factory with a limited, strategically  
9  
10 linked, and internally consistent set of demands that derive from the plant’s products, processes,  
11  
12 customers, and suppliers. Limiting the demands placed on the plant in turn limits the number of  
13  
14 manufacturing tasks in the plant, and establishes a clear set of priorities for both workers and  
15  
16 managers.” (p. 35). The definitions stated all relate focus to the strategic emphasis given to certain  
17  
18 properties of the manufacturing system or the products produced. This fortifies the subject as a strategic  
19  
20 decision of uttermost importance to any manufacturing firm. There are of course other ways to view  
21  
22 focus, one being the notion of core competence that resembles that of process focus suggesting that a  
23  
24 company should limit its span of process.  
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26  
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### 31 **2.1. Perspectives on manufacturing focus**

32  
33 There are a number of approaches to focus that can be designed into a manufacturing organisation; *cf.*  
34  
35 Table 1. Focus criteria may be based on product, process, market, volume, geography, material,  
36  
37 infrastructure and market requirements or competitive priorities see *e.g.* (Hill and Duke-Woolley 1983,  
38  
39 Lee 1992, Chambers 1997, Sheu and Laughlin 1996). Focusing by product refers to organisations  
40  
41 where a certain product sets the rules of the whole organisation. Focus by process is when a company  
42  
43 chooses products dependent on the type of operations that the particular company is able to perform  
44  
45 effectively. Often those operations require specialised skills and capital intensive equipment (Chambers  
46  
47 1997). Process focus can also imply a limitation on the number of process technologies or machine  
48  
49 types in a focus unit (Sheu and Laughlin 1996). Typically, process-focused plants concentrate technical  
50  
51 expertise but are difficult to coordinate and control (Lee 1992). Lee (1992) states that only line and  
52  
53 continuous production can achieve pure product focus and to be truly process focused only a functional  
54  
55 mode can be used. The perspective Lee takes reflects very much the way to physically organise  
56  
57 resources, *i.e.* the layout decision. Focus by market is the separation of facilities by means of the  
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1  
2 specific demands of the markets targeted. This focus provides enhanced responsiveness to market  
3  
4 needs. Volume as an approach to focus draws upon the different process technologies needed for  
5  
6 products with differing production volumes. Products with higher production volumes require a higher  
7  
8 degree of flow orientation than do products with lower volumes. Proximity to customers, suppliers,  
9  
10 material, *etc.*, may call for focus by geography. Focus by manufacturing task (market requirements,  
11  
12 order winning criterion, competitive priorities) group products together based on similarities in order  
13  
14 winning criterion, such as quality, cost, delivery speed, and delivery reliability as set by the market or  
15  
16 customers. Regardless of focus criteria the choice is to be considered strategic since focusing along any  
17  
18 one dimension means giving up focus along others (Hayes *et al.* 2005).  
19  
20  
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26 \*\*\* Table 1. \*\*\*  
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30 As seen in Table 1 the most common approaches to focus are product focus, process focus and focus by  
31  
32 competitive priorities and the manufacturing task. Most authors acknowledge product and process and  
33  
34 Hayes and Schmenner (1978) vividly describe the choice between product focus and process focus to  
35  
36 be an either-or decision. They argue that an organisation shall not try to employ both process and  
37  
38 product focus unless the parts engaged in different focus are clearly separated and managed in separate  
39  
40 ways in order to avoid confusion and conflict of interests. Keeping the scope manageable by limiting  
41  
42 the product range, process technologies employed and markets served is the essence in Skinner (1996).  
43  
44 Lee (1992) states that a narrow product or process range alone does not necessarily imply focus. Key is  
45  
46 to concentrate the entire plant on the very task that is demanded by the overall strategy and marketing  
47  
48 objective, thus focusing on the manufacturing task. Ettlle and Penner-Hahn (1990) agrees when they  
49  
50 take the strategic emphasis given to certain competitive priorities as a starting point, as do Hill (2000)  
51  
52 and Skinner (1996) when discussing focusing on the manufacturing task. Bozarth (1993) relates the  
53  
54 market requirements to the performance objectives of the manufacturing system giving a  
55  
56 manufacturing task. Sheu (1994) and Sheu and Krajewski (1996) present a measure of manufacturing  
57  
58 task similarity for products, based on competitive priorities and volume. The measure is then used to  
59  
60

