INNOVATIVE SYSTEM OF TRUCK PRE-NOTIFICATION AT BALTIC DEEPWATER CONTAINER TERMINAL IN GDANSK

Cezary Mankowski
University of Gdansk, Poland
Faculty of Economics, Department of Logistics
E-mail: ekocm@univ.gda.pl

Abstract

The problem of innovations in logistics, although not new, is very important and still actual, because it stimulates all the activities, theoretical as well as practical, focused on finding and implementing better solutions than they were before. It should be stated, that examples of innovations in logistics are taking place every day, on smaller or grater scale, even if not formally reported. Thus, it is valuable to identify them for practical and scientific purposes. One of such examples is the case of the Deepwater Container Terminal located at Gdansk. This huge land & see container logistics hub, which is the biggest Baltic container port (1,3 mln TEU in 2016), was facing a lot of logistics problems, mainly of coordination aspect, regarding the service of incoming trucks, causing great time and money loss. In response to these problems, an original truck pre-notification system was invented and applied, which has been resulting in improving the level of services offered by the terminal. However, the results of implementing this system into the terminal logistics operations have not been evaluated yet. This practical reason implies to make a scientific research focused on identification and assessment the system to disseminate knowledge and apply to other cases if possible. Therefore, the aim of this article is to analyse the system of truck pre-notification at Deepwater Container Terminal in Gdansk for the above mentioned reasons and purposes. To meet this aim the "case study" method is taken. Obtained results show that the implemented system of truck booking can be found as innovative, but in comparison to the situation before the system was implemented at DCT Gdansk, and to the other terminals, which have not applied it yet.

Key words: logistics, innovations, container terminal

1. INTRODUCTION

Deepwater Container Terminal located at Gdansk is an intermodal container hub located at the Baltic Sea. As a lot of other business organisations it suffers some logistics problems. One of them are problems of coordination aspect in relation to trucking companies, drivers and forwarders, who wish to deliver or take their containers from the terminal as soon as possible, what results, if not coordinated, in a congestion causing great time and money loss as well as a disorder for the terminal operations. In response to these problems, an truck pre-notification system was invented and applied, which was planned to reduce the problem of long truck queue before the terminal gate. However, the results of implementing this system into the

terminal logistics operations have not been evaluated yet. This practical reason implies to make a scientific research focused on identification and assessment the system to disseminate knowledge and apply to other cases if possible. Therefore, the aim of this article is to analyse the system of truck pre-notification at Deepwater Container Terminal in Gdansk for the above mentioned reasons and purposes. To meet this aim first the literature review and then the "case study" method is taken, based mainly on a company data sheet. The results of the case study are included at two chapters. First of them presents main characteristics of Deepwater Container Terminal in Gdansk according to selected perspectives. One of them is a problem of trucks coordination resulting at their congestion. It gives a right background for the next part of the research on the truck pre-notification system at the second chapter, where the specification of functionalities of the system with discussion on the innovation are included.

2. LITERATURE REVIEW ON THE PROBLEM OF TRUCK PRE-NOTIFICATION SYSTEMS IN TERMINALS

The conducted literature study resulted at the following list of problems regarding a truck pre-notification system, namely a problem with:
- terminology,
- methodology of designing,
- methodology of assessment of benefits, influence, innovativeness.

Regarding the problem of terminology some other names are used for the "system of truck pre-notification", which is used at this article, as for instance:
- truck appointment system (Zehendner & Feillet, 2014, p. 461),
- truck queuing system (Chen & Yang, 2014, p. 614),
- vehicle booking system (e.GATE, 2016).

At the literature, there is also diversity on definition of truck pre-notification system. As the above mentioned names used for these systems indicate that they are usually defined by their main function as appoint, queuing, or book. However, some other terms are used as: allocate, limit, control, schedule, reserve, arrange, manage. An example is a definition of these systems as "...systems to limit the number of trucks admitted per time slot in order to even out the demand over the day" (Zehendner & Feillet, 2014, p. 462). This definition is worth quoting, because it also indicates the main reason to introduce an application of such systems. Namely, if the demand, at the sense of trucks in numbers and time slots mainly, exceeds terminal capabilities, there is a need to develop and implement an application to regulate a truck flow, otherwise the terminal suffers congestion problems resulting at an organisation disorder, unnecessary diesel engine exhaust emissions, loss of time and money, occupation of parking lots by trucks, or even drivers' protests. At that context, the system can be perceived as a kind of trucks' regulatory tool, which in administration way controls demand (including cancellation policy), what also means on the other hand, that there is a point of a "bottle neck" at the terminal, in the sense of insufficient staff, material, financial or information resources.

A special part of the studied literature are publications, which are focused on methods and tools for designing truck pre-notification systems. Especially, there are used two main methods: mathematical formulations (Phan & Kim, 2016, p. 42-49; Zehendner & Feillet, 2014, p. 462-468), or computer simulation (Sharif et al., 2011, p. 83-88; Karafa, 2012, p. 43). In reference to the methodology tools for designing truck pre-notification systems, a computer model is preferred (Sharif et al., 2011, p. 83; Chen & Yang, 2014, p. 615-616). An example of a simulation model of a truck queuing system at container terminal of Tianjin Port (China) is presented on the Figure 1.

