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SAFETY OF LOGISTICS SYSTEMS AS AN ELEMENT OF THE TOTAL LOGISTICS MANAGEMENT CONCEPT

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Abstract: One of the most important purposes of the functioning of each logistics system is to define the desired state of security and safety. It should be noted that the various elements relating to the security and safety of the logistics system are related to a number of both external and internal conditions of the company. There are also a number of security and safety areas dependent and independent from the company. On this basis, it can use that same product, having specified characteristics and properties can affect the security and safety 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 and in a wider range on the logistical efficiency of the product.

Keywords: security, safety, vulnerable, efficiency, product, logistics

1. INTRODUCTION

Manufacturing companies wishing to compete in the global market, face a number of challenges. Most of these are associated with the continuous rationalization of many functional areas of business, directly or indirectly related to production management. Much as in the 1950s or 60s the challenge for these companies was to rationalize production in its broad meaning, by the implementation of mass production principles, the 1980s and 1990s would in turn show the tendency to strengthen the role of quality management. The implementation of Total Quality Management main concepts, related to full customer satisfaction, led to a situation where, for many reasons, it is increasingly more difficult to find new quality features that constitute success factors for an organization, in accordance with the Kano model [1], [2]. Hence, product quality has been set on some stable level and is gradually dispensed to customers, aiming now only to ensure that the organization provides only a certain specific level of satisfaction.

The challenges of the 21st century manufacturing companies are increasingly more often concentrated on the issues related to the goods and information flow, which relate to the concept of logistics in a natural way. Logistics, defined as a process of efficient and economically effective flow of goods and information from the place of origin to the place of consumption, imposes the need to re-orientate their functional and global strategies onto such that in their assumptions have to account for the primacy of the logistics-related problems. This leads to the necessity to introduce new concepts and ideas, which may include the Total Logistics Management concept, formulated by the authors.

The very TLM concept should become a strategic declaration of a company, addressing the complexity of problems and challenges the organizations face in the 21st century.

Hence, the below article broadly describes TLM in the context of one of many 21st century logistics challenges, which is logistic security, that occurs across the entire TLM concept.

2. THE CONCEPT OF TOTAL LOGISTICS MANAGEMENT

As presented in the introduction, the idea of Total Logistics Management comes from the assumption that the 21st century is the time for enterprises oriented towards the flow of goods and information. This is the way companies should build their strategies both functional and global – based on logistics.

This matter, however, may be disputable to some, due to the fact that in many cases the magnitude of problems associated with production management, market competition, sales etc. is far more complex than solely logistics as such. Moreover, in many cases logistics becomes an area that is either secreted or outsourced, which generates a question whether it makes sense to include logistics-related problems into the strategic activity of companies. However, observing numerous examples of enterprises

functioning on the global market (e.g. Ikea), we may see that they still decide to choose logistics as the strategic functioning factor on the market.

When attempting to define Total Logistics Management, it is impossible not to mention certain aspects included in it. Firstly, basing on the concept of Total Quality Management, one might define TLM as an approach to organization management, where every aspect of its activity is realized through the inclusion of the pro-logistics approach. Similarly as in TQM, TLM should also have its assumptions and principles, some of which may overlap with TQM.

As far as the principles are concerned, involvement of each employee in the company, activeness based on long-term deadlines or the optimization of the processes seems consistent for both concepts. This is because the mentioned activities are related the effectiveness and efficiency of management in every manufacturing enterprise. However, in the case of TQM, many of them are congruent with the principles formulated by the ISO quality management standard [3] and at least some part of them is universal enough to be applicable to both concepts. Hence, when we analyse the eight basic principles of quality management:

- ✓ putting customer first,
- ✓ leadership,
- ✓ employees' involvement,
- ✓ process approach,
- ✓ system approach to management,
- ✓ continuous improvement,
- ✓ fact-based decision-making,
- ✓ mutually beneficial relationships with suppliers,

it becomes apparent that some of them are associated with management effectiveness (putting the customer first, leadership, employees involvement, continuous improvement, fact-based decision-making), while the second part applies to the system-based and process approach to organizations (e.g. the system approach to management, the process approach, continuous improvement or mutually beneficial relationships with suppliers). At this point a question arises, as to what elements need to be included in the TLM concept to distinctly emphasize the logistics management-related problems.

From the perspective of modern logistics, the most important challenges faced by this area of company management, that also become the TLM mission are:

- ✓ the comprehensive implementation of the "7R" rule (right product, right quantity, right condition, right place, right time, right customer, right price) [11],
- ✓ cost rationalization in management of the entire supply chain,
- ✓ comprehensive product management in the logistics context – the concept of a logistically efficient product [4] [5],
- ✓ ensuring logistic security,
- ✓ accounting for goods identification and IT support for the flow of goods and information.