1 assign products and allocate resources when creating focussed units, *i.e.* plant-within-a-plants (PWP).  
2  
3  
4 Brush & Karnani (1996) use a specialisation ratio as a measure of product focus, and the level of  
5  
6 vertical integration as a measure of process focus (span of process rather). They find support for their  
7  
8 hypothesis that product focus is positively correlated to plant productivity while process focus is not.  
9  
10 Schroeder and Pesch (1994) and Pesch and Schroeder (1996) list five criteria that must be met for a  
11  
12 plant (or PWP) to be considered highly focused: a maximum of two competitive priorities, alignment  
13  
14 with the business strategy, internal decision-making consistency, compatible volumes in terms of lot  
15  
16 sizes, and similar manufacturing requirements among products. These criteria constitute the basis for a  
17  
18 compound measure of focus. Volumes, markets, product properties are related to production processes  
19  
20 by Hayes and Wheelwright (1984). In summary, the manufacturing focus literature discusses a number  
21  
22 of focus criteria.  
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## 29 **2.2. Main focus areas**

30  
31 Of the five focus areas in Table 1, some interdependencies exist. For example, the volume criterion is  
32  
33 captured through the focus area of competitive priorities and manufacturing task (Sheu and Laughlin  
34  
35 1996), which also is the impetus behind the considerations of product variety and life cycle stage. Sheu  
36  
37 (1994) merges the similarity of competitive priorities and the consistency of volumes into  
38  
39 manufacturing task as a focus area. The description of market as a focus criterion in Hayes and  
40  
41 Wheelwright (1984) and Lee (1992) shows strong resemblance with competitive priorities and the  
42  
43 manufacturing task. Thus, the five focus areas can be reduced to three: product focus, process focus,  
44  
45 and focus on competitive priorities and the manufacturing task. In this paper, we choose to call the  
46  
47 latter approach task focus for short. These three approaches to focus are described in greater detail in  
48  
49  
50  
51  
52  
53 Table 2.

54  
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56  
57 \*\*\* Table 2. \*\*\*  
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1  
2 The three focus areas can be related to the product life cycle with respect to applicability, in that  
3  
4 product and process focus should typically apply to different product life cycle stages, and that the set  
5  
6 of competitive priorities and the resulting manufacturing task will typically change over the product life  
7  
8 cycle. A process focus would be applicable for the early and late stages of the product life cycle,  
9  
10 whereas a product focus would be preferable during the maturity stage with stable and high volumes;  
11  
12 *cf. e.g.* Hill (2000). The competitive priorities are likely to change from flexibility and quality for low  
13  
14 volume, high-mix environments to price and delivery for high volume, low mix environments (Hayes  
15  
16 and Wheelwright 1984). Thus, a product may have to change focus and consequently manufacturing  
17  
18 system during its life cycle, in order to have the proper manufacturing support relative its market needs.  
19  
20 However, the manufacturing system producing the product is always considered to have a single focus,  
21  
22 according to the literature.  
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### 29 **3. Customer order decoupling point**

30  
31 The customer order decoupling point (CODP) is traditionally defined as the point in the manufacturing  
32  
33 value chain for a product, where the product becomes earmarked for a particular customer. Sometimes  
34  
35 the CODP is called the order penetration point (OPP) (Olhager 2003, Sharman 1984). Different  
36  
37 manufacturing environments such as make-to-stock (MTS), assemble-to-order (ATO), make-to-order  
38  
39 (MTO) and engineer-to-order (ETO) all relate to different positions of the CODP. These differ in the  
40  
41 ability to accommodate customising or a wide product range; see Figure 1. The CODP divides the  
42  
43 manufacturing stages that are forecast-driven upstream the CODP from those that are customer order-  
44  
45 driven downstream the CODP. Sharman (1984) points out that the CODP is the point where products  
46  
47 specifications get frozen in most cases, and more important, it is the last point at which inventory is  
48  
49 held. Thus, the inventory at the CODP is a strategic stock point since delivery promises are based on  
50  
51 the stock availability at the CODP and the lead times and capacity availability for the customer order  
52  
53 driven activities downstream the CODP (Olhager 2003).  
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\*\*\* Figure 1. \*\*\*

