



Telematics as a tool of efficient supply chain management

A. BUJAK^a, M. TOPOLSKI^a, R. K. MILER^b

^a WROCLAW BANKING SCHOOL, Institute of Logistics, Fabryczna 29-31, 53-609 Wrocław, Poland

^b GDAŃSK BANKING SCHOOL, Faculty of Finance and Management, Dolna Brama 8, 80-821 Gdańsk, Poland

EMAIL: andrzej.bujak@interia.pl

ABSTRACT

The management of modern supply chain requires the use of many modern tools and applications. Telematics is a tool that allows to evaluate the state of implementation of processes in the supply chain in real time, take decisions adequate to a given situation, or carry out activities effectively. It is impossible to manage something one cannot see, therefore the ability to implement such processes correctly becomes one of the essential elements of success in the current market conditions. The research team at the Institute of Logistics at Wrocław School of Banking analyses the possibility to implement the latest telematics solutions to logistics system in Lower Silesia, particularly in transport companies. These activities, in addition to the development of knowledge related to using the latest technology in logistics systems, are intended to prepare a wide variety of solutions and concepts for enterprises in Lower Silesia, in order to be able to effectively apply under the EU Horizon 2020 programme or national programme 2014-2020 POIR.

Keywords: telematics, telematics supply chain, technological innovation, safety, flexibility and reliability in the supply chain

1. Introduction

The pace of modern transformations generates the need in logistics to permanently identify the key changes that will occur in the near future and the changes that may occur in the longer term. These changes result primarily from more rapid implantation of the latest achievements of technology and modern technologies in the area of logistics. Their use generates, on the other hand, changes in concepts and implementation strategies of logistics tasks. It also creates the need for adequate preparation of personnel capable of creative, forward-looking thinking and development of new practices and paradigms in logistics to meet the needs of the market and customers. [1]

Therefore, the Institute of Logistics at Wrocław School of Banking, which is responsible for educating more than 2.5 thousand students majoring in "logistics", carries out empirical research programme, the aim of which is to indicate the directions of the development of logistics and the dynamics of the anticipated changes in particularly important areas, which among other things include: new concepts (strategies) for the implementation of logistic tasks, new technologies used in logistics, innovation and safety and risk in logistics. The

objective of these studies is on the one hand, building and customizing the logistic personnel training programmes to market requirements and customer expectations and, on the other hand, an important objective is also to indicate the direction of change in the area of system of logistics of Lower Silesia and its operation, which will prepare the system to act in forward-looking, global circumstances.

In general, the study was conducted according to the Delphi method belonging to heuristic methods of forecasting. It uses the knowledge of experts and their assumptions about the emergence of solutions to problems in the future. The studies, periodically repeated, were conducted using survey method in two stages. The main research tool was a questionnaire consisting of a few to several questions. Conducted were also expert interviews (in-depth) with specialists from the industry, based on a scenario of the conversation. The scenarios presented showed a string of events starting from the initial situation through a logical sequence of events leading to possible future, taking into account the tendencies and trends prevailing at present and in the foreseeable future

The concepts presented in the article were created among other things on the basis of the conducted research.

2. Modern logistics

Modern logistics as a global phenomenon is constantly expanding its borders. A permanently increasing complexity of the processes and logistics activities resulting from the global expansion, as well as various circumstances generated in heterogeneous parts of the world, creates not only the need for constant improvement but also for often new innovative solutions or concepts. Modern logistics must generate such capabilities, which will allow to carry out effectively the tasks facing it in the present and future circumstances. This concerns in particular the functioning of supply chains.

Changes in the functioning of the logistics and supply chains generate the following factors [2]:

- integration of all management functions, including the management of logistics in the enterprise and between enterprises;
- convergence of logistic processes in companies, links of the supply chain;
- development of international logistics networks with emphasis on the construction of logistics centres.

In view of the above factors and circumstances the key issue affecting the future logistic solutions in the area of its organisation and operation of supply chains will be the implementation of technical solutions from a variety of areas, including telematics.