The combination of the above-presented elements with the basic principles of rational management formulated by the TQM concept, reveals the comprehensive idea of Total Logistics Management. The above-presented key logistic elements, among themselves, should have their structure and gradation. Both should stem from the specific conditions of enterprise functioning, hence any preliminary positioning of the issues in question might be somewhat difficult. For that reason, in this part of the paper, the authors will attempt to characterize the problem of logistic security in the context of the TLM concept.

Table 1. Comparison between TQM and TLM

	TQM	TLM	
Effectiveness of management	putting customer first	X	X
	leadership	X	X
	employees' involvement	X	X
	continuous improvement	X	X
	fact-based decision-making	X	X
The system and process approach to management	process approach	X	X
	system approach to management	X	X
	mutually beneficial relationships with suppliers	X	X
Logistics Efficiency - the fulfilment of all listed the most important challenges faced by logistics	comprehensive implementation of the "7R" rule		X
	cost rationalization in management of the entire supply chain	X	X
	comprehensive product management in the logistics context – the concept of a logistically efficient product		X
	ensuring logistic security		X
	accounting for goods identification		X
	IT support for the flow of goods and information		X

3. SECURITY IN LOGISTICS

The security status of any system is not stable, and so it is not the good that the economic system was provided with once and for all. In real world, constant hazards occur, whether coming from the forces of nature or the unintended and intended effects of human activity. Therefore, every logistics system needs to strive to ensure a stable security status for itself. Each logistic economic system, being a link in a supply chain, should develop, among its activities, the ability to react promptly to any changes in its internal and external surroundings, including the possibility of cooperation within the confines of a security system, with other entities. This idea is nothing new, as already halfway through the last century, the father of contemporary management, Drucker, when putting forward the criteria for the selection and design of organizations stated that every company should possess the durability to survive any period of confusion and the ability to adapt to new conditions [12]. The adapted strategy of logistic functioning should not be focused solely on the realization of logistics processes and cost reduction, but it should also include the problem of contemporary hazards along the entire supply chain.

All actions in logistics, both in planning and real areas are burdened with some degree of uncertainty, which may be incurred by the danger (threat) or interference that appears. Security threats in logistics are all actions (phenomena, events) that disrupt the implementation of the logistics 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 to logistics security may be divided into five groups. The **first group** includes natural disasters and events evoked by civilization-related causes, i.e. catastrophes, failures and other events caused by human activity or negligence. This group of threats includes, inter alia: fires and floods, strong winds and hurricanes, thefts, epidemics of human, plant and animal diseases, chemical and radioactive contamination, mining, construction and road disasters, grid failures. The **second group** includes events that threaten the constitutional order of the nation(s); terrorism, road blockades, illegal demonstrations, ethnic conflicts, mass migration. The **third group** may include mechanisms that aim to destroy or distort information that is sent, transferred or stored for the needs of logistics. All disruptions in information flow cause difficulties in efficient and effective logistics management along the entire supply chain. The **fourth group** includes the threats that stem from the consequences of a financial crisis, which in fact affects everyone, including logistics processes and systems. Even an economy with great growth rates does not secure us from the crisis, and in fact the anti-crises instruments have not yet been fully developed. The **fifth group** includes threats related to the enterprise business (e.g. rapidly decreasing prices, the lack of quality adjustment to the preferences of the customer, mass departure of educated staff in search of better employment conditions, the enterprise not being able to follow the global trends, imported goods displace its production, corruption, bribery, stocking the hostility towards foreign companies, purposefully falsified data published by the rating companies, business intelligence, data banks, loss of credibility, insufficient activeness of employees caused by dissatisfaction and frustration). [6]

The mentioned threats may have a destructive effect on the logistic system, disturbing the flow of goods and information. These disruptions may be classified by the following [7]:

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

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** (under the name of modal (most probable) points of logistic network we understand all places of stopovers for the goods, i.e. warehouses transport points and nodes, factories, distribution networks [13]) of the logistic network often called transport points (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 danger 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 hazards such as fire, climate disruptions, electrostatic disruptions, passive and active attacks, random errors);

Disruptions depicted within the **subsystem that accounts for the phase division of logistics** concern aspects of: **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).

Disruptions, based on the duration criterion are divided into: **short-term** (intermittent); **long-term, growing, recurrent**).

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

The last classification criterion for disruptions is based on the **operational range: local**, concerning the logistics of a given economic system, being a link of e.g. an euro-logistic channel, or **vast** (along the entire supply chain) [9].

Hence, the logistic security system should be adapted to potential threats and the required security level which needs to be ensured for it within logistic channels. Consequently, the number of measures necessary to achieve the desired security level within the area of logistic activities, their organization and course of action (or processes, more specifically), after danger occurs (an event takes place) depends on its kind and scale, as well as on the prognoses of likelihood that other kind of danger might occur.

