INNOVATIONS AND CHANGES
IN THE LOGISTICS TASKS IMPLEMENTATIONS

Introduction

The platform of the modern development has become the economy based on knowledge and experience. Innovations as well as innovation processes itself are no longer can be perceived as occasional events, but more often a new invention is treated as a set of projects creating new products, patterns, technologies and services. The rapid pace of technological and organizational changes cause the situation when only companies which are ready to introduce new creations and innovative technologies in their everyday life will be able to survive in the modern competitive market. That is why nowadays most of the companies, including logistics companies are under pressure of innovations, which very often occur in different fields simultaneously (new products, new techniques and technologies, new organization ways, new relations with partners, etc.).

The current situation was defined very aptly by Peter Jordan and Ruud van Pluijm contributors of vision “2016 The Future Value Chain”, who said: “We face the challenge of changing our business in an integrated value chain, while maintaining the basic principles of business and fierce competition,… We can do it only by changing our internal cultures and rethinking of the components sustainability that connect us….. It causes an impact on the development of our organization and demands to identify new ways and means of action”\(^1\).

Modern logistics should not only keep pace with the changes, but in many cases predict expectations of its customers. The market researches and trends forecasts have become a normal part of logistic business. Such actions are realized by both logistics companies and research centers or such analysis and

Andrzej Bujak, Natalya Gubskaya

researches could be implemented as a common project of above-mentioned organizations. The results of such researches are usually general directions and fields of changes which will coordinate logistics tasks in the second decade of the twenty-first century. It is worth to refer to results of the research titled “Excellence in logistics”, conducted in 2009 by the European Logistics Association (ELA) and the company named A.T. Kernem. The result of this study is not only the description of recent trends in logistics, but also indication of the most important factors that influence the logistics development. The results of these studies point to such factors as:

- The significant savings on storage stocks of raw materials, intermediates and finished products,
- A comprehensive optimization and harmonization of the entire supply chain – is an essential way to cut inventory storage costs,
- The prediction that the storage of incoming goods will be decreased to around 33% and the number of distribution warehouses to about 20%,
- The network of production facilities will change for the benefit of regional structures, in the near future the majority of production facilities will serve regional markets, while the number of local or global level suppliers will undergo to further reductions in the favor of regional facilities,
- An appropriate segmentation of the supply chain should be based on the explicit customer requirements and demands,
- A reduction of inventory should be by transforming the supply chain into demand-oriented supply chain,
- The growing importance of the sustainable development concept,
- Introduction of the green transport means.

Presenting visions and concepts, it is also worth to compare with similar studies made in the same time and studies concerning the future of logistics such as: “Future Logistics Challenges”. It is important to pay attention to the study Capgemini conducted in 2005 and published among others in the report “2016 The Future Value Chain”, by the GCI (Global Commerce Initiative) in 2006, supplemented by further research and reported in study named “In a succeeding

---

Innovations and changes in the logistics tasks implementations

Volatile Market 2018” in 20086. In the context of the logistics trends it is essential to point out the significant conclusions included in the study, “Global Logistics 2015 +” realized by DB Schenker in cooperation with the Technical University in Berlin7. It is also necessary compare these concepts with the latest studies such as “Vision 2035”8. The Smarter Supply Chain of the Future and IBM Global Business Services9.

Another areas of changes and innovations are the studies and documents concerning the development of transport and infrastructure. Here, above all, there should be marked a recent document “White Paper”, “Roadmap to a Single European Transport Area – Towards a competitive and resource-efficient transport system”. There are also other studies which are treated as the basis for the “White Paper” and for the new objectives of EU transport policy10. There are following documents:

- A sustainable future for transport: Towards an integrated, technology-led and user-friendly system (COM (2009) 279 (Final)11
- the “Transvisions” study, developing a set of long-term scenarios (2030-2050) for transport and mobility in Europe,12
- an evaluation study, analyzing the performance of the Common Transport Policy in reaching the objectives laid down in the year 2001 in the transportation White Paper and in its 2006 mid-term review,
- a report produced by three main groups dealing with the topics of economy and society, technology, environment, infrastructure and logistics;

---

One more important document which should be underlined is the present article is “Europe 2020”\textsuperscript{14}. In its part devoted to transportation, two important issues were the emphasized:

1) Decarbonization:
   - A range of activities including such activities as the early infrastructure development of electric and mobile networks, intelligent traffic management, a research concerning a European green car initiatives.
   - Vision of the structural and technological changes.

