LEAN APPROACH FOR IMPROVING PRODUCT DISTRIBUTION PROCESS

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Abstract: *From the customer's perspective, distribution represents a very important phase of the supply chain. By realizing logistic processes and activities, the value that is delivered to the customer is created, while on the other hand, significant costs are generated. Since it is very difficult in practice to increase quality and value at the same time, companies are striving towards newer solutions and their applications. This paper analyzes the approach for calculating distribution costs, as well as the possibility of applying the Lean distribution concept in order to eliminate waste and create value for customers.*

Keywords*: lean distribution, logistics value, logistics costs, distribution process*

1. INTRODUCTION

Nowadays, managing logistics and distribution activities for companies may be a major challenge. With the ever-increasing globalization of markets, demands for efficient delivery of goods are growing, which means more specific services required by the customers. In order to maintain a stable position in the market and achieve profit, it is necessary to continuously plan and optimize the distribution process. Distribution logistics provides spatial and temporal transformation of goods through a structured distribution network, which can be very complex. There are various approaches to the improvement and optimization of the distribution process where the goal is to achieve a higher quality and value for consumers on the one hand, and a lower cost on the other. Distribution is an area in which significant savings can be achieved as well as waste reduction. Nowadays, logistics uses various approaches to improve process and waste disposal. In this domain, the Lean concept is emphasized, which is defined as an approach, intended for the overall improvement and improvement of the process within an organization, with a continuous reduction of waste and refers to the strategic and operational decision making level. Lean also found its application in supply chains, with special emphasis on distribution and improvement of the process by creating values and eliminating waste. Muraira et al. (2014) emphasized that customer satisfaction and understanding of the market was very important for defining the supply chain strategy. They also pointed out that the dynamics of today's industry have influenced the design of the supply chain with the emphasis on achieving a higher level of customer service, the

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quality of products and services, the costs as well as the flexibility of product offering to meet customer requirements. The subject of the research paper is devoted to the analysis of the possibility of optimizing the distribution process using the Lean concept. The main goal is to determine the overall relevant distribution processes whose optimization may affect the creation of value for the customers and thus to reduce logistics costs.

The paper is organized as follows: the first part refers to the structure and main characteristics of the distribution system; the creation of values through the distribution process is shown in the second part; in the third part, costs and wastes in the distribution were analyzed; the concept of Lean distribution is presented in the fourth part of the paper.

2. STRUCTURE AND MAIN CHARACTERISTICS OF THE DISTRIBUTION SYSTEM

For the customer, the most important phase of the supply chain is distribution. For this reason, it is necessary to pay special attention to the distribution system functionality, because it represents a direct connection with the customer, which, based on the observation of this process, creates the experience of the entire supply chain. When looking at the structure of the distribution network, in terms of the number of elements in the hierarchical structure, a decentralized and centralized distribution network model may be distinguished. The decentralized structure between the shipping warehouse and the end-user implies several levels, where different warehouse and distribution centers are located. For this reason, this structure is also called the hierarchical distribution structure. In the case of a centralized model, there are no intermediate warehouses between the dispatch point and the end-user (delivery is realized by one - central warehouse). The distribution system can be observed as a distribution system in a wider sense (from the production of raw material to retail) or as a distribution system in the narrow sense (from the production of finished goods to retail), as shown in Figure 1.

