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IMPACT OF THE PRODUCT CHARACTERISTICS ON THE DISTRIBUTION STRATEGY SELECTION: A LITERATURE REVIEW

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Abstract:-

Nowadays companies must look at developing new distribution strategies in order to achieve the required performances from their supply chain. In this quest, companies wonder about the consistency of their distribution strategy with the types of products they are selling. This paper deals with product segmentation and distribution strategy selection (cross-docking versus traditional warehousing). In the literature many factors have been described for product segmentation and supply chain selection. We classify these factors into four major groups (product, market, product/market, and supply/source factors). A literature review for each element of the groups and the supply chain orientation or distribution/inventory location strategy is carried out and summarized in a table. Finally we conclude by a discussion about the utility of this table and the opportunities to improve and extend the current research are indicated.

Keywords: - *Cross-docking, traditional warehousing, product segmentation, product characteristicsn, supply chain strategy selection*

1 INTRODUCTION

Product classification is an important scheme to help companies determine which supply chain strategy is adapted to their markets and products. Some products are more critical in terms of delivery times and have a short life cycle, high value, and an unpredictable demand. This suggests to companies to adopt a responsive supply chain to satisfy customers and react quickly to demand uncertainty and the short life cycle [1]. Other products are more functional with a stable demand, long life cycle, and have a low value and therefore need an efficient supply chain with more focus on cost minimizing.
Different distribution strategies such as cross-docking [2, 3,4], traditional warehousing [5,6,2], and direct-to-store deliveries [7,5] are available in today's supply chain, and they are chosen according to obtainable resources and supply chain design. They are not defined in terms of a reflection on customer expectations and market demand [1]. One way to choose the right distribution strategy is to develop segmentation according to product characteristics and market demand. In some cases cross-docking and traditional warehousing are combined in the same supply chain [8, 2,9]. Some products are managed with a traditional warehousing distribution strategy and others with a cross-docking distribution strategy [8], and in effect not all products are suitable for both, creating a "one size does not fit all" situation [8,9,4,10].

In the literature product segmentation is widely used in term of supply chain strategy selection [11, 1,12,13]. In our paper we consider distribution strategy as a part of the supply chain strategy [14], focusing on both for understanding the relevance of the product segmentation in the supply chain management. Cross-docking or traditional distribution strategies are part of a global supply chain strategy, and some authors have attempted to look specifically at product segmentation in term of distribution strategy selection by specifying other criteria.

The objective of this paper is to give a literature review of factors influencing the supply chain and/or distribution strategy selection. These factors are classified in four categories: product factors, markets factors, product/market factors, and source/supply factors. This paper also attempts to describe and review the supply chain and distribution strategies presented in the literature.
In the first part of this paper we will explain each of these distribution strategies, their characteristics, and performances. In the second part we will review models of product segmentation and supply chain strategy selection based on the factors identified for selection, and review models that specify product segmentation in terms of distribution strategy.

2 Distribution Strategies: Definitions, characteristics, and performances

Delivering customers have several choices of distribution strategies, each of which corresponds to a specific customer expectation in terms of performance (reactivity, time, flexibility, economic performance, etc.). There are also several types of distribution strategies (direct delivery, traditional warehousing, cross-docking) [15,7,5,6]. In our paper we focus on cross-docking and traditional warehousing distribution strategies because they are the most representative in the supply chain.

2.1 Traditional warehousing

Traditional warehousing is a distribution strategy widely used, especially in the retail supply chain [6]. Manufacturer and retailer keep stock at their distribution centers (DCs) [5]. Products are first received and stored at the DC, and when a customer requests an item, workers pick it from storage and ship it to the destination.
In the retail supply chain the sourcing and planning process are divided into two major parts: (1) the store orders and replenishes and (2) the retailer DC orders and replenishes [6] (Fig.1). When the inventory at the store is low, the purchaser orders replenishment of products needed from the retailer DC and the retailer DC prepares and delivers orders to the store. The retailer DC ships according to an inventory management policy review and if the stock runs low, he or she orders replenishment from the supplier, who prepares and delivers orders. Here the major functions of the DC are receiving, storage, order picking, and shipping [2].

