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THE IMPACT OF LOGISTICS SECURITY CONDITIONS ON THE LOGISTICAL EFFICIENCY OF THE PRODUCT

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Abstract: One of the most important purposes of each logistics system functioning is to define the desired security state. It should be noted that the various elements that refer to the security of the logistics system are related to a number of both external and internal conditions of the company. There is also a number of security areas dependent and independent from the company. On this basis, one can make a statement that the product itself, having specified characteristics and properties can affect the security of the logistics system. The article is an attempt to identify and describe the impact of logistics security conditions on vulnerability of product design, and consequently on the logistical efficiency of the product.

Keywords: security, vulnerability, efficiency, product, logistics

INTRODUCTION

The challenges faced by manufacturing companies of the 21st century increasingly more often concentrate around the problems related to the flow of goods and information which in a natural way associates itself with logistics, defined as the process of efficient and cost-effective flow of goods and information from the point of their origin to the place of consumption. This forces enterprises to re-think their functional and global strategies, into such that would account for the primacy of logistics problems. This leads to the necessity of introducing new concepts and ideas, which include the concept of Total Logistics Management (TLM) formulated by the authors.

The concept of TLM should become a strategic declaration of the enterprise, with its foundation considering the complexity of problems and organizational challenges of the 21st century. One of the key elements of the TLM concept is the need to compose some part of the logistical conditioning into the product itself, which is dependent on multiple factors and elements. Another challenge of TLM is the problem of logistic security. The below article is an attempt to interconnect both fields and define the conditions of logistic security that are possible to be composed into an item within the concept of the logistical efficiency of the product.

THE CONCEPT OF LOGISTICAL EFFICIENCY OF THE PRODUCT IN THE CONTEXT OF TOTAL LOGISTIC MANAGEMENT

For many companies the vision of managing through logistics – TLM, is strongly dependent on the product itself and the information connected to it. Both the product and the information should be subject to successful and efficient flow. The concept of TLM itself is connected with a certain group of concepts that are usually placed before logistics, such as:

✓ the comprehensive implementation of the “7R” rule (right product, right quantity, right condition, right place, right time, right customer, right price) [9],

- ✓ cost rationalization in management of entire supply chain [13],
- ✓ comprehensive managing of the product in the context of logistics – the concept of a logistically efficient product.
- ✓ Provision of logistics security,
- ✓ ensuring logistic security,
- ✓ accounting for goods identification and IT support for the flow of goods and information.

One of the elements mentioned above is connected with the idea of comprehensive product management in logistic context. Thus, the idea of a logistically efficient product arises.

The concept of logistical efficiency of the product is based on the notion that the features and characteristics of the product itself have a fundamental influence on logistic management in the enterprise.

We may therefore attempt a general statement that the correct product assessment in terms of logistical efficiency should be the starting point for any actions related to shaping the functional or global strategy of the company based on logistics (whether conceptual or adjustive [2]). However, in order to be able to implement this rule in the economic life reality one should first define the basic criteria of the discussed concept, including any conditioning that might be crucial here from the logistic perspective

Analysing every product of the market exchange, one may state that it has some features and characteristics. Features are defined as elements distinguishing or characterizing the objects in some way, as an ingredient that does not function autonomously and may be differentiated only by means of thought analysis. Characteristics are defined as whatever is typical of the given item (the dominant features) [3]. Both features and characteristics of the product can either be natural or acquired. From the logistics perspective, this notion is extremely important as it allows to use a particular chosen logistic strategy and thus, directly or indirectly, influence the product itself.

The analysis and assessment in terms of natural and added features that foster logistic processes, is bound with the concept of logistical design vulnerability. Every product may be viewed as a set of natural features and characteristics, some of which can be modified and other that cannot undergo any transformation process. All those features and characteristics which are purposely designed create the set of acquired properties. The logistical design vulnerability of the product [4], [12] (composed of the transport, storage and organizational aspects) diagnoses the scope of possible changes that can positively influence logistic management. The key question here would be whether the analysis of the logistic security issues would make it easier to extract a group of factors that can be considered in the logistically efficient product design.