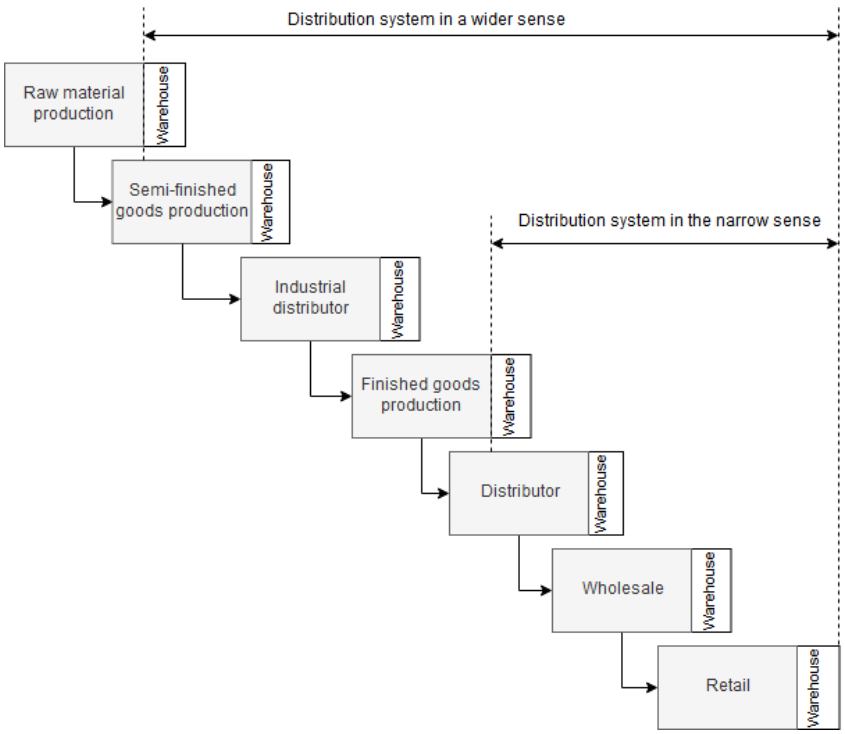

Figure 1. Distribution system (two perpectives) [2]

Therefore, the process of product distribution is an area where value is created for customers, while on the other hand it causes significant costs. For this reason, in this area, it is possible to achieve savings and eliminate waste. Of course, improvements can not be made without the use of certain expertise and approaches and attention has to be paid to the choice of an effective concept depending on the specific environment.

3. CREATING VALUE THROUGH THE DISTRIBUTION PROCESS

Huge market changes, new technologies and strong competition have led to the emergence of growing customer's demands in terms of quality of service. Specific customer's requirements have led to the fact that products and services require a certain level of customization. On the contrary, companies are trying to meet all the requirements of the customers at affordable costs. This requires the creation and improvement of value that is delivered to customers. Logistics and supply chain have become areas where products are being prepared for sale in logistics and distribution centers and where the value is created (Kilibarda et al., 2013).

A product or service is a value for the customer when provides what the user wants, expects and appreciates. Supply chain becomes a value chain when all participants strive to provide value to their direct and indirect customers, but also to eliminate wastes through the delivery system. Finally, the value delivered through the value chain is reflected as a profitability for all participants in the value chain. The value is actually represented as a ratio between "what the customer gets" and "how much it costs."

Value in logistics can be created through the realization of: standard logistics services, additional logistics services and specific logistics solutions (Kilibarda et al., 2013). The product has one value when it is at the consumer's place and the other when it is in the factory warehouse and this can be presented as a spatial value. Customers often require a product or service at a precise time and this can be presented as a time value. For example, the delivery of daily newspapers is required early in the morning and then has a certain value for the user. On the contrary, if daily newspapers are delivered in the evening, the value for the user practically does not exist. Spatial and time value are realized by the implementation of standard logistics services (transport, storage, transhipment). VAL (Value Added Logistics) services are related to the finalization of products by the realization packaging, assembly, installation, processing, marking, etc. These services relate to qualitative and quantitative changes on products that are conditioned by user requirements. Specific logistic solutions relate to: reduction of operational costs, improving the return on investments, increase of revenues and market share, improvement of flexibility and speed of logistics process implementation, improving the visibility of logistics processes, etc.

4. WASTES AND COSTS IN DISTRIBUTION

Nowadays, identification and cost optimization are a very important aspect of business, especially in logistics and distribution. Improving logistic processes and activities requires precise data of logistics costs. For this purpose, where the goal is to diversify the costs of logistics activities, a various approaches and tools are used. Distribution process

is realized from the producer to the consumers through several logistics systems. Within each system, it is possible to identify a complex set of logistics processes and activities, which can be classified into six basic groups, such as: ordering, packaging, transshipment, transport, warehousing and inventory.