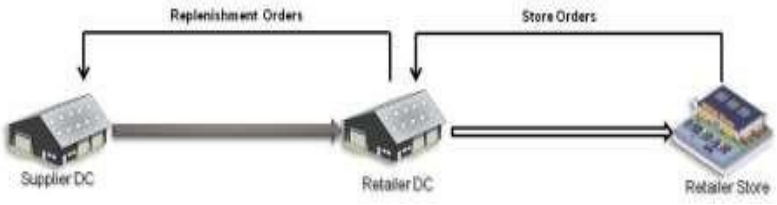

Fig.1. Traditional warehousing [5]

In this strategy the downstream customers experience a short lead time for their replenishment, with geographically nearby distribution centres [5,6]. This strategy suggests that suppliers deliver products using a full truck load, which reduces supply chain transportation costs [5]. However, the inventory costs of this strategy are high because both the retailer and supplier are keeping stock [5,6,2].

2.2 Cross-docking

Cross-docking is a distribution strategy in which DCs operate as transfer points to harmonize the continuous physical flow through a supply chain with the least storage [60]. In comparison with traditional warehousing, in a cross-docking strategy the DC functions as an inventory coordination point rather than an inventory storage point [10]. In cross-docking systems, goods arrive at the DC from the manufacturer, are transferred to vehicles serving the customers, and are delivered as quickly as possible [10]. In this strategy the storage functions are eliminated from the DC [2]. The order picking at the distribution center can be eliminated depending on the crossdocking typology [3,4].

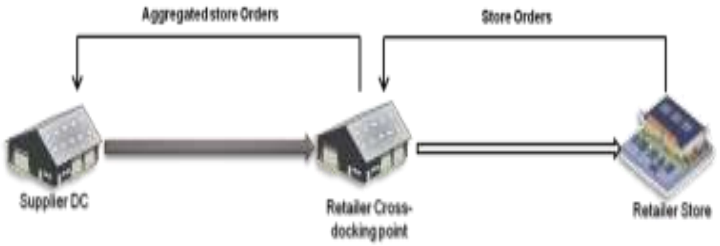

Fig.2. Cross-docking [5]

This strategy minimizes unnecessary inventory in the supply chain [16], reduces inventory costs [17,10], and improves and accelerates cash flows [17,18]. This strategy also minimizes cycle times [16,18] and increases inventory customer responsiveness [19]. The total order cycle time is reduced because of the elimination of a storage point in the supply chain [18], at the same time and in some cases the total order lead time seen by the store increase [5] . The lead time seen by the stores is greater than in traditional warehousing strategies [5,10].

There are numerous modes or typologies of cross-docking distribution strategies and several characteristics can be considered to distinguish between the various types [3,4,14,20]. A first classification can be done according to the number of touches [3] (i.e., the number of times the product will be touched in the cross-docking platform). Other classifications are done based on where and when the products are allocated to the stores [4] (called pre-allocation when the allocation is done by the supplier and post-allocation when it's done by the retailer). Vogt [14] summarizes the different factors for cross-docking distribution strategy in three major axes. The first is where in the supply chain the identification of specific items for a specific customer is done (barcode attachment, RFID, etc.). The second is where the products are sorted and prepared for final destination. The last is whether the supplier is providing only one or multiple products.

Table 1 summarizes the characteristics, performance, advantages, and disadvantages of crossdocking and traditional warehousing distribution strategies. This performance and characteristics remain relative and general and depend on each business case and circumstance.