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4 The positioning of the CODP is affected by many factors (Sharman 1984, Olhager and Östlund 1990,  
5  
6 Giesberts and Van der Tang 1992, Hoekstra and Romme 1992, van der Vlist *et al.* 1997, Mason-Jones  
7  
8 *et al.* 2000, Van Donk 2001, Aitken *et al.* 2002, Rudberg and Wikner 2004). The majority of the  
9  
10 literature deals with manufacturing operations, whereas Sharman (1984), Hoekstra and Romme (1992),  
11  
12 and Mason-Jones *et al.* (2000) primarily deal with supply chains. Case examples are found in Olhager  
13  
14 and Östlund (1990), van der Vlist *et al.* (1997), van Donk (2001), and Aitken *et al.* (2002) concerning  
15  
16 printed packaging boxes, trucks, food processing, and a lighting factory, respectively. Hoekstra and  
17  
18 Romme (1992) discuss three cases at Philips: medical systems, paging systems, and computer systems.  
19  
20 Thus, the concept of the customer order decoupling point is well established. There is a strong  
21  
22 consensus among the literature on CODP in that the operations upstream are significantly different than  
23  
24 those downstream, based on the fact that upstream activities are forecast-driven, whereas downstream  
25  
26 activities are based on customer orders. The operating characteristics that are required upstream the  
27  
28 CODP include productivity and cost reduction in order to continuously improve the low-cost  
29  
30 production capabilities. Downstream the CODP, the key issues are flexibility and lead time reduction to  
31  
32 continuously improve delivery speed and dependability; the delivery promises are based on the  
33  
34 presumption that the right material is available at the CODP.  
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45 The factors that affect the positioning of the CODP can basically be divided into three categories,  
46  
47 related to (i) market, (ii) product, and (iii) manufacturing characteristics; as suggested in Olhager  
48  
49 (2003). These issues are outlined in Table 3.  
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53

54 \*\*\* Table 3 \*\*\*  
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59 Even though all of these issues can influence the positioning of the CODP for a particular product,  
60  
typically two main issues form the basis for the CODP positioning decision. The first main issue is the  
P/D ratio, *i.e.* the ratio between the production lead time and the delivery lead time, which indicates

1  
2 whether market requirements make MTO possible or if some prefabrication is necessary. The second  
3  
4 main issue is the demand volatility, which indicates to what extent it is possible or reasonable to make  
5  
6 products to order or to stock. Low volatility means that the item can be forecast-driven. However, high  
7  
8 volatility makes forecasting difficult, wherefore such items typically need to be produced to order.  
9  
10 Olhager (2003) discuss how these two issues can be combined in an approach for selecting the  
11  
12 appropriate position for a CODP for products.  
13  
14

#### 15 16 17 **4. Different foci around the CODP**

18  
19 In the following, we will let MTO include ETO environments, which from a material flow point of  
20  
21 view are similar. Furthermore, we let MTS include all options regarding keeping inventory in the  
22  
23 distribution system; at distributors, wholesalers or retailers. In all these environments, the product is  
24  
25 produced to stock with respect to the form; however, they may differ in terms of time and space relative  
26  
27 the ultimate customer. Although the literature suggests and discusses different possible positions of the  
28  
29 CODP, the characteristics of them boil down to two fundamentally different manufacturing  
30  
31 environments, MTO and MTS environments; *cf.* Figure 2. ATO environments can be viewed as a  
32  
33 combination of these two with the CODP separating the two; MTS upstream to replenish the inventory  
34  
35 of semi-finished goods or modules, and MTO for finalising the product configuration to customer  
36  
37 order; *cf.* Figure 2. Next we will investigate the relationships between different approaches to  
38  
39 manufacturing focus relative the CODP to evaluate the level of applicability to the different parts of the  
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41 manufacturing value chain.  
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50 \*\*\* Figure 2. \*\*\*  
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#### 56 **4.1. Product focus and the CODP**

57  
58 The fundamental characteristic associated with product focus is that a single product or a generic group  
59  
60 of products forms the basis for the design of the manufacturing system; *cf.* Table 2. The resources that  
are required are positioned such as to facilitate the speedy manufacture of products through the system.