In order to calculate the logistic costs for each process individually, various techniques and models are applied in logistics. One such model is proposed by Kilibarda (2016), where, at first, the total cost of managing logistics systems is calculated, and then assigned to logistic activities. In the following part, the mentioned model was analyzed.

Ordering process includes the time that elapses from the receipt of the customer's order until the delivery of goods and the renewal of the customer's inventory. Ordering is an initial activity that dictates the structure of all other logistics activities and processes. The costs of ordering are affected by affordable space and personnel, assets, equipment, consumables, mincing materials etc. On the other hand, ordering costs depend on the amount of goods being ordered. Ordering costs may be described as follows:

$$Tpo_i = f(Npo_i, T_{upo}, Q_i) \quad (1)$$

where:

Tpo_i – ordering costs of product i; Npo_i – number of orders for the i-th product; Q_i – total flow of the i-th product; T_{upo} – total cost of ordering process.

Any administrative activity is a resource that does not represent a value in the business world. These activities require certain resources and the right information at the right time. Communication technologies such as electronic data interchange and the Internet minimize costs and risks of errors (Goldsby & Martichenko, 2005). To ensure better control and ease of management, many companies turn to technological solutions. Wastes can arise from wrong information, late information, inadequate technology, etc.

The package has a protective, transport, manipulative, storage and information function. The packaging process includes the activities of forming a logistics unit (storage, transshipment, transport). Packaging costs depends on the engagement of labor, resources, machines, space, consumables and can be described as follows:

$$Tpa_i = f(Npo_i,\ Q_i, T_{upo}) \quad (2)$$

where:

Tpa_i - packaging costs of product i; Npo_i - number of packing of i-th product; Q_i - the total quantity of the i-th packing product; T_{upo} - total packaging costs.

Inadequate packaging that does not protect the content is the cause of various damages that can be understood as waste.. Also, waste occurs when companies over-investing in packaging. When designing the packaging, it is necessary to take into consideration the efficiency and in this connection, better use of the container space, vehicle space and storage space. Many companies and entire industries are adopting packages that can be re-used. Also, packaging provides visual control in supply chains (Goldsby & Martichenko, 2005).

Transshipment has a spatial function and it refers to the loading of goods, the change of the type of transport and the unloading of goods. Transhipment costs arise as a result of the engagement of labor and transhipment manipulative mechanization, applied technology, labor volume, etc. Transshipment costs are in the function of the following factors:

$$Tpr_i = f(Npo_i, Q_i, T_{upo}) \tag{3}$$

where:

Tpr_i - transshipment costs of product i; Npo_i - number of manipulative units of the i-th product; Q_i - total flow of the i-th product; T_{upo} - total transshipment costs.

Transport is one of the most expensive processes in the supply chain. For this reason, freight forwarding and transport companies mainly focus on optimizing transport and reducing the costs of transport activities. Transportation costs can be described as follows:

$$Ttr_i = f(L_i, q_i, Tts, T_{str}, Bis_i, Q_i) \tag{4}$$

where,

Ttr_i - transportation costs of product i; L_i - average distance of transport of i-th products; q_i - average quantity of the i-th product in the transport unit; Tts - average cost of engaging the veichle ; T_{ztr} - common transport costs; Bis_i - the number of deliveries of product i; Q_i - total flow of the i-th product.

If the transport service is purchased in the market then Tts represents the price of transport, and when it comes to own transport, it is necessary to determine the total costs for the given asset.

Transport generates the highest logistics costs. In addition to affecting costs, transport is an essential component of delivery time and contributes to variations in the lead time. Transport wastes may occur due to postponement of delivery as a result of congestion in traffic, delays, equipment malfunctions, bad weather conditions, etc. The purpose of the Six Sigma concept in transport is to reduce the average delivery time and reduce variations around that average. Inefficiency and wastes occur as a result of inefficient use of resources. However, many companies do not recognize the possibility of goods consolidation, which can contribute to cost savings and service improvements.