Table 1: Characteristics and performance of cross-docking and warehousing distribution strategy

Performance and characteristics		Distribution strategy	
		Cross-docking	Traditional warehousing
Reliability	Fill rates	Low reliability in case of high variability demand	High reliability [9]
Retailer type of source		Source to order	Source stocked products
Costs	Inventory carrying cost	Low inventory costs [5,6]	High inventory costs [5,6]
	Material handling	Mid material handling costs[6]	High material handling costs[6]
	Transportation	Mid transportation costs [6]	Low transportation costs[6]
Agility	Total order fulfillment lead time	High supply chain response time [27,28]	High supply chain response time if available at the retailer DC (because it is close to stores) [5,6] and low if not (high total supply chain order fulfillment lead time) [57]
Assets	Vehicle utilization (supplier to retailer)	Low vehicle utilization [6]	High vehicle utilization [6]

3 Product segmentation and distribution strategy selection

In today's changing environment, firms make great effort to maintain their profitability and remain competitive in the market. Therefore, companies try to reduce their cost in order to improve their efficiency and maximize their margins.

Supply chains have to service a wide range of products. Product segmentation schemes are important because they help firms to determine which supply chain strategies are suitable for their product. For instance, some products are more critical in terms of delivery times, manufacturing complexity, or customization level, and others are more functional, with stable and predictable demand [1]. These two types of products should be treated differently in a segmented supply chain in order to satisfy the requirements of specific customers or markets. The first category of products need a supply chain that reacts quickly and in an efficient way to customers' needs; the second needs a supply chain where the focus is almost exclusively on minimizing physical costs.

However, to reach the objective of reducing costs and improving customer satisfaction, companies apply different distribution strategies such as cross-docking in which DCs operate as transfer points to harmonize the continuous physical flow through the supply chain with the least storage. On the other hand cross-docking is an efficient strategy to accelerate cash flow, but in some cases the total supply chain costs can increase. Traditional warehousing is considered a high-cost distribution strategy in terms of inventory-carrying costs because the inventory is kept at several echelons in the supply chain. These two strategies can be combined in the same supply chain [21,2,9]. Some products are managed with traditional warehousing distribution strategies and others with cross-docking distribution strategies [21], and in effect not all products are suitable for either one or the other [21,9,4,10].

In the literature many factors have been described as influencing supply chains and/or distribution strategy selection and product segmentation. These factors are grouped as product factors, market factors, product/market factors, and source/supply factors [12]. Product factors are closely related to the product and define the nature of the product. For example, a product can be described by its weight, size, value, and complexity, number of its variants, and its life cycle. Markets factors are related to the nature of the demand and its influence on the supply chain strategy. They include demand level (throughput) and demand variability. Product/market factors are those combining the product factors and market factors, for example, the cubic movement [8] that represents the demand level and the physical volume of the product. And finally the supply/source factors of a product are those that are dependent on lead time, the availability of components and/or raw materials, and that have production flexibility.

It is difficult or impossible for one supply chain strategy to adapt to all these combinations. The concept of single model would not make sense because the components of the performance of a given type of supply chain can be inadequate due to some constraints of the product. Thus, it becomes essential for a company to segment its products according to the strategy that has conditioned the creation of the product (innovation, quality, cost, or service) and to qualify this classification by the constraints inherent in the products, market size considered, and supply/source factors. This segmentation is used to structure the supply chain and minimize costs while ensuring the highest level of service. Product segmentation is an important tool to help companies decide which supply chain strategy is appropriate for their markets. Products are generally classified based on their specific features including physical characteristics, demand/market factors, and supply/source factors.

