



<sup>1</sup>Maciej BIELECKI, <sup>2</sup>Magdalena HANCZAK

## MASS CUSTOMIZATION AS ONE OF THE KEY ELEMENTS OF LOGISTIC EFFICIENCY OF A PRODUCT

<sup>1-2</sup>. University of Technology, Lodz, POLAND

**Abstract:** The concept of Total Logistics Management (TLM) is a response to the challenges of contemporary economy, proposing the idea of an enterprise oriented towards flow. Flow has a broad definition here. It concerns materials, information as well as finances. Effective and efficient flow as referring to any category should be the objective of any organization. It must be noted that one of the basic element of TLM is the product itself as well as designing it in such a way to make it logistically efficient. A logistically efficient product is a product that would support the flow while being attractive to a customer. When considering optimization of logistic costs and processes the features and properties of a product are usually not considered as they are believed to be limiting conditions. The changes are made in the way specific processes are executed, while product properties remain unchanged.

**Keywords:** mass customization, logistic, efficiency, product

### INTRODUCTION

When considering optimization of logistic costs and processes the features and properties of a product are usually not considered as they are believed to be limiting conditions. The changes are made in the way specific processes are executed, while product properties remain unchanged. There is a point, however, when further attempts at optimization may not bring the expected results. A question then arises how a product itself influences the execution of logistic processes in an enterprise and if the changes in a product's design can introduce specific added value for the enterprise without decreasing the value and quality of a product in the eyes of clients.

Including logistic aspect in designing a product may be a significant challenge for an enterprise and means radical change in perceiving the role of logistics in a production enterprise. Expanding production management by system and process approach to quality management should be also expanded by including logistic issues. Logistic management then becomes one of key elements that should be taken into consideration as soon as designing a product starts. This should not mean that logistics is superior to all other areas of an enterprise's activities, but that it should be included in strategic areas of management, which is one of essential assumptions of the concept of total logistics management [10].

The concept of Total Logistics Management (TLM) is a response to the challenges of contemporary economy, proposing the idea of an enterprise oriented towards flow. Flow has a broad definition here. It concerns materials, information as well as finances. Effective and efficient flow as referring to any category should be the objective of any organization. It must be noted that one of the basic element of TLM is the product itself as well as designing it in such a way to make it logistically efficient. A logistically efficient product is a product that would support the flow while being attractive to a customer.

### ESSENCE OF LOGISTICALLY-EFFICIENT PRODUCT

A logistically-efficient product is defined as a material object of market exchange which possesses a set of features and properties that enable it, within the internal dimension of an organization, to move through supply, production and distribution areas, and, in the external dimension of an organization, enable logistic management to effectively and efficiently integrate handling orders, managing supplies, storing, packaging and transport with external subjects as a part of supply chain [2]. It should also be noted that a logistically-efficient product enables both the producer and customer to gain benefit. As the interests of both sides are often contradictory, an attempt to combine the benefits will result in creating an 'imperfect' product, but

one that will facilitate executing logistic processes and one satisfying to a client [4].

Logistic efficiency may be analyzed in reference to a variety of products which is why it is difficult to unambiguously define the features and properties that will facilitate its flow in logistic channel. However, it is possible to point to general conditions that a product has to fulfil in the context of particular logistic functions.

When handling orders, the role of a product is connected mainly to the information field – the possibility of synthetic description and parametrization of the product's features. From the point of view of logistic handling a situation when a product exists in only one variation without a possibility of altering as requested by a client is beneficial. It decreases the risk of making a mistake while receiving an order and shortens the time of handling it (information necessary to be given by a client is limited to the number of pieces of an item). If a product is available in different variations (e.g. colors) it is beneficial if the variations are standard (color is chosen from a sampler, parts to be selected are standard) which enables to precisely define the variations.

When analyzing logistic efficiency of a product from the perspective of supply management, the structure of a product needs to be addressed. The supply of each of the elements comprising a product (raw materials, semi-finished products, and product parts) requires to be handled separately in management process, which is why the more complex the product the more work needs to be put into forecasting, controlling and supplementing the supplies. On the other hand, from the point of view of managing supply of the whole stock, standardization of parts is important. It is much more beneficial, in the context of logistics, if parts of items are normalized and can be used interchangeably.

Another aspect concerns technological process. Executing production goes beyond the tasks of supply management according to Pfohl; it has been assumed that the specifics of the production influence decisions regarding materials management. Firstly, material intensity of a product determines the amount of stored supplies, which, in turn, translates into the amount of frozen capital. From the point of view of logistics as well as accounting liquidity 'lean' products literally improve management [7]. Production time is also vital for logistic efficiency of a product. There is no doubt that the shorter it takes to manufacture a product the quicker the flow of materials is. Time taken to prepare production should also be considered. If the time of re-tasking machinery is too long, it is not profitable to produce a few pieces

of a product. Increasing that number often results in producing goods to store them, i.e. increasing the number of ready-made goods. Thus, it can be assumed that a product with shorter production preparation time is more logistically-efficient. In the context of storing, the following situation is beneficial:

- » a product takes less storage area and storage space (a product can be pile dup – the higher the pile the better);
- » a product does not require special storage conditions;
- » a product will not expire;
- » no adjustment activities in a warehouse are necessary (e.g. re-packaging);
- » automation is possible to be applied [8] – a product has standard shape and size.