Warehousing process involves several processes that are realized in the warehouse and can be described through three basic processes: inbound process, storing and outbound process. Warehousing costs depend on the intensity of the input and output operations, engaged assets, the administrative activities, the engaged space, etc. Thus, warehousing costs can be described as follows:

$$Tusk_i = f(Nuo_i, Nio_i, Tms, Nd_i, No_i, V_i, Tso, Q_i, Tsadm) \tag{5}$$

where:

$Tusk_i$ - warehousing costs of the product i; Nuo_i - the average number of input operations for the product i; Nio_i - the average number of output operations for the product i; Tms - costs of manipulative assets in the warehouse; Nd_i - average number of deliveries of the i-th product; No_i - the average number of shipments of the i-th product; V_i - the average volume occupied by the product i; Tso - costs of space; Q_i - total flow of the i-th product; Tsadm - the administration costs.

According to Goldsby & Martichenko (2005), it is estimated that more than half of the activities carried out in the warehouse do not add value to products while consuming resources at the same time. It is very likely that the warehouse contains assortments that do not meet the customer's requirements. On the other hand, companies are faced with the question of how much space would be enough to meet the customer requirements. Companies charge customers the storage per square meters that they occupy plus the handling of goods and additional services. It should be kept in mind that there are always fixed costs in the warehouse, while the variable costs are in function of the labor volume. Wastes in the warehouse can arise as a result of inefficient use of space, the use of inadequate technology, etc.

The inventory represent tied up capital and their holding "captures" money that could be used for other investments. The cost of keeping inventories includes the following cost components: capital costs, taxes, insurance taxes, risk costs (outdated inventory, damage, defects, etc.), storage space. The quantity of goods, the value of goods and the time of goods holding in stock have a major influence on inventory costs. Inventory costs can be described as follows:

$$T_{Zi} = f(W_i, C_i, k_s, k_{osg}, Q_i) \tag{6}$$

where:

T_{Zi} - inventory costs of product i; W_i - average quantity of i-th products in stock; C_i -price of the i-th product; k_s - coefficient of tied capital of the i-th in-stock product (interest rate); k_{osg} - coefficient of insurance of the i-th product in stock; k_g - the loss coefficient of the i-th product in stock; Q_i - total flow of the i-th product.

Inventory exist due to the absence of current production and delivery. In this case, companies have to anticipate what users desire, in which quantity and where, i.e. forecasting of requests is carried out. Forecasts are never fully accurate and companies often accumulate stocks that increase costs. Excess inventories then have to be disposed of at a lower price, removed or maintained until consumed. On the other hand, in case of lack of inventory, opportunity costs are being arised. It is necessary to find an optimal level of stock with control of variations and improvement of processes in supply chains, which is the goal of the Six Sigma concept (Goldsby & Martichenko, 2005).

When it comes to waste, knowledge may be the least recognized and least understandable resource in managing any business. It can not be seen or easily quantified, but it is largely a resource. According to Goldsby & Martichenko (2005), lack of knowledge can cause big wastes in companies. In the functions that are most often associated with a business strategy, such as research and development, engineering, marketing and finance,

knowledge is at the core of their existence – the knowledge about what buyers will buy, knowing how to create the desired product, knowing how to attract users, etc. Companies should apply formal and informal ways of cultivating knowledge in order to avoid knowledge waste. Waste is created by doubling the efforts of employees in different parts of the company. Therefore, it is necessary to share information, knowledge and vision, both in the company and in the entire supply chain.

5. LEAN DISTRIBUTION

Lean philosophy origins from Toyota (Japan) and was created around the 1970s as a Lean manufacturing. The goal not only was to eliminate wastes and excesses in production, but also to generate value for the customer for which he is ready to pay. As such, it is applied in many industries. The main advantage of Lean's implementation is cost reduction, quality improvement and improved customer service. The concept turned out to be very successful and later became a standard in industries such as automotive, aviation and computer industry (Honda, General Electric, Boeing, Helwett-Packard, IBM, Zara, Amazon, etc.). Lean is actually a philosophy that is based on the six principles: elimination of waste, a broad view, simplicity, continuous improvement, visibility, flexibility. A special emphasis is placed on the elimination of waste, where waste is anything that does not create value (Sanders, 2013).

