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IN RELATION TO THE IDEA
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DEVELOPMENT

PART III

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Maciej Brzozowski

Port of Hamburg Marketing e.V.

MEASURES TAKEN BY THE PORT OF HAMBURG TO IMPROVE ITS ACCESSIBILITY AS AN IMPORTANT FACTOR INFLUENCING PORT'S COMPETITIVE POSITION

Abstract

Port's seaside accessibility is one of the two most important factors influencing decisions of shipping lines for choosing or rejection the use of the port. The landside accessibility is connected to level of service which the port can offer in hinterland traffic. Both factors together have an enormous impact on port's competitive position on the market. The paper contains overview of problems of ensuring accessibility of the port of Hamburg for container ships as well as rail or road transportation in order to maintain the current high role of Hamburg in container traffic to and from the Northern Europe.

Keywords: container transportation, port's accessibility, port of Hamburg

Introduction

Ports are important nodes of transport and logistical infrastructure with a broad functional spectrum (Fechner, 2010). From a perspective of economic geography they could be described as a place where terminal operators decide on allocating their services or routines (Leal et al., 2011), of which consequence is selected technology and specialization. In case of container ports the chosen handling technology is based on standard of ISO containers as means of transport.

Being nodes in a transportation network connecting land and sea, ports handle seaborne cargo destined for their hinterland. The port's hinterland is geographic land area from which their respective trade originates. In Europe, due to development of the common market and relatively small distances, ports have unquestionable position on a relatively small part of their hinterland and usually

have to compete against other ports, as vast regions can be obtained via alternative routes and alternative ports.

Accessibility may have various meanings and usually is defined as the ease of reaching goods, services, activities and destinations. In this article it is understood as accessibility to the destination i.e. relative ease of reaching a particular location (Litman, 2017).

Accessibility could be regarded as scarce resource due to the limitation of expanding its transportation infrastructure. As such may limit port's development and consequently its market position. This paper focuses on measures taken in Hamburg to improve accessibility for seaborne (first chapter) and land (second chapter) traffic.

1. Importance of accessibility as a reason for a shipping line for choosing a container port

Technology itself cannot be regarded as a sole success factor for a container port; otherwise, newly constructed port terminals furnished with state-of-the-art handling equipment would be immediately much better positioned against older terminals, which is not true. In fact, construction of new port facilities in UK (London Gateway), Germany (Wilhelmshaven) or Poland (Gdansk) proves that it is not easy to change existing transportation patterns and usually requires some trigger to boost handling (e.g. certain malfunction of operations in existing "old" facilities including strike of stevedores or serious accident) and strong advantages to support further development. On the other hand, higher operational costs are in fact no obstacle for successful development of seaborne traffic in selected ports. An interesting insight into decisions behind choosing or rejecting the use of a port by shipping lines gives a query carried out by Global Shipping among shipping lines in 2010 in Hamburg (Hypovereinsbank, 2010). According to it, there are only two basic reasons for choosing/rejection the use of a port i.e. too low cargo availability and unfavourable accessibility.

Cargo availability is derived mainly from existing flow of goods which can be routed via selected port and depends on proximity to the market and availability of GDP. In North Europe the highest purchasing power and created value added have densely populated regions of Belgium, the Netherlands and North Rhine-Westphalia as well as Baden-Württemberg and Bavaria in Germany, which thus support the gateway function of big ports of the North Sea (Wedemeier, 2015). Cargo availability can be further developed by improvement of rail and road infrastructure and adding a hub function – both allowing steaming additional cargo flows to/from more distant regions including Central Europe and the Baltic Sea. However, ports have limited influence on development of major transport corridors (which lies within remit of respective governments or European Commission) or decision of shipping lines of routing transshipment containers (except from applying discounts in their tariffs), therefore the focus of ports authorities is mainly on improvement of own infrastructure and accessibility by sea and by land.

2. Market position Hamburg's and requirements towards its transportation infrastructure

Hamburg is currently the third biggest container port in Europe. In 2016 it handled 138.2 million tons of total cargo, including 91.7 million tons of containerized cargo. Container handlings reached 8.9 million TEU i.e. slightly more (+1.0%) than in former year. The modal split in hinterland traffic shows dominant role of road transportation representing 55.6% of total volume and increasing importance of rail at 42.3% in 2016. Inland waterways transportation carried 2.1% of the containerized hinterland traffic.

Being a seaport, Hamburg needs to comply with requirements of shipping lines. Recent development in container shipping shows steep rise of average size of a container vessel – compound annual growth rate of their capacity was less than 2% between 2001 and 2009 and rose to 18% between 2010 and 2015¹. The number of the biggest container ships (ULCS – Ultra Large Container Ships) calling Hamburg in 2016 rose by 60% to 240² and declined in most other ships classes (with exception of size class 2000–3999 TEU i.e. increased size of feeder ships). The bigger ships require adjustment of fairway channel due to their increased dimensions including draft and beam as well as bigger turning circle within the port due to increased ship's length (LOA). In April 2017 Korean shipyard Daewoo Shipbuilding & Marine Engineering delivered to Maersk Line the biggest container ship (Madrid Maersk), which is 399 m long (LOA), 59 m wide and has maximal draft of 16.5 m. Many ports including almost all Baltic ports are not capable of handling such big vessels. Hamburg can accept them, nevertheless not without some restrictions.

Being a sea port, Hamburg is located ca. 130 km from the coastline upwards the river Elbe. Sea-going ships approaching Hamburg have to take pilot onboard at the district boundary marked by buoy Elbe 1 on the North Sea some 145 km (76 NM) from the port (pilotage is compulsory for all ships longer than 9 m or wider than 13 m). The fairway channel on approximately half of that distance between buoy Elbe 1 and Brunsbüttel is wide and deep, however, upwards from Brunsbüttel it is becoming more demanding for navigation. The maximal ship's draft is 12.5 m independent of tide, however, when using tide, it increases to 14.8 m for incoming ships and 13.5 m for outgoing ships. In praxis, Hamburg handles all container ships, including the biggest ones, as they are never fully loaded (Hamburg is never the first or last port of call), provided they use tide windows whenever it is necessary and possible.

3. Seaside accessibility

In order to keep up the pace with growing development of ships' size, Port of Hamburg Authority together with city of Hamburg launched in 2002 a project of adjustment of the navigation channel on the Lower and Outer Elbe. Dredging

¹ Own calculation based on data from Drewry.

² Source: Hafen Hamburg Marketing.

should upgrade navigation conditions in terms of both draft as well as width of the channel to allow for maneuvering of bigger vessels:

Incoming ship irrespective of the tide: max. 13.50 m draft*,

Outgoing ship irrespective of the tide: max. 13.50 m draft*,

Incoming ship depending on tide: max. 15.60 m draft*,

– Outgoing ship depending on tide: max. 14.50 m draft*.

* in seawater

The project requires that the navigation channel in the German Bight is to be deepened from 16.98 to 19 m, the riverbed on a major section between Brunsbüttel and Hamburg to be deepened to 17.3 m and within the port of Hamburg from the junction of the North and South Elbe to Container Terminal Altenwerder from 16.70 to 17.40 m.

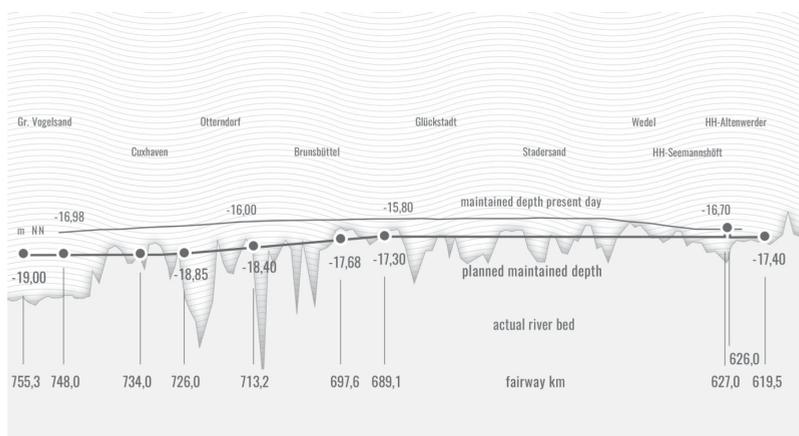


Figure 1. Current state and planned adjustment of the navigation channel

Source: (HHM, 2016)

Even though the channel is currently at least 300 wide, it allows for ships' encounter only when their combined beam does not exceed 90 m. To overcome this restriction, the channel's width shall be enhanced to at least 320 m and the section between Wedel and Wittenbergen to 385 m. There are some other measures planned or carried out recently within the port to improve its accessibility for sea-going ships including enlargement of a turning circle at the top of Tollerort Terminal (now ready for 400 m long ships) completed in February 2017 and future and extension of a turning circle at Waltershof from 480 to 600 m following construction works at Petroleumhafen.

The major problem of any construction project on the river Elbe is the complexity of proceeding on the granting of construction permission, restrictive legal rules set by Water Framework Directive as well as resistance of local citizens and environmental protection organizations. The project of adjustment of the navigation channel on the Lower and Outer Elbe has been launched in 2002 and will not have been completed by end of 2017 or even 2018. On February 9th the Federal Administrative Court in Leipzig has made its judgement on claims

against granting the construction permission. The court pointed out two serious flaws in the permission leading to infringement of Flora-Fauna-Habitat Directive including not sufficient protection of the plant species “Hemlock Water Dropwort” and non-coherent planning decisions in respect of Natura 2000 areas, but ruled out all other claims. As the result the draft of construction permission has to be amended which will take additional time, nevertheless the investment itself is now certain to be carried out.

Having restrictions in ships’ navigation, the port of Hamburg invests into specially designed IT tools supporting optimization of ships’ movements on port’s approach and departure as well as berth planning. The optimization process is based on assigning to ships time windows according to required services and berths as well as hydro navigational conditions in the fairway channel and within the port water areas. In Hamburg there are two different systems supporting decision-making of ship’s management focused at improving port’s accessibility.

The first of them is Port River Information System Elbe (PRISE) which collects information on ships’ position from as early as German Bight (basing on AIS – Automatic Identification System) up to the port of Hamburg. It gathers notifications from ships, pilots, terminals, tugboats, mooring companies as well as information from the Harbour Master Office and the German Federal Maritime and Hydrographic Agency (BSH) to ensure swift communication allowing for ship’s fitting into the pre-assigned time frame and eliminating conflicts leading to potentially dangerous situations or delay. Controlling ships’ movements on port’s approach allows for better utilization of limited capacity of navigational waters which varies significantly according to tide and water gauge. It also acts as single windows for shipping lines which need to contact only one office instead of numerous companies and institutions.

A similar establishment is Hamburg Vessel Coordination Center GmbH, a joint venture of two container terminal operators i.e. HHLA and Eurogate. HVCC offers to ships free of charge coordination services for their arrival in the Port of Hamburg, but also departure after handling at terminals thus allowing for avoidance of time waste thanks to optimization of time frames assigned to ships. HVCC is divided into two separate divisions i.e. Nautical Terminal Coordination handling ocean going container vessels (including mega-ships) and Feeder Logistics Center (FLC). Correct information allows ships to maintain the most economic speed to arrive at the border of pilotage district (Elbe 1), optimally plan their berthing and operations at a terminal in Hamburg. It also has an impact on Vessel Traffic Service Centre through reduced burden due to the optimize traffic on the Elbe.

The same applies to feeder ships which additionally benefit from optimization and control of their rotation within the port due to necessary shifting to various container terminals. Feeder ships usually have to discharge and load boxes on different terminals and non-optimized sequence may comprise more than a dozen shifting within the port which leads to delays for ships waiting to get free berth and terminals wasting too much time on mooring operations. FLC checks terminals’ work programs and berth availability and coordinates pilots, tugs and linesmen, which ensures that utilization of terminals and feeder ships is optimized.

4. Land accessibility

Rail transportation plays increasingly important role in container haulage. The share of rail in modal split of Hamburg's hinterland transportation was as high as 42.3% which amounts to 2.36 million TEU and rises steadily. Even in years of poorer port's performance when overall container throughput declined, the volume of containers carried by rail increased.

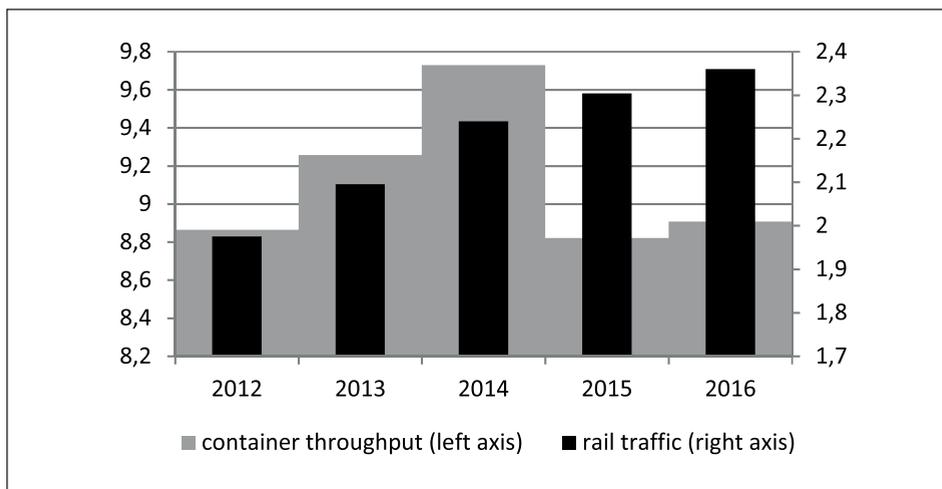


Figure 2. Port of Hamburg's rail traffic vs. container throughput
Source: (own elaboration based on data available at: HHM, 2017)

Road transportation is regarded as necessary due to its flexibility, speed and versatility and is unbeatable on short distances. Nevertheless, it is the rail which prevails on long distances due to its lower external costs and high capacity. Development of road and rail traffic in relation with port's hinterland relies heavily on development of roads and rail tracks outside Hamburg. The city of Hamburg is one of sixteen federal states of Germany, therefore can influence the federal policy regarding investments in transportation infrastructure through proposals and lobbying for infrastructural projects to be included in the Federal Transport Infrastructure Plan (the newest plan until year 2030 was passed by the German Government in August 2016), which is updated every 10 to 15 years. However, this influence is limited which means that needs of the port of Hamburg do not have priority over other needs and the process of preparing new infrastructural investments is very long and takes decades, not years.

On the other hand, in the city of Hamburg land area is very scarce resource, therefore development of new infrastructure here is also very difficult. A good example could be the Hafenuerspange (Port link road) i.e. the East-West highway road connection through the area of the port of Hamburg, which has been planned since 1980s whereas original plans date back from as early as 1940s. It has not been constructed until nowadays and will not be ready in the middle-term because

of many reasons including doubts whether it can solve traffic jams created by local traffic or rather induce additional supra-regional or national traffic.

To cope with increasing traffic, Hamburg decided to focus on creating smart infrastructure allowing for improved traffic flow control as well as better infrastructure management in respect of maintenance. A project dedicated to this task is smartPORT logistics, which is one of two pillars of a broader project portfolio smartPORT Hamburg. smartPORT logistics enhances port's accessibility by increasing mobility (level of service) and reducing time delay.

Hamburg is an essential rail hub – it acts as origin or destination of ca. 12% of total German rail freight. High traffic volume (ca. 200 trains or over 5000 rail wagons) make it the busiest railway seaport in Europe. The importance of the problem of traffic control results from high density of roads and rail tracks on a relatively small port area as well as of traffic itself. Rail infrastructure consists of 300 km rail tracks, over 800 shunting switches as well as 135 private sidings extending railway network by additional 160 km. Interlacing of road, rail and water traffic is a significant issue and can lead to conflicts on traffic priority. Whenever possible, HPA plans the infrastructure so that different transport modes are separated from each other, which applies mainly to road and rail transport infrastructure. In case of intersections of rail tracks or road with waterways, the bridges are constructed in the way which is most appropriate inclusive high bridges allowing ships passing underneath as well as moveable bridges. The latter solution, despite obvious disadvantage of interrupting land traffic to make passage for ships open, puts no restriction on ship's height which is increasing faster than the infrastructure gets outdated. Examples of movable bridges of utmost importance for the port are Rethel bascule bridge or Kattwyk vertical lift bridge, belonging to the biggest one in the world.

Intelligent infrastructure can address a handful of problems including:

- Maintenance issues,
- Identification of vehicles,
- Traffic predictability,
- Lowering energy consumption,
- Improving planning ability of truckers/transportation managers.

To make infrastructure intelligent, smartPORT logistics is applying 5 IT-megatrends including internet of things, big data, cloud computing, social networks and mobile applications for collection and analysis of data on current state of the whole transportation infrastructure as well as real-time traffic. The real-time picture of infrastructure and traffic can be conveyed to end-users through various channels inclusive mobile applications to allow decision-making and route planning.

Maintenance issues are most important for rail infrastructure where, in practice, they equal to switching from preventing to predictive maintenance, which is much more effective, by equipping critical elements of rail infrastructure inclusive switches with intelligent sensors reporting on their performance in real time and sending data allowing estimation of infrastructure's wearout. Potential failure may lead to serious consequences in the entire rail network of the port railway and could

even cause collapse of the whole system, therefore preventing such incidents is of utmost importance for port accessibility and level of service.

Identification of rail cars and locomotives helps to manage the traffic and is achieved by implementation of LED cameras in pivotal points of the rail infrastructure which are able to read rail cars' or containers identification numbers as well as dangerous goods labelling etc. These data supplement the data registered in IT platform transPORT-rail which connects all actors responsible for operating trains within the remit of Hamburg's port railways.

Evaluation of road transportation as basis for decision-making of dispatchers and truckers is even more problematic as in case of rail traffic. The main difference is connected to the fact that rail transportation has to be pre-booked and scheduled in advance whereas road transportation doesn't have to and decisions are being taken by hundreds of truckers independently. When they decide to take the same road in the same time, a traffic jam may be created unless they are informed of better alternatives. The Port Road Management Centre produces hints for most advantageous decisions regarding routing of trucks. To be able to do that it has to analyse current situation first. The roads have been equipped with different kinds of sensors including video detection, Bluetooth, inductive loops to provide reliable real time traffic information to PRMC. PRMC improves traffic flow through:

- providing real-time traffic information via mobile apps and electronic message signs in crucial road points within the port (so called EVE),
- management of incidents,
- management of parking areas as well as pre-gate car parks,
- establishing a traffic information center (DIVA).

In the future the Port Road Management Centre shall be combined with similar centers for other means of transport including rail, ships and barges. Thus, the decision makers may get a comprehensive information on traffic situation (Port Monitor) and potential threats to reliability of transportation services from a single source, enabling them to plan deliveries better in a timely manner.

In a more distant future the port management will implement a solution to the whole logistics chain using Hamburg as one of its nodes. It shall compile all possible information from partner ports/terminals/carriers on potential threads which may lead to delay. Such information could be consequently used for choosing alternative transportation solutions to avoid those threads to allow for on time delivery. The first step towards such a system has been made when eight global ports including Hamburg decided in April 2016 to create ChainPORT – a common platform for exchange of information relevant for transportation of containers.

Conclusions

The port of Hamburg takes great effort to improve its accessibility, especially from the sea side which directly influences its market position. Shipping lines require that navigational channel, port water infrastructure including turning circle, port basins etc. as well as land infrastructure (quay walls, handling equipment etc.)

are able to handle the biggest container vessels. Very fast development of container fleet especially in respect of vessels' size must be accompanied by appropriate development of ports' accessibility or the future port's market position may be inflicted.

References

- BMVI (2016), *Bundesverkehrswegeplan 2030*. Available from <https://www.bmvi.de/SharedDocs/DE/Pressemappen/2016/bundesverkehrswegeplan2030.html> [Accessed 19 April 2017].
- Fechner, I. (2010), Centra logistyczne i ich rola w procesach przepływu ładunku w systemie logistycznym Polski, *Prace Naukowe Politechniki Warszawskiej. Transport*, 76.
- HHLA (2016), *One for All: The HVCC, a Central Point of Contact*. Available from <https://www.boxletter.de/en/boxletter-2-hvcc-4/24> [Accessed 17 April 2017].
- HHM (2016), *Adjustment of the navigation channel on the Lower and Outer Elbe*. Available from <https://www.hafen-hamburg.de/en/adjustment-navigation-channel> [Accessed 13 April 2017].
- HPA, Pressemitteilung (2016), *Gründung des weltweiten Hafennetzwerks „ChainPORT“*, Hamburg. Available from <http://www.hamburg-port-authority.de/de/presse/pressearchiv/Seiten/Pressemitteilung-05-04-2016.aspx> [Accessed 21 April 2017].
- Hypovereinsbank, Global Shipping (2010), *Maritime trend barometer results*, Hamburg. Available from <https://www.hypovereinsbank.de/portal?view=/de/corporate-investment-banking/betreuungsmodelle/global-shipping.jsp> [Accessed 10 April 2017].
- Leal, E., Notteboom, T. and Sanchez, R. (2011), The Spatial Distribution of Port Activity: Theoretical and Methodological Notes for Modelling and Research. In: Notteboom, T. (Ed.), *Current Issues In Shipping, Ports and Logistics*, UPA University Press Antwerp.
- Litman, T. (2017), *Accessibility for Transportation Planning*, Victoria Transport Policy Institute. Available from <http://www.vtppi.org/access.pdf> [Accessed 21 April 2017].
- Rotschuh, M. (2012), *Geschichte der Hafenquerspange*. Available from <http://www.hamburg-fuer-die-elbe.de/wordpress/wp-content/uploads/2013/10/hafenquerspange-geschichte.pdf> [Accessed 19 April 2017].
- Wedemeier, J. et al. (2015), *Przewozy towarów między portem w Hamburgu i Polską – perspektywy rozwoju Unii Izb Łaby i Odry (KEO)*, Hamburgisches WeltWirtschaftsinstitut (HWWI).

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THE PERSPECTIVES FOR POLISH INLAND WATERWAYS DEVELOPMENT IN RELATION TO THE AGN CONVENTION

Abstract

The development of the European transport network requires the unification of technical parameters across various countries. The network of internationally significant routes and the technical demands have been specified, among others, in the agreements prepared by the United Nations Economic Commission for Europe. AGN, which applies to inland waterways is one of the agreements. Poland has joined the agreement as late as in the 2017. The goal of the article is to answer the question of whether signing the agreement will lead to a quick development of the international inland waterways network in Poland.

Keywords: transport infrastructure, European AGN agreement, inland waterways transport

Introduction

The transport infrastructure is a significant factor determining the economic growth. A cohesive transport network is the basis for economic cooperation within a given area. The first concept of a uniform European transport network was developed by the Inland Transport Committee of the Economic Commission for Europe of the United Nations in 1950. The guidelines, presented in this and other agreements prepared by the UN, have been acclaimed as the basic parameters for the transport infrastructure of the European Union. In the year 1996 the Trans-European Transport Network (TEN-T) programme has been published after being prepared by the European Parliament and the Council of Europe. There are many practical issues with the creation of uniform transport network. Particularly hard problems occur in regards to the inland waterways transport, in which the degree of the use of inland waterways depends heavily on natural resources.

On 17th March 2017, the Polish government has ratified the “European Agreement on Main Inland Waterways of International Importance” (AGN), thus agreeing to adapt the inland waterways to the international route parameters. The goal of the article is to show the impact of the AGN agreement on the infrastructure development in Poland.

1. International agreements and the transport infrastructure development in Poland

An uneven development of the transport infrastructure and different parameters across Europe led to actions towards the unification of transport network. The UN/ECE Inland Transport Committee has prepared 57 international agreements and deals since 1947. They are the legal and technical basis for the growth of international transport. However, they are binding only for countries, which became a party of the agreement upon signing it. Six of the documents apply to the technical aspects of the transport infrastructure growth (Table 1). The target route network in various modes of transport along with the technical standards and ways of reaching them has been presented in these declarations, but the time upon which the network is to be finished has not been stated. The guidelines in the agreements are set out to:

- eliminate bottlenecks by modernizing the current connections,
- elimination of missing connections by completing the current infrastructure network.

Table 1. The list of agreements applying to the European transport network

Title of the agreement	Year of preparation	Year of Polish signing
Declaration on the Construction of Main International Traffic Arteries	1950	1960
European Agreement on Main International Traffic Arteries (AGR)	1975	1976
European Agreement on Main International Railway Lines (AGC)	1985	1986
European Agreement on Important International Combined Transport Lines and Related Installations (AGTC)	1991	1992
Protocol on Combined Transport on Inland Waterways to the European Agreement on Important International Combined Transport Lines and Related Installations	1997	–
European Agreement on Main Inland Waterways of International Importance (AGN)	1996	2017

Source: (own elaboration based on data available at: UNECE, 2017)

The AGR agreement assumes a construction of a modern, appropriately large network of routes consisting of motorways or dual carriageways. Among the most important international road links in Poland, there are:

- E30 (west-east): Świecko – Świebodzin – Poznań – Krośniewice – Warszawa – Terespol (A2 motorway),
- E40 (west-east): Zgorzelec – Legnica – Wrocław – Katowice – Kraków – Rzeszów – Przemyśl – Medyka (A4 motorway),
- E75 (Polish part of the Trans-European North-South Motorway): Gdańsk – Świecie – Toruń – Krośniewice – Łódź – Piotrków Trybunalski – Katowice – Cieszyn (A1 motorway),
- E65: Świnoujście – Szczecin – Gorzów Wielkopolski – Świebodzin – Zielona Góra – Legnica – Jelenia Góra – Jakuszyce (S3 double carriageway) (Economic Commission for Europe, 2016).

Around 50% of the 5500 km AGR network roads planned in 1975 had been completed and put into use by the end of 2015. It is noteworthy that the construction and modernisation of the national roads has begun as late as in the year 2005, after the Polish accession to the European Union and subventions from the European Funds. The UEFA EURO 2012 European Football Championship organized by Poland and Ukraine remained a beneficial factor for these investments. Most motorways and dual carriageways have been put to use in the years 2010–2012 (Figure 1). They consisted of over 1600 km, which is more than a half of the current network. Despite a relatively fast motorway and dual carriageway construction tempo, the Polish road network still has a low density of the motorways (5 km/1000 sqkm, while the average for the EU-28 is 17 km/1000 sqkm) (European Commission, 2016). Investments which were carried out resulted in an improvement of the national road network. In 2015, roads in good condition amounted to 60.6%, whereas in 2005 they amounted to 48.9% (Radzikowski, 2016, p. 25).

Over 162 billion PLN was spent on infrastructure development in the years 2005–2015 (Figure 2). The biggest expenditures were carried out in the years 2009–2012. At the same time, 41 billion PLN was spent on the railway infrastructure.