At this point it may be assumed that the ability to use contemporary telematics solutions in the interest of the logistics activities becomes one of the fundamental issues. The introduction of telematics solutions allows not only to automate and shorten processes and logistics activities, but also affects their safety, allows for greater flexibility and reliability of operations within the supply chain. In addition, there it is also a feature that allows to reduce the negative impact of transport on the environment.[3]

2.1. Contemporary competitive and transparent supply chain

Some of the key challenges facing the modern logistics are issues related to the management and operation of a modern supply chain. Latest trends and concepts of the SCM relate to building opportunities for the comprehensive management of all links and processes that are carried out. However, at this point, there appears an issue essential for the implementation of the concepts: One cannot manage something which is invisible. This situation, however, is an essential prerequisite for supply chain management to start considering telematics, whose technical solutions generate the ability to not only “see” elements of the supply chain but also manage them in real time. [4]

However, before this issue is presented widely it is worth going back to what kind of requirements are placed before the contemporary perspective supply chains. Defining these requirements is also accompanied by specifying the requirements for telematics systems which they should meet to realistically help improve the management of these chains.

The changes in economic, financial, organizational, legal, technical and technological circumstances have led to the gradual transformation of the traditional model of functioning of the economy into a very

dynamic network of links and dependencies. This situation directly affected the perception and operation of supply chains. Contemporary requirements which are generated for the supply chain are, above all, its organization and functioning, which allows for quick response and the ability to meet rapidly changing demand; flexibility and ability to adapt to the optimum cost-level of service; ability to make optimal use of the resources of the company and the ability to use all of the available information.

Today attention is paid to the search for new forms, ways and concepts of operation of the supply chain, which would meet current and future requirements, especially in the area of implementation of customer expectations, creating in this way a competitive advantage. Two concepts have a specific impact on the functioning of today's supply chains:

- transfer of competitive struggle to the entire supply chain;
- increase of transparency in the supply chain.

A lot of the analysis and exploration for new and better (innovative) solutions also apply to the issue of raising the efficiency of supply chain management. In this context, a more effective solution is to “automate transactions” and “stabilize operating conditions”. Elimination and simplification of transactions shall be treated as a way to improve supply chain management.

Presented considerations once again point to telematics as an area of technical solutions and as a concept which will generate opportunities for logistics tasks in accordance with the requirements of the 21st century

3. Telematic solutions in the supply chain

Today, there is an increase in customer requirements in terms of time for delivery services, their flexibility, availability and reliability. Expectations and requirements of customers grow and, on the other hand, there is a need to reduce costs and limit the amount of frozen capital. Today, products and services tailored to the individual needs are very important for consumers. Consumers are becoming more and more impatient. How to meet these challenges in the context of the supply chain? The required speed of response with a very high level of safety and the need to ensure the possibility of efficient response to potential risks in the supply chain generates the need to use all the modern technical and technological solutions and the latest concepts of the functioning of logistics, including solutions from the area of telematics.

The widest area of the application of telematics solutions in the supply chain is obviously transport, which connects the individual links. (fig. 1).

Telematics provides a wide set of tools and services originating from information and communication techniques that allow to increase operational efficiency, improve service reliability, management of infrastructure and safety, and minimize the impact on the environment and improve the quality of information services.

Telematics communication technologies and vehicular networks can be described as as key technologies for increasing road safety and transport efficiency. The role of telematics communication technologies and vehicular networks is to ensure traffic safety for drivers, give comfort

to passengers and minimize transportation time and fuel consumption. The rise of vehicular communication and networking technologies is bound to give way to numerous applications, including emergency management, automatic collision notification and prevention, safe driving assistance, real-time traffic congestion notification, location-based driver information services, high-speed tolling, vehicle tracking, and car Internet access. Many different types of communication and networking will be used to facilitate these applications, including vehicle-to-vehicle, intra-vehicle, vehicle-to-roadside and vehicle-to-infrastructure communications [6].

