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THE SUCCESS FACTORS FOR SUPPLY CHAINS OF A SHORT LIFE CYCLE PRODUCT

Abstract: The supply chain is one of the most common concepts, broadly described and examined in logistics literature. However, hardly ever in the literature has attention been paid to relating specific methods and techniques used in supply chain, which would facilitate effective organisation management with the external conditions and operating environment. The paper presents the influence of a short life cycle product on supply chains in a context of the uncertainty and variability of customers' demand. In a later part of the paper, specific practical solutions for an effective supply chain of a short life cycle product are presented. The considerations are supported by the analysis of the selected illustrative case studies presenting practical initiatives taken by companies.

Keywords: supply chain, short life cycle product, uncertainty and variability of customer's demand.

1. Introduction

The term supply chain has risen to prominence in logistics over the past years and has been a subject of intense research both in theoretical and empirical frameworks. There are many reasons for the successful adaptation of the concept. In the opinion of J.T. Mentzer *et al.* there is a number of major reasons for the popularity of supply chains: trends in global sourcing, an emphasis on time and quality based competition, and their respective contributions to greater environmental uncertainty (Mentzer 2001).

Despite its common understanding, various definitions of a supply chain have been offered in the past several years, as the concept has been gaining popularity. For the purposes of this paper, the supply chain is defined as a set of three or more companies directly connected to one another by one or more upstream and downstream flows of products, services, finance and information from a source to a customer (Mentzer 2001). While considering a supply chain concept, two-way

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arrows indicate more than just a products flow. There are at least two more flows – of information and finance, apart from material flow in each supply chain. Figure 1 presents the supply chain structure.

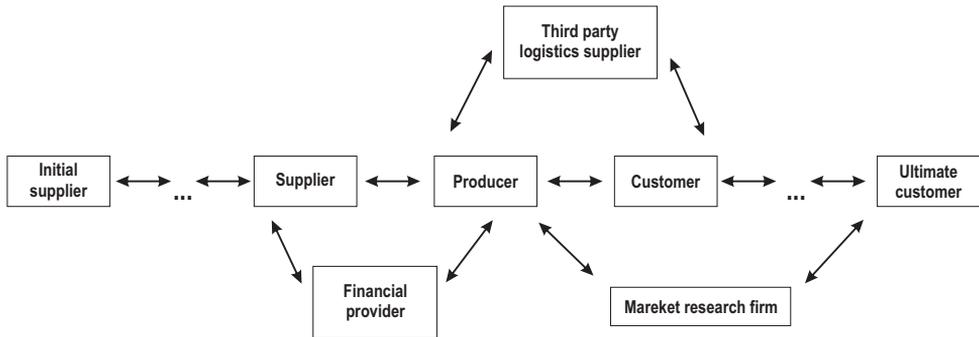


Fig. 1. *The structure of a supply chain*

Source: (Mentzer 2001)

Figure 1 illustrates a complexity that a supply chain can reach. In this example, a third-party financial provider may be providing financing, assuming some of the risk, and offering financial advice; a third-party logistics provider carries out the logistics activities, between two of the companies and a market research firm, provides information about the ultimate customer to a company well back up the supply chain. This briefly illustrates some of the numerous functions that complex supply chains can perform (Mentzer *et al.* 2001).

When organising an effective supply chain, two major elements should be taken into consideration:

- 1) Specific drivers which address the issue of external factors determining the attributes a supply chain must possess to be effective in a particular industry. In other words, the drivers require organisations to adjust. This directly relates to the concept of 'order qualifiers' developed by T. Hill, who argues that it is for every organisation important to understand what the baseline is for the entering into a specific competitive arena (Hill 1993).
- 2) Specific enablers which are perceived as a means of operating in a way that enable supply chains to enhance organisations' competitive position and achieve the desired level of characteristics required in a specific industry. It can be related to the concept of 'order winners', which assumes means that to actually win the order an organisation must implement specific capabilities.

Specific drivers of organising effective supply chains may be traced to the changes occurring in the economic and technological environment. Factors influencing these changes are: trends in the creation of the global market and a worldwide economy, a necessity to gain control over new markets with view to exert larger influence on customers, as well as a need to fight the growing pressure from the competition, the dynamic development of information technologies, the increasing

pressure from customers (driven by their newly discovered, more refined needs), the need to reduce the cost of the activity, the development of new techniques and methods of managing, the capital expenditure, and finally scientific, technological and development research, whose high level exceeds the financial capabilities of individual companies.