Each of the mentioned aspects influences the reduction of time, saving of storage space or lowering storage costs.

There is no doubt that a product's packaging should improve its logistic efficiency, which means that it should streamline the flow of materials. Packaging should then protect a product from decreasing in value to the maximum possible extent, facilitate storing, transport and manipulation as well as provide information necessary to identify the product. Features and properties of packaging can compensate for features and properties of a product itself that can reduce its logistic efficiency (e.g. non-standard shape).

From the perspective of transport optimization, the following features are important:

- » size of a product in relation to the capabilities of the available transport infrastructure;
- » features that facilitate loading and unloading;
- » lack of features that hinder transport, such as susceptibility to mechanical damage or requirement for particular transport conditions [3].

These features influence rise in quality, shortening the time and reducing the costs of transport.

When considering the conditions to be fulfilled by a logistically-efficient product in order to support the execution of each logistic function, it may be concluded that standardization should be considered an important element of logistic efficiency. For standard orders, products of standard dimensions, consisting of standard parts, having standard packaging it is easier to find solutions – concerning production process, warehouse equipment, means of transport and IT aspects – that would allow both to save time and to streamline the flow. The benefits of standardization may also include improvements in the fields of supervision, control, training, service and handling.

All of these are aimed at gaining the most important benefits for an enterprise – economical ones.

The definition of a logistically efficient product also emphasizes the fact that the product should fulfill the conditions of posing no hazard for health and life, simultaneously fulfilling a user's individual needs. A question then arises: what actions need to be taken to satisfy clients with often extremely varied preferences. The answer has to be sought in the concept of mass customization, that is: offering products tailored to customers' needs on a mass scale at prices comparable with those of standard products [1].

#### LOGISTIC DIMENSION OF MASS CUSTOMIZATION

The combination of the advantages of mass production and the possibility of offering a personalized product is the key element of the concept of logistic efficiency of a product. Mass customization combines contradictory notions, which is why its application requires a compromise between the expectations of the producer and the client. The client is involved in the process of creating a product, but their involvement may reach different stages of production process [6]. Thus, four degrees of customization with decreasing level of product personalization can be distinguished:

- » pure customization,
- » tailored customization,
- » standardized customization,
- » pure standardization.

In pure customization the client participates in designing the product, which is why it is possible to create an item that meets their individual preferences. Tailored customization assumes the client's involvement at the production stage. It allows to modify the shape and size of standard elements according to the client's requirements. Involving the client at the assembly or distribution stage, as in standardized customization, results in adjusting the product but only to the extent allowed by a list of standard options. In pure standardization an individual client's needs are not considered [9]. If the client's involvement in the process of creating a product is defined this way, it should be noted that in many cases the clients' wishes have to converge with the needs of effective and efficient flows within the enterprise. What is more, there may be many situations when these wishes contradict the logistic objectives of an organization. Thus it has become more and more frequent economic practice to attempt to create such business model in which logistic efficiency of a product becomes the key element of competition.

From the point of view of logistic efficiency of a product, standardized customization option seems to be the best choice. This approach gives the client an opportunity to choose the most suitable

parameters of a ready-made product without extra payment. Simultaneously, an enterprise can take advantage of the effect of standard elements production scale, thus gaining organizational and economic benefits.

Product customization can take on different forms depending on the range of changes to a product and product perception by a client [5]. Also in this case there are four forms of customization – here they comprise a matrix (figure 1). In the case of transparent customization, the changes to a product introduced by the producer are unnoticeable to a client. This occurs in a situation when an enterprise, based on observing clients' preferences, introduces changes to products that are bought repeatedly so as to meet the clients' expectations to the highest possible degree. Collaborative customization is based on introducing changes to a product by the producer in communication with an individual client, due to which the client can receive a product that fulfils their needs to the greatest extent. A different situation occurs in case of adaptive customization where neither the product changes nor the way it is perceived by a client does. The essence of customization here concerns the possibility of adjusting one product to different needs by the user (e.g. lighting system) or self-adjustment of a product to the user's needs (e.g. molded insoles). The last form – cosmetic customization is based on offering the client a standard product in which only the features determining its perception have been changed, e.g. packaging [9].