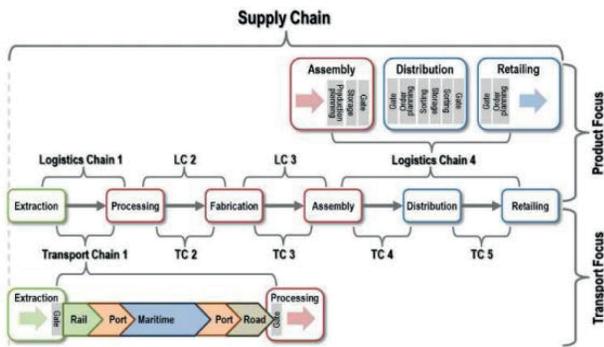


Fig. 1. The Scope of the Supply Chain, Logistics Chain and Transport Chain [5]

The modern telematics technology makes use of popular vehicular network architectures and applications as well as the next-generation vehicular network architecture, on-board computers and the Internet, modern in-vehicle networks, mobile telecommunications and applications in the vehicles.

An example of how a vehicular network can organize and connect vehicles with each other, and with mobile and fixed-locations resources is given in figure 2.

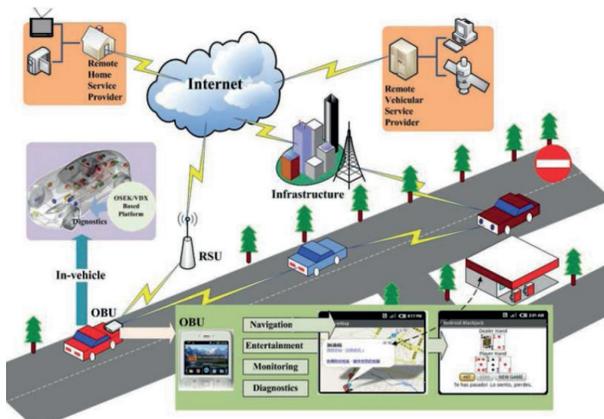


Fig. 2. In-vehicle and out-vehicle network architecture [7]

Generally it is assumed that ITS systems include:

- traffic management;
- support for the management of public transport;
- demand management;
- information for passengers;
- vehicle fleet management;

- incident management and support for emergency services;
- electronic payment and tolling;
- advanced technology inside vehicles.

To sum up, telematics and transport telematics will refer to the movement of people and goods (objects of transport), using the appropriate means of transport and technical and organizational solutions, which, by integrating information and telecommunications solutions, will allow for appropriate management and control in transport systems, increase the efficiency and safety of operation of these systems and have a positive impact on the protection of the environment.

The task of telematics is to support, supervise, control and manage processes in transport and bind these systems in all transport tasks carried out in the supply chain. The priority element for the implementation of these tasks in telematics systems are functions of information manipulation, which primarily relate to the collection, processing and distribution of data essential for making the right decisions. Such processes are both processes implemented in the manner determined in advance (e.g. automatic control of traffic) or processes arising from ad hoc situations (decisions of shippers, dispatchers, independent users of infrastructure such as drivers or pedestrians, etc., assisted by current information) [8]

The relevance of presented arguments was confirmed by a study carried out in 2012-2013 by the Logistics Institute of Wrocław School of Banking referring to the areas, capabilities and needs of using telematics solutions in implementation of logistics tasks among the 47 logistics companies in Lower Silesia. The results of these tests have indicated not only the perception of this type of solutions as needed, innovative but primarily as a cost effective way to obtain better results in the management of transport services within the supply chain. The respondents in this study have indicated to such essential elements as:

- increase in efficiency of transport management in real time;
- comprehensive fleet management;
- improvement in the quality and reliability of services;
- increase in the level of implementation of security processes and logistics activities;
- obtaining the traceability (obtaining information about the status) of goods transported;
- more efficient use of infrastructure, particularly roads capacity;
- obtaining and using information about weather conditions, accidents and other hazards in order to change and modify the routes;
- savings in transportation time;
- electronic payment and tolling;
- reduction of pollution caused by transport;
- reduction of road accident victims.

