6th International Conference on Industrial Engineering and Industrial Management.
XVI Congreso de Ingeniería de Organización. Vigo, July 18-20, 2012

Leagility in Enterprise Networks Configuration of Capital Goods Sector

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Abstract The paper reviews the characteristics of lean and agile paradigms as well as the different order fulfilment strategies, through the position of the Order Penetration Point (OPP). Based on an empirical study, the paper explores the findings of the literature review applied to the capital goods sector. It analyses four distinguishing factors between the lean and the agile paradigm: typical products, marketplace demand, product variety and customer drivers in combination with the different OPP positions: ETO, MTO, ATO and MTS.

Keywords: Agile, Lean, Leagility, Networks Configuration, Capital Good Sector

1.1 Introduction

Markets have become global and it is vital that the operations management research focus on enterprise networks and not only in a single factory. This need was detected during the late 1970s and the early 1980s when some practitioners realised the necessity to manage not only the single factory, but also enterprise networks. Rudberg and Olhager (2002) state that, although the new trend is to fo-

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cus on enterprise networks, the research performed during this period covers only single organizations.

A decade after, the market in which companies developed their activity was characterised by an increasing demand, calling for a wider range of products, with good quality, a low profit margin and a high level of service (Bolwijn and Kumpe, 1998 and Brown & Eisenhardt, 1998). For this reason, the research on operations management was addressed to enterprise network issues (Shi and Gregory, 1998 and Khurana and Talbot, 1999).

1.2 Lean and Agile Paradigm (Leagility) in Enterprise Networks Configuration. Literature Review

Mason-Jones et al. (2000) develop an approach to configure enterprise networks taking into account the lean and agile paradigm and the position of the Order Penetration Point (OPP), also termed decoupling point. The concept of OPP and its appropriate position have been widely studied in the literature and it has been contemplated as an effective strategy to get the right product, at the right price, at the right time to the consumer. The OPP defines the point where a particular product is linked to a specific customer order.

Agility means using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile market place. Whereas, leanness means developing a value stream to eliminate all waste, including time, and to enable a level schedule. The combination of agility and lean in enterprise networks via the strategic use of an OPP has been defined as "leagility" (Naylor et al., 1997).

Mason-Jones et al. (2000) make an identification of the main distinguishing factors between the lean and the agile paradigm in order to define different networks' configurations:

Table 1.1 Main distinguishing factors between the lean and the agile paradigms.

Distinguishing attributes	Lean network	Agile network
Typical products	Commodities	Fashion goods
Marketplace demand	Predictable	Volatile
Product variety	Low	High
Customer drivers	Cost	Availability
Product life cycle	Long	Short
Profit margin	Low	High
Dominant costs	Physical costs	Marketability costs
Stockout	Long term contractual	Immediate and volatile
Purchasing policy	Buy goods	Assign capacity
Information enrichment	Highly desirable	Obligatory
Forecasting mechanism	Algorithmic	Consultative

From the total value provided to the customer, the main difference between leanness and agility is that service is the key factor for agility whilst cost, and hence the sales price, is essential for lean.

By varying the position of the OPP, Mason-Jones et al. (2000) model highlights different common configurations' structures. These structures range from providing unique products to an end-user that is prepared to accept long lead times (engineer-to-order) through to providing a standard product at a fixed location (make-to-stock).

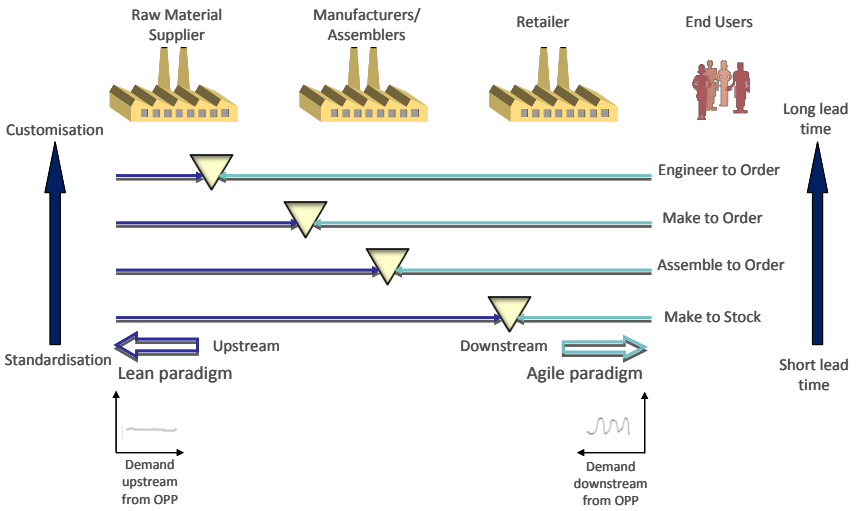

Fig. 1.1 Approach of the different networks' configurations (Adapted from Hoewstra and Romme, 1992).

