

TRANSPORT PROCESSES OF THE SMALL MANUFACTURING ENTERPRISES (SME) IN THE CONTEXT OF LOGISTICALLY EFFICIENT PRODUCT

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Abstract The article presents the concept of logistically efficient product in the logistic management and results of research conducted on a group of small manufacturing companies in the textile industry from the Lodz region. The research was conducted to determine conditions of logistic management in small manufacturing enterprises and the article shall address the concept of a logistically efficient product in terms of transport organisation and results of research which relate to this issue.

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1. INTRODUCTION

A necessity to decrease the ready products costs combined with a continuous improvement of quality and punctuality of supplying a product to the market makes companies undertake actions which rationalize the different areas of management. Management and logistics management become more and more often one of the key areas in which the production companies can gain a competitive advantage. This involves the continuous development of the current logistic processes. Such actions should always aim at improving the effectiveness of supply flows and at minimizing warehousing costs. These are the conditions precedent to maintain continuity of economic processes. In such a case, a product itself and its features start to grow in importance which can decide about its effective operation in the broadly understood logistics.

The article presents introductory studies on a logistically efficient product and the results of research conducted on a small group of production companies.

2. TRANSPORT PROCESSES OF SMALL PRODUCTION ENTERPRISES VERSUS A LOGISTICALLY EFFICIENT PRODUCT

The concept of logistics of a production enterprise should include numerous factors typically related to the features of such companies and should also generally address the knowledge which has so far been presented in the literature. The starting point should be though the analysis of the literature and phenomena occurring in logistics which would give basis to build a certain general concept of logistics in a production enterprise. Another step should include a comparison of the concept created with the results of the research conducted in small production companies. However, because the concept itself is quite extensive in its notions, this article shall present some of its general assumptions and shall deal with one of the concept's aspects, namely a logistically efficient product.

While formulating a concept of a production company, phase and functional divisions present in the literature should be treated as a starting point. On this basis it was assumed that every subsystem of a phase system penetrates a subsystem of a functional system. According to such an assumption, a supply subsystem shall include order handling, inventory management, storage, transport and packaging similarly to a production subsystem, distribution, return and disposal. Since this system functions in a given environment, it should be based on a given logistics infrastructure. This whole system which combines phase and functional divisions together with infrastructure will be referred to as a logistics center of a production company.

The described process will undergo two basic processes resulting from the features of logistics. The first are the processes of goods flows undergoing con-

tinuous management, improvement, increase of effectiveness and decrease of costs. The second are information and decision processes which together with feedback are a kind of a link between a company and its external environment.

A logistics center of a production company just as its expansion should be a purposefully designed and organized system which realizes basic tasks and aims faced by a logistic management of a production company. The attention must be paid to the fact that a product itself should play an important role.

A product treated as a physical good manufactured by a company and subject to logistics process should possess key features which decide about its purchasing power-a client's satisfaction. For the production company a product should be also approached wider as an element which exerts influence on logistic management. Therefore it seems necessary to introduce into a concept of logistics of a production company a notion of a product in the context of logistics effectiveness, called further in this paper a logistically efficient product.

Approaching logistics in a systemic manner it should be remembered that the product itself and the features resulting from its design have remarkable impact upon subsequent logistic management in the aspect of the entire company. Defining it in the aspect of a functional approach a system of handling orders, inventory management, transport, storage and packaging are in many cases considerably dependent on the design of the very product.

Such features as multi-variant products, options to customize the product or variants resulting from the company's offer happen to cause situations where particular logistic features cannot be properly realized.

What is more an arrangement of the elements of the functional division is an important problem related to the identification of a logistically efficient product. Transport, storage, packaging, inventory management or order handling evaluated against a product logistically efficient show some theoretical dependencies. Transport, storage and packaging in most cases refer directly to the very product. Therefore, a product which is logistically efficient shall influence directly these areas. On the other hand inventory management and order handling are indirectly connected with a product itself so the factors identified in these areas should exert less influence on the discussed issues.