2) The development of infrastructure:
   - The usage of EU financial instruments,
   - Speeding up the discharge of the largest overloads,
   - Modernization of European transport networks,
   - The development of the intelligent, interconnected transport and energy infrastructures.

All of these studies have a common feature directed to innovation as a key principle and condition for changes, emphasizing the role and importance of innovations and stressing the necessity to bring the culture of innovation up, but just in low degree point to the concrete solutions in this sphere.

Let us now turn to presenting of new solutions in the field of transport and infrastructure, which without any doubts will affect the logistics processes, especially in the overcrowded cities. However the potential innovative solutions should be viewed in a broader aspect, as only their comprehensive implementation will allow to achieve savings and environmental protection. The presented in the article assumptions of the concepts such as Integrated Vehicle-Based Systems, identify trends to install modern sensors which should support drivers and operations. Other solutions also are going to be presented in the article such as zero emissions or unmanned vehicles. New types of vehicles require the development of road infrastructure and in the present article some of new propositions will be discussed, for example Hydrogen Highways – HH, Automated Highway System – AHS and Underground Automated Highway – UAH). It is assumed that all the identified innovations as a system will directly affect the supply chain and logistics processes implemented in the coming years, being a long-term solution and supporting logistics and environment protecting companies.

The fields of innovative solutions

The pace of changes in the global scale is significantly influenced by the processes of globalization. As a result, the logistics also turned into the global issue, which create challenges for the global economy. Especially since these challenges apply to all sides of society and all areas of life, so that the process of globalization and regionalization really impact on logistics processes. The process of globalization put the logistics faced to aim to get used to new conditions very quickly and effectively, so that to strengthen the current position on the market and meanwhile being a reliable partner providing appropriate services. The logistics service providers are forced to search external and internal innovative solutions to improve the level of quality in existing supply chains. These innovative solutions should be connected by five aspects presented by Kent Gourding. These aspects include: Reliability – the supplier meets the customer requirements in a reliable and credible manner; time – this aspect is usually associated with the time period between customer’s demand and delivery, but also affects other logistics aspects such as warehousing, storage, costs, etc.; convenience – as a technical support; communication – as monitoring of goods, payments, information flows; fairness – as a fair presentation of capabilities and servicing in accordance with the declarations15.

In general, innovations in the logistics sector are created by new and improved possibilities and processes as well as by new products and services as the essential innovation in infrastructure and in the supply chain management16. Innovative vehicles and new solutions in the sphere of infrastructure are essential aspects that improve the reliability, speed and safety in transportation17. Furthermore the external conditions are changing rapidly, creating new difficulties for the transport processes, such as traffic in the overcrowded and ever growing cities. Thus, new technologies support the logistics operators and drivers, however, they are very expensive and require technological and scientific database, but in short or long term these innovations are associated with savings.

At the beginning of this year the European commission put forward extremely important document “White paper-Roadmap to a Single European Transport Area – Towards a competitive and resource-efficient transport system”, which shows the concept and principles of the European transport development for future 30 years. This document is based on three interdependent principles of transport sector development: ecology, safety and innovation.

First area of innovations presented in the current article is associated with the development of appropriate vehicles and road infrastructure. These solutions will affect all aspects of logistics systems, so a complex approach is a must to realize both researches and implementations of the new solutions in order to achieve the desired final result. The innovations in this field are extremely important as they influence the quality of the staff performance directly, which will increase the flow of goods and services.

As a good example of the logistics operators support could be presented the Integrated Vehicle-Based Safety Systems – IVBSS created by Transportation Research Institute, Michigan University (UMTRI), coordinated by the U.S. Department of Transportation and supported by partner companies such as: Visteon Corp., Eaton Corp., Honda R&D Americas Inc., International Truck and Engine, TK Holdings, Battelle, Con-way Freight and others.