3.1 Product factors

Products can be classified according to their life-cycle length or stage. Fisher [1] considers that products with short life cycles increase the risk of obsolescence and unpredictability. They need a responsive supply chain that reacts quickly to demand uncertainty and their short life cycle. Aitken et al. [22] consider that short life cycles require rapid time to market, a demand chain to be able to fast track product development, and require short end-to-end pipelines to enable demand to be continuously replenished during its life. They consider also that replenishment lead times need to be matched to the stage of the product life cycle to reduce lost sales and obsolescence risks. Pagh and Cooper [23] consider that each stage of the product life cycle (introduction, growth, maturity, and decline) is important, and the supply chain needs to adapt at different stages of the product life cycle. The focus in the two first stages must be on customer service and correspond to the full speculation strategy, in which products are stocked based on forecasts in anticipation of future demand at all points of the supply chain. This strategy allows a high customer service level because the products are stocked close to the final customers. During the two final stages the focus must be on minimizing risks and costs and correspond to a full postponement strategy, in which manufacturing and logistics operations are customer-order initiated. This results in low manufacturing inventory costs and a reduction of inventory in the distribution system. Another factor considered by Li et al. [8] is the product priority, that is, the ratio of value and life cycle, and considers that products with high priority are more suitable for a cross-docking distribution strategy.

Another factor described in the literature is the shelf life, which is the length of time perishable items are given before they are considered unsuitable for sale, use, or consumption. Lovell et al. [11] consider that products with a short shelf life would lend themselves to networks that hold low levels of inventory and use faster transport modes. Li et al. [8] consider that products with a short life become obsolete faster, and so it is necessary to push these products to the sales

floor as fast as possible. They consider that a cross-docking distribution strategy is most appropriate for this type of product.

Another factor in product segmentation is the value and the product's weight. Pagh and Cooper [23] address the importance of product value in the supply chain strategy selection. They define it as the monetary density that expresses the ratio between the monetary value of product and its weight. They suggest that products with high monetary density are expensive to store because they have a high value and therefore a high inventory cost in terms of working capital, and relatively inexpensive to move because of their low weight. These types of products are more suitable for a full postponement strategy, in which manufacturing and logistics operations are customer-order initiated. Products with low monetary density are more adapted to the fullspeculation strategy because they have a low value and then are relatively inexpensive to store. Lovell et al. [12] present the same criteria, calling it value density, and suggest that this factor is important to determine which elements are dominant in a logistics cost structure: warehousing and transportation, handling, or interest.

Lovell et al. [12] consider another factor. The differences in how products are handled is a key factor for selecting the most appropriate type of supply chain. For example, differences in levels of security or safety requirements of the vehicle can affect the type of mode or vehicle choice for a product, and can also lead to network constraints in the type of operation that can be used. Vogt [14] considers products more suitable for a cross-docking distribution strategy if they have similar handling characteristics, so that only one handling channel is required for the cross-dock. If more than one handling method is needed, this requires increased space, people, handling methods, and equipment, all of which reduces the efficiency.

Payne and Peters [11] consider substitutability (i.e., if a product can be substituted or not for a customer) as a key factor for selecting the right supply chain. If the product is out of stock, could the company supply another product to satisfy the customer or would the customer immediately go to a competitor to resource the product?