The security of operations within logistic networks and channels is the state that gives a sense of confidence and ensures the following:

- ✓ flow of goods and services; in consequence satisfaction of the material needs that the supply chain participants have, in accordance with the "7R" principle;
- ✓ protection and survival during dangerous situations (threats);
- ✓ adaptation to new conditions (flexibility in unplanned situations).

The security level of logistics processes is conditioned by the vulnerability of cooperating participants in channels and networks, on local and global scale.

The security of a logistic system is related to:

- ✓ the level of preparation and system resistance to counteract in extraordinary situations (the main attention is focused on the diagnosis, monitoring, analysing data and accurate decision-making in the area of logistics activities along the supply chain);
- ✓ the quality of the created and functioning security system - understood as a set of forces and means that ensure the security level acceptable for all participants of a logistic network;

Thus, a given specific level of logistic system security may be achieved in many ways, not only by ensuring particular effectiveness in direct counteraction against events that take place.

4. TOTAL LOGISTICS MANAGEMENT AND SECURITY OF LOGISTICS

The issue of logistics security should become one of more crucial elements of the TLM concept. However a question arises, in what way and place it should be set within the hereby discussed theory.

Analysing logistics security in the context of TLM, one needs to note that the problem may be discussed in two ways, depending on which of the two TLM areas we take into consideration. The first group of factors, related to the overall philosophy of efficient and effective company management is mostly related to the elements originating from TQM. Basically, the first group of factors (putting customer first, leadership, staff involvement, continuous improvement, fact-based decision-making) is directly linked with the organizational culture level, and so their influence on logistics security is significant, but still somehow limited. Hence, the second group of factors, this time concerning logistics itself, becomes the key element of the hereby-discussed theory. The security issue is inseparably linked with costs, information and IT systems, the concept of a logistically efficient product and the "7R" principle. The result is that, in many cases, the correlation of security with the mentioned conditioning of modern logistics should be precisely determined and defined.

At this point, it becomes necessary to place the issue of logistics security within the hierarchy and relating the problem to the remaining elements of TLM, related strictly to logistics. Concentrating on the first element of the TLM mission – the comprehensive implementation of the “7R” rules, which imposes on the company the necessity to focus its operations on the right product, in the right quantity and right condition would reach the right customer in the right time, with right price and to the right place. Here, one may clearly distinguish elements more and less prone to logistics security. It is difficult to ensure purely marketing-related factors, such as right product, right price, right customer or right place to be fully safe. In turn, the question of the right quantity, right condition or right time in which the product should reach the customer seems more vulnerable to safety issues. This stems from the fact that the presented problems are more in line with the procedural and systemic nature of logistics operations. It is much easier to extract real danger related to the lack of provisioning of the right quantity, condition or timing (by, for instance, the cause-result analysis, based on principles formed by Ishikawa [9] – 5M+5 – man, method, machine, material management + environment) and take the right corrective or preventive actions.

Some of the indicated factors are related to the area of IT support for the flows of goods and information that include, for instance, the possibilities given by the goods identification systems (e.g. barcodes, electronic marking or traceability). This sphere of logistics safety will in many places support reduction of risks related e.g. to the right quantity of the goods supplied to the customer, at the same time being subject to danger related with broadly understood information and IT systems security.

The entire range of activities related to logistics security will be naturally associated with costs and, just as all the other remaining logistic actions, should be subject to continuous rationalization. Analogically as with quality-related costs [10], it will be optimized where the total costs of prevention and correction of the problems arising from deficiencies in security level will be equal.

In the end, the problem of safety of the product itself is yet to occur, together with a set of its features and characteristics, both natural and acquired, which in many cases will either be favourable to logistics security or they will generate problems, due to their nature. This fits in with the concept of the logistical efficiency of the product in which, within the confines of logistic design vulnerability, certain aspects of logistic security are taken into consideration, creating a vision of a final product.

5. SUMMARY

The concept of Total Logistic Management (TLM) clearly indicates that the issue of logistic security is becoming one of the key areas. The article depicts basic problems of logistic security as such, related to its hazards, but also outlines the basic relationships between particular areas of the TLM philosophy. However, it is worth to mention that the range of problem areas directly related with logistic security is extensive and requires further analysis, which currently lies within the research scope of the authors. Legal norms and regulations within the area of global logistics security apply to all supply chain participants and are local in their nature (e.g. Container Security Initiative - USA and Canada) as well as international ISO 28000 : 2007 Supply Chain Safety Management System).

The research interest of the authors also comprises placing selected logistics security elements in the product itself, which is related to research work on the logistical efficiency of the product, the concept of which has been presented in a separate publication.

The theoretical areas hereby presented in brief clearly indicate that the entire issue of building the idea for company management via logistics should be based on the concept of product building that includes its logistical efficiency and the crucial issue which is logistic management.

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