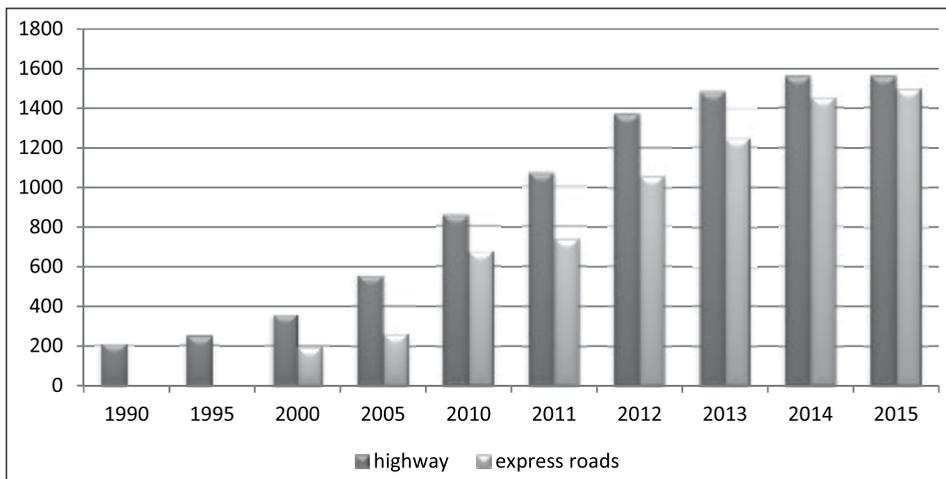


Figure 1. Length of Polish motorways and dual carriageways in the years 1990–2015 (km)
Source: (own elaboration based on data available at: GUS, 2015)

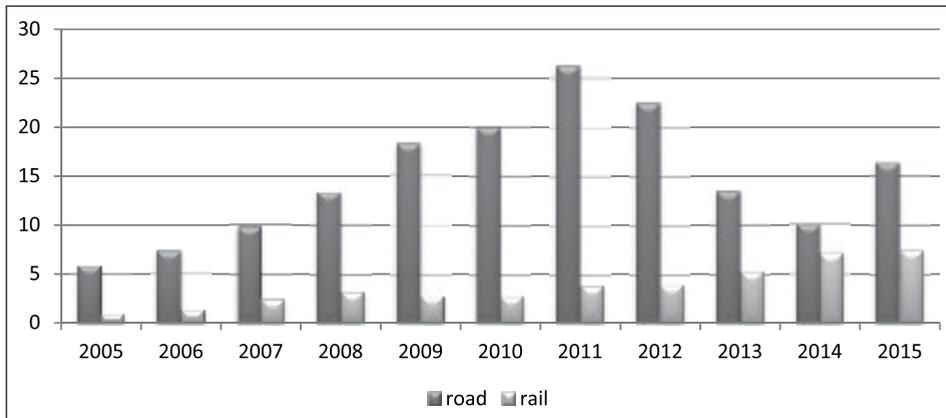


Figure 2. Investment expenditures on the railway and road transport infrastructure in the years 2005–2015 (billion PLN)

Source: (own elaboration based on data available at: PKP Polskie Linie Kolejowe, 2015; Radzikowski, 2016, p. 23; Generalna Dyrekcja Dróg Krajowych i Autostrad, 2017)

According to the international AGC and AGTC agreements four basic railway lines of international significance run through Poland:

- E20: Kunowice – Rzepin – Poznań – Łowicz – Warszawa – Łuków – Terespol,
- E30: Zgorzelec – Węgliniec – Wrocław – Katowice – Kraków – Tarnów – Przemyśl – Medyka,
- E59: Świnoujście – Szczecin – Poznań – Wrocław – Opole – Kędzierzyn – Chałupki,
- E65: Gdynia – Gdańsk – Tczew – Iława – Warszawa – Zawiercie – Katowice – Czechowice Dziedzice – Zebrzydowice (Economic Commission for Europe, 1985).

20% of the Polish railway network consists of the international railway lines. In order to adapt the railway infrastructure to the agreement standards it was necessary to:

- increase the minimal network speed to at least 160 km/h in the passenger traffic and 100 km/h in the freight traffic,
- assure that trains with a maximum 22.5 t weight per axle can run on the main lines,
- plan the modernization of the level crossings,
- reconstruct the platforms at large stations so that they are 400 meters long and the station lines for cargo trains are 750 m long.

The investments carried out in the years 2005–2015 led to an improvement of the condition of the railway infrastructure (Table 2). In 2015, 54.5% of the lines were declared to be in good condition, whereas 18.3% were deemed unsatisfactory. In 2005 less than a quarter of the infrastructure qualified as being in good condition. According to the speed scheduling structure most of the lines are adequate for speeds between 80 km/h and 120 km/h while only 0.7% are suitable for speed of up to 200km/h. Since 2011, the maximum speed was increased on more segments than

it was decreased on. In 2015, the maximum schedule speed was increased on 9% of the network length and decreased on 0.2% of the tracks.

Table 2. Select parameters of the Polish railway network in 2005 and 2015

	2005	2015
Technical evaluation (%)		
Good	25	55
Acceptable	47	27
Unacceptable	28	18
Schedule train speeds (%)		
V = 200 km/h	–	0.7
V = 160 km/h	4.9	9.7
120 km/h ≤ V < 160 km/h	15.1	21.9
80 km/h ≤ V < 120 km/h	39.2	33.9
40 km/h ≤ V < 80 km/h	29.9	27.4
V < 40 km/h	10.9	6.4
Length of railways at which speed changes occurred (km)		
Increase of speed	678	2525
Decrease of speed	1115	615
Result	–488	1910

Source: (own elaboration based on data available at: PKP Polskie Linie Kolejowe, 2006, 2016)

A significant improvement of the road and railway transport infrastructure occurred in the years 2005–2015 but there are still a lot investments waiting to be completed. The Polish road and railway network is a vital part of the Trans-European transport network. Its growth was made possible by the Polish EU accession and the inflow of European funding.

2. European Agreement on Main Inland Waterways of International Importance

In 1996, the UN Economic Commission for Europe prepared a document called European Agreement on Main Inland Waterways of International Importance in order to integrate the European network of inland waterways. The AGN agreement focuses on the construction and development of the internationally significant inland waterways which connect the 37 European countries. 33 countries, including 15 EU countries ratified or signed the agreement by the end of March, 2017. The AGN network includes rivers, canals, marine coastal routes and ports from the Atlantic Ocean to the Ural (Economic Commission for Europe, 1996). The main goal of the AGN is to set out technical standards for the economisation of the inland waterways. A unified network is necessary to increase the share of inland waterway transport in the total transport needs.

At least IV Class navigability parameters have to be met on the network of international inland waterways according to the guidelines specified in the AGN, marked

with the E symbol. This means that the waterways have to be adapted to the sailing of vessels which are at least 9.5 m wide, 85 m long, have a draft of 2.5 m and a payload of 1000–1500 t. Furthermore, the inland waterways network has to be integrated with the infrastructure of other transport modes.

The network of European waterways consists of over 36 000 km of inland waterways according to the statistics. Due to its size, the natural conditions vary both on particular stretches and on the whole lengths. Despite that, around 80% of the network was included in the AGN agreement. The inventory of the international waterways in 2013 showed an increase in the share of the highest parameter routes (Table 3). In comparison to 2004, in 2012 there was an increase of the total length of the inland waterways (by 1420 km), missing links (839 km) and Class VI routes (3129 km). On the other hand there was a decrease of the length of routes which did not meet the Class IV parameters by 1706 km. An increase of the share of Classes IV–VII in the total inland waterways length indicates a large scale of investments in the years 2004–2012.

Table 3. The structure of international inland waterways in Europe in 2004 and 2012

		Total	Missing links	Below Class IV	Class						
					IV	Va	Vb	VIa	VIb	VIc	VII
2004	Length (km)	27 711	1489	4286	3969	3270	5051	667	5766	1592	1621
	%	100	5.37	15.47	14.32	11.80	18.23	2.41	20.81	5.74	5.85
2012	Length (km)	29 131	2328	2580	4963	4558	4625	524	3532	4724	1747
	%	100	8.0	8.9	17.08	15.6	15.9	1.8	12.1	14.7	6.0

Source: (own elaboration based on data available at: Economic Commission for Europe Inland Transport Committee Working Party on Inland Water Transport, 2005, 2013)

3. Polish inland waterways according to the AGN agreement

Poland is one of the European countries which has a large network of inland waterways. Poland ranks four regarding the length of sailable rivers behind Finland (7889 km), Germany (5675 km) and France (4822 km) (Eurostat, 2017). According to the Regulation of the Council of Ministers from 2002 regarding the classification of inland waterways 6% of the 3659 km of Polish sailable waterways meet the international class criteria. Those are:

- Vistula from Przemsza estuary to the connection with Łacza Canal (37.5 km, Class IV);
- Vistula from Płock to Włocławek (55 km, Class Va);
- Dead Vistula (11.5 km, Class Vb);
- Dąbie Lake to the border with internal marine waters (9.5 km, Class Vb);
- Odra from Ognica to Klucz – Ustowo Piercing and further on as Regalica up to the estuary in Dąbie Lake (44.6 km, Class Vb);
- West Odra (36.3 km, Class Vb);
- Parnica River and Parnacki Piercing (Rada Ministrów, 2002).

The Polish network of inland waterways is not a uniform system. The quality of particular navigable routes varies greatly. Despite that, due to the location in Central Europe, Polish rivers are major links in the international network. According to the AGN agreement, the following routes in Poland have been declared as international waterways:

- E70: Odra – Vistula from Kostrzyn to Bydgoszcz, Vistula from Bydgoszczy to Biała Góra, Nogat, Szkarpa, Vistula Lagoon;
- E30: Odra and the Gliwice Canal;
- E40: the lower Vistula from the Narew estuary to Gdańsk.

The 2013 inventory of the international waterways has accepted the state of Dead Vistula and Vistula from Płock to Włocławek. The remaining waterways have been deemed to be:

- strategic bottlenecks, meeting Class IV requirements but needing modernisation to improve their quality: Odra from Widuchowo to Szczecin (40 km);
- basic bottlenecks, that is waterways which do not meet the requirements for the international waterways: Odra from Koźle to Widuchowo and Gliwice Canal, Vistula from Warsaw to Płock and from Płock to Gdańsk, Bug, Żerań Canal, waterway Vistula–Odra;
- missing links: Odra–Danube–Elbe Canal.

The current state of the inland waterways in Poland is a result of many years of negligence. No clear strategies and development plans for the Polish inland waterways, apart from the 97 km of the lower Odra, were included in the basic Trans-European TEN-T corridors.

The Polish accession to the AGN agreement in the March of 2017 does not mean an improvement of the navigation conditions on inland waterways. The AGN agreement doesn't specify the time of investment, however the need to include the Polish waterways in the European system has been specified in the *Assumptions for the development of Polish inland waterways for the years 2016–2020 with the 2030 perspective*. The initial estimated expenditures to adapt the inland waterways to international standards are as follows:

- around 30.7 bln PLN for the Odra Waterway (E30) with the Silesian Canal,
- around 31.5 bln PLN to cascading the lower Vistula,
- from 8.1 to 25.5 bln PLN to create the Vistula–Brześć connection (Ministerstwo Gospodarki Morskiej i Żeglugi Śródlądowej, 2016).

The main source of financing for the planned investments are the funds from European Funds: The Cohesion Fund, The European Regional Development Fund, The Connecting Europe Facility.

Conclusions

The AGR, AGC, AGTC and AGN agreements specify the technical parameters and the intended structure of the international transport network in Europe. The signing of agreement doesn't mean that the state of transport infrastructure will increase quickly. In Poland the accession to the EU and the development

of Trans-European TEN-T network were the driving factors behind the development of the road and railway infrastructure and not the agreements as such. The signing of the AGN agreement by the Polish government is only one of many activities necessary to improve the navigation conditions on Polish inland waterways. Compliance with the formalities so as to introduce the Polish waterways in the Trans-European network system, gathering funding from European Funds and consequence in regards to the fulfillment of programmes and strategies are among other goals.

References

- Economic Commission for Europe (2016), *European Agreement on Main International Traffic Arteries (AGR): Status of the Agreement*, Geneva. Available from <https://www.unece.org/fileadmin/DAM/trans/doc/2016/sc1/ECE-TRANS-SC1-2016-03-Rev1e.pdf> [Accessed 1 March 2017].
- Economic Commission for Europe Inland Transport Committee (1985), *European Agreement on Main International Railway Lines (AGC)*, Geneva. Available from https://www.unece.org/fileadmin/DAM/trans/conventn/AGC_e.pdf [Accessed 8 March 2017].
- Economic Commission for Europe Inland Transport Committee (1996), *European Agreement on Main Inland Waterways of International Importance (AGN)*, Geneva. Available from <https://www.unece.org/fileadmin/DAM/trans/conventn/agn.pdf> [Accessed 10 March 2017].
- Economic Commission for Europe Inland Transport Committee Working Party on Inland Water Transport (2005), *Inventory of most important bottlenecks and missing links in the E waterway network*, Resolution no. 49, as rectified by corrigendum 1, New York and Geneva. Available from <http://www.unece.org/fileadmin/DAM/trans/doc/finaldocs/sc3/TRANS-SC3-159e.pdf> [Accessed 10 March 2017].
- Economic Commission for Europe Inland Transport Committee Working Party on Inland Water Transport (2013), *Inventory of most important bottlenecks and missing links in the E waterway network*, Resolution no. 49, Revision 1., New York and Geneva. Available from <https://www.unece.org/fileadmin/DAM/trans/doc/2013/sc3wp3/ECE-TRANS-SC3-159-Rev1e.pdf> [Accessed 10 March 2017].
- European Commission (2016), *EU transport in figures. Statistical pocketbook 2016*, Directorate-General for Mobility and Transport in co-operation with Eurostat. Available from <https://ec.europa.eu/transport/sites/transport/files/pocketbook2016.pdf> [Accessed 1 March 2017].
- Eurostat (2017), *Navigable inland waterways, by waterways type*. Available from http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=iww_if_infrastr&lang=en [Accessed 13 March 2017].
- Generalna Dyrekcja Dróg Krajowych i Autostrad (2011), *Wydatki na inwestycje drogowe w Polsce w 2010 roku na poziomie 19,92 mld zł*. Available from <http://www.gddkia.gov.pl/pl/a/8481/wydatki-na-inwestycje-drogowe-w-polsce-w-2010-roku-na-poziomie-1992-mld-zl> [Accessed 1 March 2017].
- GUS (2015), *Transport – wyniki działalności 2015 r.*, Warszawa.
- Ministerstwo Gospodarki Morskiej i Żeglugi Śródlądowej (2016), *Założenia do planu rozwoju śródlądowych dróg wodnych w Polsce na lata 2016–2020 z perspektywą do 2030 roku*. Uchwała nr 79 Rady Ministrów z dnia 14 czerwca 2016 r.
- PKP Polskie Linie Kolejowe (2006), *Raport roczny 2005*. Available from http://www.plk-sa.pl/files/public/raport_roczny/Raport_2005_PL.pdf [Accessed 1 March 2017].
- PKP Polskie Linie Kolejowe (2016), *Raport roczny 2015*. Available from http://bip.plk-sa.pl/files/public/raport_roczny/RR_za_2015_rok_-13_grudnia.pdf [Accessed 1 March 2017].

- Radzikowski, M., Foryś, G. and Bogdaniuk, M. (2016), *Raport o stanie technicznym nawierzchni sieci dróg krajowych na koniec 2015 roku*, Generalna Dyrekcja Dróg Krajowych i Autostrad, Warszawa. Available from https://www.gddkia.gov.pl/userfiles/articles/r/raporty_18751/Raport%20stan%20na%20koniec%202015%20v11.pdf [Accessed 1 March 2017].
- Rozporządzenie Rady Ministrów z dnia 7 maja 2002 r. w sprawie klasyfikacji śródlądowych dróg wodnych (Dz. U. z 2002 r. Nr 77, poz. 695).
- UNECE (2017), *List of Agreements*. Available from <https://www.unece.org/trans/conventn/legalinst.html> [Accessed 10 March 2017].

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FINANCIAL RESULTS OF THE HANDLING AND WAREHOUSING COMPANIES IN POLISH MARITIME PORTS

Abstract

Companies which function in the operation area of Polish seaports, in particular the ones which offer cargo handling and warehousing services tend to display a solid financial condition. High dynamics of revenue prove this situation. In the years 2010–2015, the real revenues of the analysed companies group have increased yearly by 5.7% on average. The profitability of port handling companies also shows a significant improvement tendency. In the years 2009–2012 the return on sales, return on assets and return on equity ratios were on an acceptable (sufficient) level, while in the years 2013–2015 they increased to a satisfactory (good) level. Good financial results create large investment capabilities for these enterprises. This is especially important due to the fact that the port companies finance most of their investments with their own funds. In the years 2005–2015 the total outlays on property, plant and equipment have increased over 4 times.

Keywords: financial results, seaports, handling-warehousing companies, investment outlays

Introduction

Reaching a satisfactory level of financial efficiency is the main condition for a proper conduct of economic processes in enterprises. Economic entities have to base their activities on the traditional efficiency and optimisation criteria. An appropriate degree of financial balance, i.e. the ability to generate income, sustain the financial liquidity, increase the productivity of resources and the profitability

level, is one of the main determinants for the introduction of economically effective solutions. This rule also applies to companies which create the supply centres of port services, including a large group of handling and warehousing companies. Due to an increase of the cargo volume and a stronger position of Polish seaports on the Baltic port services market, a question arises – is this tendency accompanied by an improvement of the financial results of port companies which perform handling and warehousing services? Indeed, the maintaining of a proper financial condition is one of the factors of port companies' investment capabilities.

The goal of the paper is to identify the financial situation of the port companies which function in the operation area in Poland, for which the handling and warehousing of cargo is the main economic activity. Companies hiring more than 9 employees have been included in the research.

1. Port companies in Poland

Not only the dynamic growth of handling (Klimek, Rolbiecki, 2017) but also an increase in the number of the port companies which perform handling activities prove the dynamic growth of the port sector in Poland. In the years 2005–2015 the number of enterprises performing handling and warehousing services increased 4.7 times (from 108 to 508 entities), while at the same time the number of economic entities in the whole maritime sector increased by 56.8% (Table 1).

Table 1. The number of the economic entities in the maritime sector in Poland in the years 2010–2015

Years	Maritime economy companies	Handling and warehousing companies
2005	9019	108
2006	10 315	118
2007	10 955	113
2008	10 882	125
2009	10 955	391
2010	10 915	423
2011	11 064	431
2012	11 938	420
2013	12 213	486
2014	12 583	466
2015	14 141	508

Source: (own elaboration based on data available at: GUS, 2007, 2010c, 2016)

The maritime industry, similarly to the whole transport sector, consists mostly of small enterprises (Figure 1). In 2015, economic entities with 9 or fewer employees constituted 91.7% of the sector (nearly 13 thousand entities), while the enterprises hiring more than 49 people amounted to only 2.2% of all the companies (308 entities).

A significant fragmentation of the market is also characteristic to the port companies performing handling and warehousing services. In the years 2005–2015

the fragmentation of this activity has increased. While in the year 2005 the companies employing fewer than 10 people constituted 68.5% (74 entities) of all the port handling and warehousing companies, in 2015 this share has increased to 82.7% (420 entities) (Figure 2).

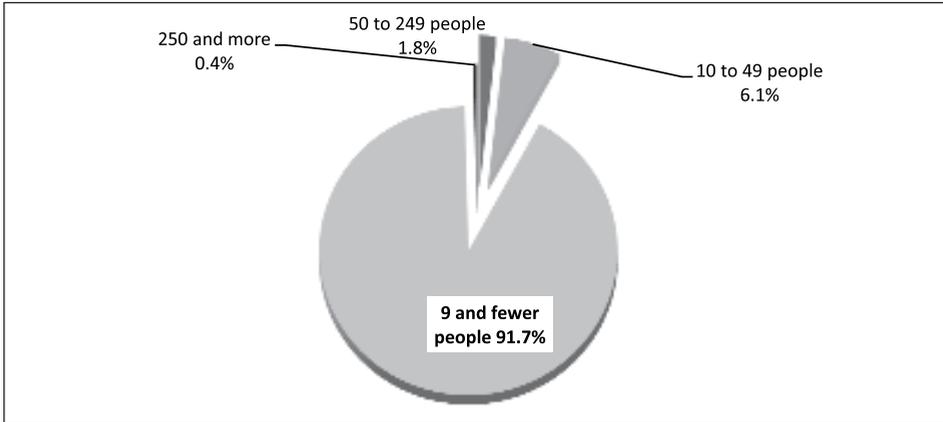


Figure 1. Structure of the maritime companies in Poland in the year 2015, according to the employment scale [%]

Source: (own elaboration based on data available at: GUS, 2016)

In various industries of the national economy only entities running a bookkeeping system and hiring more than 9 people have their financial situation analysed. In 2015, in all of the maritime industry these enterprises constituted only 8.3% of all the entities. The same share, applied to the handling and warehousing companies is higher, in 2015 it was 17.3%.

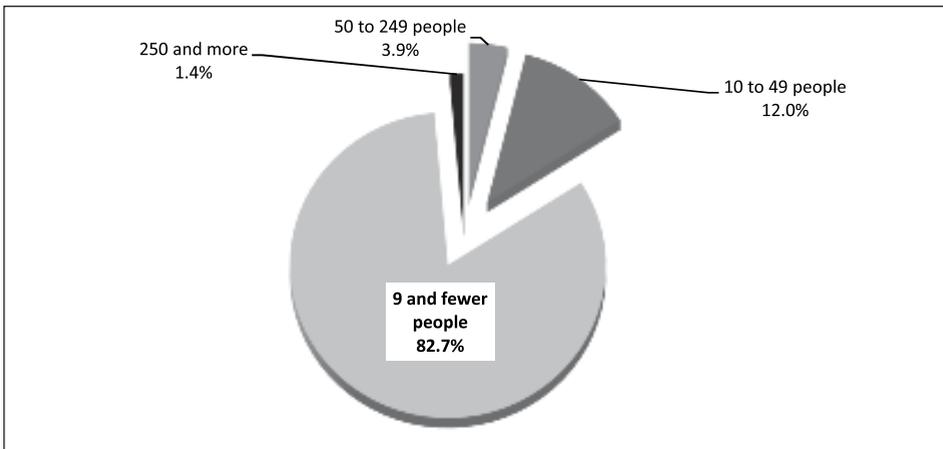


Figure 2. Structure of handling and warehousing companies in the Polish ports in the year 2015, according to the employment scale [%]

Source: (own elaboration based on data available at: GUS, 2016)

Due to the changes in the number and structure of the port handling enterprises in the years 2005–2015, the number of analysed economic entities also varied, from 34 in 2005 to 88 in 2015. These results may only be treated as a general picture of the financial condition of the handling and warehousing companies, as not all of them have been analysed.

2. The ability to generate revenues and control the activity costs

In the market economy, the act of sales is the natural activity area of every enterprise. If the enterprise is unable to find customers, it doesn't sell and therefore doesn't have a chance not only to survive on the market but also to achieve the goals which it had set.

The financial condition of the enterprises is determined mostly by the ability to generate sales revenue from basic activity, which in port handling companies includes the income from the services of handling and warehousing of cargo. Research proves that these income sources amounted to most of the port companies revenue. In the years 2005–2015 the basic activity revenues in handling and warehousing companies in Polish maritime ports had on average a share of more than 96% of all the income (Figure 3). This structure is appropriate from the point of view of the ability to sustain the existence of the analysed companies. It means that the statutory activity of these enterprises is their main income source and also the main cost coverage.

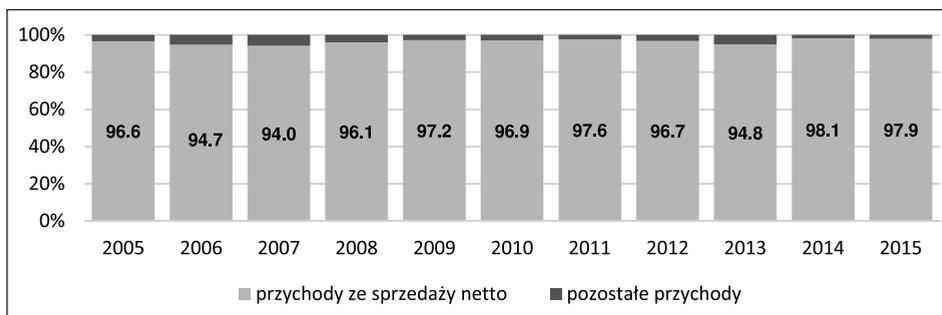


Figure 3. The share of net sales revenue in all the revenues in handling and warehousing companies in Polish maritime ports in the years 2005–2015 [%]

Source: (own elaboration based on data available at: GUS, 2007, 2010c, 2016)

An increase in the amount of revenues generated by the handling and warehousing port companies in Poland means that they display a tendency to develop (this increase is however, to a certain amount, the result of the aforementioned increase of the number of companies). In 2015, the total revenues of the port sector companies were as high as 2.4 bln PLN and they were three times as high as in 2005. The increase of the income from operational activity from 772.2 bln PLN to 2 275.2 bln PLN was of similar scale (GUS, 2007, 2010c, 2016).

The companies' ability to generate revenue is analysed with the use of revenue dynamics indexes, both in the nominal and the real variant. While the nominal changes in the revenue dynamics are the result of both the changes of service prices and the volume of services performed, the real changes only result from the changes in volume. A nominal increase of the revenue dynamics, which is a result of a mild price increase, can't be treated as a danger, even when accompanied by a short-term real sales revenue decrease. A mild, relatively small increase of prices is a desired occurrence, not only from the point of view of particular companies but also the whole economy. A decrease of the company service prices might result in the inability to cover the costs of current activity. Similarly, from the point of view of economic prosperity, prices which decrease too rapidly (deflation) might lead to a danger of "low inflation expectations trap", which means that the customers suspend their expenditures, expecting that they will be able to satisfy their demand for goods and services at a lower price later on. In consequence this leads to a decrease in consumption demand and may result in a decrease of the economic growth tempo.

Even though a small nominal revenue increase is a desired thing, in the long run the real growth, resulting from an increase in the sales decides the enterprise economic efficiency. It is not possible for the company to survive in the long run if it only achieves an increase of revenues based on the increase of prices. Obviously, the labour and goods and services resulting from it are the basis for the enterprise development.

As the data in Table 2 shows, in the years 2005–2009 the sales revenue dynamics varied greatly in the handling and warehousing port companies. Therefore, this period has been excluded from the analysis of the average yearly revenue change tempo. The analysis shows that in the following years (2010–2015), the analysed port companies have increased their sales revenue nominally by 7.6% on average every year, while the mean prices in the water transport support services have increased at a slower rate, by 1.8%.

It means that in the analysed period, the real revenues of the analysed company group have increased on average by 5.7%, which is a significant growth. For comparison, in the whole transport industry, which includes transport and warehousing economy (also entities employing more than 9 workers) the average sales income increased by 7.0% nominally and 3.9% on real in the analysed period (GUS, 2010a, 2010b, 2015a, 2015b).