3.2 Market factors

Fisher [1] classifies products on the basis of their demand patterns, which fall into one of two categories: either primarily functional or primarily innovative. Each category requires a distinctly different kind of supply chain. The functional products are those that satisfy basis needs, which don't change much over time, and they create a stable, predictable demand. This kind of product matches with an efficient supply chain strategy in which the companies can focus almost exclusively on minimizing physical costs by orchestrating the ordering, production, and delivery of supplies, thereby enabling the entire supply chain to minimize inventory and maximize production efficiency. The second category is innovative products, which are chosen by the companies to avoid low margins and have an unpredictable demand. Because of uncertain market reaction and a risk of shortages, suppliers needs a responsive supply chain for these products, reacting to customers' needs in a quick and efficient way. Cost is not a major concern in this operational strategy. Pagh and Cooper [23] also consider demand uncertainty as a major factor for selecting the right distribution strategy, and consider that for products with high demand uncertainty the speculation risk is high and therefore it will be appropriate to use a full postponement strategy for this type of product. Payne and Peters [11] judge that products with low demand variability are more adapted to the dispersed stock model. They also assume that central stock models and finish-to-order models (i.e., no finished goods held in stock anymore and products are delivered directly from manufacturing plant to customers), because of their level of postponement and risk pooling, are more capable of dealing with demand variability. Christopher et al. [24] also define demand predictability as an important factor for selecting the right supply chain strategy. They suggest that when demand is predictable then lean continuous replenishment or lean planning and execution strategies may be appropriate. And when demand is unpredictable agile quick response or agile production/logistics postponement strategies are more suitable. Uday et al. [9] consider that demand rate is a major factor that influences the suitability of cross-docking compared with traditional distribution. Hence, goods that are more suitable for cross-docking have demand rates that are more or less stable. Products with an unstable demand are more suitable for a traditional warehousing strategy because the downstream customers experience a short lead time for their replenishment, with geographically nearby distribution centers. This selection also is based on the unit stock-out cost because the probability of a stock-out situation is greater in cross-docking strategies than in traditional ones. Young et al. [26] also consider that the cross-docking system is best suited for products whose demand is stable and whose unit stock-out cost is low. Gue [6] as well considers that crossdocking strategy can perform better with products with high and stable demand. Li et al. [8] consider that a product with a constant demand is more suitable for a cross-docking strategy and traditional warehousing for products with with erratic demand to cope with variability. Yan and Tang [4] describe a quantitative model to choose the best distribution strategy based on demand uncertainty. Their conclusions are that pre-C is preferred for traditional warehousing in situations of stable demand and that post-C was preferred when considering large standard deviations of demand.

3.3 Product/market factors

Payne and Peters [11] define the order line value, such as the value of the product and its demand rate. These factors help to differentiate products in terms of how actively they are ordered by customers. As supply chain costs are mainly activity driven, and the associated costs are based on this level of activity, then a higher value order line can stand a higher amount

of activity as it passes along the supply chain and still produce a reasonable return. A low order line value will be less profitable if it experiences significant activities through the supply chain. They consider that products with high order line values are suitable for a dispersed stock model.

Another factor defined by Payne and Peters [11] is the order line weight. This factor is important because it has a big impact on the transportation costs incurred in moving that order line along the supply chain. They consider that a product with low order line weight is preferable for a central stock model or finish-to-order model because it allows a gain in maximum economies by using a more expensive parcel carrier.

Product palettes volume is another factor for segmentation defined by Payne and Peters [11]. This factor is a product/market factor because it represents a combination of the product physical volume and its demand. They consider that products with high volume in terms of number of pallets are suitable for a dispersed stock model, in which products are manufactured based on forecasts and shipped to several DCs where they are stocked for final distribution to downstream customers. This strategy is efficient for high-volume products because they can be shipped economically into the warehouses. They consider also that products with a low volume are more suitable for a central stock model in which finished goods are manufactured based on forecast and shipped to only one CD center. This choice is also based on distribution because products with low volume (numbers of pallets) are expensive to move, and a central stock model is more adapted for consolidating flows.

Li et al. [8] present a factor called *cubic movement* that refers to the product physical size/volume multiplied by demand rate. They consider that a product with high cubic movement is suitable for a cross-docking strategy because space is a constraint in a facility and assigning a product with a high cubic movement through this distribution strategy would save inventory cost.

3.4 Supply factors

Another important factor for product segmentation is the delivery lead time. Pagh and Cooper [23] define the delivery lead time as the average delivery time to customers in proportion to the average manufacturing and delivery time. They consider that products with long delivery times are more suitable for a full-postponement strategy and products with a short lead time for the full-speculation strategy. Christopher et al. [24] also consider that lead time is important for selecting the right supply chain strategy. They suggest that when lead time is short then lean continuous replenishment or agile quick response strategies may be appropriate. And when lead time is long lean planning and execution or agile production/logistics postponement strategies are more suitable. Yan and Tang [4] studied the suitability of a cross-docking distribution strategy based on outside supply lead time including production and transport of products from supplier to retailer DC. Their conclusions are that pre-C is preferred with short outside supply lead times and post-C with big lead times. Gallego et al. [25] also compared different distribution strategies (i.e., cross-docking [zero inventory at the depot], stock pooling [traditional warehousing], and zero safety stock) depending inter alia on lead time from the supplier to the retailer.