SELECTED NOTIONS OF LOGISTIC SECURITY

The rapid technological development and increasing range of economic globalization, along with the disappearance of traditional boundaries, are some of the many factors causing an increase in security threats within logistics systems. The number of factors generating risk is constantly growing along with the development of civilization. Among these we might include: rising energy and transport costs, the unexpected bankruptcy of strategic logistics providers, difficulty in maintaining regular cash flow, the need to adapt to the new requirements (including eco-logistics) of the local and international law, shortage of skilled employees among the shippers performing the loading of the goods or those providing transport services and logistics, rising insurance, road and credit fees.

The optimistic thing is that when new types of threats appear people are able to combat them by creating new methods, or by improving the older ways to organize prevention. The logistic systems, which are vulnerable to all changes and threats, both close and remote ones, due to the global length and width of the supply chain, must adapt to new technological, technical and legal conditions both in on the national and international scale.

The safety status of every system unstable and thus it cannot be seen as an item that is granted to the economic system once and for all. In the real world there are constant threats, caused both by the forces of nature as well as unintentional and intentional effects of human activities. Therefore every logistic system must put effort to assure itself a stable security status and, as a link in the supply chain, should include the possibility to react quickly to all changes, both internal and external, including the possibility of cooperation with other entities within the scope of the security system. This statement is nothing new as in the middle of the previous century, the father of contemporary management Drucker while proposing the criteria of choosing and designing an organization stated that every enterprise should have an end stability to survive in the time of confusion and the ability to adjust to new conditions [10]. The adopted strategy of logistic functioning should not be targeted only on implementing logistic processes and lowering costs but also should take into account the issues of contemporary threats along the whole supply chain.

Every action in logistics both in the planning and real phase is burdened with uncertainty that may be caused by the arising threat (threats) or disruption(s). By threats to logistic security we mean all actions (events, incidents) that disrupt the realization of logistic processes, the flow of goods and information (along with the logistics processes associated with them, such as the processes of transport, warehousing, packaging, order handling and inventory management). One also needs to note that logistic security is hugely influenced by the logistics management areas that are indirectly or directly connected with the above-mentioned processes: the infrastructure of logistics stream and logistic costs. These kinds of events may occur individually or jointly, creating a situation that is hazardous from the business perspective for the economic system and all participants of the supply chains. These threats may be directed inwards or outwards, and the measures taken to reduce them should go in the same direction. Threats can be destructive to the logistic system disrupting the flow of the goods and information. These disruptions can be divided based on [6]:

- ✓ *the place where the threat occurs;*
- ✓ *subsystem (according to the phase or functional approach to logistics [8]);*
- ✓ *duration;*
- ✓ *physical properties;*
- ✓ *range.*

The short description of disruptions according to the duration or range criteria may not be included here as it is difficult to distinguish particular categories within these issues that can be used in the concept of logistical efficiency of the product. The remaining threats should be presented so that they might be referred to in the following chapter. The disruptions depicted within the place criterion will mainly apply to: routes of all transport modes (i.e. road, rail, air, inland-waterway and marine); the modal points of the logistic network often called transport points [11] (e.g. a warehouse, independent container points, airports, marine ports, logistics centers; auxiliary devices facilitating service on roads and at transport points, management (i.e. lack of full identification of threat effects, overestimation of capabilities, inaccurate interpretation of results, lack of tools for optimization and simulation of activities, growing prices of energy and transport, sudden bankruptcy of logistic service providers).

The disruptions depicted under the criterion of the functional subsystem refer to: transport (e.g. a fire, an explosion, an accident of the transport means, washing off the deck, lack of possibility to move due to weather conditions, defective transport means, unadjusted internal transportation, change in regulations of the transport management, thefts, catastrophes), related to inventory storage and shaping (e.g. thefts, losses due to oversized inventories, fires, floods, construction disasters, grid and IT network downtime, damage of the automatic identification system), packaging services (e.g. environment contamination, damage of the goods while