1  
2 The similarity of resource requirements and the total demand volume for the product or product group  
3 allows for the use of dedicated equipment. Typically, a product focus is applied to stable, high-volume  
4 environments, *e.g.* in the maturity stage of the product life cycle (Hill 2000). In such environments the  
5 main competitive priority (the main order winning criterion) is price, and the products are made to  
6 stock. Relating these aspects concerning product focus to the manufacturing operations upstream versus  
7 downstream a CODP, the critical issue is the fact that the CODP is the last point where inventory is  
8 held. MTS operations are only found upstream the CODP, basically by definition. Upstream the CODP  
9 the items have volume and variety properties that allow the items to be produced to stock.  
10 Consequently, a product focus is applicable to operations upstream the CODP.  
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#### 24 **4.2. Process focus and the CODP**

25  
26 The fundamental logic when applying a process focus is that it concentrates on one or a few  
27 manufacturing processes that typically require specialised skills and capital-intensive technologies; *cf.*  
28 Table 2. With respect to these characteristics such process stages are typically not duplicated. If more  
29 capacity is needed it is typically located at the same facility in order to take advantage of the skills  
30 already present. With a manufacturing system containing general purpose equipment to supplement the  
31 key manufacturing processes, a process focus is used for products that are made to order or engineered  
32 to order. Typically the manufacturing firm sells manufacturing competence and capability related to  
33 one or a few key processes. Furthermore, it is typically applied to the early and late product life cycle  
34 stages, where volumes are low and volatile. Relating these process focus aspects to the CODP concept,  
35 the critical issue is that products are made or engineered to order. Thus, a process focus cannot be  
36 applied to operations upstream the CODP. Instead, product customization and low and volatile demand  
37 per individual item belong to operational characteristics downstream the CODP. Consequently, a  
38 process focus is applicable downstream the CODP.  
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#### 58 **4.3. Task focus and the CODP**

59 The task focus approach means that products are grouped based on similar order-winning criteria; *cf.*  
60 Table 2, which implies that the products require similar manufacturing tasks. Such grouping of

1  
2 products makes it clear which particular performance objectives support the strategic plan and that has  
3  
4 to be met by the manufacturing system. This also means that products may have to change  
5  
6 manufacturing system if the competitive priorities change. With respect to the changes in demand  
7  
8 volume and volatility, and product variety during a product life cycle it is likely that the competitive  
9  
10 priorities change accordingly (Hill 2000, Hayes and Wheelwright 1984). With a shift in manufacturing  
11  
12 task the products would better fit together with other products with the similar set of competitive  
13  
14 priorities. Still, this approach to focus is consistently based on the principle of competitive priorities  
15  
16 and manufacturing task. As a consequence, the focus will sometimes resemble a product focus and  
17  
18 sometimes resemble a process focus, since product and process foci are associated with different sets of  
19  
20 competitive priorities. Thus, from a product life cycle perspective a manufacturing focus based on  
21  
22 competitive priorities will be alternating over time from the introductory to the mature to the late  
23  
24 phases. Combining this approach to focus and the CODP, with its inherent nature of MTS upstream and  
25  
26 MTO downstream (*cf.* Figure 2), it can be deduced that different manufacturing tasks are required  
27  
28 upstream and downstream the CODP, since the competitive priorities are different. The manufacturing  
29  
30 task upstream is to provide for low cost manufacturing and high service level at the CODP. The task  
31  
32 downstream, related to customer orders, is to manufacture to customer specification and to provide for  
33  
34 short and accurate lead times in order to attain good delivery performance. In principle, the use of a  
35  
36 task focus implies that the upstream part will resemble a product focus and the downstream part a  
37  
38 process focus.  
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##### 48 **5. A model for differentiating focus with respect to the CODP**

49  
50 Combining the characteristics of a manufacturing system around the customer order decoupling point  
51  
52 with the characteristics of different approaches to focus reinforces that there are two fundamentally  
53  
54 different parts along the total manufacturing value chain, and that the point around which  
55  
56 differentiation is needed is the CODP; *cf.* Figure 3. These two parts require different foci and  
57  
58 manufacturing tasks based on the different sets of competitive priorities that dominate each respective  
59  
60 part. In Figure 3, we add the key property and the major performance improvement priority of each

1 part. The two major properties of manufacturing systems are productivity and flexibility (Grubbström  
2 and Olhager 1997). Productivity is required if the products are made to stock and compete on price.  
3  
4  
5  
6 Flexibility is typically not needed for such environments and would only lead to higher costs. The  
7  
8 reverse interest in key properties holds for customized, make-to-order products where delivery speed  
9  
10 and reliability are the major competitive priorities. Performance improvement initiatives should be  
11  
12 linked to the competitive priorities, the manufacturing task, and the key properties. Consequently, cost  
13  
14 reduction is vital in MTS environments whereas lead-time reduction is vital in MTO environments.  
15  
16 Fisher (1997) discusses a similar distinction for enhancing performance in physically efficient versus  
17  
18 market-responsive supply chains.  
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26 \*\*\* Figure 3. \*\*\*  
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### 31 **5.1. Make-to-stock companies**