The listed external factors to a large extent have forced companies to look for more effective ways to coordinate the flow of materials into and out of the company, plan and develop methods and tools (logistics and non-logistics) contributing to achieving their objectives and higher level of supply chain performance.

2. Short life cycle product as a driver of changes in supply chains

The 21st century marketplace is characterised by an increasing number of changes. One of such important changes is the nature of customers' demand mainly characterised by two attributes: variability and uncertainty. According to A. Bhattacharya, *et al.*, variability and uncertainty of customers' demand may cause 'swirls, blockages and pileups' (Bal *et al.* 1999). This opinion is supported by R.I. van Hoek, who argues that uncertainty about customers' demand leads to large upswings and downswings in the need for capacity and in inventory levels. This effect ripples through the supply chain and gets worse further from the end customer (van Hoek 2001).

This article mainly focuses on a product life cycle as one of the consequences of demand's variability and uncertainty¹. There are numerous other elements which affect a life cycle of product, such as: continuous development of information and communication technology, summary technological progress, competition progress and diversity of consumer tastes.

The product life cycle is an important element in devising an effective supply chain. It can be defined as a length of time from the stage of product's introduction in a specific market, through the growth and maturation to the product's decline in this market. In many contemporary industries, product life cycles are continuously shortening.

According to P. O'Connell, President of Operations Concepts Incorporation, a standard product life cycle lasts up to two years. In the opinion of M.L. Fisher, a short life cycle product varies from three months to one year and longer product life cycle is over two years (Fisher 1997). This view is also supported by H. Peck

¹ The product life cycle is tightly related to the number of other market characteristics, such as: demand predictability, product variety, market standards regarding lead time and service, profit margin, stock-out penalties, purchasing policy, forecasting mechanism, dominant costs, etc. However, despite those variables, which may describe a specific industry from many different perspectives, most authors artificially limit their considerations to building the continuum with two extremes and highlighting only completely stable and dynamic market-place. The fundamental criterion for such classification is the extreme intensity level (the lowest and the highest) of listed variables. See: R. Mason-Jones, B. Naylor, D.R. Towill: *Engineering the leagile supply chain*. International Journal of Agile Management Systems, Vol. 2, No.1, 2000, pp. 54–61.

and M. Christopher, who argue that a short life cycle product lasts up to 12 months (Peck *et al.* 2002).

For the purposes of this paper, a short life cycle is defined as a life cycle whose length in a specific industry, from the stage of product launch to the decline phase is up to two years. The short life cycle is mainly characteristic of the following industries: information technology (esp. personal computers, printers), telecommunications market (mobile phones), clothing industry (jeans) and such products as: fashion goods, electronic equipment, toys, jewellery, books and CDs.

The shortening of a product life cycle is mainly connected with the permanent development of technology, the implementation of new solutions and the improvement of old products.

The specific stages of the product life cycle can be referred to both the demand uncertainty and its variability (Fig. 2). The uncertainty of customers' demand is presented by A. Bhattacharya, *et al.* In their opinion, the disturbances in a product flow caused by frequent and unexpected changes in demand can be called *turbulence*. They classify turbulence into several categories. Two of them are specifically relevant to the products which have short life cycles, namely: design and volume.

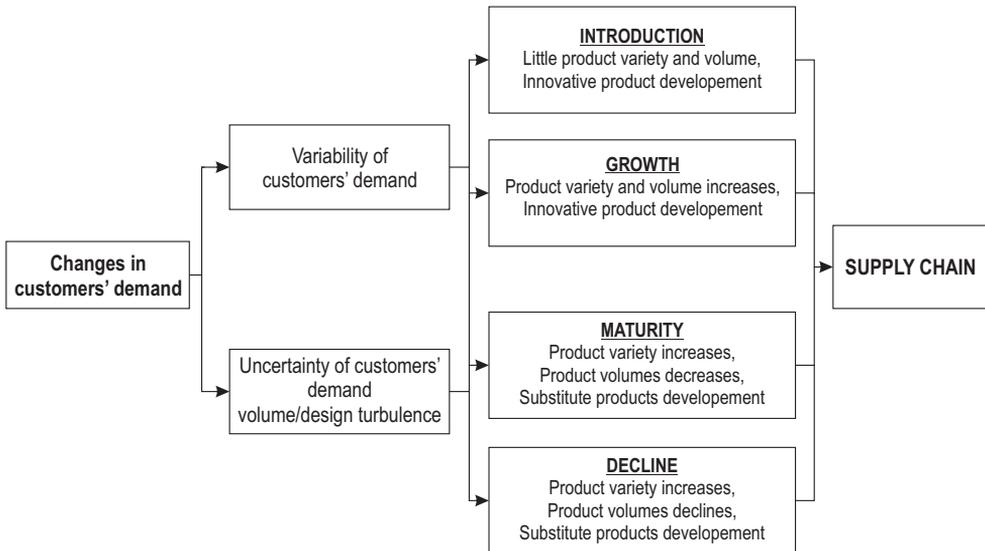


Fig. 2. The influence of changes in the nature of customers' demand on the supply chain from the perspective of a short life cycle product