transportation resulting from bad weather conditions), handling customer's orders (e.g. shortage of inventories, incorrect order or invoice, late delivery, damaged goods delivered to the customer, lack of response to complaints and delays, fire, theft, destruction of goods). Information-related (e.g. loss of confidentiality, integrity and possibility to dispose, natural threats such as fire, climate disruptions, electrostatic disruptions, passive and active attacks, random errors); The disruptions depicted within the subsystem that accounts for the phase division of logistics are related to supply (e.g. lack of timeliness, bad quality, price or quantity, bad assortment, bribery, corruption, lack of possibility to obtain components for manufacturing, information system corruption, lack of buffer stock), production (e.g. inefficient manufacturing system, damage, losses, thefts of resources, availability of professional staff, production interruptions, technical failures, floods, fires, disasters), distribution (e.g. new products, new producers, thefts, economic crisis, neglecting customer relationship management, neglecting flow of goods management within the supply chain).

The disruptions classification that considers the materiality criterion is divided into: material ones (e.g. transport-related) information-based ones (e.g. damage of information system, damage of automated identification system), energy-related ones (e.g. concerning gas or fuel), assets-related (e.g. financial crisis);

Disruptions and threats have a direct influence on logistic security. However to be able to describe this notion, one needs to predefine what characterizes the safety of actions in logistic networks and channels. By definition, it can be said that it is a state that gives the feeling of certainty and a guarantee for:

- ✓ the flow of material goods and services;
- ✓ the flow of information for planning and management of logistics processes;
- ✓ protection and survival during dangerous situations (threats);
- ✓ adaption to new conditions (flexibility in unplanned situations).

The security level of logistics processes is dependent on the condition of the hazards of cooperating participants in the channels and networks at local and global levels.

The security of a logistics system is associated with:

- ✓ preparation and resistance level of the system to combat emergency situations (the majority of the attention is concentrated on recognition, monitoring, analysing data and correct decision-making within the scope of logistic operation along the entire supply chain);
- ✓ the quality of the created and functioning security system - understood as a set of forces and means of ensuring a security status acceptable by the participants of the international logistics network.

A certain degree of safety of international logistics can be achieved in various ways - not only by providing a predetermined efficiency of direct countermeasures towards occurred events. The people managing the company have the opportunity to shape the security

level of international logistics services through their management, which can be defined as a set of coordinated actions taken at the time of the emergence of threats (interference), aimed at the logistical resources of all members of the supply chain, with a view to achieve the objective, which may be the security of supply, reduce risks, to realize the conditions set by the owner of the cargo and the protection of market position and brand. Controllable values in this case are the parameters characterizing the factors affecting the level of security of the system, which is associated with¹:

- ✓ prevention of possible threats to the security processes implemented within the framework of international logistics.
- ✓ preparation of the logistics systems for the event of activation of these risks;
- ✓ resources countering these threats;
- ✓ removal of the consequences of the event.

Referring the presented notions to the logistic efficiency of the product it can be noticed that in fact the biggest influence on the product itself should be the prevention of possible threats to the security of the international logistics which includes:

- ✓ formulation of security policies by all members of supply chain;
- ✓ risk assessment [7][8] during the implementation of processes in the supply chain;
- ✓ developing a plan for managing and reducing the identified threats;
- ✓ detection, identification, recording and control the possible risks;
- ✓ foreseeing the possibility of crisis (e.g. with the use of data warehouses or computerized systems);
- ✓ examination of the acceptance level of risks in the supply chain among its members;
- ✓ determination of the type and scope of activities to prevent risks in the area such as road transport, warehousing, distribution, logistics costs – increased fuel costs;
- ✓ providing training to the people involved in logistics on both micro-level (individual economic system) and macro-level, with particular attention to:
 - » the institutionalization of logistic relations
 - » standardization of logistics processes,
 - » standardization of processes (e.g. according to GS1)
 - » increasing the requirements of the economic system transparency in business and logistics contacts,
 - » tightening the criteria for risk-taking and the professionalization of activities within the supply chain
 - » need to broaden international cooperation of science and industry in the field of improvement of logistics processes,
 - » reconstruction of destroyed ecosystems and wider use of renewable energy sources,
 - » trust management, risk and security in logistics operations

¹ See. E. Kołodziński, *Istota inżynierii systemów zarządzania bezpieczeństwem*, <http://www.uwm.edu.pl>, 10.04.2012.