Another factor in product segmentation is delivery frequency. Pagh and Cooper [23] define delivery frequency as the average delivery frequency to customers in proportion to the average manufacturing and delivery cycle time. Also products with high delivery frequency are suitable for a full speculation strategy and products with low delivery frequency are suitable for the full postponement strategy.

3.5 Synthesis - Discussion

Below a table which sums up the major papers dealing with product segmentation and supply chain/distribution strategy selection. We divided the table in two major part: Fist one, the supply chain orientation and the distribution/inventory location strategy. The supply chain orientation is the strategy adapted by a company based on a reflection on customer expectations, market demand changes, and which focus on the supply chain physical function, and market mediation function. Second one, the distribution/inventory location strategy that has to answer efficiently to customer expectations and to the market demand. It is based on the supply chain design with more focus the physical function of the supply chain.

Table 2: Product segmentation, supply chain, and distribution strategy

Group	Factors		Supply chain strategy orientation	*Key performance for selection*	Author	Distribution/ Inventory location strategies	*Key performance for selection*	Author
Product factors	Life cycle stage	Introduction/ Growth				Full speculation	*Reliability*	[23]
		Maturity/ Decline				Full postponement	*Costs*	
	Life cycle length	Short	Responsive	*Inventory excess (obsolescence)/ lost sales*	[1,22]	Cross-docking Traditional warehousing	*Inventory excess (obsolescence)*	[8]
		Long	Efficient					
	Shelf life	Short				Cross-docking Traditional warehousing	*Inventory excess (obsolescence)*	[8]
		Long						
	Value	High				Cross-docking Traditional warehousing	*Lost sales*	[8]
		Low						
	Monetary density	High				Full postponement	*Inventory / transportation cost*	[23]
		Low				Full postponement		
Market factors	Demand uncertainty	High	Responsive Agile quick response	*Lost sales*	[1]	Full postponement Central stock, finish to order	*Lost sales*	[23]
				Reliability	[24]		*Reliability*	[11]
			Agile			Traditional warehousing	*Stock-out cost/reliability*	[9, 26,6, 8,4]
		Low	Efficient lean continuous replenishment lean planning and execution	*Lost sales*	[1]	Full speculation Dispersed stock	*Lost sales*	[23]
				Reliability	[24]		*Inventory cost*	[11]
						Cross-docking	*Stock-out cost/reliability*	[9,26 ,6,8, 4]

	Demand volume	High Low	Cross-docking Traditional warehousing	*Transportation cost*	[6]
Product/ market factors	Order line value	High Low	Central stock Dispersed stock	*Costs*	[11]
	Order line volume	High Low	Dispersed stock Central stock	*Transportation cost*	[11]
	Palette volume	High Low	Dispersed stock Central stock	*Transportation cost*	[11]
	Cubic movement	High Low	Cross-docking Traditional warehousing	*Inventory cost*	[8]
Source supply factors	Outside lead time	High	Full postponement lean planning and execution Post-C cross-docking	*Reliability* *Reliability* *Cost*	[23] [24] [4]
		Low	Full speculation Lean continuous replenishment / agile quick response Pre-C cross-docking	*Reliability* *Reliability* *Cost*	[23] [24] [4]
	Delivery frequency	High Low	Full speculation Full postponement		[23] [23]

In this table factors of selection are divided in four parts (i.e. Products factors, market factors, product/market factors and supply/source factors). Each group is composed of several factors. This factors are then matched to the supply chain orientation or the distribution/inventory location strategy adapted.