The results of the second edition of the study (2013/2014), which covered 43 transport companies, show that the respondents are aware of the potential that resides in ITS, as well as their practical use can contribute to:

1. creation of regional and inter-regional (global) transport networks;

The global exchange of goods and services constantly increase - the emergence of "Global Trade" - requires new investments and the development of new infrastructure and services. It also requires a

system that will integrate and provide all sorts of services and data in real time, and ITS is such a system.

2. increase in attractiveness of intermodal transport;

The development of intermodal transport is an important element and the necessity for today's global economy. Further and rapid increase in the carriage of goods in road sector is not intentional due to such effects as: congestion, noise, pollution and damage to the infrastructure. The use of innovative strategies and technologies which include ITS systems can limit these impacts by providing solutions to significantly improve the quality, speed or costs of intermodal transport, thereby contributing to an increase in the attractiveness of the transport within an integrated supply chain.

3. sustainable mobility;

4. growth of transport safety;

5. clean transport;

6. rationality in the growth of employment in the transport sector

7. the creation of an integrated transport system

With regard to urban areas respondents indicated the following basic areas of application of telematics and its systems:

1. urban traffic control;

The main task is to improve the flow of traffic in the network of streets, avoid congestion and jams and to improve the safety.

2. public transport management;

3. management of transport services with variable frequencies;

4. the use of telematics for the following applications: ticketing systems, charges in public transport or passenger information;

The smooth functioning of these elements is an essential factor in optimising the quality of public transport services.

5. information and controlling with the use of variable message signs;

Variable Message Signs should serve to transmit real-time information to drivers and passengers of public transport. They should significantly improve the city traffic control through dynamic alerting on jams or motor vehicle accidents, informing on alternative routes and providing parking information.

Part of the respondents also paid attention to:

1. providing current information for passengers;

The creation of a simple and reliable traffic information system for passengers is one of the key elements to improve the quality of public transport services. The traveller should be updated on journey times, its purpose and the cost. Very often the means to achieve these aims are Variable Communication Signs.

2. managing additional services.

Controlling the entry of vehicles to specific areas or electronic tolling systems, assistance in accidents.

Overall, the respondents also stated that the development of modern supply chains, and particularly various transport systems related to them requires the proper use of existing infrastructure, its capabilities, but also to counteract any problems which may occur in the course of its use. The proper implementation of this principle will be possible only through the use of intelligent transport systems (ITS).

The analysis of the obtained research results also indicated the need for a large variety of compatibility solutions and telematics applications, which can be used by the various participants

implementing the tasks within the supply chain. The use of different devices and applications within this concept, such as: mobile networks and the Internet, radio communications systems, geographical databases, road databases, satellite navigation systems, traffic monitoring devices (sensors, detectors, cameras, radars), devices for monitoring the weather, data transmission equipment for users of transport systems (e.g. variable message boards) and the other requires the creation of a common approach (platform), which will allow for their rational and joined using.

Currently there is no uniform concept of the use of telematics solutions in the implementation of logistics tasks in the supply chain. These tasks are very diverse in nature and concern both the processes of planning and organizing, as well as forwarding tasks, storage area, transport and many other activities undertaken within modern logistics, especially TSL systems. In all of these areas, particularly in their current state of development, some opportunities can be noticed for the application and use of modern telematics systems. It should be assumed that the increasing demands facing supply chains, the rapid shortening of time limits, expectations related to the optimization of production and cutting costs will further prompt the implementation of many new solutions from this area. It also seems to be reasonable to put forward a thesis that the pace of the development of new applications and telematics solutions and their implementation will constantly grow causing further automatization of many processes within the supply chain.

The following most important applications of telematics solutions were indicated:

3. applications supporting fleet management and control of vehicles in traffic. The essential elements of these applications were mentioned as follows:

4. event management in the supply chain.