The tools that help to manage the security of logistic systems at the micro and macro scale are the solutions that arise from the norms provided by national and international organizations as well as from various technical and technological aspects.

As for the normalization, it should be noted that in most cases it relates to the establishment of standards that systemically solve issues such as risk management in a supply chain (ISO 28000 2007), or ensure the continuity of the action (BS 25999:2007).

The group of technical and technological solutions includes among others: traceability (comprehensive traceability or origin - identification of the batch of the product, raw materials used for its manufacture, followed by individual identification of each product comprising the batch during production and/or distribution to the direct consumer), GS1 standard (bar codes and electronic product codes), Business Intelligence - BI (business intelligence) or the monitoring network.

THE IMPACT OF LOGISTIC SECURITY ON THE LOGISTIC EFFICIENCY OF THE PRODUCT

The above-presented logistics and security issues should be the basis of the considerations related to the design of the product itself as seen in the light of hereby discussed issues. The logistical efficiency of the product should allow for incorporation of certain solutions in the product itself to make it possible to provide more efficient and effective management across the entire supply chain. The presented overview of selected topics on logistics management clearly shows that there is a group of logistic security issues, which cannot be included in the logistical efficiency of the product. However, to attempt a discussion as to which safety features can be included in the product, one needs first to look closer at the issues that might possibly generate threats to logistics and analyse their impact on the product itself.

The division of disruptions presented in the article allows us to notice, that the factors categorized within the groups associated with the place, subsystem and physical attributes should have an impact on the concept of logistical efficiency of the product. The question of where disturbances occur, i.e. all modes of transport routes, modal points, auxiliary equipment to facilitate road maintenance and transport points, is in fact related to the concepts of transport, storage and organization vulnerability. The combination of the three together creates the logistic vulnerability of the product, which in turn is a key element of the logistics efficiency of the product. The same applies to the interference generated by the subsystems in terms of the functional and phase approach. The same might be said, to an even greater degree, of disruptions associated with physical properties, where the division to material and information-related interference, allows to decide which of the basic vulnerability analyses might include particular disturbances from this group. In the context of logistics system security, the level of preparedness and resilience of the system to the prevention of emergency situations, as well as the quality of the functioning security solutions, is inextricably linked to

the organizational vulnerability of the product. Another, separate matter would be to investigate which of the elements associated with the preparation, resistance and quality of such a system can be integrated into the widely understood product, or, more precisely, into the its organizational vulnerability aspect. In case of both preventive measures and tools that assist safety management, one may see that, as regards the latter, that the impact of particular standards widely associated with logistics security, usually applies to the organizational sphere of company activity, forgetting the product itself. In most cases, no one analyses the possible changes in the product just adapt it to some specific standard unless this standard is enforced by law. The situation is different with technical and technological solutions. The implementation of identification systems based on the GS1 standard barcode or RFID or comprehensive Tracing, often forces the producers to incorporate specific sets of characters either directly into the product or its packaging, thus allowing to identify individual elements in each dimension. The described preventive actions range shows that the available range of processes affects product modification only indirectly. That so happens because they are mostly related only to the way the system is organized or managed, i.e. to its organizational vulnerability.

SUMMARY

The concept of logistic efficiency of the product implies the possibility of incorporating the optimum number of features and characteristics that would facilitate the flow of this product along with related information. To be able to discuss the issue further, one need to distinguish the design vulnerability of the product, which consists of transportability, storage and organization and describe the circumstances that may impact all of these vulnerabilities. The sphere of logistics security is one of the groups of conditions described here, which similarly to the customer service subsystem is mainly related to organization and management of logistic system. Organizational vulnerability clearly provides framework to the debated issue, at the same time affecting the logistical efficiency of the product.

The further scientific research intended by the authors will involve the identification of these factors of organizational susceptibility (including logistics security), which may already be intentionally designed at the stage of product design, thus increasing the subsequent efficiency of the entire logistic chain. Moreover, the above presentation of logistic security issues and logistical efficiency of the product allows the reader to notice that specific analytical tools allowing to diagnose the scale of threats and uncertainties of logistic operations in terms of security and the product itself, are yet missing; this matter will also become a focus of the further conducted research.

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