The concept IVBSS is a five-year long research program aimed to combine several collision warning systems into a single integrated system to enhance the passenger safety in trucks and other vehicles. Phase I (November 2005-May 2008) is called conceptual and include: the system architecture development, the identification of suitable sensors, the testing process of all human factors for the development of “driver-vehicle” interface. Phase II (June 2008-October 2010) include: the system improvement activities, the preparation of the test fleet consists of 16 cars and 10 trucks equipped in integrated security system, the pilot tests on public roads and a full analysis of the data received. Currently the final report is on the stage of preparation. This 32 million USD worth project is associated with vehicles equipped in sensors: Forward Crash Warning – FCW sensor; Lateral Drift Warning – LDW sensor, Lane-change/Merge – LCM sensor, Curve Speed Warning – CSW sensor and others.

---

19 Integrated Vehicle-Based Safety Systems (IVBSS), Transportation Research Institute, the University of Michigan, www.umtri.umich.edu/divisionPage.php?pageID=249
During the second Phase (February 2009-December 2009) the test of 10 trucks was carried out. These 10 trucks had to drive 1mln km during 16 500 working hours in order to collect full data from 224 000 km. The test proved the effectiveness of installed sensors and a positive effect on drivers and their skills, however showed around 5 incorrect warnings every 160km that is considered to be too much difference. The University of Michigan was a key partner in this program as was able to find right research methodology and appropriate tools. IVBSS is an excellent example of a comprehensive approach of several partners united by a common goal.

The next direction is aimed to work out an unmanned vehicle in order to eliminate the human errors. The goal of Intelligent Transportation Systems – ITS development is to build an autonomous vehicle capable to move on the road, to perform complicated maneuvers such as: joining the traffic, overtaking, parking and crossing intersections. All these actions show the process of searching for innovative solutions as a natural process in the competitive conditions. Therefore, the creativity of the process participants is not limited and allow to search for the special solutions.

The next important direction of innovation is related to ecology, as the majority of vehicles throw out large quantities of the harmful gas. In this context, the transportation processes are considered as a negative contributor especially in the big cities. Thus, new types of vehicles with zero level of exhausted emissions are highly desirable and this direction is supported by the carriers. As good examples for the following solutions could be named: the electric propulsion, the usage of solar energy, hybrid vehicles, hydrogen propulsion and so on and so forth. The following cars could represent the above mentioned solution: Honda FCX Clarity, BMW Hydriagen 7 and Think Nordic Hydrogen are cars using hydrogen instead of petrol, Nissan Leaf and Mercedes F 600 Hygenius are electric models. The Mercedes F600 Hygenius is equipped with latest-generation fuel element characterized by the emission at the zero level. This kind of fuel element burns the quantity of hydrogen which is equal to 2.9l of petrol per 100 km. This solution allows pass 400 km without refueling so it is an important step in the fuel elements development. Till the year 2015 this model is predicted to be ready for a wholesale production.

---

22 www.darpa.mil/grandchallenge
23 www.hydrogencarsnow.com/mercedes-f600-hygenius.htm; www.mercedes-benz.pl/content/poland/mpc/website/pl/
The trucks also go under the process of development. During the demonstration of equipment and vehicles in Chicago in 2009, the Smith Electric Vehicles’ American company presented a new truck called Smith Newton Electric. This kind of truck can transport 7380 kg of goods with maximum speed 80 km/h and pass 160 km without charging. As the examples the following trucks could be also mentioned: Vision Industries Tyrano and Phoenix Sport Utility Truck (SUT). Bikes are also appearing in this category of solution.

The current achievements in the field of innovative vehicles are very hopeful as there is a great potential for their dynamic development. A test project Intercontinental Autonomous Challenge implemented under the aegis of the European Research Council is a good example of innovations development. The project is headed by Professor Alberto Broggi from Parma University in Italy. Four smart and non-polluting, “powered by green energy” vehicles defeated 13 000 km from Italy to Shanghai successfully in different weather conditions and traffic conditions that allows to collect the data necessary for research\(^\text{24}\).