32  
33 The typical MTS company practically only experience an upstream part since they deliver directly from  
34  
35 the finished goods inventory. For these companies the demand is characterized by high volume per  
36  
37 individual item, fairly stable demand that can be predicted with high accuracy, a natural setting for  
38  
39 applying product focus. The competitive priorities important in this setting are, besides quality that is to  
40  
41 be considered a market qualifier, delivery reliability and price *i.e.* an organisation with high level of  
42  
43 productivity. Formulating a manufacturing task for the upstream operations should end up in a mission  
44  
45 statement including low cost manufacturing and high stock availability at the CODP. Since price is a  
46  
47 dominant priority most of the performance improvement efforts should include productivity gains *e.g.*  
48  
49 cost reduction, while not jeopardising the delivery reliability. Companies that operate in a MTS  
50  
51 environment should focus their entire organisation towards high productivity, *i.e.* one single focus.  
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57

### 58 **5.2. Make-to-order companies**

59 Situations that require an MTO approach are when the products offered are made to customer  
60  
specification, which reduces the opportunities for advance planning. The downstream part of the

1  
2 manufacturing value chain is where all the customization takes place, wherefore demand predictability  
3  
4 is low. The uncertainty involves both product configuration (within the limitations of the company  
5  
6 product breadth) as well as the level of actual demand. To deal with the uncertain environment the  
7  
8 organisation needs to be flexible in terms of capacity and versatility. The manufacturing task for such  
9  
10 an organisation is to manufacture to customer specification and to achieve short and predictable lead  
11  
12 times. High delivery reliability is important to keep customer promises while short delivery lead times  
13  
14 might win orders from competitors. Efforts to improve performance in the operations downstream  
15  
16 should emphasize the reduction of lead times, although keeping a high level of flexibility intact.  
17  
18 Companies that manufacture to customer specification should apply a focus for flexibility and speed for  
19  
20 all operations within the company, one single focus.  
21  
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23  
24  
25

### 26 **5.3. Assemble-to-order companies**

27  
28 Companies that operate in ATO environments face very interesting manufacturing challenges since  
29  
30 they comprise both downstream and upstream operations. Often, such companies manufacture semi-  
31  
32 finished goods or modules to an intermediate stock point from where end products are assembled upon  
33  
34 customer order. For these companies a dual foci approach should be employed, focus towards  
35  
36 productivity and low cost for the MTS-type operations upstream the CODP and focus for flexibility and  
37  
38 speed for the MTO-type operations downstream. This means that the organisation no longer should  
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40 have only one focus and should therefore no longer be managed in one and the same way. Instead, the  
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42 relative stability and predictability of upstream operations should be exploited by focusing on the  
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44 products produced and emphasising cost reduction initiatives. At the same time enough excess capacity  
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46 downstream should be employed to be able to offer short and precise delivery lead times, prioritising  
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48 improvement efforts aimed at shortening them. Thus, the rationale of the dual foci approach is to  
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50 facilitate cost efficiency where appropriate while simultaneously provide short and dependable delivery  
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52 lead times.  
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#### 5.4. Methodology

In order to aid practitioners and others in achieving a focus differentiated manufacturing system we propose the following methodology:

1. Identify the CODP.
2. Differentiate the operations between upstream and downstream.
3. Apply different foci for these two parts:
  - (a) Focus on productivity for the operations upstream the CODP.
  - (b) Focus on flexibility for the operations downstream the CODP.
4. Continuously improve the operations with respect to the focus at each part of the flow (cost reduction upstream and lead-time reduction downstream) and monitor the market requirements in terms of competitive priorities.

If this methodology is pursued each manufacturing system will have a single distinct CODP, which makes it easy to apply an MTS-type focus for the upstream part and an MTO-type focus for the downstream part. The rationale for separating products with pure MTS into one manufacturing system and products with pure MTO into another is that this approach typically coincides with grouping products based on the order winning criteria as suggested by Hill (2000); see also the Rohm and Haas case (D'Alessandro and Baveja 2000). If the market requirements change for a product, the fundamental issue is whether the product should change from a MTS to a MTO fashion or if the CODP should shift forward or backward to some degree. The most interesting area is for those companies that have an internal CODP for some products, implying that the internal material flow for these products need to be split up into two distinct parts; the upstream focusing on productivity and cost reduction and the downstream focusing on flexibility and lead time reduction.