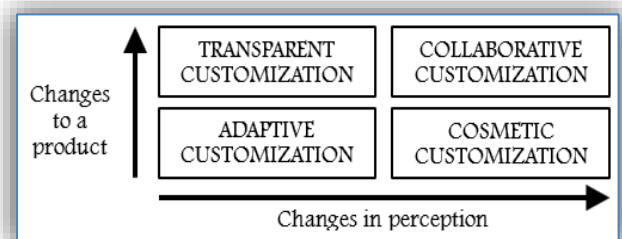


Figure 1. Forms of customization [9]

Considering the assumptions regarding logistic efficiency of a product, the most favorable forms of customization from the point of view of logistic efficiency of a product are transparent and collaborative customization. In both cases the possibility of introducing changes to a product allows to find features and properties that can be modified to the benefit of both clients and production enterprise, particularly in logistic context. Obviously, it is vital to find a common ground for the added value which will improve the competitiveness of a product from the point of view of a client and an enterprise. It seems that the notion of logistic efficiency of a product as a source

of added value for a client and a production enterprise should become the next step in research conducted by the authors.

From the point of view of logistic efficiency of a product, there is one notion that deserves attention in the concept of mass customization that is the notion of modularity. Product modularity means that a product consists of independent modules by combining which a product tailored to an individual client's needs is created. [9]. Standard modules perform the function of spare parts which results in the possibility of using the same elements in different products which, in turn, translates into the reduction of the amount of supplies and decreasing the risk of surplus or shortage of components [9].

To illustrate the issue of mass customization as an element of logistic efficiency of a product an example of furniture production can be given. A producer usually offers several lines of products (systems) differing in style, consisting of products fulfilling the same functions (wardrobes, shelves, chests of drawers). If an enterprise treats each of these lines separately, it offers its customers a wide range of products (due to this, there is greater likelihood of meeting the requirements of an individual client), however, it has to face managing a significant number of components. If the products of the same function are treated as one product it might be possible to simplify managing the range. For the purpose of customization, it is necessary to isolate modules that can be changed according to a client's requirements. In case of a chest of drawers there can be four modules: drawers front sides, elements of the body, handles and other equipment (slides, other parts of drawers). The last module is standard and will not be subject to a client's choice. The choice of the first three modules from among variations differing in color, pattern, material will allow the client to create a chest of drawers with features that they most prefer. If the company additionally designs its products in such a way that standard modules can be applied in several products (identical dimensions, distance between handle holes), it can take full advantage of mass production and the clients will gain a wide range of personalized products at the price of standard ones.

### CONCLUSIONS

Contemporary logistics meets clients' expectations. Supplying the right product" in accordance with the 7R rule requires taking individual needs of customers into consideration. The concept of Total Logistics Management uses the notion of logistically efficient product able to offer benefits for both the producer and client. The application of mass customization through re-designing products in a way that is favorable for mass production and

through the use of theory of modularity becomes one of the key elements of logistic efficiency of a product. Modularity allows to adjust a standard product to clients' preferences without generating additional costs and simultaneously enables to create a product that supports the realization of logistic functions in an enterprise. The presented analysis and the authors' reflections have initiated research into logistic efficiency of a product as a source of added value for a client and for a production enterprise.

### References

- [1.] Bednarz L., Operacjonalizacja strategii masowej kastomizacji [Operationalization of Mass Customization Strategy], KZZ Conference, Zakopane 2010.
- [2.] Bielecki M., Miejsce podatności ładunku w koncepcji logistycznej sprawności produktu [The Position of Transportability in the Concept of Logistic Efficiency of a Product], „Logistyka” [Logistics], 2013, no. 5.
- [3.] Bielecki M., Transport processes of the small manufacturing enterprises (SME) in the context of logistically efficient product, “Research in Logistics & Production”, 2013, no. 3.
- [4.] Bielecki M., The influence of a logistically efficient product on the logistics of a manufacturing enterprise, “Annals of Faculty Engineering Hunedoara – International Journal of Engineering”, 2013, vol. 6.
- [5.] Da Silveira G., Borenstein D., Fogliatto F., Mass customization: Literature review and research directions, “International Journal of Production Economics”, 2001, vol. 72.
- [6.] Dudziak A., Zając G., Słowik T., Szyszlak-Bargłowicz J., Masowa kastomizacja – odpowiedź na potrzeby rynku [Mass Customization – the Answer to Market Needs], „Logistyka” [Logistics], 2014, no 6.
- [7.] Pawlak N., Niewiadomski P., Koncepcja szczupłego produktu oraz jej implikacje kosztowe i jakościowe [The Concept of Lean Product and Its Cost and Quality Implications], „Gospodarka Materiałowa i Logistyka” [Materials Management and Logistics], 2012, no. 12.
- [8.] Pfohl H.-Ch., Systemy logistyczne. Podstawy organizacji i zarządzania [Logistic Systems. Fundamentals of Organization and Management], Publishing House of the Institute of Logistics and Warehousing, Poznań 1998.
- [9.] Rudnicki J., Siuta-Stolarska B., Innowacyjność w środowisku masowej kastomizacji [Innovativeness in the Environment of Mass Customization], „Journal of Science of the gen. Tadeusz Kosciuszko Military Academy of Land Forces”, Wrocław 2014, no. 3.
- [10.] Szymonik A., Bielecki M., Bezpieczeństwo systemu logistycznego w nowoczesnym zarządzaniu [Security of a Logistic System in Modern Management], Difin Publishing House, Warszawa 2015.