The lean paradigm can be applied to network upstream of the OPP as the demand is smooth and standard products flow through a number of value streams. Thereafter the agile paradigm should be applied downstream from the OPP as demand is variable and the product variety per value stream has increased.

1.3 Empirical Study in the Capital Goods Sector

A quantitative study was performed by means of the development of an online survey*. The main objective of the survey was to gather information from a representative sample of European capital goods manufacturing plants in order to identify the main paradigm used in the capital goods sector by means the distinguishing factors between the lean and the agile paradigms and the position of the OPP.

* Survey URL: http://www.remplanet.eu/ResilienceSurvey

- Distinguishing factors between the lean and the agile paradigms.

The study performed is only focused on the first 4 distinguishing factors of Table 1.1:

– Typical products.

This factor is analysed with regard to the different customisation degree. Most companies offer some type of product customisation. Only 20% point out that their product is standard and cannot be customised. Special characteristics of the target market for capital goods manufacturers lead to a high percentage of companies (28%) to provide highly customised products (unique products) where participation of design and production engineering departments is a prerequisite. Often, companies have catalogues in which products take in a set of standard options that can be combined with tailor-made options to cover specific customer needs (35%). To a lesser extent, 17% of companies offer to market products that can only be configured from a number of standard options with no custom development.

Fig. 1.2 Degree of product customisation

– Marketplace demand.

The empirical study analyses the demand characteristics over the past 5 years. A large majority of companies (87%) states that current economic crisis, which is taking place worldwide, has increased dramatically the volatility and uncertainty of demand directly concerning their productive activity.

Table 1.2 Demand characteristics over the past 5 years.

	No	**Yes**
Stability: demand is distributed more or less regularly throughout the year	59%	41%
Volatility and uncertainty: demand has changed abruptly due to the economic cycle	13%	87%

– Product variety

In order to analyse the product variety, the number of different product families that are in the catalogue of the companies is studied. The results show that companies have product catalogues with a high varied product range. Most of them (38%) have a wide catalogue that includes more than ten product families and, on the contrary, only 9% have one product family.

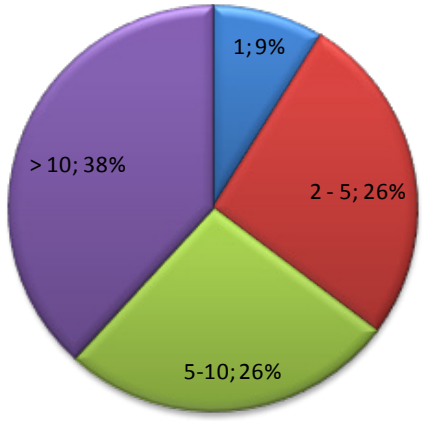

Fig. 1.3 Number of different product families in the catalogue

– Customer drivers

Additional services as product delivery time, quality, customisation and consistence with commitments offered by companies are very well valued by customers. Whereas, price of the product, while important, is not decisive for purchasing decisions.

Table 1.3 Competitive factors valued by customers.

		Not Relevant	Little Relevant	Relevant	Very Relevant	Decisive
	Product price	0%	10%	47%	27%	17%
Services	Product quality	0%	0%	13%	38%	50%
	Product customisation ability	9%	13%	6%	25%	47%
	Consistency with commitments	0%	0%	22%	41%	38%

- The position of the OPP.

Companies in the sector of capital goods embrace one or more order fulfilment strategies, which are defined by the position of the OPP, based on the target market and product characteristics. Main strategies referenced in the production management literature are present in the sample. Strategies such as Engineer to Order (ETO) in 55% of the cases and Make to Order (MTO) in 18% are the most common. Both comprise design and manufacturing activities to meet product charac-

teristics with customer needs. These strategies are usually associated with complex and technical products and long lead times requiring a high level of customisation (e.g. machine tool). Pressure exerted by markets demanding shorter delivery times, is driving companies to adopt different strategies such as Assembly to Order (ATO) (16%) in which final products are manufactured from standard components or modules that are assembled based on orders received. This strategy involves the assumption of high risks due to the large investment in inventories companies require and the great uncertainty on market performance concerning forecasts made. Product complexity, wide configuration options possibilities alongside a frequent small number of orders hugely complicate forecasting. Finally, only 11% of the companies supply their products from stock.