The interpretation of the logistic management by a prism of a logistically efficient product allows for a dichotomous division in the approach to logistic management into static and the dynamic approach.

Logistic management in the static approach will refer to a situation in which a company rationalizes only logistic processes. The pressure in such activities is put mainly on the processes resulting from a functional division (inventory management, transport, storage, packaging and order handling). Logistics in a static approach tries to eliminate the negative impacts of logistic actions by means of optimization and rationalization of activities in relation to all the parties of logistic management. In the static approach the role of the very product in the logistic system is omitted as it is treated as an inviolable element.

The logistic management in the dynamic approach is approaching the issues of logistics in such a way that it is tried to include in the very product and in the elements related to it the biggest possible number of features which influence logistics. The identified features and their proper consideration should lead to the improvement of the logistic management of a concrete product by increasing the effectiveness of its flow in a logistic channel. With such an approach to the discussed issue in the dynamic approach at least two possibilities can be recognized.

The first possibility, called a project possibility, refers to considering already on the stage of a project design many important logistic factors which definitely influence the effectiveness of logistic management. In this case there are two possibilities. The first one refers to a situation when the design works are carried in such a manner so as to include the biggest number of logistic aspects of the product being designed, without considering an option to streamline the products in terms of logistics. The second approach means a slightly wider approach to the range of design works and allows a broader scope of design works which includes in the design works future options of implementing changes to the product (streamlining) which shall obviously impact a more effective adaptation of the product to logistic aspects.

The second possibility, called an improving one, refers to a situation in which a logistic management in the static approach allows for the changes of the certain features of the product in order to improve the effectiveness of logistics of the whole company. The concept of the logistics of a logistic company briefly presented justifies the analysis of the issues of the logistically efficient product.

Logistic features of a product imply a concept of logical effectiveness of the product which the company manages. This effectiveness allows to classify the product in terms of logistics and tools which should be used in logistic management. It also shows directions to improve the product whose superior purpose should be a growth of logistic management effectiveness.

Taking the knowledge commonly presented in the literature as a starting point, an attempt should be made to describe the conditions which a product should meet to be logistically managed in a more effective manner.

Golemska defines a logistic product as a "collection of customer's wishes and expectations regarding goods or services of a shape and quality which can only be fulfilled in a logistic system. Therefore, a product or a service as logistic products are flow products in a logistic channel on one hand, and on the other the economic form of such products allows all participants of the channel to gain profits." (Golemska, 1999, p. 53). The definition presented allows to conclude that, according to the author, each product should on one hand be appropriate for the flow in a logistic channel, and on the other hand it should meet customer's expectations providing profit for the company. Then efficiency, in a technical aspect, according to a Polish language on-line dictionary, means a relation of an achieved effect of actions to resources used for this purpose, provided in per cents (Golemska, 1999, p. 57). From the point of view of management, the relation of the effect to the effort is often named productivity or effectiveness. From the viewpoint of the

entire concept of small production company logistics, it seems that the very wording (be it efficiency, effectiveness or productivity) is of no significant importance.

Fusing the two definitions of a logistic product and of efficiency (even from the point of view of mechanics) allows to create a new term of a logistically efficient product which shall be understood as goods or services which allow to achieve logistic profits for both the manufacturer and the customer where the aggregate relation of the effect to the efforts shall always exceed 1. Obviously, defining all characteristics of the effect and the effort may cause many problems, not to mention presenting all the elements listed as quantitative data (not just qualitative). Therefore, during the initial phase of determining conditions for a logistically efficient product, actions shall focus on finding basic conditions which allow to effectively manage the product in terms of logistics.

The definition of a logistic product quoted misses one crucial aspect regarding relations between the customer and the manufacturer in terms of a logistically efficient product. An attempt to link benefits of a product logistically efficient for the manufacturer and the customers is many cases related to conflicts between a company that offers a product (adapting the product to flow, inventory streamlining) and the customer (who wishes to receive a satisfactory product). This often demands a compromise and creating an "imperfect" product which is friendly for logistic flows and processes and which simultaneously pleases the customer. Assuming that the problem of a product satisfactory for the customer fuses the issues of marketing, design, production, quality and many other management aspects, the author shall try to determine conditions which should allow to characterize a "logistically efficient" product as a set of interconnected features which allow to manage the product more effectively in terms of logistics.