5. the use of mobile devices connected to the IT network within telematics solutions.

6. an application designed to monitor traffic and to assist drivers on motorways and other non-urban roads.

The considerations carried out and the findings from the two editions of studies not only confirmed the need and the rationale for the implementation of telematics solutions within the supply chain, they also mentioned the increase of knowledge of respondents from this area.

In the summary, as in the previous edition of the study, it can be concluded that the implementation of ITS system allows for greater flexibility and transparency in the supply chain, optimization and acceleration and minimisation of costs of many processes and procedures, but it also:

- enables to take advantage of economies of scale in supply, production and distribution, which results in the reduction in the cost of products and services;
- ensures consistency of information provided to end users;
- encourages to invest in applications and telematics solutions;
- provides interoperability of elements, even if they are produced by different manufacturers, which is especially beneficial for small and medium-sized businesses;
- provides an adequate level of technological independence and easy implementation of new technologies. [9]

In conclusion, it should be noted that today the ability to ensure a smooth and efficient transport of people and goods, which is prepared to carry out the tasks in conditions of interference is an essential requirement. One of the ways to guarantee such possibility is the introduction and extensive use of telematics solutions in the supply chain. The delay in the implementation or the lack of such solutions may result in the loss or reduction of competitiveness and will generate the unsustainable use of logistics infrastructure. [10]

4. Conclusion

At present, when most of the products are manufactured in large distances from markets, the efficient storage management and movement of goods is critical to the functioning of many companies. Modern logistics is not in a position to do without large-scale information and technical systems. This refers to the whole logistics, and in particular to the supply chain management (SCM) focused on the effective and efficient management of the flow of goods and services in real time, which is a key factor contributing to the increase in the competitiveness of the whole supply chain as well as its individual links.

The essential challenges facing logistics are as follows: reconfiguration, integration and optimising of supply chains within the global logistics network. Effective management of the modern supply chain requires not only the view of all processes and the links of the chain, but also the automation of many processes. Efficient and flexible supply chain management also requires a lot of data, which must be obtained in real time. Meeting the expectations which are generated in relation to the modern and forward-looking supply chain, which permanently continues to grow and which is also constantly facing increasing requirements while awaiting a permanent reduction of costs and time for logistics activities is becoming more difficult, more complicated and requires taking into consideration numerous data and variables. A solution that will allow, or largely facilitate the fulfilment of these difficult requirements and expectations is telematics and pragmatic solutions related to it.

The studies which were carried out (their second edition) confirmed the thesis: the introduction of telematics solutions for the supply chain allows not only to automate and shorten processes and logistics activities, but also affects their safety, allows for greater flexibility and reliability of operations within the supply chain. The effect of their implementation is a significant improvement of the functioning of many processes within this chain, especially the increase in the level of quality and speed of implementation of transport services. In addition, it is also a feature that allows to reduce the negative impact of transport on the environment.

The studies also allow to ascertain that the ability to use an even wider range of opportunities generated by modern telematics and its solutions in the interest of logistics activities becomes one of

the fundamental issues. The use of telematics solutions within the supply chain should be considered as a process of dissemination of technological innovation. Research and analysis from this area related to the application in logistics practice is now to be considered as one of the priority areas.

According to the analysis and research carried out, the benefits which arise from the use of ITS systems are obvious, in addition, the introduction of these systems is necessary due to the increasing requirements of the global economy. It is, then, relevant to encourage and speed up decision making related to the implementation of ITS at local, regional as well as national and even European level. Their implementation results in saving the time of flows, their greater cost-effectiveness, coordination, increase in mobility in cities and outside them, reducing the cost of logistics operations as well as the increase in safety and greener transportation. This positive assessment of the benefits offered by the intelligent transport systems and services generated by them points to the need and the necessity for their wide application. The support to take this type of decision may be the ability to use the funds of the EU programme "Horizon 2020" or our Polish programme for the period 2014-2020 POIR (Operational Programme Innovative Development).

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