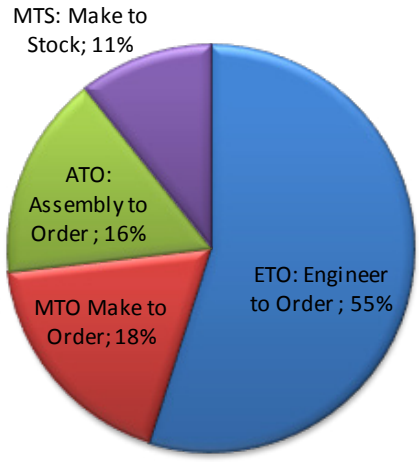

Fig. 1.4 Order fulfilment strategies used by companies.

Sanchis et al., (2012) performed a study of the capital good sector in which they corroborated that a correlation between the degree of product customisation and the position of the OPP exists. They state (based on empirical data too) that the capital goods sector products are mainly complex and customisable products from a catalogue with standard options and unique products with complete design and production engineering and the producers chose MTO and ETO as the main strategies to manufacture these types of products.

1.4 Correlation between the distinguishing attributes of lean and agile paradigm and the position of the OPP

In order to analyse Mason-Jones et al. (2000) approach applied to the capital sector, the data of the four distinguishing attributes of the lean and agile paradigm, al-

ready studied in isolation in the previous section, have been crossed with the data of the different order fulfilment strategies, which are the different positions of the OPP (Table 1.4).

Table 1.4 Correlation between the distinguishing attributes of lean and agile paradigm and the position of the OPP.

	Typical products		Marketplace demand		Product variety		Customer drivers	
	Standard and configurable	Customisable and Unique	Stability	Volatile	Low	High	Cost	Availibility / Service
ETO	0%	100%	3%	97%	38%	61%	49%	51%
MTO	49%	51%	15%	85%	30%	72%	43%	57%
ATO	100%	0%	24%	76%	18%	83%	44%	56%
MTS	100%	0%	33%	67%	36%	65%	48%	52%

With regard to the typical product factor, the capital good sector offers an agile response when products have high degree of customisation in order to adapt its network to the high variety of customers' requirements, using mainly ETO strategy. However, when products are standard or present low customisation degree, the capital goods sector seems to approach to a more costs efficient structure than a flexible one and to do so, the strategies most used are ATO and MTS.

The correlation study also shows that although in some cases the demand is predictable, the specific requirements of customers make difficult the task of forecasting. Moreover, currently markets are characterised by an increasingly volatile and unpredictable demand amplified by the situation of global economic crisis. For this reason, in this type of competitive environment, it seems that the most important value for the capital goods sector is to maximise its ability to configure their processes and operations to the demand requirements, being as flexible as possible. For this reason, capital goods producers apply ETO and MTO to face up to this unpredictability.

The factor of product variety has been studied considering the different product families in the catalogue and the capital goods sector offers a high range of products families. The four order fulfilment strategies analysed in this studied present high percentages of product variety, being MTO and ATO the ones that offer the highest levels of product variety. The capital goods manufacturers that adopt MTO have their production systems ready to offer a wide range of product combinations from the initial production stages and the manufacturers that use ATO, also offer high product variety to the customer through the combination of standard options that are already in stock. In the case of ETO and MTS, the product variety decreases. In the first case, it may be due to the fact that the product is highly customisable but with fewer options to choose, and in the second case, because the finished product demand is very difficult to predict.

Finally, the customer preferences are equally balanced. Customers require to the capital goods sector to configure its network as efficiently as possible both in price and in additional services, such as quality, availability of products on time or consistency with commitments. Therefore, the capital goods sector should apply the lean and agile approaches to depending on different aspects such as the cus-

tomisation degree or complexity of products, the preferences of each specific customer, among other. All these aspects also support the adoption of one order fulfilment strategy or another.

1.5 Conclusions

The analysis of the distinguishing attributes between the lean and agile networks in the capital goods sector shows that agility is one of the most required features to configure networks in order to give the quickest response to customers. Moreover, it seems that there is a correlation between the agile paradigm and the OPP position. In the capital goods sector, the ETO strategy is aligned with the distinguishing attributes of Mason-Jones et al. (2000) approach.

Acknowledgement

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° NMP2-SL-2009- 229333.

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