The research are directly related with the appropriate road infrastructure development to meet new requirements of innovative vehicles, especially in urban centers. The future hydrogen vehicles are associated with the building of Hydrogen Highways – HH, which is currently under design and development. The examples are: Hydrogen highway network in the European Union, the hydrogen highways in Japan, California etc. Their purpose is to promote the H2 as a carrier of clean energy and the development of public infrastructure to implement this type of vehicle. For example Scandinavian Hydrogen Highway Project-SHHP is a regional project which combine three different projects in the same area: Danish Hydrogen Link Project, Norwegian HyNor Project and Swedish HyFuture Project. It is still being developed and in future would be connected with the network of hydrogen highways of the EU, supporting the implementation of new green vehicles on the continent.

The research program associated with the modern vehicles support and equipped with multifunction sensors, which allow to control the traffic is Automated Highway System – AHS, also known as the Smart Road\(^\text{25}\). It is an innovative concept that can be described as “a new relationship between vehicles and

\(^{24}\) From Europe to China: Intelligent driverless vehicle reaches end goal in Shanghai after 13 000 km; the European Research Council, Press release, Brussels, 27 October 2010.

Innovations and changes in the logistics tasks implementations

infrastructure. It refers to the dedicated lanes on the selected roads, where vehicles equipped with special elements are moving under a full automatic control”. It is a fully automated system for intelligent roads, which has its origin in the existing highways. Initially there will be only short lengths. These roads will allow to move independently and at the high level of safety, increasing efficiency and staff comfort in the cities and out of them. The primary goal of modern environmental-friendly and unmanned vehicles on the new types of roads is to reduce traffic, especially during peak hours, to reduce the exhaust concentration and the noise level. It will be achieved by merging vehicles in convoys for example driving at night. The sensors will allow to monitor these convoys in real time.

As a part of this concept there are also prompts to take into consideration the Underground Automated Highways – UAH as an innovative solution that will improve the flow of goods and services as well as safety, especially in big cities. In future the majority of transport will flow through the underground systems, it is just a matter of time of around 50 years when a new underground system of road will be a reality. Although there are also difficulties in UAH development such as: the necessary degree of AHS network development, still ongoing attempts to design zero emission cars as well as tunneling technologies. However some projects have already been implemented, for example, in Southern California. In Singapore there are large underground storage centers and stores under the process of building. In China there were modern underwater highways built successfully, such as Xiang’an Harbor Port tunnel and Qingdao Jiaozhou Bay Undersea Tunnel. A very ambitious project is being considered in Asia, aiming to build 209 km UAH connected Korean Island Geoje near Pusan with Karatsu in northwestern Japan. Thus, in the years 2030-2050 a combination of AHS and UAH systems will create a “giant network”, which will contribute to overcoming the current and future transportation challenges, directly affecting the efficiency of supply chains.

The implementation of innovation solution is important in all means of transportation, as it is the basis of rail, water and air transport development. In the last few years a new type of tank-container called Swap Body becomes a very popular solution in the intermodal transport. The volume of Swap Body container is 10-20% more than Standard ISO containers. At the same time the

Swap Body tank-container has all advantages of a standard container. This type of containers has an increased size, but it is also allowed to be transported on rails or roads. The European carriers have already calculated the profitability of such containers while transporting liquid chemicals from Russia and CIS countries. The block-train solution is another modern innovation in the rail transport. The main advantage of such train is the goods transportation without reloading, in the system terminal-terminal, thus shortening the delivery time and provides a competitive advantage of the rail transport over road transport. However there is also a disadvantage in this solution as it is required to pay for the whole train even if it is not entirely loaded. In turn as an example of a more future-oriented innovation in the rail industry there can be marked the invention of Japanese scientists from Tohoku University – a train on the airbag equipped with wings and fans. This project is still at the stage of testing, but the authors of this train plan to create a connection between two cities using the flying train possibilities. This kind of train has no connection with the rails so it is much more speedy then a normal train.