The level of costs i.e. the purposeful use of resources, evaluated monetarily is the main criterion for the evaluation and assessment of the economic efficiency of port enterprises. The total activity cost level ratio (the ratio of total activity costs and total activity revenues) is the main indicator used in such an assessment. According to the financial standards this ratio shouldn't exceed 90% (Sierpińska, Jachna, 2004) which is the level of a borderline profitability of performed services. If a company crosses that threshold it means that it might have serious difficulties in regards to cost coverage.

Table 2. Nominal and real net sales revenue changes of the handling and warehousing companies in Poland in the years 2005–2015 (previous year = 100)

Years	Sales revenue		The mean price changes in the water transport support services [%]	Real sales changes [%]
	mln PLN	nominal dynamics [%]		
2005	772.2	–	–	–
2006	767.2	99.4	100.9	98.5
2007	769.3	100.3	100.5	99.8
2008	786.0	102.2	100.9	101.3
2009	1419.6	180.6	105.2	171.7
2010	1631.4	114.9	101.1	113.7
2011	1460.1	89.5	102.6	87.2
2012	1587.2	108.7	104.0	104.5
2013	2010.2	126.7	102.0	124.2
2014	2275.2	113.2	101.5	111.5
2015	2350.2	103.3	98.8	104.6

Source: (own elaboration based on data available at: GUS, 2007, 2010b, 2010c, 2015b, 2016)

According to the research covering the period of 2005–2015, the handling and warehousing port companies, which hired more than 9 people had the lowest abilities to cover costs in the year 2008. In the analysed group of companies the total cost level ratio was equal to 101.5% which means that the incomes weren't sufficient to cover the costs of activity. Since 2008 the ratio has been decreasing (Figure 4), which signifies an improvement of the resource economic efficiency.

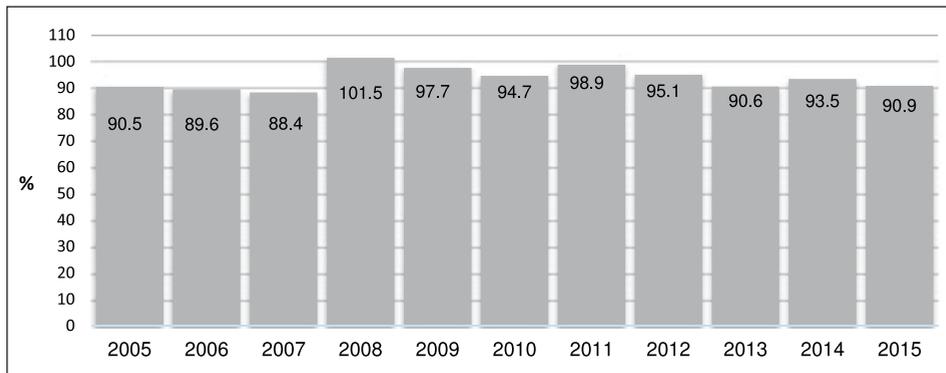


Figure 4. The total activity cost level ratio in handling and warehousing port companies in Poland in the years 2005–2015 [%]

Source: (own elaboration based on data available at: GUS, 2007, 2010c, 2016)

In 2015, the cost level ratio was equal to 90.9% which was one of the lowest in the period (2005–2015), however it exceeded the acceptable standard. This is a problem which is symptomatic for many transport companies in Poland. In comparison, in 2015 in the whole transport and warehousing industry, in companies comparable regarding the employment, the ratio was equal to 95.8% (GUS, 2015a).

3. Financial liquidity and profitability of business entities

The analysis of financial liquidity plays a crucial role in the analysis of operational activity of economic entities (Table 3). A significant role of the financial liquidity in the current activity assessment results from the fact that the existence of company is determined by its ability to cover their short term liabilities. Even if the enterprise isn't profitable, it can survive thanks to the maintaining of current liquidity resulting from financial assets accumulated while the sales was profitable (Gabrusewicz, 2014).

Table 3. Basic indicators used in the analysis of financial liquidity of a company

Liquidity ratio	Indicator level	Assessment of the situation
Current ratio, i.e. III degree ratio (current assets/current liabilities) \times 100 [%]	over 150%	very good
	120–149.9%	satisfactory
	80–119.9%	sufficient
	lower than 80%	unsatisfactory
Quick ratio, i.e. II degree ratio (current assets less inventory and deferred asset charges/current liabilities) \times 100 [%]	over 120%	very good
	100–119.9%	satisfactory
	70–99.9%	sufficient
	lower than 70%	unsatisfactory
Cash ratio, i.e. I degree ratio (short term investments/current liabilities) \times 100 [%]	no border values	

Source: (own elaboration based on: Czajkowska, 2013; Nowak, 2017)

The companies which perform handling and warehousing services in Polish maritime ports have shown in general very good and good financial liquidity during the analysed period (Table 4). In particular, the I degree ratio proves a significant ability to pay off current liabilities.

Some problems occurred in 2014, when the current and quick ratio showed the values of 94.6% and 87.2%. These values, according to the generally accepted standards can be seen only as sufficient. This situation was mostly caused by the accumulation of current liabilities payoff resulting from credits and loans. The analysis of the current liabilities of the port enterprises shows that in 2014, in comparison to 2013, the current liabilities (regarding the credits and loans) increased 3.1 times, i.e. from 115.4 mln PLN to 355.0 mln PLN (GUS, 2016).

Table 4. The current liquidity ratio of handling and warehousing companies in Poland (hiring over 9 employees) in the years 2005–2015 [%]

Years	Liquidity ratios		
	current (III degree liquidity)	quick (II degree liquidity)	cash (I degree liquidity)
2005	157.6	144.1	62.3
2006	162.4	150.4	76.3
2007	155.4	141.6	62.5
2008	153.4	141.3	56.8
2009	104.2	97.0	41.0
2010	135.9	126.2	56.4
2011	149.2	139.1	64.2
2012	120.7	111.5	49.3
2013	131.0	123.7	50.4
2014	94.6	87.2	34.9
2015	138.2	126.8	54.6

Source: (own elaboration based on data available at: GUS, 2007, 2010c, 2016)

While the analysis of the financial liquidity matters from the current activity perspective, the development ability of a company in the long run is determined by the company ability to generate a positive financial result. This ability is shown with the use of profitability ratios. These indicators are one of the most synthetic measures of the economic resource efficiency in an enterprise. In regards to the profitability ratios no optimal values are established. Therefore, values from previous periods, results of other entities and industry means are assumed as a reference point to assess the results of a given company (Nowak, 2017).

In the analysis of the profitability level of the handling and warehousing port companies in Poland it was assumed that the return on sales, return on revenue and return on assets signify a strong development basis if they exceed 10%, and the return on equity ratio proves the same if it exceeds 15% (Table 5). On the other hand, a negative value of these indicators show that the economic activity of a company results in a negative financial result (such a situation in fact proves a lack of financial balance). Long term negative values of profitability indicators proves that the company ability to develop further has disappeared and it may lead to the company bankruptcy.

According to the research (Table 6), 2008 was the only year in which the port companies were not profitable. It was the only year during the analysed period (2005–2015) in which the profitability ratios signified a deficit economic activity. This is when the companies of the port industry, which is especially dependant on the situation on the international markets (both cargo and transport), experienced the results of the worldwide economic breakdown.

Despite the recession on the global markets in the years 2008–2010 and the occurrence of the second bottom of recession in 2012 the profitability of the handling and warehousing port companies in Poland has displayed a significant improvement tendency since 2009. In the years 2009–2012 the ratios of return on sales, total revenue, assets and equity were on an acceptable level, while in the years 2013–2015

they reached a satisfactory level. The year 2015 was one of the better periods (based on profitability) for the analysed companies, since they generated 7.5 PLN of net profit and 9.1 PLN of gross profit for every 100 PLN of sales revenue and also 7.0 PLN and 16.2 PLN for every 100 PLN of assets and equity, appropriately.

Table 5. Main ratios used in the profitability analysis of an enterprise

Profitability ratio	Ratio level	Assessment of the situation
Return on sales (net financial result/sales revenue) × 100 [%]	over 10%	very good
Return on total revenue (net or gross financial result/total revenue) × 100 [%]	5.0–9.9%	satisfactory
Return on assets (net profit/mean value of assets) × 100 [%]	0–4.9%	acceptable
	negative value	very bad
Return on equity (net profit/mean value of equity) × 100 [%]	over 15%	very good
	10.0–14.9%	satisfactory
	0–9.9%	acceptable
	negative value	very bad

Source: (own elaboration based on: Czajkowska, 2013)

Table 6. The profitability ratios of handling and warehousing companies in Poland (hiring over 9 employees) in the years 2005–2015 [%]

Years	Profitability ratios				
	sales revenue	gross total revenue	net total revenue	assets	equity*
2005	7.7	9.5	7.4	8.0	12.7
2006	8.7	10.4	8.3	8.2	15.0
2007	9.9	11.6	9.3	8.7	16.8
2008	-1.2	-1.5	-1.1	-1.0	-2.1
2009	1.5	2.5	1.5	1.9	4.1
2010	4.0	5.2	3.9	4.7	10.5
2011	0.5	1.2	0.5	0.5	1.3
2012	3.4	4.9	3.2	3.8	8.9
2013	8.2	9.4	7.8	10.4	23.1
2014	5.5	6.5	5.3	6.6	14.7
2015	7.7	9.1	7.5	7.0	16.2

* total owner's equity

Source: (own elaboration based on data available at: GUS, 2007, 2010c, 2016)

This situation was significantly better than for the whole transport industry (including transport and warehousing industry). In comparison to the companies comparable regarding the employment in the whole transport and warehousing industry, the net and gross revenue profitability ratios were 4.0 p.p. and 4.9. p.p. higher and the return on assets and return on equity ratios were 4.4. p.p. and 8.9. p.p. higher (GUS, 2015a).

4. The development investment layouts of handling and warehousing port companies

The financial condition of the Polish handling and warehousing port companies is the main factor which determines their investment ability. The investments which are handled by these companies are mostly financed with their own funds. In 2014, these funds were the 59.4% of all the capitals, whereas in 2015 they were equal to 70.0% (GUS, 2016). The investment activity of these companies is therefore carried out with a lack of budget funds and a relatively low support of funding from credits and loans.

Good financial results, especially regarding the high sales revenue dynamics and also an increase of the profitability of the analysed entities has increased their proneness to investment (Table 7). In the years 2005–2015 their total layouts on tangible assets increased from 135.7 mln PLN to 546.8 mln PLN.

Table 7. Investment layouts on tangible assets of Polish handling and warehousing companies and seaports authorities, current prices, years 2005–2015 [mln PLN]

Years	Investment layouts of Polish handling and warehousing companies			Investment layouts of seaports authorities		
	total	buildings and structures	machinery, technical equipment, tools and transport equipment	total	buildings and structures	machinery, technical equipment, tools and transport equipment
2005	134.7	31,4	103.3	145.7	138.5	7.3
2006	144.6	83,3	61.3	179.4	170.7	8.7
2007	97.5	37,8	59.7	193.5	184.5	9.0
2008	105.0	44,8	60.2	190.7	170.1	20.7
2009	105.0	38,4	66.6	116.3	110.9	5.3
2010	125.4	41,1	84.3	125.4	121.2	4.2
2011	124.6	37,9	86.7	162.4	154.2	8.1
2012	217.8	99,5	118.3	214.5	209.5	5.0
2013	268.0	105,0	162.9	256.0	250.9	5.1
2014	293.5	87,3	206.1	361.5	347.8	13.7
2015	546.8	319,8	227.0	397.4	304.4	93.0

Source: (own elaboration based on data available at: GUS, 2007, 2010c, 2016)

Even though the port infrastructural objects (buildings and constructions) are the mainly the domain of seaport authorities (about 94.0%), the layouts on these objects were also an important position for the handling and warehousing companies. An especially significant increase in the layouts on buildings and constructions could have been observed in 2015 when they amounted to 320 mln PLN which was 58.5% of all the layouts on tangible assets in the port industry. At the same time, in the analysed period the layouts on suprastructure investments were higher for the handling and warehousing companies than they were for the seaport authorities. This is a result of the Act of 20 December 1996 on the Ports and Harbours, which specifies the goals on which the port authorities can spend their financial assets (Ustawa z dnia 20 grudnia 1996).

Conclusions

Development programmes and investment plans of both the Polish seaport authorities and the operation area companies are connected not only with their positive financial condition but also with the situation in their surroundings. The growth of international trade markets influences the volume of goods carried by sea, and causes an intensive competition on the port services market. Factors connected with the environment, especially regarding the environment protection and corporate social responsibility mean that the maritime ports (as the areas of supply) have to adjust their service potentials to the demand of their customers. The necessity to provide appropriate port infrastructure parameters (which is a domain of the seaport authorities) and equipment which allows a complex service for the customers and a high quality of service is the main condition of sustaining and increasing the competitive power of the handling and warehousing companies in Polish maritime ports. However, the ability to create the competitive power of these companies depends on their financial condition which, in years 2005–2015, was positive enough to enable a further growth of their service potential.

References

- Czajkowska, A. (2013), *Kredytowanie przedsiębiorstw indywidualnych. Specyfika, procesy polityka*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź, pp. 318–319.
- Gabrusewicz, W. (2014), *Analiza finansowa przedsiębiorstwa. Teoria i zastosowanie*, PWE, Warszawa, p. 327.
- GUS (2007), *Rocznik Statystyczny Gospodarki Morskiej*. Available from <http://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-gospodarki-morskiej-2016,11,9.html> [Accessed 31 May 2017].
- GUS (2010a), *Bilansowe wyniki finansowe podmiotów gospodarczych*, Warszawa. Available from <http://stat.gov.pl/obszary-tematyczne/podmioty-gospodarcze-wyniki-finansowe/> [Accessed 27 April 2017].
- GUS (2010b), *Ceny w gospodarce narodowej*, Warszawa. Available from <http://stat.gov.pl/obszary-tematyczne/ceny-handel/> [Accessed 27 April 2017].
- GUS (2010c), *Rocznik Statystyczny Gospodarki Morskiej*. Available from <http://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-gospodarki-morskiej-2016,11,9.html> [Accessed 31 May 2017].
- GUS (2015a), *Bilansowe wyniki finansowe podmiotów gospodarczych*, Warszawa. Available from [http://stat.gov.pl/obszary-tematyczne/podmioty-gospodarcze-wyniki-finansowe/\(27.04.2017\)](http://stat.gov.pl/obszary-tematyczne/podmioty-gospodarcze-wyniki-finansowe/(27.04.2017)) [Accessed 27 April 2017].
- GUS (2015b), *Ceny w gospodarce narodowej*, Warszawa. Available from <http://stat.gov.pl/obszary-tematyczne/ceny-handel/> [Accessed 27 April 2017].
- GUS (2016), *Rocznik Statystyczny Gospodarki Morskiej*. Available from <http://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-gospodarki-morskiej-2016,11,9.html> [Accessed 31 May 2017].
- Klimek, H. and Rolbiecki, R. (2017), Funkcja transportowa największych polskich portów morskich. In: *Rozwój i funkcjonowanie transportu w świetle idei zrównoważonego rozwoju*, *Zeszyty Naukowe Uniwersytetu Gdańskiego. Ekonomia Transportu Lądowego*, 63, pp. 80–87.
- Nowak, E. (2017), *Analiza sprawozdań finansowych*, PWE, Warszawa, pp. 207, 238–239.

Port of Gdansk (2017), *FACTS & FIGURES*. Available from http://www.portgdansk.pl/zmpg-sa/media?open_cat=20&rtfr=1 [Accessed 27 April 2017].

Sierpińska, M. and Jachna, T. (2004), *Ocena przedsiębiorstwa według standardów światowych*, Wydawnictwo Naukowe PWN, Warszawa, p. 179.

Ustawa z dnia 20 grudnia 1996 r. o portach i przystaniach morskich (Dz. U. z 1997 r. Nr 9, poz. 44).

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EDUCATIONAL PROGRAMMES AS PART OF CORPORATE SOCIAL RESPONSIBILITY STRATEGY IN LOGISTICS

Abstract

The idea of *corporate social responsibility* (CSR) becomes a popular base to form a long-term competitive strategy in logistics. Global logistic market demands high efficiency, complying with global quality standards and offering services at unified prices worldwide. Therefore logistic companies very often aim to raise their competitive potential by forming a strategy that allows for a long-term stable growth, based not only on reaching economic goals, but also on friendly coexistence of the company and its environment (CSR approach). The paper shows that educational programmes can be applied in relation to various issues of social responsibility chosen by an individual company. They can become an efficient tool to fulfill CSR goals in a strategy of a global logistic provider, as well as it can support the strategy of a much smaller logistic company. The benefits of a well-designed and implemented educational programmes are presented.

Keywords: CSR, strategy, education, educational programmes, CSR in logistics, CSR goals

Introduction

Logistics is often considered to be an extremely expansive industry, especially in relation to the harmful effects of transportation on the natural environment, the trade development and the natural resources exploitation. As a result, logistic companies aim to reduce the negative impact of their activity on their surroundings and spread the environmental awareness. Therefore, contemporary logistic distribution chains are often based on a certain level of CSR implemented by each and every partner in the logistic chain. CSR policy may be one of the criteria while tendering business partners in logistics. However, CSR tolls can also support goals

in a single corporate strategy. The CSR is often defined around issues such as: *trust, harmony, friendly cooperation* and *communication*. Educational programmes can be an effective tool in each of these issues, especially due to the fact that they can be implemented to reach each of the CSR goals officially defined by the United Nations. The goal of the article is to analyze the components of a well-designed educational programme and the way it can become a low-cost and efficient tool to support CSR goals in logistic activity.

1. CSR in corporate strategy

The idea of CSR is often misunderstood and some single marketing activities such as sponsoring, educational events, environment protection projects etc., tend to be seen as CSR. Companies find it difficult to place CSR within existing strategy and to identify goals and tools that might be useful. Thus, the first step to implement the idea of CSR to logistics, as well as to any other form of economic activity, is to start by defining what it really means for a company to be socially responsible. Popular definitions explain that CSR “is an innovative, voluntary management strategy that combines reaching economic goals with social, ethical and ecological aspects, on the field of both business operations and interactions with stakeholders”. In this type of strategy, economic goals remain in relation with social goals and care for natural environment. Effective communication with stakeholders (i.e.: employees, customers, shareholders, business partners, local community) allows for raising competitiveness and creating favorable conditions for social and economic development within company’s surroundings. The other important benefits of implementing CSR are:

- creating a reliable, strong brand, by building trust and better relations between the company, its customers, business partners and local community;
- possibility to add a unique value to standard products and services, resulting in increasing competitive potential;
- enhancing employee and customer loyalty, by acting along fair play, transparent procedures; taking into account employees’ and customers’ views, needs and preferences when forming a strategy;
- better access to financing, as social awareness and transparent business procedures are considered to be the features of well-managed projects and companies;
- possibilities to enter new markets, on which high CSR standards are required;
- establishing corporate culture, based on understanding and cooperation between employees (Encyklopedia CSR, 2017).

It is important to perceive CSR as a base and integral part of the complex management strategy. When properly integrated with economic vision and operation procedures, the CSR will allow for acquiring benefits mentioned above. CSR aspects are then present in the most important parts of the strategy (technology, financing and marketing). In the field of technology, CSR approach would ensure environmentally and socially responsible logistic services and manufacturing processes. In relation to financing, the focus is on socially responsible projects,

both inside the company (i.e.: supporting employees' involvement and creativity in introducing improvements to the strategy) and outside (i.e.: customers education on energy-saving solutions in transportation and smart packaging). Marketing, as part of the general competitiveness strategy, should provide measures to support and promote social and environmental activities, with a focus on the ethical and responsible way in which the company reaches economic goals.

2. Building CSR in logistics

The first step to build a strategy based on CSR approach is to identify groups of stakeholders of the company. Stakeholders are all those people, institutions, groups of interest and communities that exist in company's surroundings and are by some means affected by results of the company's presence and operations. Logistic operations usually allow to distinguish stakeholders as:

- actual and potential customers – considered to be the most significant group, particularly sensitive to the factors determining logistics brands;
- actual and potential business partners and shareholders – this group of stakeholders pay special attention to the value of the brand to the overall shape of competitive strategy, i.e.: banks, insurance companies;
- suppliers – carriers, warehouse suppliers, IT services;
- communities - on national, local and international level, depending on the range of operations and number and localization of branches of the logistic company;
- local governments and institutions;
- competitors – other companies offering logistic services to the same groups of potential customers;
- academic surroundings – providing human resources, technology, know-how, evaluation of market processes;
- media – creating opinions, providing means of social communication;
- natural environment – ecosystems and organizations influencing the way a logistic company may develop its operations.

Precise identification of stakeholders allows to shape CSR goals in relation to each group and its expectations and to choose the right tools of communication. *Effective communication* is the base that enables mutual understanding and building positive relations with each group. CSR strategy should be based on sustainable growth of business operations, considering interests, preferences and opinions of all stakeholders, and integrating the needs of the social and environmental surroundings with logistic activity and gaining revenues. Due to the fact that CSR requires a constant exchange of information between logistic company and its stakeholders, establishing effective channels of communication becomes a priority issue. There are three major fields of communication: inside the company – between managers and employees; between the company as a whole and the logistic services market and between the company and local/national community. In each case a constant exchange of information in both directions should be established.

According to the identified groups of stakeholders, range of operations and CSR goals, a logistic company may choose to use different tools, among which the most popular are:

- in relation to employees: voluntary projects in which employees are encouraged to actively support ecological or social initiatives, campaigns to build corporate culture on the base of employees' ideas to improve the company, helping employees to develop their individual passions and sharing them with the others or local community, supporting working mothers;
- in relation to customers: building easily accessible channels of communication (i.e.: call-centers, free info-lines) to encourage customers to express their needs, doubts, problems according to logistic issues, offering advice on issues such as how to prepare goods for transportation, fill in necessary documents, etc.;
- in relation to local community: projects offering education, raising quality of life, integrating social groups (i.e.: children, disabled people, senior citizens) around certain activities (i.e.: sport, art, community service), campaigns giving local community a chance to express their expectations according logistic operator's activity;
- in relation to natural surroundings: projects supporting environment protection and research, initiatives raising environmental awareness and supporting education.

CSR is therefore a vision and strategy that may be shaped individually by different logistic companies. Although it offers many significant benefits both to the company and its surroundings, it is not common for logistic companies in Poland to build a competitive strategy with CSR approach. Global logistic operators, operating with ISO standards were the first to introduce CSR into their management. However smaller operators often tend to avoid such strategies, due to the lack of knowledge as to what the true meaning of CSR is and also due to the need to avoid additional costs. There are also other reasons for not very common use of CSR in logistics, such as the lack of feedback from local community or clients or other practices (not compatible with such approach) that have already been implemented.

3. CSR Educational programmes

Education is an essential part of CSR policy and therefore it is an important tool for responsible companies to make an impact on their environment. Companies are willing to share their knowledge and build social awareness of various problems. They take responsibility for the kind of knowledge they want to transfer and they make an effort to reach certain groups of people, for example their employees, clients, local communities, students. etc. Educational programme planning consists of the following elements:

1. educational goal,
2. target group definition,
3. range of knowledge,
4. encouragement,

5. duration of the programme,
6. other partners involved,
7. ways of presentation,
8. form of completion of the programme.

Chosen forms of education depend on the social goals of CSR policy and the nature of knowledge that is to be shared, for example some companies decide to cooperate with schools, universities or institutions of non-educational nature to initiate or support an existing course, others decide to launch a course on their own, meeting people outside the company or inviting them in to share knowledge. Educational programmes may include general issues such as (Albińska, 2017):

- environment,
- health,
- safety and security,
- cooperation with suppliers,
- career paths and labor market,
- consumption models,
- lifestyle,
- culture,
- technology,
- personal development.

Most of the programmes are designed as a part of long-term educational strategy, and as in other types of strategic activity, it is important that the company gets feedback from society about popularity of the program and reaction of local population or other addressed groups. The feedback allows to identify the fields of knowledge that are most appreciated and as a result to design and implement more socially approved programs.

In 2016, human rights and climate change remain the highest priorities for corporate sustainability (BSR: The State of Sustainable Business, 2016). As educational programmes are essential in both fields, companies around the world can use them to address their CSR goals. According to the Rapport on CSR in Poland in 2016 (Albińska, 2017) there have been numerous CSR activities implemented by companies in Poland in relation to education. Over 300 educational initiatives were submitted to the Rapport in 2016.

Under the guidelines of The United Nations Organization, Sustainable Development Goals were established in 2015. There are 17 main targets to be reached until 2030. They have become an outline for companies to set their own selective set of CSR goals and tasks that comply with the sustainable development rules. The named goals are (UN, 2016):

Goal 1. End poverty in all its forms everywhere.

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

Goal 3. Ensure healthy lives and promote well-being for all at all ages.

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Goal 5. Achieve gender equality and empower all women and girls.

Goal 6. Ensure availability and sustainable management of water and sanitation for all.

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all.

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Goal 10. Reduce inequality within and among countries.

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.

Goal 12. Ensure sustainable consumption and production patterns.

Goal 13. Take urgent action to combat climate change and its impacts.

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

Each of the goals sets a field for a variety of educational programmes and activities which can be developed within a corporate CSR strategy. For example, according to the Goal 1, poverty is more than the lack of income and resources to ensure a sustainable livelihood. Its manifestations include hunger and malnutrition, limited access to education and other basic services, social discrimination and exclusion as well as the lack of participation in decision-making (UN, 2016), thus educational programmes addressing the goal may be evolve around these complex issues. Companies select their individual activities to suit their management strategy and support education according to issues that are important for local community and environment. To develop an interesting educational programme, a company needs to identify key social issues important in their local communities to address:

- geo-political issues (for example: campaigns against war, understanding the nature and consequences of migrations);
- environmental problems (for example: initiatives to clear the oceans and beaches, supporting endangered species of animals);
- economic issues (for example: enhancing sustainable economic growth, change of the global food and agriculture system to nourish the hungry, supporting humanitarian action amid rising malnutrition, thirst and disease);
- safety and security (for example: various health awareness initiatives, promoting safe behaviour patterns).

The addressed problems need to be intelligible and up to date for the local community. The company is to show it takes a burden to give help through education

and support. To identify the most important social issues the company needs to be aware of the social structure of their geographical and economic surroundings and observe the problems that appear in various aspects local community life. To achieve this goal, companies often decide to meet their stakeholders. For example in 2016 DB Schenker invited its stakeholders to its Białystok branch. The meeting was held within the framework of the project 'DB Schenker – the preferred Neighbor'. Representatives of State and local institutions, community organizations, local universities and the business environment, including customers of DB Schenker took part in the meeting. Participants discussed activities of the company and the expectations of the local community. Similar CSR initiative was launched by Raben Group, it consisted of a project of dialog sessions called the "Common Way". Stakeholders from 3 main company locations: Gądki near Poznań, Straszyn near Gdansk and Grodzisk Mazowiecki were invited to join the meetings. The aim of the project was to get to know the needs and expectations of the representatives of the local communities, suppliers and immediate neighbours. As a result, the company collected 183 demands and suggestions from the stakeholders.