## 6. Discussion and managerial implications

In this paper we have reviewed the concept of manufacturing focus, condensed the number of approaches to focus in the literature to three basic types, and discussed their merits relative the customer order decoupling point. The use of competitive priorities and manufacturing task as the approach to focus is likely to be appealing to practitioners; however, we show that this approach to focus will take on different forms depending upon the market and product characteristics, alternating between product or process foci. Practitioners intuitively experience and appreciate that MTO operations need to be managed differently than MTS operations on a number of accounts, wherefore it is a natural basis for selecting focus. We therefore suggest that the distinction between MTS and MTO operations is a simpler and more direct approach to selecting focus. What is especially intriguing is the approach needed for firms operating in assemble-to-order environments, requiring a focus differentiation between the upstream part and the downstream part of the manufacturing value chain relative to the customer order decoupling point. Here, it is not sufficient to have a single focus for the entire manufacturing system. Instead, different foci need to be applied around the customer order decoupling point. We propose that the customer order decoupling point acts as a base for differentiating manufacturing focus, and provide a framework for the choice of focus approach for operations upstream versus downstream the CODP including key properties for the manufacturing system and performance improvement priorities. We hope that this framework will contribute to a fuller understanding of the concept of manufacturing focus and the role of the CODP, as well as aid practitioners in the design of manufacturing systems that can more effectively support the products in the marketplace.

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Table 1. Approaches to focus in the literature

Focus area	Author											
	Skinner (1974)	Hayes & Schmenner (1978)	Hill & Duke-Woolley (1983)	Hayes & Wheelwright (1984)	Ettlie & Penner-Hahn (1990)	Lee (1992)	Bozarth (1993)	Schroeder & Pesch (1994), Pesch & Schroeder (1996)	Sheu, (1994), Sheu & Krajewski (1996)	Brush & Karnani (1996)	Skinner (1996)	Hill (2000)
Product	X	X	X	X		X		X		X		X
Process	X	X	X	X		X		X		X		X
Market	X			X								
Volume	X			X				X	X			
Competitive priorities & manufacturing task	X		X		X		X	X	X		X	X

Table 2. Major characteristics, advantages, disadvantages, and environmental fit for the three main focus areas

Focus area	Product	Process	Task
Characteristics	A single product or a generic group of products that have similar resource requirements (Chambers, 1997, Hill 2000) Marketing's view on the business (Hill 2000, Hayes and Wheelwright 1984)	General purpose facility (Chambers 1997, Hill 2000)	Grouping of products with similar order-winning criteria (Chambers 1997, Skinner 1996, Hill 2000) Manufacturing's view on the business (Hill 2000) Meet the particular performance objectives that would support the strategic plan of the unit (Skinner 1996)
Advantages	Similar process requirements allows for a dedicated facility (Chambers 1997, Hill 2000) Facilitates new product introduction (Hayes and Wheelwright 1984) Simplifies product cost estimation (Hayes and Wheelwright 1984)	Concentrates specialized skills and capital-intensive technologies (Chambers 1997, Hayes and Wheelwright 1984) Minimum duplication of plant involved (Chambers 1997, Hill 2000, Hayes and Wheelwright 1984) Encourages standardization (Hayes and Wheelwright 1984)	Greatest potential for creating effective and efficient infrastructures (Chambers 1997, Hill 2000) Narrow range of order-winners (Hill 2000)
Disadvantages	Can create inflexibility; vulnerable to volume and mix variations (Chambers 1997) Duplication of resources across several facilities (Sheu 1994, Hayes and Wheelwright 1984) Product transfers become awkward (Hayes and Wheelwright 1984)	Higher costs of coordination (Hayes and Wheelwright 1984) Slow response to new product and market requirements (Hayes and Wheelwright 1984)	Products and toolings must be moved from plant to plant when the order-winning criteria change (Chambers 1997)
Applicability	Most appropriate in stable, high-volume environments (Chambers 1997, Hill 2000)	Most appropriate in early and late product life stages (Hill 2000)	Generally appropriate (Skinner 1996, Hill 2000)

Table 3. Factors that affect the position of the customer order decoupling point (based on Olhager, 2003).