In the sea transport there are also many modern solutions. Most of them are aimed at shortening the delivery time through the design and construction of High Speed Crafts – HSC and Super High Speed Container Ship – HTH. The fundamental concepts of the development of these transport modes include:

- The concept of environmental-friendly ships powered by compressed natural gas (concept vessel E/S Orcelle),
- The concept of new ships generation (using a solar-type kite such as Beluga SkySails),
- The concept of automated logistics systems in ports (virtual deep sea terminals) and modern containers (fordable containers).

The innovative concepts in the air transport in addition to the concept of building larger and larger aircrafts are extremely focused on the protection of environment. The concept of reducing emissions in the air is not just oriented to environmental protection but the actions are also taken to reduce the fuel consumption. The results of these green innovations are noticed in some new models of aircrafts such as Airbus A380 or A350. This model need just

---

Innovations and changes in the logistics tasks implementations

31/100 km fuel per passenger in the comparison with 4-4.5/100 km in the earlier models. The scientists are trying to design the aircraft using engines for biofuel to meet the requirements of ecological concepts. The first practical test of this solution (aircraft B747-400) has already been undertaken by British scientists, using coconut and bamboo oil as a biofuel mixture. The new solutions in the airline industry are focused not only on building new and modern aircrafts but also on providing changes in the construction of airports infrastructure. As an example there can be presented even building of power stations on the German airports to provide electrical energy to the parking planes and this way to reduce the fuel consumption as well as thereby minimize the amount of CO2 in the atmosphere.

Conclusion

Innovation and innovation processes in the modern world are not only the basis of modern economic growth strategy and business development, but also are treated as a concept and a solution in the competitive struggle. The structures of high-developed world economies continually move towards industry and services based on knowledge and experience. The knowledge-based economy has become the basis of the modern development. Innovation and innovation process are no longer perceived as separate events, but more often are treated as a complex of projects creating new products, patterns, technologies and services. The pace of technique, technology and organization changes makes only companies introducing innovative solutions able to survive in an increasingly competitive market. That is why nowadays most of the companies, including logistics companies are under pressure of innovations, which very often occur simultaneously in different fields (new products, new techniques and technologies, new ways of organization, new relations with partners, etc.).

Vehicles modernization, green transport means construction and deployment of new infrastructure simultaneously will create a synergistic effect by combining the features of all components. The comprehensive action is the only solution to achieve the desired aims. As a result, logistics processes will be more reliable, predictable and ecological as well as human errors will be minimized. The benefit of this innovative solutions will be noticed soon, especially in the

big cities. The supply chains will be more efficient especially in the urban areas where logistics expectations are rising rapidly. Future vehicles supported by infrastructure will create the effect of the components interplay in the relation to the needs. The concepts of infrastructure HH, AHS and UAH are promising solutions which will be able to provide a comprehensive support for a new type of fleet in the logistics companies. These innovations will affect the evolution of logistics and transport services. To continue the development directions it is important to select the appropriate partners from the world of science, business, local and national authorities as it will guarantee the implementation of innovative solutions. As a result, innovation will give a new dimension of competition among logistics companies to be better, faster and more reliable trading partners.

From the presented considerations it is concluded that the condition to participate in today’s global development processes is, among others, an activity aimed at the achievement of a competitive advantage. The innovation is a prerequisite for the logistics development, adapted the logistics to the requirements of the twenty-first century. The Innovation implementation is the way to increase competitiveness and enterprise, region as well as entire economy development conditions.

The core of innovation in the logistics is based on a crucial necessity to access the latest, the most modern and broad knowledge, which today goes beyond the capabilities of one company. Therefore, interoperability standards, which enable the wider access to knowledge and make the transfer of information and know-how easier, play a fundamental role for all companies operating in the supply chain and create their ability to be competitive on the base of innovative solutions.

References

Innovations and changes in the logistics tasks implementations


25. www.dbschenker.com/

26. www.hydrogencarsnow.com/; www.mercedes-benz.pl/content/

27. www.hydrogencarsnow.com/

28. www.xesc.cat/