In turn, in 2016, Polish State Railway (PKP) carried out an inclusive design workshop, that allowed for involvement of society and local government units in the planning process of functional utility of infrastructure. The involvement of stakeholders takes place at the earliest stage of the preparation of projects involving the reconstruction or construction of railway stations. The aim is to significantly improve the quality of life of users and availability of infrastructure of railway transport (Albińska, 2017).

4. CSR educational programmes in logistics

Logistic activity influences various groups of stakeholders. Among them are employees, clients, cooperating companies and institutions, local communities, but also groups affected by environmental consequences of the development of transport and logistic systems. Therefore logistic companies set their CSR goals usually among those concerning environmental, health and safety issues and direct them towards the main stakeholders' groups. However all 17 CSR goals may be an inspiration for an innovative programme. Still, the more unique the CSR tools, the bigger the impact on company's competitive advantage (Rok, 2013). Thus educational programmes are tools that usually require an innovative approach and staff involvement rather than big budget. The following examples describe different types of CSR educational programmes launched by logistic companies of various characteristics and size. They bring benefits both to the companies and the participants involved.

International or global logistic operators often present a high level of CSR awareness and launch many initiatives adapted to the specific needs of local communities. In 2016 DB Schenker has developed an educational program on ethics and compliance. "Fair Play" game increases the awareness of employees in relation to compliance with law, fighting corruption, business gift reception,

situations of conflict of interest, asset protection, the rules of dealing with competition. In 2016, the game was played by 97% of DB Schenker employees. Safety and care for the natural resources are addressed in the strategy of DB Cargo Poland. The company organised Security Health-event for customers, employees and civil service, which were accompanied by lectures, training and demonstrations to simulate dangerous event.

Another global logistic operator Kuehne + Nagel launched a security awareness programme for their employees. The goal of "Security good for you, good for families, good for the company" is to increase the awareness of health, safety and environmental protection in the logistic workplace. The company runs conferences and workshops where employees share good practices.

However, smaller logistic operators may also benefit from developing CSR educational programmes. They operate on local basis and it's easier for them to both identify and meet the expectations of their shareholders. In 2012, a middle-sized Polish logistic operator UniLogistics together with the University of Gdańsk launched an educational programme for Transport and Logistics Department students, called The Orange Academy of UniLogistics. The aim of the project was to give the students an opportunity to meet logistic professionals in their workplace surroundings and learn from them. Another goal was to show the students the diversity of activities within logistic processes and help them to choose their future career path that suits their professional preferences. The practical knowledge together with a chance to actively cooperate with logistic partners in various parts of supply chains gave the students a strong advantage in their career-building process on the logistic labour market. During meetings and workshops, the emphasis was placed also on safety and security procedures in logistics. The programme lasts for 6 months and it ends with a ceremony during which the students are awarded with certificates of competence of The Orange Academy of UniLogistics. When the students entered the labour market a year later, most of them were employed by UniLogistics and its partners in the supply chain. The first edition of the programme was honoured by The Responsible Business Forum and was described in the *Responsible Business in Poland Report in 2010*.

Micro companies in logistic sector can also successfully deploy CSR goals through educational programmes. Such companies usually have a much smaller financial budget, but with an innovative approach they can benefit from a CSR campaign even more than the global players. It is often difficult for micro companies to build a trusted brand visible on the market and a CSR educational programme may become also a low cost marketing tool.

A micro company SSiL Research and Consulting is a Polish company working in the field of logistic consulting, safety and security in logistic chains and logistic business development. In 2014, in cooperation with 3 universities, a programme called "Young Experts Group (YEG)" was started. YEG is an international project set up to promote the involvement of students in issues related to transportation, logistics, environmental protection in logistics and marketing. YEG promotes ideas and commitment. The programme allows students to pick logistic issues they consider interesting and important for the future of logistics and natural environment,

consult them with international experts and then publish a paper presenting their findings. The papers were published on SSiL's official website and were open for discussion for both academic and business partners of the programme. The goal was to enhance the involvement and activity of students on a logistic market and to give them a chance to discuss the problems that they found important with international professionals. Another goal was to present students' professional passions and interests on a logistic global market so that to give the cooperating companies a chance to find the best young employees. It has become a unique support with recruitment processes for numerous companies.

Conclusions

Educational programmes in logistic can be designed to support most of the main CSR goals and thus they are suitable for each corporate strategy. They can be planned as a series of events as well as single meeting or workshop. They can be designed to work with any group of stakeholders including children, students, employees, clients or local communities. Educational programmes usually do not require a high budget, it's the staff involvement that it the main factor of success. The basic rule is that educational programmes, as well as other CSR tools, are meant to make a change, popularise knowledge, influence behaviour and therefore should never be designed just for marketing purposes. The main advantages of educational programmes for business are:

- they enhance commitment and integration inside the company team,
- they develop market recognition of the company or brand,
- they create positive image of the company,
- they allow the company to be in touch with their stakeholders,
- they enhance employees' satisfaction as being a part of a friendly and responsible business,
- they allow to establish new levels of communication with business partners and national and local institutions.

There are also numerous advantages for the groups addressed by the programmes and local communities as a whole, such as:

- they offer free, unique education and professional support;
- they allow local communities to better understand how the business works and communicate their expectations regarding issues of a local or even global importance;
- they allow stakeholders to influence company's management goals;
- they allow the participants to integrate around responsible purposes, and achieve environmental or social goals.

In 2016, a complex research according to the consumers' perception of corporate CSR and communication activities was conducted on a representative sample of 1039 Poles aged 18–55 years (Barometr CSR, 2016). The results of the research prove that Polish consumers positively assess observed corporate CSR activities, as shown on Figure 1.

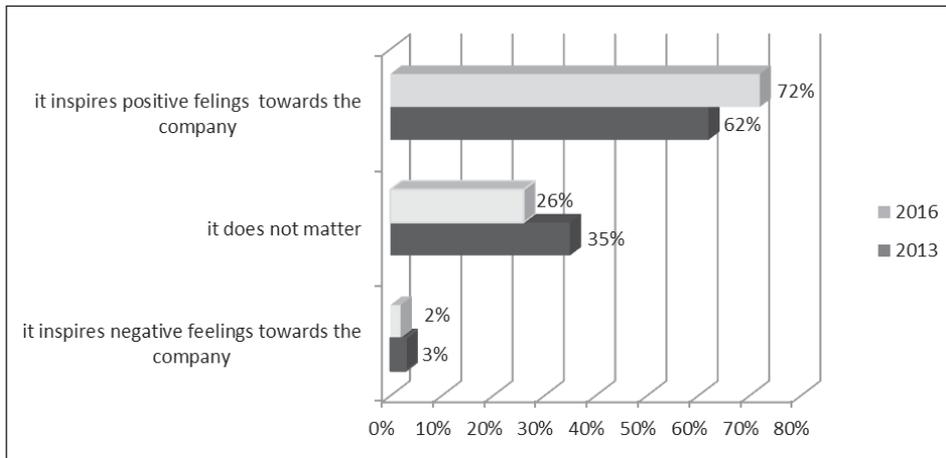


Figure 1. The attitude changes in the Polish consumers' perception of CSR activities in 2016 compared to 2013

Source: (Barometr CSR, 2016)

Up to 72% of respondents declare that such actions raise positive feelings in relation to the company. In 2013 the share of respondents amounted to 62%. In comparison with the previous edition of the survey, the share of consumers who declared that it did not matter to them whether the company engaged in activities for the community or environment protection, decreased by 9%.

34% of customers declare that they understand CSR as an innovative way of business development, which benefits both society and the company itself (Albińska, 2017).

References

- Albińska, E. (2017), Edukacyjna działalność biznesu. Przedmiot obowiązkowy. In: *Raport „Odpowiedzialny biznes w Polsce. Dobre praktyki 2016”*. Available from <http://odpowiedzialny-biznes.pl/wp-content/uploads/2017/03/Raport-Odpowiedzialny-biznes-w-Polsce-2016-Dobre-praktyki.pdf> [Accessed 15 September 2017].
- Barometr CSR (2016), *O trendach wśród polskich konsumentów. Raport of CSR Consulting and MAISON & PARTNERS*. Available from http://www.ptbrio.pl/images/stories/barometrcsr_podsumowanie_wynik%C3%B3w.pdf [Accessed 15 September 2017].
- BSR: The State of Sustainable Business (2016), *Results of the 8th Annual Survey of Sustainable Business Leaders. October 2016*. Available from https://www.bsr.org/reports/BSR_GlobeScan_State_of_Sustainable_Business_Survey_2016.pdf [Accessed 15 September 2017].
- Encyklopedia CSR (2016), *Spoleczna odpowiedzialność biznesu*. Available from http://odpowie-dzialnybiznes.pl/hasla-encyklopedii/spoleczna-odpowiedzialnosc-biznesu-csr/?gclid=EAIaIQobChMIu97Q3Iy1gIVVYmyCh3tRQRqEAAYASAAEgLFp_D_BwE [Accessed 15 September 2017].
- Rok, B. (2013), *Podstawy odpowiedzialności społecznej w zarządzaniu*, Poltex, Warszawa, p. 138.

United Nations (2015), *Transforming Our World: The 2030 Agenda for Sustainable Development. Resolution adopted by the General Assembly on 25 September 2015*. Available from http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E [Accessed 15 September 2017].

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LAST MILE LOGISTICS DELIVERY IN THE FASHION RETAIL SECTOR: THE CASE OF POLAND

Abstract

The paper analyses the delivery options available to Polish customers. It compares two companies: Zalando, a solely online fashion player, and TOP SECRET, an omnichannel retailer which uses both online and traditional stores. For each company, an overview of logistic systems is presented and delivery options as well as product return conditions are analysed. This snapshot of the fashion market confirms that Polish customers have a wide choice of delivery options, from home delivery, through manned collection points (post offices, kiosks and others), to a well-developed city network of automated lockers. In the case of TOP SECRET, in-store collection was also possible. However, delivery times, from up to two days, are not as fast as countries such as the United Kingdom, where next day delivery is offered by local retailers. The development of e-commerce and omnichannel was stimulated by the recent modernisation of the transport and logistics networks in Poland.

Keywords: logistics, delivery, last mile, fashion industry, last mile logistics, Poland, e-commerce, omnichannel, multichannel, retail

Introduction

Fashion retail is one of the most active sectors of both e-commerce and omnichannel. Retailers have been aiming to integrate sales channels, not only run traditional stores but also customer-friendly websites and mobile apps as an integrated system. However, managing inventory across channels, seamless delivery, and unified customer experience at the same time as ensuring the highest possible level of consumer satisfaction is a challenging task. The main competitive factors

of the delivery process: flexibility, price, speed and quality have to be taken into account. The competition among fashion retailers and between sale channels is fierce, therefore last mile logistics delivery is one of the factors influencing the level of customer satisfaction as well as the bottom line.

There is an issue of how to deliver to the customer in the most efficient way. As e-commerce and omnichannel retail are relatively new, fashion retailers test and adapt various models of delivery depending on their business models, strategic positioning and potential to use the existing delivery network. However, in many cases online fashion shops do not fully exploit the potential to add value to customer service by implementing a flexible and efficient last mile logistic delivery model. The purpose of this paper is to answer the following research question: "What are the delivery options for fashion goods in Poland?"

This exploratory paper reviews models in fashion retail, looking at two cases from the Polish market. The paper is structured as follows: at the beginning, e-commerce development in Poland and the European Union (EU) is briefly overviewed, followed by a short methodology section. Two companies, a solely online player and an omnichannel retailer, are then analysed from customer point of view to find out what delivery options are offered. Finally, some conclusions are drawn.

1. E-commerce development in Poland and other European countries

Due to the globalization of trade and wide accessibility of internet technology, e-commerce, both in volume and value, has been increasing significantly. In 2015, in Poland, 33.5% of companies purchased goods through a website, homepage or mobile application and 7.1% sent orders as EDI messages. On the other hand, the percentage of companies receiving orders via the internet webpages was smaller and amounted to 12.4%, which implies the tendency to cross-border shopping. Three-quarters (75.7%) of Polish households use a broadband internet connection.

According to the results of a survey carried out in April 2017 by TNS Poland, up to 42% of Poles purchase goods via the internet at least once a year. Figure 1 presents the percentages of individual customers ordering goods or services over the internet for private use in Poland in years 2012–2016. Within this period the proportion of e-customers rose by 11.6%. In 2016, more than 12 million people in the 16–74 age group (41.9% of the total population of Poland) confirmed having gone internet shopping.

According to the Kantar TNS E-Shopper Barometer report (DPD, 2017), in 2016 the visible trends in European e-commerce are:

- the rapid growth of mobile shopping in countries with lower internet penetration,
- the increasing preference for e-shopping abroad,
- the importance of transparency and flexibility offered in deliveries and returns.

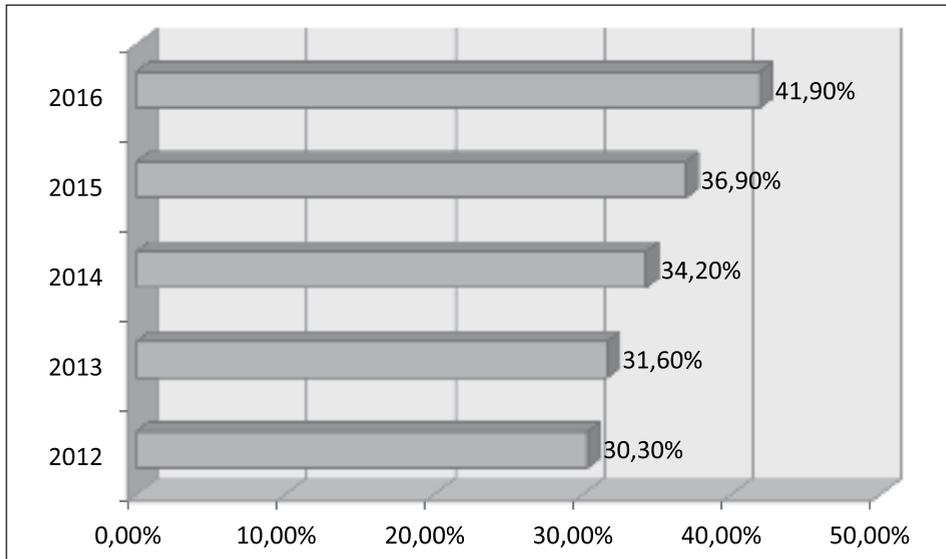


Figure 1. The percentage of individual customers ordering goods or services over the internet for private use in Poland in years 2012–2016

Source: (GUS, 2016)

The main devices used to order online are: laptops (63%), desktops (53%) and smartphones (35%) (DPD, 2017). As the mobile shopping sector is expected to continue to grow, it is important for e-shops to develop mobile-friendly websites with easily accessible basic information and customer services.

According to the Kantar TNS E-shopper Barometer (DPD, 2017), 52% of Europeans have made a purchase online from foreign websites. The most popular websites are those located in Europe (UK, Germany and France), China and the US. A third (31%) of European e-shoppers that never bought online from foreign websites declare that they might do so in the future, of which Poland has the highest growth rate potential of 61%. European e-shoppers generally prefer to choose websites located in neighbouring countries. The drawbacks of foreign e-shopping are a longer delivery time, problematic and lengthy return conditions and the possible difficulty of adjusting to the website language. However, due to globalization processes, customers are becoming aware that cross-border shopping is a way to gain access to better prices and a wider variety of products than what is available locally.

In most categories, European e-commerce is dominated by large companies: e-tailers, whether global or local. The large scale of operation develops the trust of customers. Additionally, the main characteristics of a successful website are safety and comfort of service. Flexible delivery options and transparency of delivery costs are essential for contemporary e-shoppers. Free delivery in many categories is available. E-shoppers expect to be able to choose delivery to a convenient place, whether it is their home, workplace or any other address of their choice. Preferred delivery options vary across different regions. The E-shopper Barometer (DPD, 2017) shows that the most preferable delivery place in Europe is the customer's

home (84% of deliveries). However, in some countries, e-shoppers choose other options more frequently, for example: in Estonia, 81% of deliveries are made to parcel locker stations, in France, 55% to parcel shops, and in the Czech Republic, 25% to retailer stores. Another characteristic of a preferred e-tailer is the convenient return options of purchased goods. When it comes to delivery and return options, the top drivers of e-shopping are (DPD, 2017):

- transparent and complete delivery cost (for 91% of buyers), and
- free delivery, free return and a clear returns policy (for 89% of buyers).

Transport features are essential for making an efficient delivery. E-shoppers indicate their preferred features of delivery, such as:

- next day delivery (86%),
- real time information on delivery processes (84%),
- possibility to reschedule delivery (83%),
- knowing the exact 1-hour window of delivery (77%).

Customers in multi-, cross- and omnichannel retail have options to select between several delivery choices. This includes secured or unsecured home delivery (McKinnon et al., 2003). Secured delivery means items are given to the person identified as the customer, while unattended delivery refers to leaving a parcel in a pre-defined location, without proof of delivery. Unattended delivery is less secure but allows greater flexibility since parcels can be left without customer presence. Instead of the customer's home, items can be delivered to collection points, which can be automated, non-staffed (such as automated lockers) or staffed, such as shops, kiosks and other places with high customer flow (Morganti et al., 2014; Visser et al., 2014). Parcels can be delivered by dedicated couriers, trucking companies or via postal services (Visser et al., 2014).

The features mentioned above indicate that express delivery companies and postal services are most appropriate to offer efficient transport service. Moreover, the categories of goods purchased most frequently by Europeans are those more likely to be packed in small package units that in turn can be easily processed by automatic terminals. The most popular categories of goods in European e-commerce are shown on Figure 2.

European e-shoppers are globally satisfied with their online purchase experience: 96% rate their last experience as 'good' and 74% declare that making their last online purchase was 'easy,' according to the E-shopper Barometer (DPD, 2017). However, online shopping still represents only about one tenth of the overall declared purchase of physical goods in volume. This, together with the anticipated growth of internet accessibility, enables us to predict that European e-commerce is going to experience continuous growth in coming years.

In addition to pure online players there is also an increasing transition of traditional stores to online channels. This includes various models, such as multi-channel, when both online and traditional channels are used but are not interlinked. It also includes cross-channel, where there is some integration between channels, for example, joint marketing, or 'click and collect' (ordering online, collecting in store), and up to full integration between online, traditional store, mobile apps and social media – the omnichannel. In the omnichannel, which is at an emerging stage

internationally, the focus is on customer experience and brands, since customers can move seamlessly between channels (Brynjolfsson et al., 2013; Piotrowicz, Cuthbertson, 2014). The fashion industry is no exception and a variety of technologies are used to support multi- and omnichannel development as well as channel integration (Blázquez, 2014). Those technologies used in fashion retail include RFID, mobile apps, beacons and “magic mirrors” (Bonnetti, Perry, 2017), in addition to links with social media and supply chain management information systems (Piotrowicz, Cuthbertson, 2014).

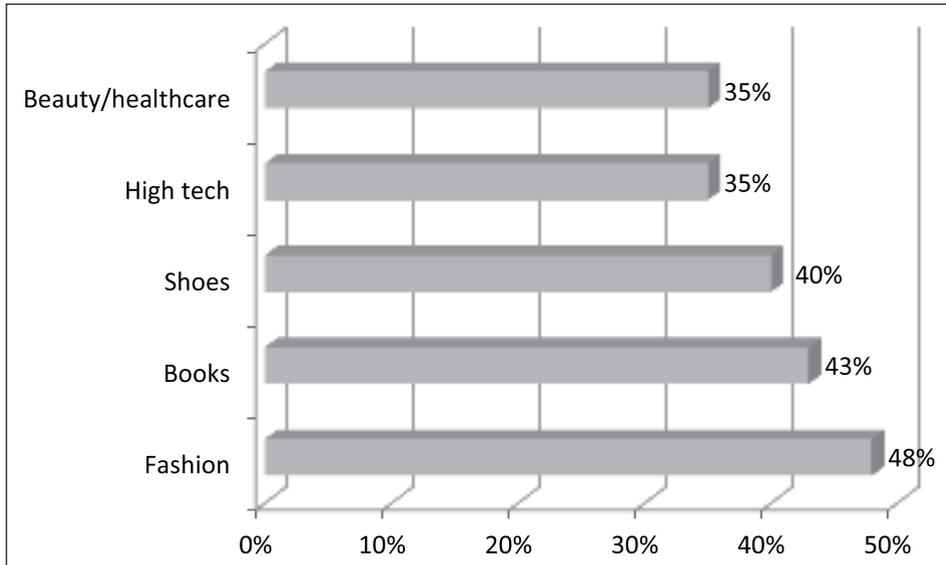


Figure 2. The most popular categories of goods in European e-commerce in 2016
Source: (DPD, 2017)

2. Methodology and case selection

This study is exploratory. The phenomenon of omnichannel retail as well as country studies are not well explored. Poland is still considered as transitional economy which moved from a centrally planned economy to free market. However, in the retail and logistics sectors at least, the transition is already complete. Poland was among the first wave of countries which opened retail to foreign investors and removed trade barriers (Waters, 1999), which resulted in retail modernisation (Dries et al., 2004) and consolidation (Karasiewicz, Nowak, 2010). At the same time, there was growth of local companies, including those from fashion industry which are exploring foreign markets. Despite such changes, there is still a lack of research which explores information systems, information technology and e-commerce developments in Poland and in wider central and eastern Europe (Piotrowicz, 2015; Roztock, Weistroffer, 2015).

This paper aims to close this gap. Qualitative research is based on content analysis. Firstly, the fashion retail market was analysed, then two players with different models, one pure online (Zalando) and one omnichannel (TOP SECRET) were selected for further analysis. Webpages and other sources available in the public domain were analysed. The aim was to look from the customer's point of view to explore delivery options and conditions available. This approach has limitations, since perspectives from the company side were not captured, nor was there any investigation of individual users (customers) or business partners such as logistic companies.

3. Fulfilment models in fashion e-commerce and omnichannel retail

Fashion is the most popular category of goods in online shopping across Europe. In 2016, 48% of surveyed e-shoppers declared they bought at least one product in this category (DPD, 2017). Small online fashion shops often rely on an in-house inventory which allows for a high level of fulfilment quality control but becomes difficult as the scale of operation grows. Global fashion brands tend to use e-commerce as well as retail shops. Using stores for order fulfilment has become a popular method. In this model, offline stores provide physical contact with the products. This solution requires that a wide inventory of products is kept in physical stores while customers order online. Online orders can be placed from within the shop or any other location using internet access at a time freely chosen by the consumer. The customer decides whether to pick up the goods in a physical store of their choice or to have them sent from a distribution centre. In the latter scenario, most retailers offer a wide choice of possible delivery places for a client to choose from based on the analysis of their customer density and local preferences. The possible drop-off points include home or work address (home delivery), parcel shop, parcel locker station, a neighbourhood retail store or post office.

Most fashion brands choose to have final control on the quality, branding, marketing and documentation of the goods before they are sent to the customer. They need to rely on to a number of cooperating partners. However, the final point of dispatch (goods fulfilment centre or own physical retail shop) remains in-house for better control. In addition to pure online players, there are multiple organisations which operate in the retail sector as multi-, cross- and omnichannel retailers. Fashion retailers integrate channels, linking physical and online (Kent et al., 2016). The Polish fashion market has been developing over last several years, moving towards consolidation phase (Regiodata, 2013). While the market leaders are international players (H&M, Zara, etc.), there is also a Polish LPP company which has around a 15% share of the market. The growth in internet shopping (Euromonitor, 2017) among apparel buyers is in part due to the move towards ordering via mobile devices such as tablets and smartphones. This motivates fashion retailers to establish an online presence and build transactional webpages. The case study companies here are no exception and they widely use social media channels such as Facebook, Twitter, Pinterest, Google Plus and Instagram, as well as mobile applications.

4. Fulfilment in pure online fashion retail – Zalando

Zalando's online store, with headquarters in Berlin, is offering customers in fifteen European countries a variety of products from a variety of brand partners. With more than 20 million active customers, Zalando acquired around €3.6 billion in revenue in 2016. Orders are distributed through custom-built logistics centres, the warehouses located in such a way that approximately 85% of active customers live within a nine-hour truck drive. Zalando's customer care unit together with external service providers handle all pre- and post-order inquiries by telephone or email. Zalando uses proprietary technological solutions to run their online store and drive all workflows from purchasing to ordering processes and fulfilment. The software is developed and implemented by an in-house tech team which allows for a high level of customization. To ensure the safety of customer personal data, Zalando works in collaboration with external security experts in order to minimize any risk of a breach of data security.

Logistics is a core competence for Zalando. A European logistics network has been established, consisting of four German sites in Brandenburg, Thuringia, North Rhine Westphalia and Baden-Wuerttemberg as well as smaller sites in northern Italy and close to Paris. In 2017 at least two further international sites in Sweden and Poland will start operations. Zalando's fulfilment centres host about 6500 employees across an area of 460 000 m². Unlike many other e-tailers, Zalando's warehouses are not operated by a third party but by their own qualified staff which ensures a high level of process quality. The fulfilment centres also control the process of returning goods which is crucial for a high quality of service. However, in 2014 Zalando, among other retailers, was accused of mistreating workers employed in their logistic centres (Reuters, 2014).

In order to meet the demand for quick and efficient fulfilment system, Zalando uses an online retail model, with a combination of delivery options to suit consumers' needs on local markets. In this solution, a customer is offered a choice of possible options to place an order, pay and receive the goods at a time and place most suitable for them. Standard delivery is free of charge and takes up to four working days, however the consumer may choose an express delivery option, in which the goods are delivered within two working days. The consumer covers the cost of express delivery, unless it takes more than two days in which case Zalando covers delivery cost. A third-party logistics company operates transport to the customer.

Zalando offers a 100 days period to return unused goods that are not accepted by a customer. The returns procedure is free of charge. This gives the consumers the freedom to try and choose the goods at home and easily return those that do not comply with their needs and preferences. To start a returns procedure, the client completes a return document online, providing the date, time and address at which the package will be picked up by the logistics company. The goods can be sent back in their original packaging. When returned to the fulfilment centre, the goods are scanned and checked. They can then be processed for re-sale or, if the state of the goods is not good enough, sold at a reduced price. The returns procedure should be launched in the same country in which the order was originally placed

because the online shop is segmented in order to operate locally. The quality of the returns process is very important since Zalando has a 50% returns rate across all product categories.

5. Omnichannel retail and delivery – TOP SECRET

TOP SECRET is a Polish retail company offering a variety of fashion products, accessories and shoes. It is a fashion brand, part of the Capital Group Redan and one of the best recognized fashion brands in Poland. The company targets young and active consumers willing to actively create their own personal style whether casual or more formal. The basic retail network consists of retail physical shops and franchised physical shops as well as an online store. The development strategy includes opening new shops in cities with over 15 000 inhabitants. In 2017, the retail shop network includes 29 retail stores and 156 franchised stores (TOP SECRET, 2017a). The network covers Poland, Slovakia and the Czech Republic.