Category	Factor	Characteristics
Market	Delivery lead-time requirements	Restricts how far backwards the CODP can be positioned. A benchmark for manufacturing lead-time improvements in order to make delivery speed an order winner.
	Demand volatility	Indicates to what extent it is possible or reasonable to make products to order or to stock.
	Demand volume	Related to the position in the product life cycle.
	Product range	A broad product range makes it impossible to provide products on a make-to-stock basis.
	Product customisation requirements	A wide set of customisation required by the customer makes it impossible to provide on a make-to-stock basis.
Product	Customer order size and frequency	Indicators of volume and the repetitive nature of demand. Large customer order sizes are typically associated with high demand volumes. High frequency leads to repetitive demand making forecasting easier.
	Seasonality of demand	Typically uneconomical for the manufacturing firm to respond to all demand when it occurs.
	Modular product design	Typically related to assemble-to-order operations. Often a response by the producer to create a variety of choices for the customer, a relatively short delivery lead time, and manufacturing efficiency for upstream operations.
	Customisation opportunities offered	If the customisation offered is wide and affects the product at early production stages, a make-to-order policy is necessary, whereas if customisation enters at a very late production stage assemble-to-order may be more appropriate.
Manufacturing	Material profile (V, A, T, etc)	The CODP is typically positioned at the material profile waist, where the independent demand occurs.
	Product structure complexity	A deep product structure typically corresponds to long cumulative manufacturing lead times. The various paths of the product structure need to be analysed in terms of lead times to determine where in-process inventories need to be kept relative the delivery lead time requirements.
	Manufacturing lead time	Poses a major constraint on the CODP position, relative the market delivery lead requirements.
Manufacturing	Number of planning points (work centres)	Restricts the number of potential CODP positions. In a job shop where individual resources are planned the variety for positioning the CODP is large. A dedicated line or continuous process can be treated as a single production unit and therefore offers only two possibilities; before or after the process.
	Flexibility	A prerequisite for producing to order. A wider range of products and customisation can be accommodated in the production system.
	Bottleneck position	It is advantageous to have the bottleneck upstream the CODP, so the bottleneck does not have to deal with volatile demand and a variety of different products.
	Sequence-dependent setup times (or dominant setup times)	Best positioned upstream the CODP. Such resources can easily turn into bottlenecks without proper sequencing, and are not desirable for downstream operations.

1  
2 Figure 1. Different product delivery strategies relate to different CODPs. The dotted lines depict the  
3 production activities that are forecast driven, whereas the solid lines depict customer order driven  
4 activities (based on Sharman (1984)).  
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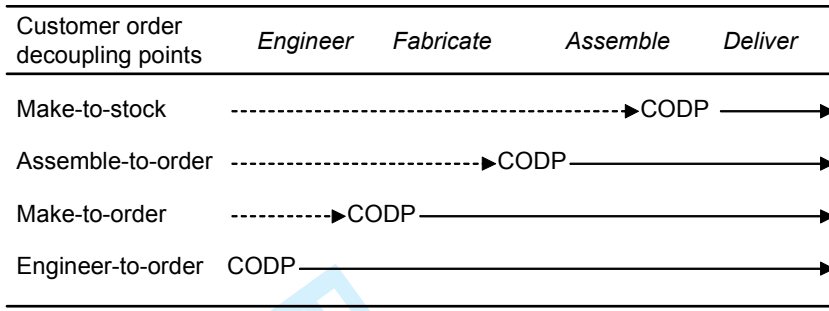
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7 Figure 2. Operations upstream and downstream the CODP are fundamentally different  
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10 Figure 3. Differentiating manufacturing focus upstream and downstream the CODP  
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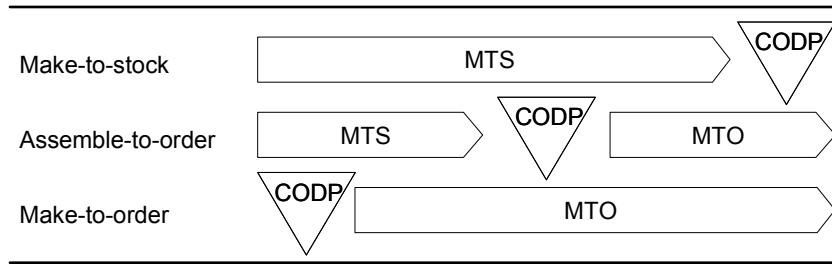
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Figure 1.



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Figure 2.



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Figure 3.