Source: Own study

Design turbulence relates to disturbances caused in the production flow by changes in a product design. This kind of turbulence is very likely to occur when manufactured products have short life cycles or go through numerous design changes within their life cycle. This is precisely the case in mass customised markets such as the automotive industry (Saisse *et al.* 1995).

Volume turbulence is a consequence of changes in total production volumes and usually occurs in the form of capacity constraints or materials shortages. Manufacturing has to work with very short planning horizons and, consequently, may be prone to volume turbulence. Because products in mass customised markets have short life cycles, it is difficult to buffer variations in demand (even when they are expected) by building stocks. This is a particular problem in tiered supply chains, like automotive or aerospace (Bal *et al.* 1999).

The short life cycle of a product can also be a result of less predictable variance of customers' demand. The traditional four-step lifecycle passes several quadrants of variance, which influence the supply chain.

During the introduction phase, little volume and variety is in place. Volume increases in the growth phase and the supply chain has to get organised, formalised and structured to cope with the market. In the maturity phase, variety increases in a response to decelerating growth within the existing main product line and the supply chain has to be adjusted accordingly. In the decline stage, variety continues to increase as market segments scatter into micro markets, while volume declines (van Hoek 2001).

A short life cycle of a product results from customer's demand variability and uncertainty. The observed changes in specific industries influence the supply chain, forcing an organisation to be more responsive, flexible and, finally, agile. In the opinion of M.L. Fisher, products which have short life cycles require a fundamentally different supply chain than products having long life cycles (Fisher 1997).

Supply chain organisation must be able to cope with the effects of demand instability and learn to adjust to the permanent changes in customers' needs and requirements. In other words, organisations have to adopt modern initiatives (methods of management and supporting technical tools) which attempt to remove some of the causes of customers' demand variability and uncertainty, and thus to reduce investments and time-to-solutions.

3. The logistical and non-logistical enabler of supply chains for a short life cycle product

In order to suggest valid practices to cope with the variance and uncertainty of a customer's demand resulting from a short life cycle of a product, several methods and tools may be employed in supply chains. It should be stressed that the application of specific enablers in practice is in particular determined by the characteristics of industry in which a supply chain is operating.

There are several logistical and non-logistical methods and techniques to be planned and employed in specific areas of supply chain activity, such as: manufacturing, planning and forecasting, replenishment, inventory management, distribution and transport, as well as customer service. The appropriate implementation of those general initiatives may enable a specific supply chain to operate in industries in which short life cycle products occur. The activities which should be undertaken are illustrated in Table 1.

Table 1. *The logistical and non-logistical enablers of a supply chain for a short life cycle product*

Activity areas	Enablers of supply chain for a short life cycle product	Enablers of a supply chain for a long life cycle product
Planning	<ul style="list-style-type: none"> – Elementary planning – separate demand estimation for every product and service, followed by computing a single value for the company 	<ul style="list-style-type: none"> – Global/General planning – a single sales forecast is estimated for the company; it is possible with a robust range of products
Forecasting	<ul style="list-style-type: none"> – Heuristic methods of forecasting – Qualitative methods – Forecast by analogy 	<ul style="list-style-type: none"> – Quantitative methods – Statistical methods of forecasting
Manufacturing	<ul style="list-style-type: none"> – Flexible manufacturing systems – Highly automated systems – Manufacturing of a wide range of products – Outsourcing – Hybrid manufacturing processes: the number of manufacturing operations carried out in a technological process and the employees are delegated to the manufacturing of products with similar manufacturing requirements 	<ul style="list-style-type: none"> – Highly automated systems – Production lines
Inventories and warehouse management	<ul style="list-style-type: none"> – Manufacturing to order – Reducing a number of stored materials and products 	<ul style="list-style-type: none"> – Manufacturing for stock – Purchasing of products for stock
Replenishment (suppliers)	<ul style="list-style-type: none"> – Global replenishment systems – Long term contracts enabling flexible time planning and ordered quantities – Reducing a number of suppliers to those who offer the widest ranges of raw materials – Consolidation of orders from multiple sources – Using B2B Internet sites 	<ul style="list-style-type: none"> – Domestic and local suppliers – Frequent changes of suppliers – Long delivery times – Large number of suppliers – Traditional way of communication, no common and shared information systems
Customer service	<ul style="list-style-type: none"> – Customer is the driver of changes – Adapting the offering to the needs and preferences of end users – Quick response to market developments 	<ul style="list-style-type: none"> – Manufacturer, who determines the design and types of marketed products and services, is the driver of the process