Orders can be placed on the online store by either selecting the goods and completing the order form or by calling the Customer Service Call Centre. The first option is available 24 hours a day, 7 days a week, whereas telephone order is available only within the Customer Service Call Centre's opening hours, which means working days between 8.00 a.m. and 8.00 p.m. Available payment methods include credit/debit card, direct online bank transfer and cash on delivery.

In Poland, the possible delivery options are:

- Polish Post (Poczta Polska S.A.),
- express delivery company,
- In Post parcel locker,
- delivery to the newsagent's point (Paczka w Ruchu),
- goods are picked from a physical retail TOP SECRET store.

In the Czech Republic and Slovakia, delivery is only possible to In Post automated parcel locker stations. Customers decide on certain delivery options while completing an order form. Delivery is free of charge for many options if the total purchase value exceeds 149 PLN. Delivery to the physical shop is free of charge regardless of the purchase value. Delivery fees are also dependent on the delivery time, as shown in Table 1.

Cross-border shopping is available only with online payment, the delivery fee in this case amounts to 45 PLN. If the parcel value exceeds 500 PLN, the delivery is free of charge.

Where the chosen delivery option is express delivery company, the courier arrives at the delivery address. However, where the parcel is not picked up – either because of customer absence or a lack of funds to pay in cash on delivery where this payment method has been chosen – the customer receives an e-mail message with the address of the courier base where the parcel can be collected.

Table 1. Delivery options offered by TOP SECRET retail

	Polish Post	Express delivery company	In Post parcel locker station	Newsagent's point	Physical retail shop
Delivery time, up to	5 working days	2 working days	4 working days	6 working days	5 working days
Cash on delivery	0 PLN >149 PLN parcel value	0 PLN >149 PLN parcel value	-	-	-
	19 PLN <149 PLN parcel value	19 PLN <149 PLN parcel value	-	-	-
Online payment	0 PLN >149 PLN parcel value	0 PLN >149 PLN parcel value	0 PLN >149 PLN parcel value	0 PLN >149 PLN parcel value	0 PLN
	15 PLN <149 PLN parcel value	15 PLN <149 PLN parcel value	10 PLN <149 PLN parcel value	6.50 PLN <149 PLN parcel value	0 PLN

Source: (TOP SECRET, 2017b)

Parcels delivered to the In Post parcel lockers are available for collection for two working days after which they are sent to the Customer Service Point unless the customer completes an online "prolongation" form. When delivery is made to a newsagents collection point, the parcel is available for collection for five working days and, where the collection time is not prolonged, the goods are sent back to the sender. Parcels delivered to the physical retail shop remain available for collection for seven working days. Regardless of the chosen delivery method, customers are informed about the arrival of the parcel via text (SMS) or email.

TOP SECRET online store allows for a 30-day period for claim submission, followed by a 14-day period for return of goods. The goods, including those ordered online, may be returned to a physical TOP SECRET store named on the list available at the company website. The customers bear the cost for the return procedure (packing and sending of goods) unless the goods are brought to the store by the customer.

Conclusions

Regarding delivery choices, Polish customers have a very wide selection. This can be related to three issues: the availability of automated lockers, the dense network of post offices and other collection points, and the development of courier services. In Poland, the network of automated lockers designed by the Polish company, In Post, is well developed, covering the majority of larger cities. This is supplemented by other non-automated, staffed collection points such as newsagents, flower shops and other small service points which operate long working hours. Also, the state-owned Polish Post (Poczta Polska) maintains a wide network

of offices, even in small towns or villages. The rapid development and investment in the transport and logistics infrastructure (motorways, inner-city roads and warehouses) has enabled the growth of courier services, reducing costs of operations and transport times. There was huge improvement in road transportation following investments supported by EU funds transferred to Poland after 2004, which has reduced transport times between key locations within the country, as well as accelerating cross-border trade. However, delivery time is generally longer than, for example, in the United Kingdom. Next day delivery is not promised to customers in Poland.

Findings also indicate the importance of returns management. A high level of returns requires the creation of the return flows, however instead of managing returns which are non-value added activities, focus should be on reducing the percentage of goods returned by customers. This can be achieved by the growth of showrooms so customers can check the physical properties of a product before ordering it online or in-store. However, returns in omnichannel retail, as is the case of TOP SECRET, could be used to attract an online customer to the physical store, allowing goods ordered online to be returned in-store. This might result in increased sales in-store.

This paper is exploratory, the focus is on two fashion retailers only. Thus there are opportunities to extend this research. Some of the options available include detailed case studies, comparison between Polish and international retail chains, as well as the analysis of small boutique shops. Analysis could be conducted from the customer, retailer, or logistic provider point of view. In particular, we recommend that the next step in research the analysis of primary data through interviews with retailers and service providers.

References

- Blázquez, M. (2014), Fashion shopping in multichannel retail: The role of technology in enhancing the customer experience, *International Journal of Electronic Commerce*, 18, pp. 97–116.
- Bonetti, F. and Perry, P. (2017), A Review of Consumer-Facing Digital Technologies Across Different Types of Fashion Store Formats. In: *Advanced Fashion Technology and Operations Management*, IGI Global, pp. 137–163.
- Brynjolfsson, E., Hu, Y.J. and Rahman, M. (2013), Competing in the age of omnichannel retailing, *MIT Sloan Management Review*, 54, pp. 23–29.
- DPD (2017), *Kantar TNS E-shopper barometer*. Available from https://www.dpd.com/home/insights/e_shopper_barometer [Accessed 6 August 2017].
- Dries, L., Reardon, T. and Swinnen, J.F. (2004), The rapid rise of supermarkets in Central and Eastern Europe: Implications for the agrifood sector and rural development, *Development Policy Review*, 22, pp. 525–556.
- Euromonitor (2017), *Apparel and Footwear in Poland*. Available from <http://www.euromonitor.com/apparel-and-footwear-in-poland/report> [Accessed 6 August 2017].
- GUS (2016), *Spoleczeństwo informacyjne w Polsce. Wyniki badań statystycznych z lat 2012–2016*, Warszawa. Available from <http://stat.gov.pl/obszary-tematyczne/nauka-i-technika-spoleczenstwo-informacyjne/spoleczenstwo-informacyjne/spoleczenstwo-informacyjne-w-polsce-wyniki-badan-statystycznych-z-lat-2012-2016,1,10.html> [Accessed 6 August 2017].

- Karasiewicz, G. and Nowak, J. (2010), Looking back at the 20 years of retailing change in Poland, *The International Review of Retail, Distribution and Consumer Research*, 20, pp. 103–117.
- Kent, A., Vianello, M., Cano, M.B. and Helberger, E. (2016), Omnichannel fashion retail and channel integration: The case of department stores. In: *Handbook of Research on Global Fashion Management and Merchandising*, IGI Global, pp. 398–419.
- McKinnon, A.C. and Tallam, D. (2003), Unattended delivery to the home: An assessment of the security implications, *International Journal of Retail and Distribution Management*, 31, pp. 30–41.
- Morganti, E., Laetitia, D. and Fortin, F. (2014), Final deliveries for online shopping: The deployment of pickup point networks in urban and suburban areas, *Research in Transportation Business and Management*, 11, pp. 23–31.
- Piotrowicz, W. (2015), Information technology and systems in the Visegrád group of countries (Czech Republic, Hungary, Poland, and Slovakia): A literature review, *Journal of Global Information Technology Management*, 18, pp. 77–93.
- Piotrowicz, W. and Richard, C. (2014), Introduction to the special issue information technology in retail: Toward omnichannel retailing, *International Journal of Electronic Commerce*, 18, pp. 5–16.
- Regiodata (2013), *Apparel Retail in Poland: Bullish for years now*. Available from <http://www.regiodata.eu/en/981-apparel-retail-in-poland-bullish-for-years-now> [Accessed on 6 August 2017].
- Reuters (2014), *Online retailers in Germany under fire over working conditions*. Available from <http://www.reuters.com/article/us-amazon-germany/online-retailers-in-germany-under-fire-over-working-conditions-idUSBREA3G08S20140417> [Accessed 6 August 2017].
- Roztocki, N. and Weistroffer, H.R. (2015), Information and communication technology in transition economies: an assessment of research trends, *Information Technology for Development*, 21, pp. 330–364.
- TOP SECRET (2017a), *Oferta Sklepu Franczyzowego TOP SECRET*. Available from <http://www.topsecret.pl/pl-PL/franczyza> [Accessed 6 August 2017].
- TOP SECRET (2017b), *Regulamin sklepu internetowego TOP SECRET*. Available from <http://www.topsecret.pl/pl-PL/regulamin> [Accessed 15 September 2017].
- Visser, J., Toshinori, N. and Browne, M. (2014), Home delivery and the impacts on urban freight transport: A review, *Procedia – Social and Behavioral Sciences*, 125, pp. 15–27.
- Waters, C.D.J. (1999), Changing role of the retail sector in Poland during a period of economic transition, *International Journal of Retail and Distribution Management*, 27, pp. 319–327.
- Zalando (2017), *Our responsibility*. Available from <https://corporate.zalando.com/en/our-responsibility-p#fc-433> [Accessed 6 August 2017].

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THE ARGUMENTATION FOR THE IMPLEMENTATION OF URBAN CONSOLIDATION CENTER FOR THE OLD TOWN IN GDAŃSK AS AN INDICATION OF SUSTAINABLE URBAN FREIGHT LOGISTICS

Abstract

Distribution of goods in urban areas is one of the most important factors affecting the operation of the region but the management of these services is often overlooked by transport policy makers in Polish cities. Historical buildings create additional difficulties because they make the infrastructure development impossible. It is estimated that in large European cities approximately 25% of CO₂ emissions, 30% of nitrogen oxides and 50% of particulates from transport are emitted by trucks and vans. The doctoral thesis presents methods used to optimize distribution processes in cities with historic buildings in Europe and around the world. It also presents the results of a research carried out in the Old Town of Gdańsk and proposes a method to optimize distribution processes for the area, which was the main objective of the work. The hypothesis of the trial has been formulated as follows: locating Urban Consolidation Center not far away from the center of the City of Gdańsk would bring tangible benefits for the city and all users of the urban space. The study used a method of analysis and criticism of literature; detailed study of a particular case and the method of observation. According to the design model, the proposed solution will bring tangible benefits to all users of space – residents, businesses and city authorities. The results of tests carried out on account of this thesis were provided to the city authorities.

Keywords: urban consolidation center, city logistics, urban freight, sustainable mobility, smart mobility, city mobility, urban mobility, last mile logistics, old town, Gdańsk, historical city, historical cities, smart freight solutions

Introduction

According to the United Nations, by 2050 the number of people living in cities will have increased from 3.9 billion to 6.3 billion, which will constitute 67% of the world population. Public spaces constitute a special challenge when it comes to freight transport – both in terms of logistics and in terms of influence on the environment (emission of harmful substances, noise, accidents, congestion, area exploitation). Each day in every city we can observe the flow of tangible resources, which constitutes a significant part of city traffic. These transfers are accompanied by logistic activities – loading, unloading, warehousing, packing and that creates demand for additional space. All these factors influence problems connected with transport system in public spaces, such as:

- congestion,
- environment pollution,
- decreased safety,
- energy consumption,
- inefficient infrastructure.

Historical cities seem to be in a more difficult situation. While creating conditions for development, we have to respect the cultural heritage which at the same time creates some spatial limitations. Moreover, transport affects the buildings as it creates ground vibrations. These in turn lead to quicker ground concentration which results in building subsidence, destruction of elevation or even destruction of load-bearing walls. The civilization progress must take the historical landscape into consideration.

City logistics is supposed to be conducive to sustainable development. Assumptions of that type of logistics combine different aims of all the users of public space – city council, residents, tourists and businesses. City logistics is supposed to provide better service and greater safety, with lower costs and smaller impact on the environment. City councils strive to provide greater safety and reduce the pollution, residents and tourists want a safe and friendly life space, the business sphere aims at obtaining profit and retaining good reputation.

1. Making urban freight logistics more sustainable – historical towns of the world examples

Historical towns have different ways of dealing with the organization of distribution processes – Gotheborg and Tel Aviv use solutions called Freight quality partnership. Regular meetings of workgroups made up of representatives of all the public space users allow for all the parties to realize the needs of others, which helps to come up with conciliatory solutions. In Barcelona and New York time access restrictions have been introduced. These measures impose restrictions on the times when freight activity can take place. The intent is to reduce freight traffic during peak hours in historical urban areas.

In London and Bilbao there are parking restrictions. The main types of parking regulation measures are: loading and parking restrictions, vehicle parking reservation systems, timesharing of parking spaces, loading/unloading areas. Another idea is to implement environmental restrictions, like in London, Gotheborg, Oslo, Berlin, Mediolan, Stockholm. These kinds of measures are aimed at preserving the liveability of city centers by trying to reduce the negative externalities produced by freight vehicles, both in terms of emissions and noise. The most popular measures are: emission standard and engine related restrictions, low/zero emission zones. Most historical cities in Europe have implemented size or load access restrictions. There are restrictions that prevent vehicles of a certain weight or size from using a particular area. Interesting examples have been implemented in Madrid where companies that use electric vehicles for deliveries are subsidized, and in Genova where tradeable permits and mobility credits have been implemented (Stefanelli, 2016).

2. The Old Town in Gdańsk – overview of the current situation

The Old Town is the main tourist attraction of Gdańsk so the space has to be functional. This is an area with dozens of eating places and each of these receives deliveries on a daily basis. Increased congestion means limited access for all users and the historical character limits the transport possibilities. Because the city receives economical and image profits due to the attractiveness of the region, it cannot allow itself for decreased functionality of the area. According to a research prepared by Deloitte and Targeo, in 2015 an average inhabitant incurred a cost of 5 hours per month due to congestion, which was 2.223 PLN nominally.

The author of this article conducted two research studies in the Old Town. The first one was under the auspices of the President of Gdańsk and took place at the turn of 2012 and 2013. The research consisted in directly contacting the tenants in Old Town as well as suppliers to that area. After collecting the results, it turned out that in all the examined companies there was an organizational chaos, there was no person responsible for deliveries and the deliveries were cumulated in peak hours. As far as the suppliers were concerned, the Old Town was not their final destination, but only one of the points on their everyday route which resulted in their being usually late and in constant hurry. They would park in random places, also those prohibited ones. Despite all that, nobody was willing to introduce any changes. This can be attributed to a specific kind of mentality and lack of awareness regarding the importance of logistic activities when it comes to functioning, comfort and the income of the examined entities.

In July 2013 during a meeting organized by the President of Gdańsk, with the participation of the representatives of the Road Authorities, Urban and Architecture Department and Municipal Police, the author presented the results of the research studies. 6 months later, in February 2014, the Restricted Access Area was established in the area of Old Town (Figure1).



Figure 1. Restricted Access Area

Source: (Naskręt, 2014)

The regulation read as follows: “In connection with the approved project of traffic organization in the Old Town which introduces traffic ban in places marked with the B-1 sign »no traffic in both directions« and refers to streets between the following streets: Ogarna, Podgarbary, Wełniarska, Teatralna, Latarniana, Szeroka, Old Motława river (excluding Ogarna, Szeroka and Teatralna streets), and also in connection with the fact that the traffic ban does not apply to vehicles with the Old Town Identifier, taxis, public buses, bikes, official police cars, Municipal Police official cars, ambulances, hotel guests (with a printed valid booking), vehicles with the R Identifier, owners of valid Municipal Police subscriptions, Regulations are introduced regarding the issuing and using of Old Town Identifiers which entitle their owners to enter the Restricted Access Area in the Old Town, which constitutes Appendix no 1 of this regulation”. In the aforementioned Appendix we can find information that the Identifier is issued by the Director of the Road Authorities in Gdańsk for a period defined in the identifier. It can be issued for vehicles of: residents, owners of place, tenants, cultural and educational institutions, health services with their seat in the Old Town (official cars only), municipal services, performing municipal services, press, radio and television (official cars only), supply vehicles from 1st May to 30th September from 10 p.m. to 11 a.m., from 1st October to 30th April from 5 p.m. to 11 a.m, courier and post companies, other entities for which access is indispensable and will be substantiated properly. Identifiers for the above mentioned entities are issued for vehicles with permissible gross weight of up to 3.5 tons.

At the turn of 2014 and 2015 the research was repeated and no changes were observed, which means that the President's regulation was completely ignored. Delivery vehicles entered the zone during day and in peak hours at times when the regulation prohibits them to do so. Moreover, the municipal services did not execute the regulation in any way.

3. Optimising the distribution processes in Gdańsk

The tangible shift of delivery hours would allow to avoid increased traffic in peak hours and would facilitate the unloading and loading processes. If the suppliers were forced to obey the law, this would require reorganization of the delivery process. It seems reasonable that while making a regulation the City Council should help the suppliers in solving the problem and adjusting to new solutions, which would be beneficial for all the space users. According to the Author, consolidation of deliveries to the Old Town in a dedicated logistic centre and synchronized management of the deliveries is a tangible solution to implement. The point being to replace a few or a dozen of delivery vehicles going to one recipient (each with freight from a different supplier) with one delivery car. The freight is preped in the logistic centre located in the city, but out of the city centre. Figure 2 presents the scheme of Urban Consolidation Center functioning.

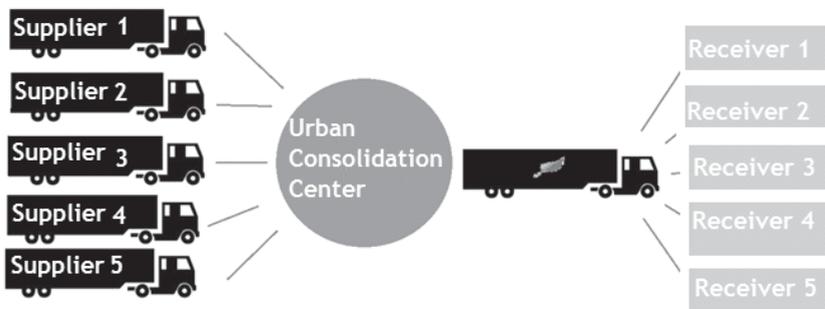


Figure 2. Urban Consolidation Center, UCC
Source: (own illustration)

In a document *Strategy of Transport and Mobility of the Metropolitan Area Gdańsk – Gdynia – Sopot until 2030*, created by the association of the 3 cities' councils, the possibility to create such a center has been taken into consideration. It shows the councils' awareness of state-of-the-art urban logistics solutions, as well as the awareness of the necessity to take such actions. Location of such a center should be characterized by two types of access: external – referring to access for suppliers who most frequently use trucks with high load capacity, and internal – referring to easy reaching the destination from the consolidation center. It has been assumed that the consolidation center should be located approximately within 15 km from the serviced area, with the maximum use of the highest category roads. The strategy

enumerates four possible locations of the Urban Consolidation Center, one of them being Pomeranian Logistic Center (PLC) at the back of the Deepwater Container Terminal in Gdańsk (Figure 3 and 4).

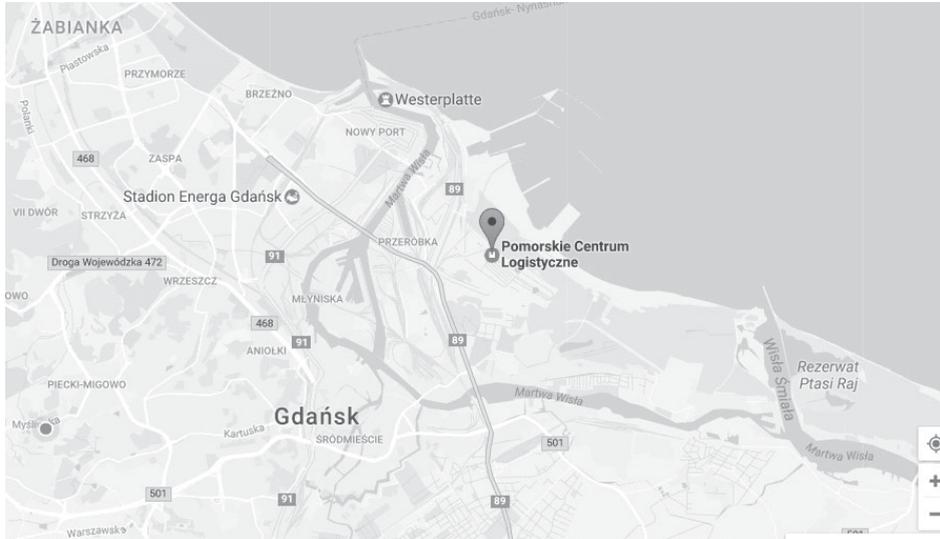


Figure 3. Pomeranian Logistic Center location
Source: (Google Maps)



Figure 4. DCT and Pomeranian Logistic Center – visualisation
Source: (Kosior, 2015)

To picture the profitability of the enterprise, some simplified assumptions have been made. In the Old Town there are around 100 eating places (restaurants, cafes, pubs, confectioneries) and groceries. Each of these points receives deliveries independently, a couple of times each week.

If we assume that restaurant A receives 2 load units 3 times a week, from a warehouse in Pruszcz Gdański located 18 km away and that the transport rate for

1 kilometer is 6.5 PLN, then the weekly cost of deliveries is 351 PLN and the monthly cost is 1404 PLN. If we additionally assume that shop B receives 3 load units 3 times a week from a warehouse in Żukowo, located 22 km away from the Old Town, and the transport rate for 1 kilometer is 6.5 PLN, then the weekly cost of deliveries is 429 PLN and the monthly cost is 1716 PLN.

If the UCC was located in PLC, then the distance from PLC to the Old Town would be 8 km. With an average rate of 6.5 PLN per km, the cost of one transport would be 52 PLN. Assuming that every day in the early hours (before peak hours) and late in the evening (after peak hours) 2 full load trucks would enter the area, the receivers would incur a cost of 208 PLN per day. However, that cost would be divided among all 100 tenants so each of them would pay 2.08 PLN. On a monthly basis that would be 62.4 PLN per tenant. This amount needs to be increased by the cost of maintaining the warehouse in PLC. According to the average for cities, which is 18 PLN/m², that would make 9000 PLN a month, even if the warehouse was 500 m². However, this amount should also be divided among 100 users, so each of them would incur a monthly cost of 90 PLN. If we add the cost of the delivery from UCC to the Old Town to the cost of the warehouse maintenance, we will receive a monthly cost of 152.4 PLN per tenant.

However, it must be taken into consideration that each of the companies would have to make sure that they have a stock of products necessary each week, so a cost of deliveries from warehouses to PLC should be added. In case of company A with warehouse in Pruszcz, 4 deliveries a month with a fully loaded truck would cost 468 PLN, and company B would pay 780 PLN for 4 deliveries a month from Żukowo.

Transports from warehouses of the companies to UCC in PLC: Company A would then incur a total monthly cost of maintaining the warehouse in PLC of 620.4 PLN (468 + 152.4), and company B 932.4 PLN (780 + 152.4). This would give savings of 56% in case of company A (initial 1404 PLN–620.4 PLN) and 45% of savings in case of company B (initial 1716 PLN–932.4 PLN).

Of course the calculation is not perfect, because the vehicles hired for PLC would also have to make their way back. That is why the calculation is based on an inflated spedition rate of 6.5 PLN per 1 km. Whereas in case of dedicated transport the real amount of petrol used would be taken into account. It is also a simplification to assume a certain and fixed number of deliveries from the warehouses of particular companies to PLC, however there is no denying the fact that in each case using the UCC would be profitable. European experience shows that the savings range from 30% to 80%.

In case of undertaking the enterprise, load capacity of the delivery vehicles should be taken into consideration. These granted access to the Restricted Access Area (3.5 t) have an approximate load capacity of 1.3 tons. One of the most popular delivery vans – Peugeot Boxer L3H2, has a 3.7 m length, 1.93 m height and 1.82 m width of freight space (1.42 m between wheels housing). Such a vehicle has a capacity from 7.5 to 14 m³. Let us assume an average of 10 m³. The average storage standard for a warehouse is 360 kg/m², although in case of the data provided by the PLC administrator it is 5 t/m². In case of 500 m² it would be 2500 tons. Height of the warehouse is 10 m, so the capacity of the warehouse is 5000 m³.

If once a week each of the 100 tenants delivered a fully loaded vehicle of 10 m³ capacity, on a monthly basis that would amount to 4000 m³ (400 × 10 m³). Thus, excluding rotation, the freight from all the entities would get into the warehouse. If we calculate the weight, 400 × 1.3 tons will amount to 600 tons. Thus, excluding daily rotation, the warehouse in PLC would allow for such a weight.

These economical advantages are indispensable to convince the entrepreneurs to change their concept of distribution. However, for the city council and the society, the environmental and social advantages are of greatest importance. Due to lack of unified emission calculator, many transport and logistics companies establish their own emission calculators based on the transport network and take into consideration CO₂ emission per package, both during transport and loading. However, what is also important is the decrease of external costs, not only the emission of harmful substances, but also decrease in the number of accidents, increased safety and decreased noise. In European countries in which urban consolidation centres are common, they are usually serviced by electric cars. In Poland however, due to the fact that we mainly obtain energy from carbon, this idea has no justification.

Conclusions

To sum up, Poland is one of the few countries in Europe, in which the issue of rational and optimal freight distribution is underappreciated. Deliveries in Gdańsk are not managed effectively and the regulations aiming at their organization are not obeyed. Locating a universal consolidation and distribution center in the close vicinity of Old Town which would be based on the assumption of “cooperation on the road, competition on the shelf”, would bring tangible economic profits to the entrepreneurs, as well as social and environmental benefits to the city and all the space users. Creating the urban consolidation center is a way to optimize the distribution processes.

Deliveries will take place in particular hours, so the freight is going to be delivered on time. The city will get rid of a significant number of vehicles, especially the delivery ones – heavier, emitting harmful substances to the atmosphere, which have a detrimental effect on the historical buildings. It will also contribute to a higher comfort of living of the residents who will move around in safer space and breathe fresher air. This will also encourage a large number of tourists to visit Gdańsk. Entrepreneurs will be able to manage their businesses more effectively thanks to timely deliveries, they will improve stock planning which in turn will allow for savings. Getting extra time also translates into tangible profits. All that will bring advantages to the city council which will manage a revitalised city, at the same time a city that is safer and less congested with cars. The air in Gdańsk is going to be fresher and the receipts to the city budget are going to be higher.

References

- Kosior, W. (2015), *Pomorskie Centrum Logistyczne*. Available from <http://pl.goodman.com/nieruchomosci/dostepne-nieruchomosci-w-polsce/pomeranian-logistics-centre> [Accessed 10 May 2017].
- Naskręt, M. (2014), *Trudniejszy wjazd do centrum Gdańska*. Available from <http://www.trojmiasto.pl/wiadomosci/Trudniejszy-wjazd-do-centrum-Gdanska-n76115.html> [Accessed 10 May 2017].
- Stefanelli, T. et al. (2016), *Making urban freight logistics more sustainable*, CIVITAS Policy Note.