At the strategic decision-making level, Lean refers to an increase in value, while at the operational level it involves a range of techniques and tools. Some of the most important tools Lean uses are: Kaizen, Pull System or Kanban, Taguchi Method, 5S, JIT (Just-in-time), Poka Yoke, TPM (Total Productive Maintenance).

Lean's concept of distribution emerged as well as its predecessor - Lean Manufacturing, in the automotive industry (Toyota, Japan) as an approach for managing large and complex supply chain networks in order to reduce costs and provide high quality (Vecchiato, 2012).

Lean distribution is essential to improve the logistics process, and has a significant effect on the efficient implementation of the logistic activities, as shown in table 1.

When it comes to customer service, Lean relies on managing all flows in line with customer's consumption, while traditional approaches are more focused on forecasting. In this case, forecasting is fairly accurate in traditional approaches, while Lean uses the forecast only for long-term planning. In terms of inventory, Lean's advantage is that goods are consolidated at source, so flows are flexible - they can be routed in relation to changing customer requirements. In comparison to traditional approaches, Lean is more focused on customer requirements and therefore on their variable requirements and aims to reduce variability. Regarding transport activities, both traditional approaches and Lean tend to improve efficiency through optimization of transport routes. As costs are one of the biggest problems occurring in logistics, it can be noted that all the concepts that are applied have the aim of reducing costs. When it comes to distribution, Lean is focused on reducing overall costs by comprehensively optimizing the process. As Lean is based on the Pull concept, it means that it is based on customer's demand, which further means lower level of stock, better communication, precise production and accurate information

of customer needs. Thus, companies overcome oscillations and create space for flexibility, all in order to reduce total costs.

Table 1. The influence of lean distribution on logistics dimensions [7]

Dimension	Traditional approach	Lean distribution
Customer Service	Collaborate to forecast	Manage flows as customer consumes
Forecasts	Accurate enough, but should strive to be more accurate	Limited accuracy; use for long-term planning
Inventory	Is an asset and should be close to the customer to meet lead time demands	Consolidate at the source and redirect flow quickly for changing replenishment needs
Variability	Not explicitly used in planning, but measured in operations if Lean and Six Sigma are embraced	Customer demand and supply chain variability used in Lean processes
Transportation	Changing with forecasts and orders; seek to reduce	Replenishment cycle driven; stabilize lanes to reduce
Optimization	Reduce each component of cost while filling forecasted demand	Streamline distribution total costs to replenish actual demand
Assumptions	Forecasts are sufficiently accurate and stable for planning; all cost reductions add to net profit; inventory costs less than labor	*Pull* reduces variation and improves service; only total cost reduction adds to profit; Inventory, handling and storage costs are understated

5. CONCLUSION

Nowadays, companies operate in the market of increasing competition, where it is of huge importance to respond to the demands of customers in order to meet their needs and desires. Efficient realisation of the process requires some time-consuming and resource-intensive efforts. In order to meet customer demands, companies not only use sources inefficiently, but also generate unnecessary costs, which means lower profit and less market share. Distribution process is an area where it is possible to work in order to reduce costs. On the other hand, it is necessary to consider the customer requirements and on that basis, to improve the services.

The complex distribution networks and processes that are implemented within them not only require efficient management, adequate cooperation with the goal of reducing the number of subcontractors, understanding, patience and efforts of employees, but also large investments. Leading global companies efficiently use the Lean concept and its techniques and tools, where for each concept there is an accurate application and goal. Business with low level of inventory has led to enormous changes in business, where the JIT concept plays an important role. The advantages of Lean concept are tremendous, but certain shortcomings can be noticed here as well. Dealing with only one supplier can cause major problems if that same supplier suddenly stops working. Although Lean is originally related to the production process, nowadays, it is successfully applied in all aspects of business. An efficient and effective implementation of this concept requires detailed analysis of processes and environments, a certain amount of time and large investments.

The ability of apply depends on the commitment of management, the knowledge of processes and customers and competitors.

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