Table 1. *contd*

Distribution and transport	<ul style="list-style-type: none"> – Cross-docking – Multimodal transport – Radial shipping systems – Extension of the offering concerning after-sale support of customers, which includes: technical and information service, customer training, help in product activation, etc. 	<ul style="list-style-type: none"> – Direct transport from the manufacturer to the customer
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Source: Adapted from: (Bozarth *et al.* 2007)

When considering a product life cycle, the responsiveness is required in the first (introduction) and last (decline) stages of the cycle. It is here that market opportunities are captured. In the other stages, efficiency and structured standardisation are more important (van Hoek 2001). The authors argue that in numerous market situations a pure marketing approach, depending on reversing the product life cycle, is sufficient no longer.

The only solution is involving a customer in supply chain design and product/service proposed development. Under this approach, the customer is the ultimate tier in the whole supply chain.

It entails asking customers to specify their demand by selecting from options and co-constructing the most relevant response to the opportunity, based upon direct interaction and link to the source of the opportunity (van Hoek 2001).

Variability and uncertainty of customers' demand exert significant influence on the organisations involved; for example, in clothes and new-technology trade. Consequently, objects are specific enablers which enable quick response to changes in customers' tastes and trends on the market.

A flexible approach to production, delivery and distribution can be observed in the companies successfully trading in clothes, e.g., Inditex Group, Big Star or in new-technology products, such as Hewlett-Packard and Cisco Systems. Specific enablers of the supply chain for these companies are shown in Table 2.

The breakdown table enables to the comparison of the enablers of supply chains for short life cycle product in the clothes and new technology sectors. The listed factors enable those companies to gain competitive advantage over competitors.

By comparing the examples presented in Table 2 with the logistical and non-logistical enablers of a supply chain for a short life cycle product (Tab. 1), we may conclude that in most cases the used methods and techniques support the management of a short life cycle product.

Based on the analysis of supply chains (Tab. 2), we can observe that forecasts and plans are made using heuristic methods of forecasting and qualitative methods as forecast by analogy. However, manufacturing is flexible and very often outsourced from the company, because it is a very labour- and time-consuming activity.

Table 2. *The logistical and non-logistical enablers of supply chain for hypothetical companies*

Activity area	Inditex Group	Big Star	Hewlett-Packard	Cisco Systems
Products design	<ul style="list-style-type: none"> – Employing young designers – Designs based on the local market research carried out at the main shops – Continuing monitoring 	<ul style="list-style-type: none"> – Central designing – Changing designs to include new market trends – Applying of special design devices like InvenTex or Easy Cut, which support immediate design processing in the electronic form with use of a production cutting plotter 	<ul style="list-style-type: none"> – Well developed R&D department – Focus on new technology development and launching novelties 	<ul style="list-style-type: none"> – Well developed R&D department – Focus on new technology development and launching novelties
Forecasting and planning	<ul style="list-style-type: none"> – Forecast based on market research and following customer requirements/ needs – Central planning of both quantity of produced devices and opening new shops 	<ul style="list-style-type: none"> – Performing market research – Following clothes market trends – Central planning 	<ul style="list-style-type: none"> – Creating new forecast methods – Forecasting by analogy – Elementary planning 	<ul style="list-style-type: none"> – Anticipation to get orders – Forecasting and planning based on sales orders
Manufacturing	<ul style="list-style-type: none"> – Flexible manufacturing systems – Manufacturing a wide range of products – Outsourcing of sewing 	<ul style="list-style-type: none"> – Flexible manufacturing systems – Manufacturing a wide range of products – Outsourcing to third parties (China) 	<ul style="list-style-type: none"> – Mass production – High degree of automation 	<ul style="list-style-type: none"> – Global virtual manufacturing – Manufacturing a wide range of products – Outsourcing the production, except for the technologically advanced products