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DEVELOPMENT DIRECTIONS OF ALTERNATIVE FUELS INFRASTRUCTURE

Abstract

An increase of the energetic efficiency of the economy is one of the priority goals of EU policy. In all the sectors of the EU-28 countries this goal has been achieved. However, in the transport sector, which is especially dependent on the supplies of crude oil, the energy consumption continues to increase. This is why, a wider use of alternative fuels is one of the ways of increasing the transport energy efficiency and decrease the dependency on crude oil. In transportation, there is a chance to increase the use of electricity and natural gas. However, the use of these energy sources in transport depends on the development of appropriate infrastructure. The requirements regarding the technical specification of the alternative fuel infrastructure and the time horizon for the construction of these facilities have been described in the European Parliament and Council Directive of 22.10.2014 on the development of alternative fuels infrastructure. In Poland, the development directions regarding the use of alternative fuels in transport and the goals of the transport infrastructure development have been set out in the year 2016 in the national framework for the policy of alternative fuels infrastructure development.

Keywords: transport, alternative fuels, infrastructure

Introduction

Among various economic resources, the energy has a strategic significance for the socio-economic growth. The provision of adequate energy resources is profoundly important for the economies of EU countries, which are highly dependent on the supplies of crude oil. This dependency is especially strong in transportation.

This is why, activities towards a wider use of alternative fuels are very important in this sector. The goal of the article is to present:

- reasons and possibilities of the use of alternative fuels in transport,
- European guidelines for the construction of appropriate alternative fuels infrastructure,
- growth directions of the alternative fuels infrastructure in Poland.

The research has been conducted on the base of literature and EU documents related to the development of alternative fuels infrastructure.

1. Reasons and possibilities of the use of alternative fuels in transport

An increase of the energetic safety is one of the leading priorities of the “Europe 2020” strategy. In the strategy a necessity to increase the efficiency of the energy use by 20% and the share of renewable energy shares in their final use to 20% have been pointed out (European Commission, 2010). Therefore, it has been assumed that by the year 2020, the use of energy should be 20% lower than its hypothetical use according to the hitherto model of production and consumption. Based on the assumption, according to the prognosis from 2007, the hypothetical use of primary energy in 2020 would have been 1842 mtoe (million tons in the crude oil equivalent) and the final energy use would have been 1347.5 mtoe. The decrease of this level by 20% means that in the year 2020:

- the use of primary energy cannot be higher than 1473.6 mtoe,
- the use of final energy cannot be higher than 1078 mtoe (Directive of 25.10.2012).

In all the sectors of the EU-28 countries this goal has almost been achieved. The use of final energy on the EU-28 counties in the year 2015 was 1082.2 mtoe (Eurostat, 2016). However, the use of final energy still increases in the transport sector. As one can observe on Figure 1, the use was equal to 358.6 mtoe in the year 2015 and was 26,2% higher than in the year 1990. In the EU-28 countries the transport sector amounts to over 33% of the final energy use (European Commission, 2016). At the same time, the transport sector is heavily dependent on the crude oil supplies. In 2014, the share of crude oil and its products in the total energy consumption in transport exceeded 95% (Figure 2).

Therefore, it is necessary for the transport system development to be targeted at the technical innovations, which are supposed to increase the energy efficiency of the vehicles in all the transport modes, e.g. by a wider use of more ecological fuels and drive systems (European Commission, 2011).

The innovations based on a wider use of alternative fuels have a particular significance in the process of the increase of energy efficiency and supply safety in the EU. The alternative fuels are “fuels and energy sources, which at least partially substitute the energy sources based on crude oil and have a potential to decarbonize transport and help to achieve the ecological transport goals” (European Parliament, 2014). The main fuels alternative to the crude oil are: electricity, hydrogen, biofuels, synthetic and paraffin fuels, natural gas, including biomethane (in the form

of compressed natural gas – CNG, liquefied natural gas – LNG or gas to liquid – GTL) and also liquefied petroleum gas (LPG). According to Table 1, the possibilities for the use of this type of fuel in transport are significant.

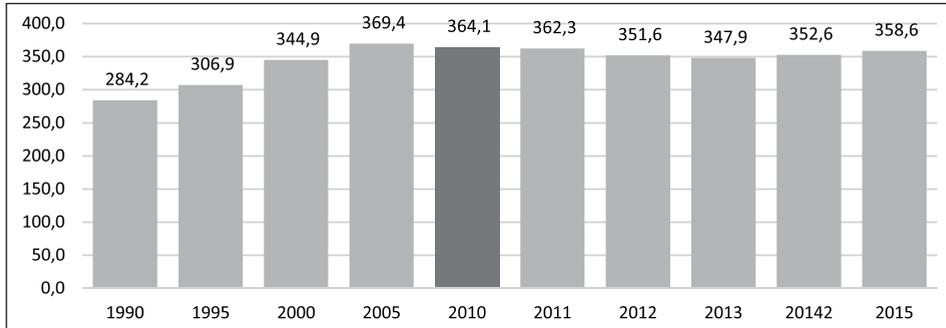


Figure 1. The use of final energy in transport in the EU-28 countries (years 1990–2015, mtoe)
Source: (own elaboration based on data available at: Eurostat, 2016)

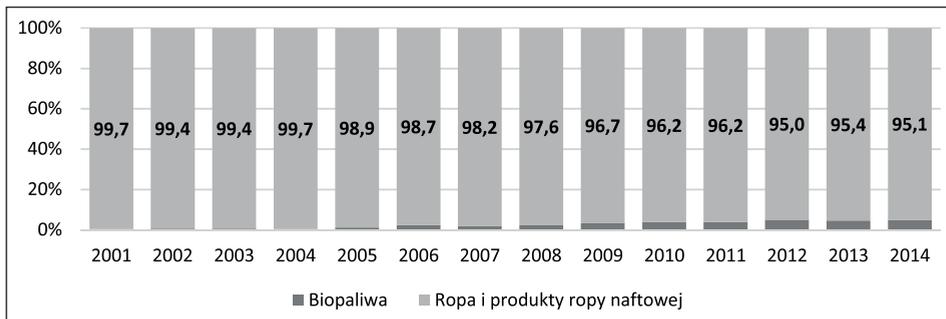


Figure 2. The share of crude oil and crude oil products in the total energy consumption in transport of the EU-28 countries [%]

Source: (own elaboration based on data available at: European Commission, 2013)

Table 1. The possibilities for the use of alternative fuels in modes of transport

Specification	Road passenger transport			Road cargo transport			Air transport	Rail transport	Inland waterways transport	Sea transport	
	Near	Mid	Far	Near	Mid	Far				Near	Far
LPG											
Natural gas	LNG										
	CNG										
Electricity											
Biofuels											
Hydrogen											

Source: (European Commission, 2013)

2. European guidelines for the construction of appropriate alternative fuels infrastructure

A wider of fuels such as electricity, natural gas (LNG, CNG) and hydrogen in transport requires an appropriate infrastructure, which allows to supply the means of transport with alternative fuels. The development process of this infrastructure must comply with the technical specifications of the EU, the safety specifications regarding the safety of LNG and CNG refueling points and the safety specifications regarding the introduction of biomethane into the natural gas network.

Within their national policy, the Member States have to provide an appropriate distribution of public charging points by the end of 2020 (Table 2) so as to enable the use of electric vehicles at least in the urban and suburban areas as well as other densely populated areas. The approximated number of electric vehicles should be the basis for the distribution of these points. Generally, it is assumed that there should be at least one charging point for every 10 vehicles. An appropriate number of public charging points should be installed, in particular, next to public transport points such as: port passenger terminals, airports and railway stations. It is also vital to provide proper access to charging points in parking lots, next to blocks of flats, office buildings and industrial plants.

Table 2. Time horizon for the development of alternative fuel infrastructure

Type of alternative fuel infrastructure	Time horizon for the construction of infrastructure objects
Charging points for electric cars	31.12.2020
Facilities for charging ship with electricity	31.12.2025
CNG Refuelling points – TEN-T basic road network	31.12.2025
CNG Refuelling stations – agglomerations	31.12.2020
LNG Refuelling points – TEN-T basic road network	31.12.2025
LNG Refuelling points – TEN-T basic marine ports	31.12.2025
LNG Refuelling points – TEN-T basic inland waterway transport ports	31.12.2030
Hydrogen Refuelling points (depending on country's interest)	31.12.2025

Source: (Directive of 22.10.2014)

Electricity can also be used auxiliary to power marine or inland ships during their stay in ports. Particular Member States should consider the possibility to power the ships from land, within the national policy. In economically justifiable cases, the facilities used to power the ships with electricity should be installed in the ports of TEN-T core network and other ports before the 31st of December 2025 as a matter of priority.

Significant energetic and ecological benefits can be achieved in the passenger and cargo car transport as a result of using CNG alternative fuel. So as to enable the flow of vehicles driven by CNG across the EU, the Member States should construct an adequate number of publically accessible CNG refueling points by the end of year 2025, at least within the current TEN-T core network. As a priority,

the CNG stations should be constructed in the urban and suburban areas as well as other densely populated areas, by the end of year 2020. Similarly, the Member States, should create an adequate amount of LNG refueling points, at least within the current TEN-T core network.

There are large possibilities of using LNG in marine and inland transport. It is assumed that an appropriate number of LNG refueling points will be created in the European marine ports by 31st December 2025 so as to allow the movement of marine and inland ships. An appropriate number of LNG refueling points will be created in the European inland ports by 31st December 2030.

These provisions apply mostly to the locations of bunkering points within the TEN-T core network (Directive, 22.10.2014). Due to the fact that large inland vessels are more predestined to use the LNG engines, it is expected that inland routes with high technical parameters will be equipped with the refueling stations. This mostly applies to routes of Rhein, Danube and Elbe. The growth of bunkering stations onto other waterways will be dependent on the further development of the network of inland waterways and also the economic possibility to use the LNG engines in smaller vessels (Wurster et al., 2014).

The hydrogen is an important alternative to the fossil fuels. Across the world, the hydrogen fuel cells are used in personal cars, buses and light commercial vehicles. There is also a possibility to use the hydrogen drive in trains instead of the Diesel engines, small ships and in big ships as an auxiliary energy source whilst anchoring. The hydrogen technology is currently the alternative fuel which is the least developed in the transport sector. On estimate, there are only 82 hydrogen refueling stations (The Ministry of Energy, 2016) and only a few of the Member States plan to expand their network of hydrogen refueling. This is why, the countries which assume the development of the hydrogen drive as part of their strategies should grant access to an adequate number of hydrogen refueling points by the end of year 2025 as part of their national strategies.

3. Growth directions of the alternative fuels infrastructure in Poland

Taking into considerations the experience of the use of alternative fuels in Poland so far, a special attention should be paid to the development of infrastructure regarding:

- electricity charging points and stations,
- LNG and CNG refueling points and stations

so as to support the dependence of transport on the conventional fossil fuels.

Currently in Poland, both the electric cars market and network of charging points and stations is barely developed. In 2014, only 1.29% of newly registered personal cars were electric cars. On estimate, there are 305 public charging points in Poland (the number of private points is unknown). They are mostly located in Warsaw, Kraków, Poznań and Gdańsk (The Ministry of Energy, 2016).

An observable growth in this matter is determined by a proper development of the vehicle charging infrastructure. Given the current stage of technological progress, it is assumed that the technology will be mostly used in urban transport. In 2020, on estimate there will be 54 thousand electric vehicles in the 32 agglomerations in Poland (not counting the buses), whereas there will be 6859 charging points: 1367 in Warsaw, 523 in Kraków, 431 in Łódź and 320 in Gdańsk.

As mentioned above, the electricity may also be used to power ships. Based on analysis, there is not enough demand to justify equipping all the sea ports within the TEN-T network with charging points (stations). In Poland, the appropriate installations might be constructed in Szczecin and Świnoujście ports.

The use liquefied natural gas and compressed natural gas is an attractive possibility of the alternative fuel use in transport. In Poland, there is a relatively small number of natural gas vehicles and refueling points (stations). In 2011 there were 32 such stations and the number has consistently decreased. On estimate, currently there are 26 such stations and 3600 vehicles powered by natural gas are used.

The use of CNG, mostly due to the range of up to 300 km is especially popular in urban buses, commercial vehicles and taxis. In Polish agglomerations 72 refueling points are supposed to be created by 2020, including 6 in the Warsaw agglomeration, 3 in the Cracow and Wrocław agglomerations and 2 each in the remaining agglomerations. What is more, by the end of 2025, across the core corridors within the core network 32 CNG refueling points and 14 LNG refueling points are supposed to be created.

As mentioned before, hydrogen is an important alternative to the conventional fossil fuels. However, the introduction of hydrogen energy is connected with significant difficulties, in particular creating:

- a quick and cheap method of hydrogen production (current technologies are based on thermo-chemical processes, which are based on limited non-renewable fuels);
- methods for safe and cheap transport and storage of hydrogen;
- engine, cell or battery with the highest possible energy efficiency.

Currently in Poland there are no infrastructure objects for hydrogen refueling, moreover there are reasons to develop them (The Ministry of Energy, 2016).

Conclusions

The transport sector is particularly dependent on the supplies of crude oil. This is why the use of alternative fuels has a high significance in the process of decreasing this dependency. This, however, depends on the progress of infrastructure development. Without such enterprises all the other activity towards the use of alternative fuels will remain futile. Also, it is important for the process of development of alternative fuel infrastructure to be carried out according to identical technical specifications. The use of universal solutions is the basic condition for the development of alternative fuel markets and the increase of significance of these fuels in the European transport market. The national objectives of the policy for

the growth of alternative fuel infrastructure mean that the support of the use of alternative fuels in the urban car transport plays a key role in the process of decreasing the dependency on the traditional fossil fuels.

References

- Directive of 22.10.2012 of European Parliament and Council 2012/27/UE r. on energy efficiency, Dz. U. Unii Europejskiej L 315/1 z dnia 14.11.2012. Available from <http://eur-lex.europa.eu/legal-content/PL/TXT/PDF/?uri=CELEX:32012L0027&from=PL> [Accessed 6 February 2017].
- Directive of 22.10.2014 of European Parliament and Council 2014/94/UE regarding the growth of infrastructure for alternative fuels, Dz.U.U.E.L.2014.307.1. Available from <http://www.lex.pl/serial-akt/-/akt/dz-u-ue-l-2014-307-1> [Accessed 20 February 2017].
- European Commission (2010), *Europe 2020: A strategy for smart, sustainable and inclusive growth*, COM(2010), Brussels. Available from http://ec.europa.eu/eu2020/pdf/1_PL_ACT_part1_v1.pdf [Accessed 26 January 2017].
- European Commission (2011), *The White Paper: The Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*, COM(2011) 144, Brussels. Available from <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0144:FIN:pl:PDF> [Accessed 14 January 2017].
- European Commission (2013a), *Clean energy for transport: European strategy for alternative fuels*, Communication from the Commission to the European Parliament and the Council, COM(2013) 17 final, Brussels. Available from <http://ec.europa.eu/transparency/regdoc/rep/1/2013/PL/1-2013-17-PL-F1-1.Pdf> [Accessed 13 January 2017].
- European Commission (2013b), *Energy, transport and environment indicators*, Luxembourg.
- European Commission (2016), *EU transport in figures*, Luxembourg.
- Eurostat (2016), *Final energy consumption by sector*. Available from <http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tsdpc320&language=en> [Accessed 14 January 2017].
- Ministerstwo Energii (2016), *Krajowe ramy polityki rozwoju infrastruktury paliw alternatywnych*, Warszawa. Available from https://www.senat.gov.pl/gfx/senat/userfiles/_public/k9/komisje/2016/kgni/materialy/048/me_krajowe_ramy_projekt.pdf [Accessed 13 March 2017].
- Parlament Europejski (2014), *Position of the European Parliament adopted at first reading on 15 April 2014 so as to accept the Directive of European Parliament and Council 2014/UE on locations for alternative fuel infrastructure*, pp. 40, 48–49. Available from <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P7-TA-2014-0352+0+DOC+XML+V0//PL> [Accessed 6 February 2017].
- Wurster, R. et al. (2014), *LNG als Alternativkraftstoff für den Antrieb von Schiffen und schweren Nutzfahrzeugen*, Deutsches Zentrum für Luft- und Raumfahrt e.V., Institut für Verkehrsforschung München/Ottobrunn, Heidelberg, Berlin. Available from http://www.bmvi.de/SharedDocs/DE/Anlage/MKS/mks-kurzstudie-lng.pdf?__blob=publicationFile [Accessed 12 January 2017].

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THE USE OF EU FUNDS FOR TRANSPORT INFRASTRUCTURE DEVELOPMENT IN POLAND

Abstract

Significant backlog of transport infrastructure development in Poland is to a great extent a consequence of small capital spending on transport development. Since Poland entered the EU, European funds are an important source of support to infrastructure investments in transport sector. Financial support from the European Regional Development Fund and the Cohesion Fund obtained by Poland in years 2004–2006 and 2007–2013, allowed for a substantial increase in investment expenditure on transport infrastructure and as a result, allowed for accelerating infrastructure modernization. Also in the current budgetary perspective of 2014–2020 there are no delays in the use of the structural funds and the Cohesion Fund. The processes of signing funding agreements and the submission of applications for refund are smoothly covered.

Keywords: transport infrastructure, European Regional Development Fund, Cohesion Fund

Introduction

Insufficient level of investment on transport infrastructure results in the infrastructure in Poland not complying with European standards and still seen as one of the major barriers to socio-economic development of the country. Significant opportunities to break that barrier have emerged at the time of Polish accession to the European Union. Between 2004–2006 Poland acquired 12.5 billion EUR of European funds, and between 2007–2013 the amount reached 67.3 billion EUR, including about 25.1 billion for infrastructure investments in the transport sector. Even greater measures are available for Poland to be used in current budgetary

perspective of 2014–2020. For the implementation of cohesion policy in this period Poland has received 82.5 billion euro, which is 15.2 billion euros more than in the previous fiscal term of 2007–2013.

The resulting level of funding by the EU does not mean, however, that these measures are effectively managed. The utilization of the granted amount is associated with the fulfillment of a number of terms and conditions, which often means breaking a number of barriers, resulting for example from the difficulty of securing adequate level of domestic contributions, lack of experience or knowledge in the field of preservation of necessary procedures. Therefore, the aim of the article is to identify the effectiveness of the management of EU funds, with particular emphasis on the use of EU aid programmes to support the development of transport infrastructure.

1. Budgetary perspective of 2004–2006

The deployment of structural funds and the Cohesion Fund assigned in the period of 2004–2006 was completed in 2012. The total of formally correct proposals for funding by the end of 2012 was over 76.4 billion PLN, which amounted to 234% of funds provided for allocation for the entire programming period 2004–2006 (The Council of Ministers, 2013).

During this period the transport infrastructure investments have been implemented in the framework of:

- Sectoral Operational Programme TRANSPORT (SPOT);
- Integrated Regional Development Operational Programme (ZPORR);
- The strategy of use of the Cohesion Fund (Wojewódzka, Rolbiecki, 2008).

EU funds assigned for the financing of the tasks included in the SPOT had been managed effectively. As shown on Figure 1, since the beginning of implementation of the programme till the end of December 2012, the value of agreements for funding by the EU in relation to the contribution (commitments) of the EU amounted to 128%. Within this programme 146 projects had been implemented, and the total amount of payments received from the EC was 1 163 million euro.

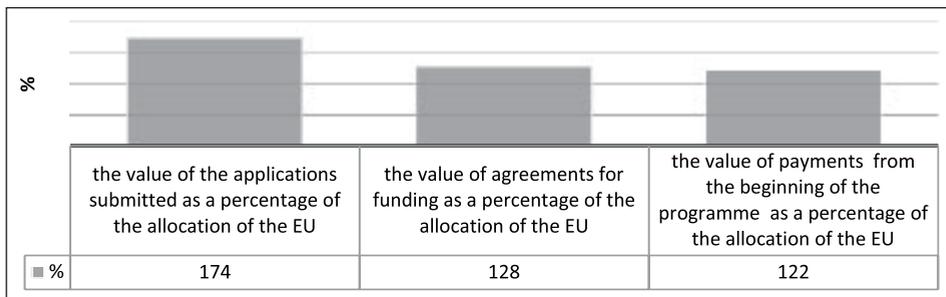


Figure 1. The deployment of EU funds within the SPOT programme during the budgetary perspective of 2004–2006 (as of the end of December, 2012)

Source: (own elaboration based on data available at: The Ministry of Regional Development, 2013)

In the analyzed period, the process of absorption of EU funds for investment task included in the Integrated Regional Development Operational Programme was significantly effective. Within this programme, from 1 January 2014 to the end of December 2012, 13 655 projects were completed, the total value of the grant from the EU amounted to 12.2 billion PLN, and payments made from Community funds matched 111% of funds allocation assigned under this programme for the entire programming period (Ministry of Regional Development, 2013).

EU funds in the budgetary perspective of 2004–2006 for the implementation of the Strategy of using the Cohesion Fund have been used less effectively. It can be seen from Figure 2, that the value of contracts signed under this programme by the end of December 2012 amounted to 9.5 billion euro, and the share of funds related to transport amounted to 4.3 billion euro. On the other hand, as can be seen from Figure 3, the total amount of funds received by beneficiaries from the European Commission by the end of 2012, equaled 4.9 billion euros, which is 89.0% in relation to the level of funding from the Cohesion Fund.

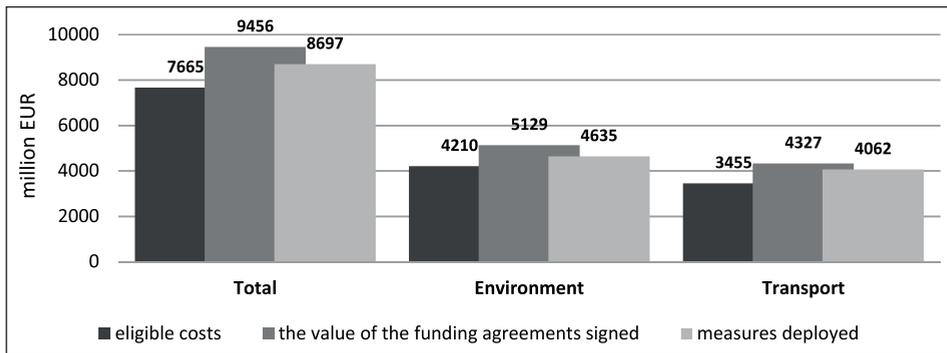


Figure 2. Contracted and disbursed funds under the Strategy of using the Cohesion Fund in budgetary perspective of 2004–2006 in EUR million (as of the end of December, 2012)
 Source: (own elaboration based on data available at: The Ministry of Regional Development, 2013)

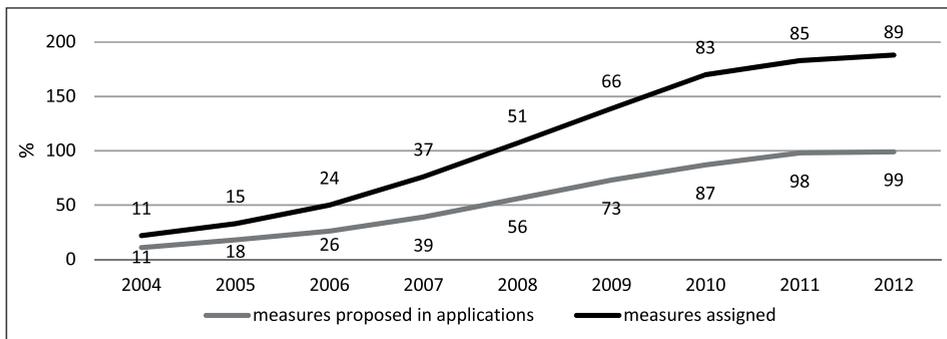


Figure 3. Payments from the European Commission in relation to the financing of the Cohesion Fund during the budgetary period of 2004–2006 (as of the end of December, 2012)
 Source: (own elaboration based on data available at: The Ministry of Regional Development, 2013)

In the transport sector, the Cohesion Fund had been used mainly for investments focusing on modernization, reconstruction and expansion of the trans-European transport network TEN-T. From the resources of this Fund, the following infrastructure was built or modernized:

- almost 789 km of road network;
- 506 bridge objects (including bridges, overpasses, crosswalks, flyovers);
- about 721 km of railway lines;
- 469 bridges, viaducts, culverts and underpasses, overpasses for animals (Council of Ministers, 2013).

2. Budgetary perspective of 2007–2013

The process of deployment of European funds during the budgetary period of 2007–2013 has been finished. The deployment level analysis of Community funds related to transport part of Operational Programme Infrastructure and Environment, shows that at the end of 2016, the value of the grant agreements signed reached 105.1% of available funds. The payments made to beneficiaries in relation to the commitments of the EU accounted for 103.7% in 2016 (Table 1).

Table 1. The deployment of EU funds for infrastructure investments in the period of 2007–2013 in the framework of Infrastructure and Environment Programme and The Development of Polish Eastern Regions in %.

Specification	2009	2010	2011	2012	2013	2014	2015	2016
The Operational Programme Infrastructure and Environment – investments in transport sector								
the level of contracted EU funds (or that of the grant agreement from the EU) in relation to the Community contribution	12.5	43.6	72.9	85.8	96.5	101.9	103.6	105.1
payments from the European Commission to beneficiaries in relation to the Community contribution	4.3	10.4	29.5	53.3	62.0	78.4	93.4	103.7
Operational Programme Development of Polish Eastern Regions – in the section on priority axis transport infrastructure								
the level of contracted EU funds (that of signed EU grant agreements) in relation to the Community contribution	8.0	45.0	50.0	97.0	99.0	99.0	102.0	104.0
– payments from the European Commission to beneficiaries in relation to the Community contribution	1.0	14.0	34.0	47.0	69.0	91.0	100.0	102.0

Source: (own elaboration based on data available at: The Ministry of Development, 2017a, 2017b)

With financial support of the Operational Programme ‘Infrastructure and Environment’ of 2007–2013, 455 km of motorways and 680 km of expressways have been built, 162 km of roads has been adapted to the carrying capacity of 115 kN/axle,

8 airports in the TEN-T network have been modernized (The Ministry of Development, 2017a).

Progress has been observed also in the cultivation process of EU funds (signing contracts) assigned to the implementation of the infrastructure investment and recovery of payments from the European Commission within the framework of the Operational Programme Development of Polish Eastern Regions (Table 1). With regard to transport infrastructure projects by the end of 2016 the value of the contracts signed amounted to 104.0% compared to the level of funding from the EU funds. However, the value of the payments from the European Commission at the end of 2016 represented a 102.0% of the value of EU commitments. The measures allowed for the construction or modernization of 353 km of national and provincial roads and the construction of 23 ring roads more than 110 km long (The Ministry of Development, 2017b).