As we can notice, a considerable number of papers about product segmentation and supply chain strategy adapted have been published. Several papers deal with the supply chain strategy in a more general way (e.g. Efficient, responsive, lean, agile…), while other papers are about a specific type of problems (cross-docking, traditional warehousing, postponement, decentralized...). The first category is considered as the orientation of the supply chain and the second one is more specific and concerns the distribution/inventory location strategy. Despite this attention, there are still many opportunities to improve and to extend the current research.

First of all, the problems which cross-docking practitioners are confronted with are not all widely discussed. As it is demonstrated in the part 2.2, there are several kinds of cross-docking which correspond to different industries, business cases and circumstances. From a case to another one, the segmentation factors can be different and have different impacts. For instance, product lead time is critical in some industries such as the retail supply chain, since the storage capacities is limited at the downstream point (stores), and we should have a short lead time with frequent deliveries. In other cases, the criticality of the lead time is less important and a segmentation based on this factor is less important.

In the second place, supply chain performance are not all studied. In the papers reviewed, the performance attributes can be classified in three categories: (i.e. Customer satisfaction, inventory cost, and transportation cost). The supply chain's sustainability is not studied in literature in terms of product segmentation. This performance is important to set the right supply chain or the distribution strategy of a product. For instance, in a supply chain where we can combine the cross-docking with the traditional warehousing, determining the right balance between the products chosen for each category can allow a high vehicle utilization and then reduce CO2 emissions.

At last, many of the presented papers make simplifying assumptions that limit the real-world applicability. Indeed, the segmentation is usually done according to the performance of one echelon or partner in the supply chain, and doesn't take into account the end-to-end performance [11, 4,8]. A product adapted to a supply chain strategy according to a partner is not necessarily adapted for others.

4 Conclusion

Determining the right strategy of distribution for a product is not an easy task because different factors have to be taken into account. Products must be categorized according to the market factors, the supply factors as well as the physical/product factor. These factors are most of the time conflicting and then, the choice becomes more difficult. The selection of product classification's variables is challenging since it is hard to determine which factors have more relevance. It depends mainly on the company's objectives, the supply chain design, the nature of the products and the industry.

Literature suggests that the way products are classified can helpt to determine the strategies of the supply chain. However, only few papers really study the segmentation based on distribution strategy. Our approach which consists in focusing on both cases (i.e. supply chain strategies and distribution strategies) allows us to identify the key factors for segmentation and the performances impacted by the products and market factors.

5 References

[1].Fisher, M. L. (1997). What is the right supply chain for your product? Harvard Business Review, 75(2), 105.

[2].Van Belle, Jan, Valckenaers, Paul, & Cattrysse, Dirk. (2012). Cross-docking: State of the art. Omega, 40(6), 827–846.

[3].(2008). Cross-docking trends report.www.saddlecrk.com/whitepaperS.

[4].Yan, H., & Tang, S. (2009). Pre-distribution and post-distribution cross-docking operations. Transportation Research Part E: Logistics and Transportation Review, 45(6), 843–859.

[5].van der Vlist, Piet. (2007). Synchronizing the retail supply chain. Rotterdam, the Netherlands: Erasmus Research Institute of Management, RSM Erasmus University.

[6].Gue, K. (2007). Warehouses without inventory. International Commerce Review, pp. 124– 132.

[7].Thönemann, U., Behrenbeck, K., Küpper, J., & Magnus, K.-H. (2005). Supply chain excellence in trade. Gabler.

[8].Li, Z., Low, M.Y.H., Lim, Y. G., & Ma, B. (2008). Optimal decision-making on product ranking for crossdocking/warehousing operations. IEEE International Conference on Industrial Informatics, pp. 871–876.

[9].Uday, M. Apte, & Viswanathan, S. (2000). Effective cross docking for improving distribution efficiencies. International Journal of Logistics Research and Applications, 3(3), 291–302.