Commencing the determination of the conditions which shall define a logistically efficient product, one should also refer to some commonly accessible theoretical issues which allow to logically arrange conditions for a logistically efficient product. Considering the phase and the functional approach (for example, Pfohl, 2001, pp. 16-19), (Blaik, 2001, p. 68) as a starting point it should be necessary to extend Gołemska's definition (Gołemska, 1999, p. 53) and to adopt an assumption that a logistically efficient product should have some specific features which result from both the functional division (order handling, inventory management, warehousing, transport and packaging) and also include the fact of product movement according to the phase division (within subsystems of supplies, production, distribution, disposal and returns) which would facilitate effective management of logistics.

Certainly, the supreme fact is that a logistically efficient product, according to the concept of production company logistics and the aforementioned definition of a logistic product, has to undergo flows and should be coherent with the system of information and decision-making processes.

The aforementioned reservations enforce some generalised assumptions which shall allow to properly interpret the analysis of product conditioning in the context of its logistic efficiency:

- the concept of the product shall refer to both the final product (the direct factors) and all the features assigned to it which directly or indirectly impact the issues of logistics (the indirect factors) – a widened structure of a logistic product,
- each of the conditions shall be analyzed from the perspective of the customer, the manufacturer and common benefits,
- each of the conditions shall be analyzed in respect of optimizing one of the 7Rs,
- each of the conditions shall be analyzed from the perspective of the influence not only on logistics but also on other areas e.g. production, quality, sales.

However, in order to create a possibility to set exact guidelines for a designer which could allow to create a logistically efficient product, first an attempt should be made to analyze available knowledge in order to identify some precise features which shall support company's logistic activities. Initially, the aspects of indirect factors of a functional division and namely: transport, storage or packaging shall be analyzed. Further in this paper only the aspect of transport will be analyzed.

3. CONDITIONS FOR A LOGISTICALLY EFFICIENT PRODUCT IN TRANSPORT- RESEARCH RESULTS

Dealing with the transport subsystem in the context of features influencing logistic efficiency of the entire system, one should remember that transport operating as a binder between the defined dispatch and delivery venues should draw plenty of information from order handling processes. Also inventory management shall be of significant meaning here. Transport is not only related to choosing the transport method, which for most small production companies is the road transport, but also to strategic choice related to the decision "Make or Buy" that is to arrange the transport with own resources or outsource transport with external carriers. In order to refer to the conditions of a logistically efficient product in the aspect of transport it shall be tried to define at the beginning the features which a product must possess to make its transport more effective.

Analyzing transport and transport management in terms of a logistically efficient product, a general statement may be produced that a transported product should have:

- features which facilitate the transport itself (product sizes in relation to the available transport infrastructure),
- features which facilitate loading and unloading,
- the smallest possible number of features which make transport more difficult (external features such e.g. sharp edges, internal features such as sus-

ceptibility to damage or to mechanical, chemical reactions, etc.) or features which enforce special transport conditions, e.g. appropriate temperature,

- a clear goods identification system,
- features which consider environmental issues,
- consider the criteria of widely understood safety and ergonomics.

Any features which facilitate the transport itself should be related to including an ability to transport the product in the product design processes. Such issues as standard sizes of trailers, a possibility to use Euro pallets or a possibility to transport in box vehicles, refrigerated lorries or other commonly used transport vehicles, ability to employ rail transport by using particular cargo cars or finally issues related to containers and intermodal freight transport should determine actions related to designing new products and streamlining already existing products in respect of improving logistic management. Also remarkable importance should be on the part of issues related to loading and unloading of a given product.