Significant progress in the implementation of projects, including infrastructure projects, is observed also in case of regional operational programmes (ROP). The value of all implemented projects together with those still in progress amounted to 110.6 billion PLN at the end of December 2015, of which 71.7 billion PLN came from EU funds. As shown on Figure 4, the contracting level of EU funds at the end of December 2015, measured for all 16 RPO amounted to 99.6%, and the total expenditure incurred by the beneficiaries as declared in the applications for refund in part on EU commitments reached almost 67.6 billion PLN (94.0% of allocation). As a result, EU funds for years 2007-2013 EU have been almost entirely assigned and are current activities are related to the management of possible savings and the financial closure of the period.

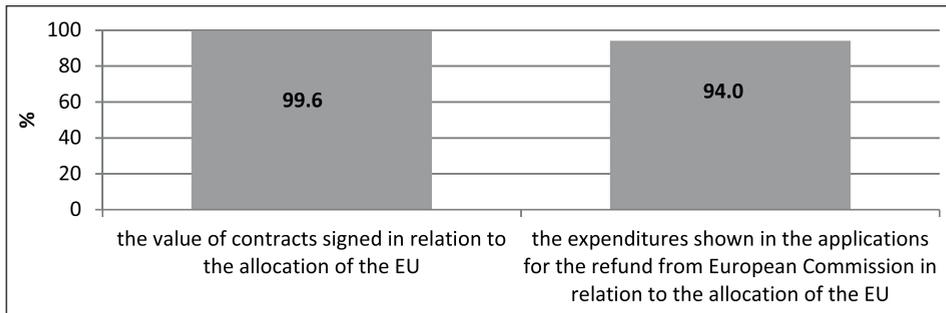


Figure 4. The deployment of EU funds in the framework of the regional operational programmes in the programming period of 2007–2013 (at the end of December 2015)

Source: (own elaboration based on data available at: The Ministry of Development, 2016b)

As a result of infrastructure investments under regional programmes of 2007–2013, 867 km of roads have been built, more than 8.9 thousand km of roads have been modernized and 982 km of railway lines has been built or modernized. In addition, these measures have allowed to build or mark 1.8 thousand. km bike roads (The Ministry of Development, 2016b).

3. Budgetary perspective of 2014–2020

Since 2014 the next stage of the cohesion policy has been implemented in Poland. 9.3 billion EUR from the The European Regional Development Fund and the 14.5 billion EUR from The Cohesion Fund (a total of 23.9 billion EUR) has been assigned for promotion of sustainable transport and the development of transport infrastructure. These measures are about 30% share of the allocation provided for the implementation of cohesion policy in the programming period 2014–2020.

As in the previous period, in the budgetary perspective of 2014–2020 transport infrastructure investments are included in the Infrastructure and Environment Programme (18.5 billion EUR), The Operational Programme Eastern Poland (0.8 billion EUR) and 16 regional programmes (4.5 billion EUR) (The Ministry of Development, 2016c).

Despite some delays in the deployment of EU funds at the beginning of the programming period, from 2016 there has been a clear advancement in signing contracts with funding from the EU funds and in submitting applications. As shown in Table 2, till November 30, 2016 the value of the agreements signed with the beneficiaries for the implementation of the tasks solely assigned to priority “development of the TEN-T road network and multimodal transport” within The Operational Programme Infrastructure and Environment was amounted to around 12.7 billion PLN, and the value of the applications for refund from the European Commission amounted to 5.7 billion PLN.

Table 2. Applications for funding, signed agreements on the EU funding and expenditures in the applications for the refund from the European Commission in the framework of The Infrastructure and the Environment Programme in years 2014–2020 (as of November 30, 2016) in million PLN

Priorities	Applications for EU funding	Agreements on the EU funding	Applications for the refund from the European Commission
Reduction of emissivity of the economy	1628.8	129.0	5.2
Environment protection	6423.6	2901.0	12.4
The development of TEN-T road network and multimodal transport	12 890.9	12 665.1	5727.1
Road infrastructure in the cities	3015.7	2505.4	1154.5
The development of railway transport	645.4	5547.2	496.1
The development of low-emission public transport in cities	2065.2	1826.3	0.0
Security of energy supply	1538.1	559.4	0.0
Cultural heritage	694.7	244.6	0.4
The infrastructure of healthcare	253.1	89.5	0.0
Technical support	206.7	195.5	3.3
The Operational Programme Infrastructure and environment (total)	34 862.4	26 663.0	7399.1

Source: (own elaboration based on data available at: The Ministry of Development, 2016a)

Currently, EU funds on infrastructure investments within the Programme Eastern Poland have been deployed only to a small extent. As shown in Table 3, till the end of November 2016 only measures in part referred to as “modern transport infrastructure” have been used. The value of signed contracts for financing of this type of projects amounted to approximately 1.2 billion PLN, and expenditures shown in the applications for reimbursement amounted to 18.2 million PLN.

Table 3. Applications for funding, signed agreements on the EU funding and expenditures in the applications for the refund from the European Commission in the framework of The Programme Eastern Poland in years 2014–2020 (as of November 30, 2016) in million PLN

Priorities	Applications for funding	Agreements on the EU funding	Expenditures in the applications for the refund from the European Commission
Entrepreneurial Eastern Poland	935.3	147.5	1.6
Modern transport infrastructure	1334.1	1183.9	18.2
Interregional railway infrastructure	0.0	0.0	0.0
Technical support	12.4	8.8	4.2
Operational Programme Eastern Poland (total)	2281.8	1340.2	24.0

Source: (own elaboration based on: The Ministry of Development, 2016a)

Regional operational programmes, for which 31 billion EUR is assigned in the financial perspective of 2014–2020, are carried out a little more slowly than national programmes. It is estimated that by the end of November 2016, under these programs, around 14% of EU funds was contracted (Kwieciński, 2016). The leaders in terms of value of the contracts signed are voivodeships of Silesia, Wielkopolska and Pomerania. In turn, in terms of expenditure indicated in the applications for reimbursement the highest effectiveness of the deployment of EU funds was observed in the region of Łódź, Opole and Pomerania (The Ministry of Development, 2016a). It is expected that a significant acceleration of the implementation of operational programmes in the current programming period will occur when local governments start to implement the investments in the field of transport infrastructure.

Conclusions

The deployment analysis of measures available within structural funds and the Cohesion Fund, shows that there are no delays in the implementation of the programmes both national and regional. The processes of contract signing and applications submission goes smoothly in case of infrastructural investments, even though the procedures are often complex and time-consuming.

Out of EU countries, Poland uses financial assistance for the implementation of cohesion policy to the greatest extent. Concerns that these measures would not be properly managed has not been confirmed. In terms of the effectiveness of deployment of EU funds, Poland is currently in first place among the other EU countries. It is estimated that since the beginning of the membership in the EU the total transfers from the EU budget to Poland amounted to 130 billion PLN, whereas Polish contribution to the EU budget amounted to 42.4 billion PLN (Kwieciński, 2016).

Funds from the European Regional Development Fund and the Cohesion Fund, obtained by Poland since 2004 have allowed, in effect, to an increase in investment expenditure on transport infrastructure in Poland. While in the years 1997–1999 the level of investment in transport infrastructure amounted from 0.3% to 0.4% of GDP, in 2014 it rose to the level of 0.7% of GDP (OECD, 2017). The result is a clear acceleration of the process of development and modernization of transport infrastructure in Poland, which in turn allows for the successive reduction of the gap in the quality level of transport infrastructure between Poland and well developed EU countries.

References

- Kwieciński, J. (2016), Polska najszybciej dzieli dofinansowanie z UE, *Puls Biznesu*, 235, Appendix, pp. II–III.
- Ministerstwo Rozwoju Regionalnego (2013), *Sprawozdanie końcowe z realizacji Narodowego Planu Rozwoju na lata 2004–2006*, Warszawa. Available from https://www.mr.gov.pl/media/4527/Sprawozdanie_koncowe_z_realizacji_NPR_2004_2006_071013.pdf [Accessed 30 November 2016].
- Ministerstwo Rozwoju (2016a), *Stan wdrażania Funduszy Europejskich w Polsce w latach 2014–2020: Nabory – Wnioski o dofinansowanie – Umowy – Wnioski o płatność*. Available from <http://www.funduszeuropejskie.gov.pl/strony/o-funduszach/raporty/raporty-sprawozdania/stan-wdrazania-funduszy-europejskich-w-polsce-w-latach-2014-2020-nabory-wniosk-i-o-dofinansowanie-umowy-wnioski-o-platnosc/> [Accessed 5 December 2016].
- Ministerstwo Rozwoju (2016b), *Stan wdrażania Programów Regionalnych 2007–2013 – 31 grudnia 2015 r.* Available from http://www.funduszeuropejskie.2007-2013.gov.pl/RPO/Aktualnosc/Strony/RPO_stan_wdrazania_2015_12_31.aspx [Accessed 10 December 2016].
- Ministerstwo Rozwoju (2016c), *Sprawozdanie z postępów realizacji w 2014 i 2015 r. Umowy Partnerstwa 2014–2020*. Available from https://www.mr.gov.pl/media/27846/Sprawozdanie_z_realizacji_Umowy_Partnerstwa_w_2014_i_2015_roku.pdf [Accessed 19 December 2016].
- Ministerstwo Rozwoju (2017a), *Sprawozdanie końcowe z realizacji Programu Operacyjnego Infrastruktura i Środowisko 2007–2014*. Available from http://www.pois.2007-2013.gov.pl/AnalizyRaportyPodsumowania/Strony/Stan_realizacji_POiS.aspx [Accessed 20 May 2017].
- Ministerstwo Rozwoju (2017b), *Sprawozdanie końcowe z realizacji Programu Operacyjnego Rozwój Polski Wschodniej*. Available from <http://www.polskawschodnia.2007-2013.gov.pl/AnalizyRaportyPodsumowania/Strony/default.aspx#strona=1&zakladka=2> [Accessed 20 May 2017].
- OECD (2017), *Transport infrastructure investment and maintenance spending*. Available from <http://stats.oecd.org/> [Accessed 30 November 2016].
- Rada Ministrów (2013), *Uchwała w sprawie przyjęcia sprawozdania końcowego z realizacji Narodowego Planu Rozwoju 2004–2006, 158/2013*. Available from <http://orka.sejm.gov>.

pl/Druki7ka.nsf/0/78755355C7E7FAA1C1257C050045D691/\$File/1826.pdf [Accessed 30 November 2016].

Wojewódzka-Król, K. and Rolbiecki, R. (2008), *Infrastruktura transportu*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk, pp. 314–317.

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TRENDS IN THE DEVELOPMENT OF INFORMATION SYSTEMS FOR TRANSPORT MANAGEMENT

Abstract

Transport management is one of the key element of successful and efficient organization of logistic processes within companies (Rydzkowski, Wojewódzka-Król, 2010). The primary purpose of this article is to present results of authors' study on the existing and modern concepts, tools and techniques of transport management. The analysis is based on research priorities specified by the European Logistics Technology Platform ALICE and relating to the Physical Internet and the Internet of Things concepts. Survey, desk research and real case study results were used in the paper. Finally, assumptions of modern IT tool for transport management were presented in the last chapter.

Keywords: transport management, TMS, track&trace, CRM, European Logistics Technology Platform ALICE

Introduction

The primary purpose of this article is to analyse the existing and modern concepts and techniques of transport management. The analysis is based on research priorities specified by the European Logistics Technology Platform ALICE and relating to the Physical Internet and the Internet of Things concepts.

Those research priorities according to ALICE (Alliance, 2016) are to improve the key element, allowing efficient and effective organisation of the logistic process, i.e. real-time access to reliable information on the current status of a loading unit (Zijm, Klumpp, 2016). At present, there are solutions using GPS (location) and GPRS (data transmission) to monitor transport means and occasionally loading units (mostly intermodal loading units) (Fang, 2012). However, those solutions

have a substantial disadvantage – they are very expensive if used on a global scale. Maintenance costs of the existing solutions allows them to be used by medium and large local companies, within one country only or, optionally, the European Union. As a result, a company using and providing logistics services are not able to utilize the available logistics resources to a maximum extent. Furthermore, according to Systems Theory, enterprises operate in a specific environment, using its resources and influencing it as well. Therefore, when companies do not operate efficiently or their processes are irrational, it all affects the environment where the companies function. Repercussions of this phenomenon include intensified road traffic, higher emissions of harmful substances or noise.

It is the lack of fast and safe real-time access to structured information and low utilization of solutions allowing communication between a forwarder, subcontractors, customers, and physical resources that is the main barrier in company development. It stems from the fact that both the applicant and their partners (customers and subcontractors) operate in scattered systems. The effect is that the same data must be entered manually in several or even a dozen or so systems. Additionally, the logistics resource and staff management itself is ineffective, as the applicant is using three non-integrated IT systems.

The staff of transport and logistic companies are forced to use traditional e-mail and phone communication with customers, marine container terminals, agents, railroad carriers, road carriers, and administration representatives. This leads to reducing efficiency, effectiveness, and safety of services rendered to customers. Profitability of services offered by transport and logistic companies is also reduced, which results in lower competitiveness in international markets.

Therefore, this article aims to determine the major barriers for companies in organising transport and identification of their needs in terms of utilising modern technologies for transport and forwarding management. This rationalisation is to reduce transport costs and the use of intermodal transport is one of the fundamental methods in specific boundary conditions. Additionally, those works allow supporting the implementation of the European transport policy.

The analysis of national and international literature on modern transport management IT systems

Analysing national and international literature, we can distinguish four groups of IT systems that support the operations of TSL companies:

- CRM (Customer Relationship Management),
- TMS (Transport Management System),
- financial and accounting systems,
- Track&Trace systems.

Below there are brief descriptions of each group. Note that CRM, financial and accounting systems are used in various industries and are intended for supporting trade. Therefore, further in the article you shall find a detailed analysis of systems designed for supporting transport management, i.e. Track&Trace and TMS.

CRM System – it is a computer system supporting trade processes (acquisition, support) between a company and its customers (Khodakarami, Yolande, 2014). CRM systems support the following departments:

- sales (sales reps),
- operation (forwarders),
- customer service,
- management.

A CRM system should facilitate all the communication steps between a customer and a company – from recognising their needs and identification, through making a transaction, to after-sales services.

Financial and accounting system – it is a computer programme supporting the operations of financial and accounting as well as economic departments of TSL companies. A financial and accounting systems must allow a company to follow the Accounting Act of 29 September 1994 (Journal of Laws 121.591). Those systems allow the user to account for transport/forwarding services rendered.

Transport Management System (TMS) – it is ERP (Enterprise Resource Planning) software dedicated for the logistics and transport industry. TMS allows carriers to process electronic data regarding customer orders and is responsible for effective work organisation and planning (Martin, 2016).

TMS is a primary system of a transport company. It features accepting orders, specifying revenues and costs of a transport service, and preparation of transport documents. Other features of TMS include (Cheng-Chieh et al., 2016): monitoring transport-related events; planning of services, repairs, and overhauls; preparation of analyses and reports; invoicing and payment management through integration with other forwarding or accounting systems; creating requests for payment and enforcement documents; planning working hours of drivers and processing of data from tachographs; leave management; business travel settlement; sending orders directly to drivers; creating order pricelists and reducing their processing time (Martijn, 2016). TMS also ensures continuous contact with customers and increases the service quality. Table 1 compares chosen TMS systems and their primary features.

The features shown in Table 1 were selected based on an analysis of existing TMS systems. The analysis of features also included the fundamental postulates of the Physical Internet concept, i.e. fully electronic communication between all the members of a supply chain (including drivers and means of transport) (Ballot et al., 2014).

The results in Table 1 indicate that the most complex TMS systems are Transwide, Roadnet, and JD Edwards. Those systems are also one of the most frequently chosen systems for transport management by medium and large companies. Their disadvantage is a high cost of implementation and monthly charges. Note also that none of the systems offered all the selected features and modules.

Table 1. Analysis of chosen TMS systems

No.	Features/modules	Supplier										
		Transwide	Mercury Gate TMS	BTC TMS	Carrier TMS	Freight-Pal	Freightware TMS	Helios	GSA	JD Edwards Enterprise One	Roadnet Transportation Suite	iCargo
1.	Recording of orders	1	1	1	1	1	1	1	1	1	1	1
2.	Generating offers for customers	1	0	0	0	1	1	1	0	1	1	0
3.	Managing pricelists of service providers	1	0	1	0	1	1	1	0	1	1	0
4.	Road transport support	1	1	1	1	1	1	1	1	1	1	1
5.	Railway transport support	1	0	0	0	0	0	0	0	1	1	0
6.	Air transport support	1	0	0	0	0	0	0	0	1	1	0
7.	Marine transport support	1	0	0	0	0	0	0	0	1	1	0
8.	Intermodal transport support	0	0	0	0	0	0	0	0	0	0	0
9.	Route planning	1	0	1	0	0	0	1	1	1	1	0
10.	Generating packing lists	1	1	1	0	0	1	1	0	1	1	1
11.	Generating transport documents	1	1	1	1	0	1	1	0	1	1	1
12.	Access to the Track&Trace module based on the GPS system	0	0	0	0	0	0	0	0	0	1	1
13.	Mobile application for drivers	0	0	0	0	0	0	0	0	0	0	0
14.	System of electronic notifications/notices	1	0	1	0	0	0	0	0	0	1	1
15.	Digital map	0	0	0	0	0	0	0	0	0	1	1
16.	Managing layers on the map	0	0	0	0	0	0	0	0	0	1	1
17.	Report creator	1	1	1	1	1	1	1	0	0	1	1
18.	Sales invoices generator	1	1	1	0	0	1	1	1	1	0	1
19.	Revenues and costs control	1	1	1	0	0	1	1	1	1	0	1
20.	Purchase settlements	1	1	1	0	0	1	1	1	1	0	1
21.	Auto Invoicing	1	1	1	0	0	1	1	1	1	0	0
22.	Complain management	1	0	1	0	0	0	0	0	1	1	0
23.	Transport resources management	1	1	1	1	0	1	1	1	1	1	1
24.	Transport unit management	1	1	1	1	0	1	1	1	1	1	1
25.	Customer management	1	1	1	1	1	1	1	1	1	1	1
26.	Service provider management	1	1	1	1	1	1	1	1	1	1	1
27.	Management of roles and permission in the system	1	1	1	1	1	1	1	1	1	1	0
28.	Cloud access	1	1	1	1	1	1	1	1	0	1	1
Total features/functions		23	15	19	10	9	17	18	13	20	22	17
% share in the total number		82%	54%	68%	36%	32%	61%	64%	46%	71%	79%	61%

Source: (own elaboration)

Later, the article identifies the most and less frequent features and modules that occur in TMS systems. The results of the analysis are presented in Table 2.

Table 2. The analysis of the most popular features incorporated in the analysed TMS system

Features/modules	Number of analysed systems	Number of systems with a given feature [%]
Recording of orders	11	100
Road transport support	11	100
Customer management	11	100
Service provider management	11	100
Transport resource management	11	91
Transport unit management	11	91
Management of roles and permissions in the system	11	91
Cloud access	11	91
Generating transport documents	11	82
Report creators	11	82
Generating packing lists	11	73
Sales invoice generator	11	73
Revenues and costs control	11	73
Purchase settlements	11	73
Managing pricelists of service providers	11	64
Auto invoicing	11	64
Generating offers for customers	11	55
Route planning	11	55
System of electronic notifications/notices	11	36
Complaint management	11	36
Railway transport support	11	27
Air transport support	11	27
Marine transport support	11	27
Access to the Track&Trace module based on the GPS system	11	18
Digital map	11	18
Managing layers on the map	11	18
Intermodal transport support	11	0
Mobile application for	11	0

Source: (own elaboration)

Based on the results shown in Table 2 we can see that most of the modern TMS systems are available in the cloud and support the basic operations of transport companies. However, much information is still acquired manually. Modules allowing automation of the transport monitoring process and the electronic communication with a driver still happens rarely in that type of solutions.

Another group of analysed systems are Track&Trace solutions. Track&Trace System – a solution composed of an IT system and GPS devices allowing real-time monitoring of the location of a transport resource and its map visualisation (Sharma

et al., 2015). Track&Trace systems use GPS (Global Positioning System) and GPRS (General Packet Radio Service) that allow monitoring of transport means and loading units (mostly containers). In order to the real-time monitoring of transport resources to be possible, they must be equipped with monitoring devices. Such a device is made up of three basic elements:

- GPS module – allowing location of a monitored means of transport;
- GSM module with a SIM card from a mobile operator – allowing sending through GPRS channel information containing the current position of a monitored means of transport to a server;
- battery – responsible for the functioning of a device for monitoring a railway rolling stock.

The GPS module allows using the system of the GPS satellite navigation system. GPS is one of the systems of satellite navigation created by the United States Department of Defense covering the entire globe. The system is composed of three segments (Szymczak, 2001):

- Space Segment – 31 satellites flying in medium Earth orbit;
- Control Segment – monitor and control stations on the ground;
- User Segment – receiver equipment, i.e. monitored devices, e.g. mounted on a railroad car.

The system is responsible for supplying the user with information regarding their position. The information is supplied in the text form and contains data on the current longitude and latitude coordinates. Those data are subsequently transferred to the user server using GPRS and a SIM card, where they are displayed on a map. The system's working principle is illustrated in Figure 1.

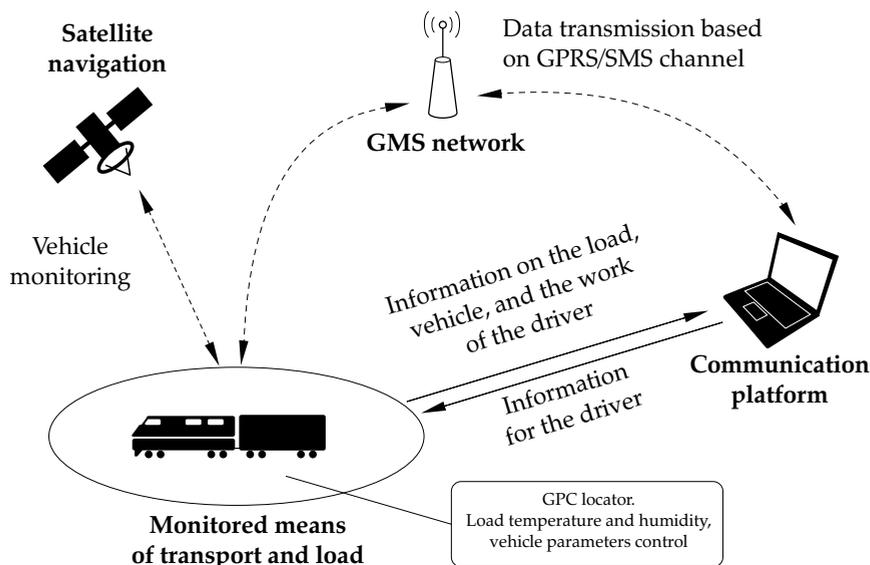


Figure 1. Track&Trace systems working principle

Source: (own elaboration based on: NovaTMS.com)

Nowadays, there are several solutions allowing real-time monitoring of means of transport. Selected products offered all over the world have been selected for analysis. Table 3 lists chosen products offered on individual continents.

Table 3. The analysis of chosen solutions allowing real-time management of transport

Product name and website	Major features
AFRICA	
Trackntrace http://www.trackntrace.co.ke/index.php	<ul style="list-style-type: none"> - Information of fuel consumption, theft prevention - Detailed location on an on-line map - GPRS data transmission
PearTrack Systems Ltd http://www.peartrack.com/	<ul style="list-style-type: none"> - Sharing location without the need to charge the devices for up to 10 years - Temperature monitoring and open door reporting - Unauthorised vehicle movement alarms - GPRS data transmission
NORTH AMERICA	
Track Your Truck http://www.trackyourtruck.com/	<ul style="list-style-type: none"> - Specifying location on a map and route history - Mobile access from a phone - Creating reports on vehicle activity - GPRS data transmission
FreightWatch International http://www.freightsecurity.net/	<ul style="list-style-type: none"> - Access to location via Google Maps - Mobile access from a phone - Device battery life – 1 year - Alarm and notification module - GPRS data transmission
Wireless Matrix http://www.wirelessmatrix.org/	<ul style="list-style-type: none"> - Access to location via Google Maps - Unauthorised vehicle movement alarms - Device battery life – up to 7 year - GPRS data transmission
Safety Track of Michigan http://www.safetytrackofmichigan.com/	<ul style="list-style-type: none"> - Access to location via Google Maps - Device battery life – up to 5 year - Information on changed location every 15 minutes - GPRS data transmission
AUSTRALIA	
Navmann Wireless www.navmanwireless.co.nz	<ul style="list-style-type: none"> - Access to location via Google Maps - Device battery life – up to 7 year - Easy installation of equipment (magnet) - Archiving load movement history - GPRS data transmission
EUROPE	
Visirun http://www.visirun.pl/index.php/pl/	<ul style="list-style-type: none"> - Location on a map in real time - Reporting - Mobile access from a phone - GPRS data transmission
Finder http://www.finder.pl/	<ul style="list-style-type: none"> - Access to location via Google Maps - Reporting - Mobile access from a phone - GPRS data transmission
Satis http://satisgps.com/pl/	<ul style="list-style-type: none"> - Location on a map in real time - Reports and analyses - GPRS data transmission

Product name and website	Major features
Tronik http://tronik.pl/	<ul style="list-style-type: none"> – Location on a map in real time – GPRS data transmission
Data System Group http://www.datasystem.pl/	<ul style="list-style-type: none"> – Location on a map in real time – Mobile access from a phone – GPRS data transmission. Lump-sum payment for data roaming within the European Union
Frotcom International http://www.frotcom.com	<ul style="list-style-type: none"> – Location on a map in real time – Detailed information on the route of means of transport – Alarms feature – GPRS data transmission
Tracks360 Ltd – Wireless Asset Tracking Specialists http://www.tracks360.com/	<ul style="list-style-type: none"> – Location on a map in real time – Choice of batteries with different life – GPRS data transmission

Source: (own elaboration)

Summarizing the analysis of chosen products in Table 3, we can distinguish the following major features of the current solutions (Boswarthick et al., 2012):

- access via a web browser and visualisation of the current location of a monitored means of transport on a map,
- location of a means of transport using a mobile device with a built-in GPS and GPRS modules and battery,
- access to a reporting module.

The primary disadvantage of all the analysed solutions is that they only use the GPRS channel in their products to send information on the current location of a means of transport (Aslekar et al., 2016). What is more, none of the analysed suppliers offer their service globally, which is caused by enormous roaming costs. If a particular customer wants to use the monitoring service abroad, it is necessary to specify the exact countries. Based on that, a monthly subscription for the monitoring service of a particular means of transport is estimated.

The use of the GPRS module for data transmission and resulting high roaming charges is a considerable barrier for the global use of the existing products.

The operation costs of the existing solutions allow them to be used by medium and large local companies, within one country only. As a result, a company using and providing logistics services are not able to utilize the available logistics resources to a maximum extent (Chopra, 2004).