Table 2. *contd*

Retail sale network	<ul style="list-style-type: none"> - Owned stores/sales network world-wide 	<ul style="list-style-type: none"> - No own sales network (other than the shop in Kalisz) - Sales orders executed through an agent or dealer 	<ul style="list-style-type: none"> - No own sales network - Sold products distributed by third-party network representatives 	<ul style="list-style-type: none"> - Sales through CCO (Cisco Connection Online), where orders are placed and order execution dates are agreed
Inventories and warehouse management	<ul style="list-style-type: none"> - Reducing volumes of stored materials and products - Purchasing raw materials for stock or placing orders - Manufacturing for stock - Transferring storage products to the retailers 	<ul style="list-style-type: none"> - Manufacturing for the central warehouse in Kalisz - Purchasing raw materials for stock 	<ul style="list-style-type: none"> - Manufacturing for stocking 	<ul style="list-style-type: none"> - Manufacturing to fulfil placed orders - Purchasing raw materials to fulfil placed orders
Replenishment (suppliers)	<ul style="list-style-type: none"> - Global supply/replenishment systems - Concluding long-term contracts - Reducing a number of suppliers - Consolidation of orders - Taking advantage of own suppliers 	<ul style="list-style-type: none"> - Global supply/replenishment systems - Concluding long-term contracts - Reducing a number of suppliers - Consolidation of orders 	<ul style="list-style-type: none"> - Using the Internet B2B transaction platforms - Using the HP corporate Internet portal enables free configuration among individual supply chain cells 	<ul style="list-style-type: none"> - Using the Internet B2B transaction platforms known as CCO (Cisco Connection Online) - Selecting the supplier and determining the order terms by using extranet
Customer service	<ul style="list-style-type: none"> - Customer initiates and drives changes - Adapting the offering to the needs and preferences of end users 	<ul style="list-style-type: none"> - Customer initiates and drives changes - Adapting the offering to the needs and preferences of end users 	<ul style="list-style-type: none"> - Manufacturer initiates and drives designs and decides which products are marketed 	<ul style="list-style-type: none"> - Adjusting offering to tastes and needs of end users - Quick response to changes in the market

Table 2. *contd*

Activity area	Inditex Group	Big Star	Hewlett-Packard	Cisco Systems
Customer service	– Quick (within a week) response to changes in the market	– Quick (within a month) response to changes in the market		– Quick response to changes in the market
Distribution and transport	<ul style="list-style-type: none"> – Products are transferred from warehouses to logistic centres in Spain – road and railway transport – The products shipped from warehouses directly to the retailers worldwide (air freight or ground transport), delivery time up to 72 hours – Shortening order execution time to 8 hours 	<ul style="list-style-type: none"> – Products shipped from warehouses in China to be stocked in Kalisz (ground or air freight (multimodal) transport) – Retailers collecting their own orders from the warehouse in Kalisz using their own transport facilities 	– Arranging delivery for their customers, the HP corporate portal is used, which enables free configuration among individual supply chain cells, regardless of the geographical location	<ul style="list-style-type: none"> – Direct transport from manufacturer to customers – Using Internet to load and enhance programs – It takes 5-8 business days to complete an order

Source: *Own study. Adopted from: (Radziszewska 2006, Schary et al. 2002, Świerczek 2006)*

One of the most important things in the clothing industry is designing garments in a way that often gives these companies competitive advantage. In the new technologies sector it is crucial to organise replenishment and distribution with use of Internet B2B transaction platforms.

However, all four companies expect to have a quick communications channel and efficient exchange and search engines to transmit information across their respective organisations and among the co-operating cells of the supply chain.

Enablers techniques of a supply chain for a short life cycle product are the decisive factors in enabling these companies to maintain close relations with end users. The companies are supposed to follow new market trends and respond to the uncertainty and variability of customers demand. Therefore, the companies often prefer to invest into design, formation and marketing of new products. In order to 'beat' the competition, it is crucial to both shorten the time necessary to introduce innovations, and to provide manufactured and distributed products of high quality.

4. Summary

In today's global economy, the supply chains operate in an uncertain and ever-changing environment. The elements of these changes are the uncertainty and variability of customers' demand, which results in an ever shortening product life cycle.

Achieving successes in the market is a huge challenge to the companies. In order to survive and gain competitive advantage, the supply chains should be customer-oriented, which means they should be sensitive to customers' requirements and needs. One of the sources of competitive advantage is the use specific enablers which enable the effects of uncertainty and variability of customers' demand to be mitigated. However, the specific enablers are not a panacea for every organisation, as they depend on the environmental context in which a supply chain operates.

This paper proposes that owing to the adoption of innovative solutions, adjusted to the specific supply chains, the products with short life cycles can develop and expand. It enables the supply chains to operate more effectively and overcome the obstacles occurring in the business environment.

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