Another important product feature which impacts the transport process is the issue of external and internal features of a product. Golemska notices that these include all physiochemical properties but also biological ones (Golemska, 1994, pp. 22-31). She also notices that "manager's knowledge of external (exogenous) and internal (endogenous) impact resulting from the construction of a logistic product is a condition precedent to handle such a product in the entire logistic system" (Golemska, 1994, pp. 22-31). It is hard to disagree with the author, but it should be noted that having a broader look at logistics, so considering and anticipating some actions for product's specific features during its design phase may remarkably simplify further transport processes. Manager's knowledge of the aforementioned features should also determine any and all improving actions which include either minimizing the impact of specific features upon transport processes or their elimination as far as it is possible.

Another, equally important aspect is related to a clear and well-thought-out goods identification system. It should facilitate the transport process itself and, which seems even more important, counteract and eliminate all mistakes which may occur in transport processes. This factor directly relates to the last factor, namely proper integration of the goods identification system into transport processes and entire logistics in a company.

Still growing importance is assigned to including environmental aspects in most company processes. This also refers to the transport issue. It should relate not only to streamlining of transport processes in terms of selecting optimum transport routes and thus reducing fuel consumption, but also to "empty runs" (often unavoidable) or other manifestations of "transport waste". Moreover, options to use various and pro-environmental transport solutions should be considered here, such as water or railroad transport.

Considering the widely understood issues of safety and ergonomics in the transport processes has little indirect influence on logistic actions. From the point of view of a strategic approach to logistics they can play quite an important role in a

long-time perspective. By minimizing total logistics costs which would include e.g. compensations for accidents or costs related to illness absenteeism of employees (resulting e.g. from the lack of the application of basic rules of ergonomics in the design of a product which facilitate the transport) an enterprise would be able to improve the effectiveness of logistic processes.

Analyzing certain aspects of transport processes in relation to logistically efficient product it can be noticed that there is a relatively wide range of potential features which can be considered in the context of logistic effectiveness of a product. Therefore, it is relevant to ask a question how each of these features is treated in the economic practice and what their real impact on the logistics effectiveness is. In order to answer this question, the results of pilot research shall be presented.

In order to test small manufacturing companies in the aspect of the aforementioned concept of logistics in a small production enterprise and conditions for its operations, a survey questionnaire was developed which was divided into: a part referring to the company manager, a part referring to operating conditions of small production enterprises and a part concerning logistics, divided into specific logistic subsystems and processes occurring therein.

It should be noticed that, as the problem of the conditions of logistic management in small production enterprises is very extensive, and the scale of similarity of certain logistic processes resulting from specific features of given enterprises can differ considerably, the research was decided to be carried out upon a certain heterogeneous group of manufacturing companies which share a common characteristic of operating within a common branch – in this case the textile branch. The research started in November 2009 and finished in March 2010. 96 small manufacturing companies employing 10 to 49 employees participated in the research.

Additionally, the research was intended to analyze companies managed only by native entrepreneurs and those not exceeding certain turnover limit. Hence certain additional assumptions were made referring to: company's size, ownership structure and income level.

When determining conditions for transport in the studied group of companies, it should be pointed out that in case of supplies entrepreneurs mostly use their own transport (ca. 40% of the enterprises use their own transport only for supply needs, and ca. 30% of the researched companies use mixed transport for supply- their own and supplier's). In case of distribution processes the own transport is dominant (ca. 70% of companies deliver own products with own transport and only in 13% of cases transport is provided by purchasers of company's products).

The average age of transport vehicles in most cases ranges from 5 to 10 years, more than 70% of companies possess vehicles of that age.

The researched companies, in principle, in more than 50% of cases do not analyze means of transport. This refers both to an analysis connected with the transport functioning (more than 67% of companies do not do such an analysis), the analysis of the operation costs of the different means of transport (more than 68% of companies do not do such analysis) and to an analysis of the selected routes costs (more

than 85% of companies do not do such analysis). The presented part of the research results clearly shows that the companies have basis to design or to improve product in the context of its logistic efficiency in transport- most of them use own means of transport. It is worth noticing that these means of transport are relatively old and what is more companies do not take any analytical actions connected with them which is quite important in identifying transport features which exert influence on logistically efficient product.