[10]. Waller, Matthew A., Cassady, C. Richard, & Ozment, John. (2006). Impact of crossdocking on inventory in a decentralized retail supply chain. Transportation Research Part E: Logistics and Transportation Review, 42(5), 359–382.

[11]. Payne, Tim, & Peters, Melvyn J. (2004). What is the right supply chain for your products? The International Journal of Logistics Management, 15(2), 77–92.

[12]. Lovell, Antony, Saw, Richard, & Stimson, Jennifer. (2005). Product value-density: Managing diversity through supply chain segmentation. The International Journal of Logistics Management, 16(1), 142–158.

[13]. Vonderembse, M., Uppal, M., Huang, S., & Dismukes, J. (2006). Designing supply chains: Towards theory development. International Journal of Production Economics, 100, 223–238.

[14]. Vogt, John Joseph. (2010). The successful cross-dock based supply chain. Journal of Business Logistics, 31(1), 99.

[15]. Whiteoak, P. (1999). Rethinking efficient replenishment in the grocery sector. In John Fernie and Leigh Sparks (Eds.), Logistics and retail management (pp. 138–163). London: Kogan Page.

[16]. Musa, Rami, Arnaout, Jean-Paul, & Jung, Hosang. (2010). Ant colony optimization algorithm to solve for the transportation problem of cross-docking network. Computers and Industrial Engineering, 59(1), 85–92. doi:10.1016/j.cie.2010.03.002.

[17]. Shakeri, Mojtaba, Low, Malcolm Yoke Hean, Turner, Stephen John, & Lee, Eng Wah. (2012). A robust two-phase heuristic algorithm for the truck scheduling problem in a resourceconstrained crossdock, Computers and Operations Research, 39(11), 2564–2577.
[18]. Dondo, Rodolfo, Méndez, Carlos A., & Cerdá, Jaime. (2011). The multi-echelon vehicle routing problem with cross docking in supply chain management. Computers and Chemical Engineering, 35(12), 3002–3024.
[19]. Soltani, Roya, & Sadjadi, Seyed Jafar. (2010). Scheduling trucks in cross-docking systems: A robust meta-heuristics approach. Transportation Research Part E: Logistics and Transportation Review, 46(5), 650–666.
[20]. Chandran, P. Mohan. (2003). Wal-mart's supply chain management practices. Center for Management Research.
[21]. Lee, H. (2002). Aligning supply chain strategies with product uncertainties. California Management Review, 44(3), 105–119.
[22]. Aitken, James, Childerhouse, Paul, & Towill, Denis. (2003). The impact of product life cycle on supply chain strategy. International Journal of Production Economics, 85(2), 127–140.
[23]. Pagh, J. D., & Cooper, M. C. (1998). Supply chain postponement and speculation strategies: How to choose the right strategy. Journal of Business Logistics, 19(2), 13–33.
[24]. Christopher, M., Peck, H., & Towill, D. (2006). A taxonomy for selecting global supply chain strategies. The International Journal of Logistics Management, 17(2), 277–287.
[25]. Gallego, G., Ozer, O., & Zipkin, P. (2007). Bounds, heuristics, and aproximations for distribution systems. Operations Research, pp. 503–517.
[26]. Hae Lee, Young, Jung, Jung Woo, & Lee, Kyong Min. (2006). Vehicle routing scheduling for cross-docking in the supply chain. Computers and Industrial Engineering, 51(2), 247–256. doi:10.1016/j.cie.2006.02.006.
[27]. Lyu, JrJung, Ding, Jyh-Hong, & Chen, Ping-Shun. (2010). coordinating replenishment mechanisms in the supply chain: From the collaborative supplier and store-level retailer perspective. International Journal of Production Economics, 123(1), 221–234.
[28]. Van Hoek, Remko I., Harrison, Alan, & Christopher, Martin. (2001). Measuring agile capabilities in the supply chain. International Journal of Operations & Production Management, 21(1/2), 126–147.