2. The qualitative and quantitative analysis of the effects of implementing selected transport management IT systems

In order to prepare the analysis, a set of indicators was developed to allow qualitative and quantitative assessment of the effects of implementing modern transport management systems (TMS) (Hentschel et al., 2015).

Table 4. Indicators for assessment of TMS systems in companies

No.	Indicator
1.	Number of orders recorded electronically during one day
2.	Number of orders planned during one day
3.	Number of electronic transport documents generated during one day
4.	Number of electronic invoices generated during one day
5.	Number of electronic offers generated during one day
6.	Time needed to check the availability of a means of transport
7.	Time needed to check the current location of a means of transport
8.	Time needed to check the anticipated time of arrival of a means of transport to a destination
9.	Time needed to generate a forwarding/transport order
10.	Time needed to generate a waybill
11.	Time needed to generate a sales invoices for a customer
12.	Time needed to settle costs with a service provider (carrier)

Source: (own elaboration)

A comparison of time needed to acquire information on the current location of a vehicle and the status of an order in a forwarder before and after the implementation of a modern transport management system (TMS) with a Track&Trace module is presented on Figure 2. The studies were conducted in Speedbergx in the town of Tomaszów Mazowiecki.

Figure 2 presents the time needed to acquire the information without the support of a modern IT system. Figure 3, on the other hand, illustrates how the process works with a real-time transport management system implemented.

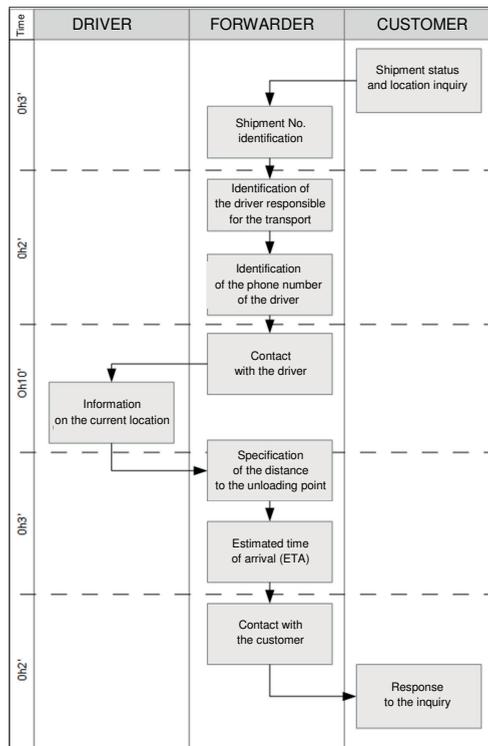


Figure 2. Manual process of acquiring information on the status of an order
 Source: (own elaboration)

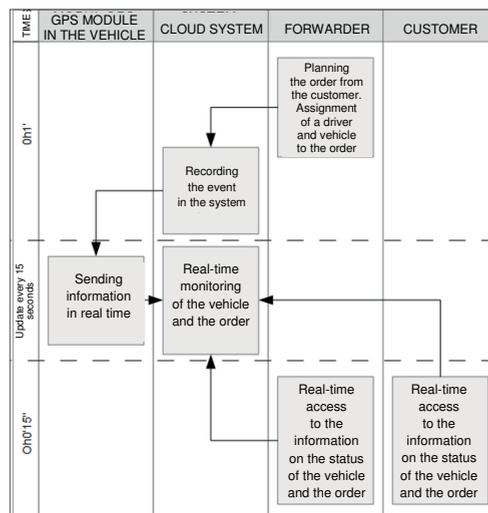


Figure 3. Automated process of acquiring information on the status of an order
 Source: (own elaboration)

The study results presented in Figures 2 and 3 clearly indicate that applying modern IT solutions considerably improves the processes and reduces the time needed to finish the components of a process. With regard to the process of acquiring information on the current location of a vehicle and the status of an order, the time is reduced from 15 minutes to less than 2 minutes. It is an enormous productivity boost in a company.

Title of the second (or next) chapter Surveys conducted among companies on the subject of the transport management needs

First of all, the survey template was developed that was subsequently used to conduct the survey among chosen companies.

The following companies were surveyed: Uni Logistic Sp. z o.o., Speedbergx Sp. z o.o., Neonet Sp. z o.o., Pepsico Sp. z o.o., DPD Sp. z o.o., Solid Logistics Sp. z o.o., Uniq Logisitcs Sp. z o.o., Animex S.A., Agri Plus Sp. z o.o., Carlsberg S.A.

Table 5. Survey template used during the survey conducted among enterprises

Company name	
Respondent's position in the company	
Industry	
Company size	<ul style="list-style-type: none"> a) Micro (less than 10 employees, annual net turnover no more than EUR 2 m) b) Small (less than 50 employees, annual net turnover no more than EUR 10 m) c) Medium (less than 250 employees, annual net turnover no more than EUR 50 m) d) Large (more than 250 employees, annual net turnover more than EUR 50 m)
Scope of Operations	<ul style="list-style-type: none"> a) Poland b) European Union c) World d) Other.....
Does the company use a TMS system?	
Does the company use a Track&Trace system with a GPS module?	
Does the company use a CRM module?	
Does the company use a dedicated invoicing software?	
Does the company use mobile applications for communication with drivers?	
What are the major barriers limiting the company development in terms of transport organisation and logistics?	

Source: (own elaboration)

Based on the survey, a list of barriers limiting the company development in terms of transport and logistics was developed. The major problem in organising transport processes indicated by the companies participated in the survey is the lack of fast and safe real-time access to structured information and low utilization of solutions allowing communication between a forwarder, subcontracts, customers, and physical resources. It stems from the fact that both service providers and customers operate in scattered systems. The effect is that the same data must be entered manually in several or even a dozen or so systems. Additionally, the logistics resource and staff management itself is ineffective, as the respondent companies are using several non-integrated IT systems.

Organising transport, the staff of the companies are forced to use traditional e-mail and phone communication with customers, marine container terminals, agents, railroad carriers, road carriers, and administration representatives.

This leads to decrease efficiency, effectiveness, and safety of services rendered to customers by the applicant. Profitability of services offered by the companies is also reduced, which results in lower competitiveness in international markets.

Therefore, during the survey, the following barriers for the company development in terms of transport and forwarding processes organisation were identified:

- 1) lack of real-time access to information on the status of services rendered, which reduces the profitability of the service;
- 2) work in a scattered IT environment resulting in the lack of access to analytical data;
- 3) the lack of standards and electronic documents, which makes it necessary to use different types of documents with customers and subcontractors to perform the same processes (e.g. container arrival notice at a marine container terminal);
- 4) low efficiency and effectiveness of processing a customer order caused by the necessary manual acquisition of data on the available transport resources in the company as well as subcontractors;
- 5) the lack of electronic and structured communication with a customer and automatic notification on the status of an order to the customer;
- 6) no system allowing creation of on-line access accounts for customers for the purpose of electronic submission of transport inquiries and orders;
- 7) no system allowing creation of on-line access accounts for subcontractors of a company (e.g. carriers) for the purpose of receiving, accepting, and settling transport orders – it happens frequently that subcontractors/partners of a company have no IT system implemented and work using telephone and e-mail only and issue invoices manually;
- 8) the lack of electronic and structured communication with marine container terminals (BCT Gdynia, GCT Gdynia, BCT Gdańsk) with carriers/railway operators;
- 9) long time needed to plan container transport by road due to scattered access to information on the current location and availability of transport resources;
- 10) communication with a driver to provide them with information on current tasks – only via telephone, non-structured, and unarchived;

- 11) the lack of automatic information sent by a vehicle regarding the location, the status of an order, the distance to a destination, estimated time of delivery – the concept of the Internet of Things not used in practice;
- 12) no system allowing the improvement of the safety of services rendered through, for example, identification whether a vehicle with a load is performing an order in accordance with the requirements or whether it was stolen or it changed its route – the concept of the Internet of Things not used in practice;
- 13) the lack of a solution allowing precise estimation of the time of goods delivery to a customer, considering the current road traffic – the concept of the Internet of Things not used in practice.

To conclude, companies seek modern IT systems that would integrate the features of TMS, Track&Trace, CRM, and accounting systems under a single solution. It is undoubtedly what the future of IT solutions for the logistic industry will look like. One of the example of such a modern TMS system is web-based NovaTMS.

NovaTMS platform delivers dynamic and easy to use tool that boost productivity both in the field and back office with on-demand communication. In is a complete solution that merges three types of IT systems – TMS/ERP, CRM, Track&Trace with mobile app – in one online solution.

Conclusions

Today, transport management IT systems are being developed under three independent groups: transport management systems, traffic management systems, and services management, financial and accounting systems. It results in the lack of synchronization between the systems, difficult access to information and, consequently, unbalanced use of available logistics resources. It is necessary to develop a solution allowing integration of the IT systems and their further synchronized development so that, during planning, the user has real-time access to the data on road traffic, various services available, and transport resources.

Such a measure would provide a range of benefits for the users, such as:

- higher availability of goods thanks to more effective organisation of transports,
- transport cost reduction,
- higher customer satisfaction,
- better use of loading space of means of transport,
- more intermodal transports,
- reduction of empty runs,
- reduced transport time,
- reduced time spent at loading/container terminals,
- lower CO₂ emission.

References

- Alliance for Logistics Innovation through Collaboration in Europe info note. Available from <http://www.etp-logistics.eu> [Accessed 10 May 2016].
- Aslekar, P., Londhe, P. and Ashwini, G.A. (2016), M2M Communication – Power Link Technology, *IJSRD – International Journal for Scientific Research and Development*, 4, ISSN (online): 2321–0613.
- Ballot, E., Montreuil, B. and Meller, R. (2014), *The Physical Internet*, The network of logistics networks, la documentation Française.
- Boswarthick, D., Elloumi, O. and Hersent, O. (Eds.). (2012), *M2M communications: A systems approach*, John Wiley & Sons.
- Cheng-Chieh, C. and Yu-Chieh, C. (2016), A Dynamic Programming Model for Attended Delivery Time Slot Management, *Transportation Research Board 95th Annual Meeting*, 16–0559.
- Christopher, M. (2016), *Logistics and supply chain management*, Pearson, UK.
- Hentschel, B. et al. (2015), Ranking of integration factors within supply chains of forward and backward types-recommendations from researches, *LogForum*, 11, pp. 63–77.
- Khodakarami, F. and Yolande, E. (2014), Exploring the role of customer relationship management (CRM) systems in customer knowledge creation, *Information and Management*, 51, pp. 27–42.
- Mes, M.R.K. and Iacob, M.E. (2016), Synchromodal Transport Planning at a Logistics Service Provider, *Logistics and Supply Chain Innovation. Springer International Publishing*, pp. 23–36.
- Ming, F. et al. (2012), GSM/GPRS Bearers Efficiency Analysis for Machine Type Communications, *Vehicular Technology Conference (VTC Spring), 2012 IEEE 75th, IEEE*.
- Nettsträter, A. et al. (2015), Logistics Software Systems and Functions: An Overview of ERP, WMS, TMS and SCM Systems. In: *Cloud Computing for Logistics. Springer International Publishing*, pp. 1–11.
- Rydzkowski, W. and Wojewódzka-Król, K. (Eds.). (2010), *Transport*, Wydawnictwo Naukowe PWN, Warszawa.
- Sharma, A., Vineet, K. and Tomar, R.P.S. (2015), Location Based Services in M-Commerce: Customer Trust and Transaction Security Issues, *International Journal of Computer Science and Security*, 9, p. 11.
- Szymczak, M. (2001), Satelitarna nawigacja pojazdów. System Navstar GPS, *Eurologistics*, 4.
- Zijm, H. and Klumpp, M. (2016), Logistics and Supply Chain Management: Developments and Trends. In: Zijm, H., Klumpp, M., Clausen, U. and Hompel, M.T. (Eds.), *Logistics and Supply Chain Innovation*, Springer International Publishing, pp. 1–20.

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MACROECONOMIC EFFECTS OF INLAND WATERWAYS DEVELOPMENT

Abstract

The aim of this article is to show, at the example of lower Vistula River, that the characteristics of inland waterways may increase the benefits of multipurpose development of waterways. In the paper, the nature of the multipurpose development of waterways, the impact of the specifics of the waterways to the share of inland waterway transport in handling the transportation needs, the process of creating an international transport network, and the effects of the development of waterways in the light of the idea of sustainable development will be presented.

Keywords: multipurpose development of waterways, inland navigation, transport network

Introduction

The characteristics of inland waterways is a result of both the complex nature of their development and the fact that their layout and length are determined by natural conditions. Because of these factors there are some common mistaken ideas about the possibilities and needs for development of waterways, which in effect have a negative impact on the process of their growth.

1. Multipurpose nature of waterways

In contrast to routes in other modes of transport, waterways are used not only for transport of people and cargo. Three groups of investments in infrastructure can be distinguished in the waterway development process, namely:

- aimed at improvement of navigation conditions in waterways (deepening, regulation, sewerage, reservoirs, canals and shipping tunnels);
 - undertaken to meet the water needs of other sectors of national economy and to counteract the negative impact of waters;
 - used in other modes of transport, built at intersections of waterways and roads.
- The first two groups of investments are closely related because:
- the majority of investments undertaken for the purpose of inland navigation affects the hydrographic conditions, and hence the water management method;
 - objectives of individual sectors of the economy can be common when the investment meets the needs of different sectors, or conflicting when the fulfilment of the needs of one sector has a negative impact on another sector;
 - individual investment plans complement each other.

Therefore, it can be concluded that there are no single-purpose investments in infrastructure related to water management. The “single-purpose investment” term used in the literature can at most mean that a structure is built to meet the needs of a single water user, without taking into account the impact – both positive and negative – of this project on other sectors of the economy. As the losses caused by such an investment may significantly exceed the planned effects, the only rational way to develop a waterway is multipurpose development that takes into account interests of various consumers and water users (Wojewódzka-Król, 2011).

Multipurpose investments have a higher efficiency than a single-purpose investment that pursues similar objectives because:

- their objectives are in line with general economic objectives and allow for selection of the investment variant which is best from the point of view of the whole economy;
- expenditures on their implementation are lower than the amounts of expenditures on implementation of so-called single-purpose solutions.

Certain expenditures for multipurpose development of waterways are the so-called common part, which benefits all sectors of the economy, while the remaining can be divided and assigned to individual sectors of the economy (Figure 1).

Total expenditures on multipurpose waterway development are usually large, but the efficiency of achievement of individual tasks is high while including only a part of common costs and separable costs. As a result, the costs of development of inland waterways, for example, are usually lower than the costs of road construction in competitive modes (per tonne-kilometre [tkm]).

Due to the lack of awareness of these relationships, significant total expenditures are often wrongly an argument against the development of inland waterways, in particular for the purposes inland waterway transport or power industry. It also happens that urgent problems are solved in a piecemeal fashion “to achieve savings”, which often causes more losses than benefits in various areas of the economy.

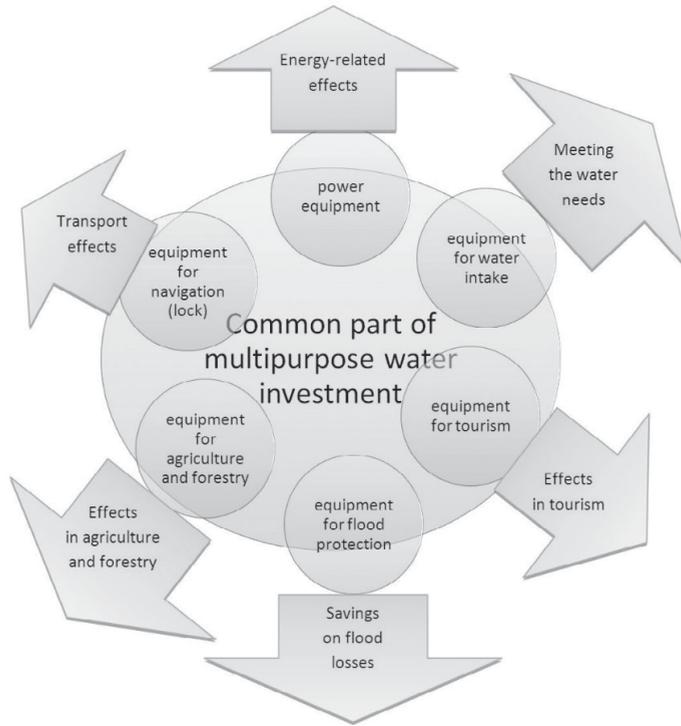


Figure 1. The structure of expenditures and effects of multipurpose water investments
Source: (own elaboration)

An example of a multipurpose water investment can be the construction of the cascade of dams at the Austrian section of the Danube, which began in 1954 from Ybbs-Persenbeug dam, and 9 dams were built over the next 43 years. The following have been ensured as a result: safe passage of flood waves formed under influence of alpine torrential rains, melting snow and glaciers of the Alps; safe, cheap and environmentally friendly water transport at the Rhine – Main – Danube route (e.g. leisure and hotel ships with a tonnage of approx. 2 thousand tonnes navigate at that section); operation of 9 hydropower plants with a capacity of 2100 MW, generating 13.300 GWh per year; operation of municipal and industrial water intakes. Hundreds of kilometres of walking paths for pedestrians and bikers, swimming areas and observation points for motorized tourists were built along the reservoirs; safe exploration of the equipment located at barrages is allowed. Fish migration is possible through various fish passes, including passes in the form of a mountain stream. The purity of Water in the Danube has been improved through the comprehensive construction of sewage treatment plant (Depczyński, 2015).

2. The development of inland waterways for transport needs

A common argument against the development of waterways for transport needs is the low share of inland waterway transport in handling the transport needs. In countries where natural water courses are unevenly distributed or short, the share of this mode in relation to transport needs may indeed be low. However, the low share should not be considered equivalent to marginal importance of this mode, in the context of either transport needs or the country's socio-economic development.

In the region of occurrence of inland waterways, the share of this mode may in fact be quite dominant or at least significant, and its impact on the socio-economic development – very big. For example, in Poland – this share is 0.1% on average, and in handling of Szczecin–Świnoujście Ports – approx. 9% (in the period best for navigation – 25%), in the UK – 0.1% on average, while in the city logistics in London – 6% (9 million tonnes, i.e. over twice more than carried through navigation in Poland); in Netherlands – 39% in average, in handling of the Port of Rotterdam – 79%.

Modern transport needs the infrastructure of international importance. According to the definition of “infrastructure”, it is the basis of economic development, which suggests the need for its pre-emptive development in relation to needs (Wojewódzka-Król, 1975). Transport infrastructure is an important factor in economic development. Its development may be stimulating to the socio-economic development and integration processes.

However, the relationships between the development of international links and infrastructure are not one-sided:

- a good layout of transport network with uniform parameters is a factor stimulating the development of international cooperation (the lack of convenient transport links restricts international exchange, hinders contact and can create a barrier to integration);
- the development of integration contributes to creation of specific needs in terms of infrastructure and thus affects the acceleration of processes to establish a uniform transport network; integration also creates new possibilities for funding the transport network development.

Significant impact of infrastructure on the socio-economic development, equalisation of differences and opportunities for development of regions and economic integration is the cause of numerous measures in the EU countries to support the development of infrastructure, equalisation of differences in the infrastructure development status, elimination of bottlenecks, construction of missing links and creation of environmentally friendly modal structure of transport systems. Improperly established structure can become a limiting factor for socio-economic development and international cooperation, can reduce or even nullify the development measures taken in other areas of the economy.

In practice, the creation of a uniform transport network corresponding with the needs of economic integration in terms of both layout and parameters faces numerous limitations. In addition to the barriers typically associated with the creation of infrastructure (existing zoning, environmental and capital-related barriers),

they include, above all, difficulties resulting from the conflict between national and common interests of countries that establish a common transport network.

In this case, a condition necessary to establish a uniform European transport network is to clearly identify the desired objective understood as the target system and the target applicable technical standards, as well as the methods to achieve it. Therefore, it has become to determine the following:

- priority investment projects to support the existing infrastructure system;
- priority modernization investments to eliminate the so-called bottlenecks in the future transport network;
- priority modernization investments aimed at adjustment of existing roads that are a part of the future European transport network to European standards.

An important initiative to unify the European waterways is the European Agreement on Main Inland Waterways of International Importance adopted in 1996, known in short as AGN (Figure 2).



Figure 2. AGN waterways
Source: (ECE Trans/120, 1996)

From the point of view of international relations, Polish waterways represent great potential and their use is very important for implementation of the idea of trans-European transport networks. Unfortunately, Polish waterways remain a bottleneck on the map of European inland waterways, therefore hindering the development of inland waterway transport in Europe as an integral element of sustainable transport development.

Plans for 2014–2020 assume that the EU funding in the field of transport infrastructure will be focused on the core transport network, supplementation of missing border links, elimination of the so-called bottlenecks and support of smart grids. The core network will be implemented in nine corridors with at least three modes of transport running through at least three member states and including two cross-border sections.

This means that the previously dominant concept of intermodal competition is replaced by the concept of cooperation between all modes of transport, which allows for more environmentally friendly solution to today's transport problems. The concept of corridors strengthens the position of inland waterway transport, because road and railway transport routes are often built in river valleys, so the corridors often run along inland waterways. As a matter of fact, these routes do not always meet the criteria for the core network (e.g. they do not run through three countries), but the location in the transport corridor creates demand conditions favourable for development of navigation. The lower Vistula River is located in the 1st transport corridor: Baltic – Adriatic

3. Multipurpose waterways development in the light of the idea of sustainable development

The idea of sustainable development provides for meeting social needs in an economically efficient and environmentally sound manner.

Sustainable growth means:

- building a more competitive low-carbon economy that makes efficient, sustainable use of resources;
- protecting the environment, reducing emissions and preventing biodiversity loss;
- capitalising on Europe's leadership in developing new green technologies and production methods;
- introducing efficient smart electricity grids;
- harnessing EU-scale networks to give our businesses (especially small manufacturing firms) an additional competitive advantage;
- improving the business environment, in particular for SMEs;
- helping consumers make well-informed choices.

EU targets for sustainable growth include:

- reducing greenhouse gas emissions by 20% compared to 1990 levels by 2020. The EU is prepared to go further and reduce by 30% if other developed countries make similar commitments and developing countries contribute according to their abilities, as part of a comprehensive global agreement;
- increasing the share of renewables in final energy consumption to 20%;
- moving towards a 20% increase in energy efficiency (European Commission, 2010).

In the energy sector, this means the need to increase energy production from renewable sources. Sustainable growth also affects other water users and consumers.

In transport, the way to realise this idea is not only to support the development of environmentally friendly modes, but also a complete change in the concept of the transport system based on accelerating the implementation of the basic trans-European links and the creation of the aforementioned transport corridors that will enable the choice of modes of transport as well as efficient and effective fulfilment of transport needs.

The idea of sustainable development assumes a proper balance between the social, economic and environmental aspects. This does not mean that the environment will remain untouched, as every investment activity affects the environment, and it does not mean a primacy of the economic aspect, because sometimes social considerations are a priority, but it also does not mean the fulfilment of social needs at any cost. Therefore, the investment appraisal using any of these aspects independently of the others violates the principle of sustainable growth.

The benefits of the development of inland waterways are felt in many areas of the economy (Figure 3) and they are both economic and non-economic effects (including in particular social effects and some environmental effects that are different to measure).

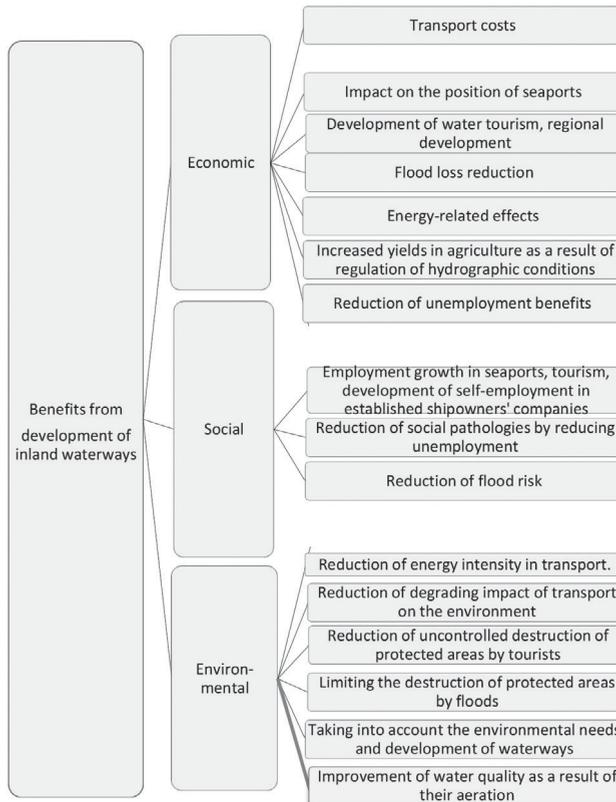


Figure 3. The effects of the multipurpose development of inland waterways
 Source: (own elaboration)

For example, the benefits of comprehensive development of the lower Vistula River are significant and appear in many areas of the economy. Transport, including in particular seaports and logistics centres, flood protection, water supply for population, industry, agriculture and forestry, energy sector and tourism are fields in which tangible and intangible effects could be achieved, which improve the quality of life to build the wealth of a modern, environmentally friendly energy efficient economy and to be the basis for the development of regions associated with the lower Vistula River, thus meeting the contemporary criteria for the development of the EU regions.

Conclusions

Abandonment of the development of inland waterways can mean a definite loss of opportunity for:

- sustainable economic growth (sustainable development of transport, use of renewable energy, prevention of devastation of the natural environment in the areas of rivers and flood protection);
- a dominant position in the Baltic Sea achieved by dynamically growing Polish seaports;
- enhancing the regional development.

References

- Depczyński, W. (2015), *Włocławek, 40 lat stopnia wodnego – fakty i mity o zagrożeniu*. Available from http://www.inzynierbudownictwa.pl/technika,materialy_i_technologie,artykul,wloclawek_40_lat_stopnia_wodnego___fakty_i_mity_o_zagrozeniu,3146 [Accessed 2 August 2015].
- ECE Trans/120 (1996), *European Agreement on Main Inland Waterways of International Importance AGN*, Geneva, 19 January 1996.
- European Commission (2010), *Europa 2020. Strategia na rzecz inteligentnego i zrównoważonego rozwoju sprzyjającego włączeniu społecznemu*, KOM(2010), Bruksela. Available from http://ec.europa.eu/eu2020/pdf/1_PL_ACT_part1_v1.pdf [Accessed 26 January 2017].
- Wojewódzka-Król, K. (1975), Uwagi o zakresie pojęcia i niektórych cechach infrastruktury transportu, *Zeszyty Naukowe Wydziału Ekonomiki Transportu Uniwersytetu Gdańskiego*, 5, p. 25.
- Wojewódzka-Król, K. (2011), Współzależności w rozwoju śródlądowych dróg wodnych, *Logistyka* (addition on CD Logistyka-nauka), [electronic document] No. 6, pp. 5089–5100CD, CD No. 3.

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