Another question is connected with the specialization level of transport vehicles possessed by the studied companies. In 70% plus of the researched companies cars are used for transport and only 14% of the group are vehicles equipped with additional elements to facilitate transport, e.g. hangers. The presented research results clearly show that transport means used by the researched companies are not, in most cases, specialized vehicles. The level of the vehicles' specialization is also connected with packages used in the researched companies.

Referring to other group of conditionings called generally packaging, only 24% of the analyzed enterprises consider an option to pack products in group packages while almost 50% of the companies try to adapt individual products to transport needs. The distribution of answers referring to packaging of ready products also looks quite interesting. About 95% of enterprises pack their ready products manually using plastic bags in more than 90% of cases. The packaging process is based on an owner's recommendations (more than 80% of answers) and the control of packaging processes means a random checking of a packaging (70% of cases).

As far as goods identification in transport processes is concerned, it can be clearly seen that most companies under research use simple actions for this purpose. A bothering fact is that ca. 15% of the analyzed enterprises do not use any visible system of goods identification (often an identification system is based on putting layers of given number of items of a product or a visual inspection and thus products are identified). More than 50% of the questioned companies use small size IDs (size stickers or other hardly visible solutions, e.g. tags). Only 8% of the analyzed enterprises use barcodes to mark their products.

The ecological, ergonomic and safety issues are generally omitted by the companies under research. A quite representative outcome has been achieved in this respect, which logically comes from the previous research results presented, where the entire studied group considers no environmental issues whatsoever, be it when choosing a transport method or planning further delivery routes. The only dominating factor is the economic one which sometimes influences the environment one (e.g. using LPG propelled vehicles, optimizing routes using software of GPS equipment) but as the research shows this is merely a coincidental relation.

The issues of product safety in transport hardly ever exist. In more than 80% of cases a rule of packing a vehicle to the full with products is applied in order to decrease a unit cost of transport. The features connected with ergonomics can be in principle referred to the answers on the basic rules of ergonomics in which 90% of the companies under research stated that they do not apply any basic rules of ergonomics.

The presented research results show some specific conditions which regard logistic management in small manufacturing companies and in particular allow to create an opinion on the concept of a logistically efficient product in the light of transport in the researched companies.

4. CONCLUSION

The presented research results unambiguously show that there is no concept of a logistically efficient product in the analyzed companies. It results from a relatively low level of general logistic management in the researched companies. Referring to the stages of logistics development it can be stated that the majority of the companies under research are nowadays on the level of a functional isolation and that an integration of the logistic functions in these companies is very rare. With such an approach to the issues of logistically efficient product but probably also to the issues of logistics it is difficult to foresee that these companies will include any aspects of logistics in the activities of designing a product or modifying it.

Products offered by the companies and the features of transport operations in the aspect of logistic effectiveness show that further research should be conducted on selected enterprises which undertake actions aiming to improve the effectiveness of logistics. On the basis of such research it would be possible to create a theory of a logistically efficient product and to try to create specific solutions for small enterprises.

A simple group of rules which would make companies realize that it is necessary to treat their products differently, particularly in the aspect of their logistic efficiency, should be among the solutions. In many cases it should be connected with a creation of the simple methods, techniques and tools which allow to define quickly which product features should be changed in order to improve its logistic effectiveness. The described group of tools should not only support a process of streamlining a product in the aspect of single features (which can be the first stage of the improvement activities) but it should also consider the whole concept of logistics of a small manufacturing company in the following stages to refer to the issues in a process and systemic ways.

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BIOGRAPHICAL NOTES

Maciej Bielecki is a Ph. dr at Technical University of Lodz. He teaches logistic management, production management, quality management and computer aided of this areas. His research interests are functioning logistics management in small production enterprises and widely understood problems of logistics, production and quality management. He is the author and co-author over 30 articles and publication and editor of monograph. He is also consultant, trainer, author many industrial projects and the author of laboratory of production management.