Figure 1. 3D snapshot of the queue simulation at a terminal gate in PARAMICS software

Source: Chen & Yang, 2014, p. 615

The above cited example of the gate queue simulation system at Tianjin container terminal is one of many other examples, which present that the main method to assess benefits or influence of a truck pre-notification system is a case study. For instance, P. Dougherty (2010, p. 29) evaluated the impact of a truck appointment system at the Port Newark/Elizabeth marine terminals, and Zehendner, E. & Feillet, D. (2014, p. 467) estimated operations at the Grand Port Maritime de Marseille terminal without an appointment system and with a truck appointment system. In result, this paper was also decided to be a case study, this time on the Baltic Deepwater Container Terminal in Gdansk.

3. MAIN CHCARACTERISTICS OF THE BALTIC DEPWATER CONTAINER TERMINAL IN GDANSK

Deepwater Container Terminal in Gdansk (Poland) (shorter - DCT Gdansk) is the biggest Baltic container port (1,3 mln TEU in 2016), which can be classified as a multimodal node (Grzelakowski & Matczak, 2015, p. 28), that integrates three

transportation modes, i.e. maritime, rail and road, into a modern logistics hub. Its main characteristics are described from the following points of view or aspects:
- legal status,
- logistics network location,
- offered services,
- KPI (key performance indicators),
- problems.

From the legal point of view, DCT Gdansk is a stock-joint company, but not listed at Warsaw Stock Exchange, registered at the National Court, Department of Business Affairs, under the identification no. 0000031077 on 27 July 2001, while the terminal operations were started in full on 1 June 2007. The equity capital amounts at 67 mln Polish zloty (about 15,5 mln Euro) and consists of 6700 shares valued 1000 zł each. Regarding the structure of owners, it has to be noticed that the majority shareholder is not a Polish capital unfortunately, but one of the world's largest investment fund named Macquarie Group, based in Australia. According to the Court Registry the company is allowed to run the activities as follows: cargo transhipment (handling) in seaports and other reloading places, warehousing and storage, service activities supporting land and maritime transportation, rental and management of own or leased property, auxiliary activities related to property security, wireless telecommunications activities, excluding satellite telecommunications, learning foreign languages, extracurricular forms of education in driving and pilot. Probably, the last two activities requires some explanation, namely the company offers foreign language courses (mainly in English) and carries out training courses to get terminal equipment driving or pilot licences by employees.

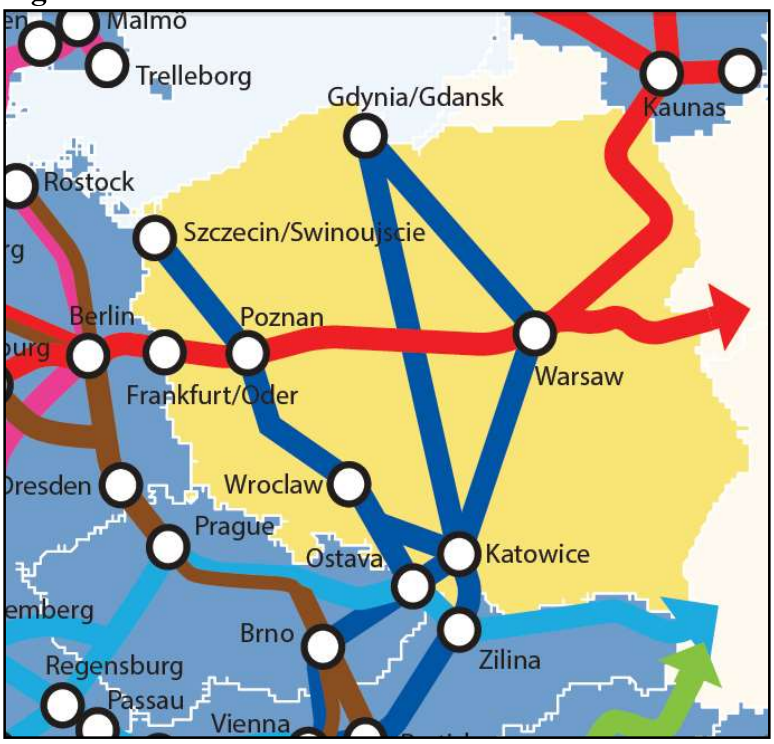
Figure 2. Location of DCT Gdansk

Source: DCT portal [available at http://dctgdansk.pl, access May 12, 2017]

DCT is located at the north of Poland by the Gulf of Gdańsk at the Baltic Sea with the GPS coordinates of latitude: 54.382563 and longitude: 18.711337 (Figure 2). This company is located on 76,2 ha of the coast in compliance with the norm of ISO 14001 on environment protection. There are two core trans-European transport network (TEN-T) corridors crossing Poland (Figure 3):
- Baltic-Adriatic,
- North Sea-Baltic.

DCT is a node of the first one, which links the Polish ports Gdansk/Gdynia, and Szczecin/Swinoujscie, via Czech Republic or Slovakia and through eastern Austria to the Slovenian port of Koper and to the Italian ports of Trieste, Venice and Ravenna. This corridor includes ports, rail, road, airports, and rail-road terminals. Despite the company is not located directly within the second corridor linking the North Sea ports (Amsterdam, Antwerp, Rotterdam, Hamburg) with the Baltic countries' ports (Klaipeda, Ventspils, Riga and Tallinn as well as Helsinki), it has a good connection via highway A1 (140 km/h), two rail lines and airports in Gdansk and Warsaw. The inland waterway by Vistula River is also planned to modernise to serve a transportation of containers between Gdansk and Warsaw[1]. In broader context, DCT is a part of global supply chains. A good example is the

Figure 3. Location of DCT Gdansk at the TEN-T corridors



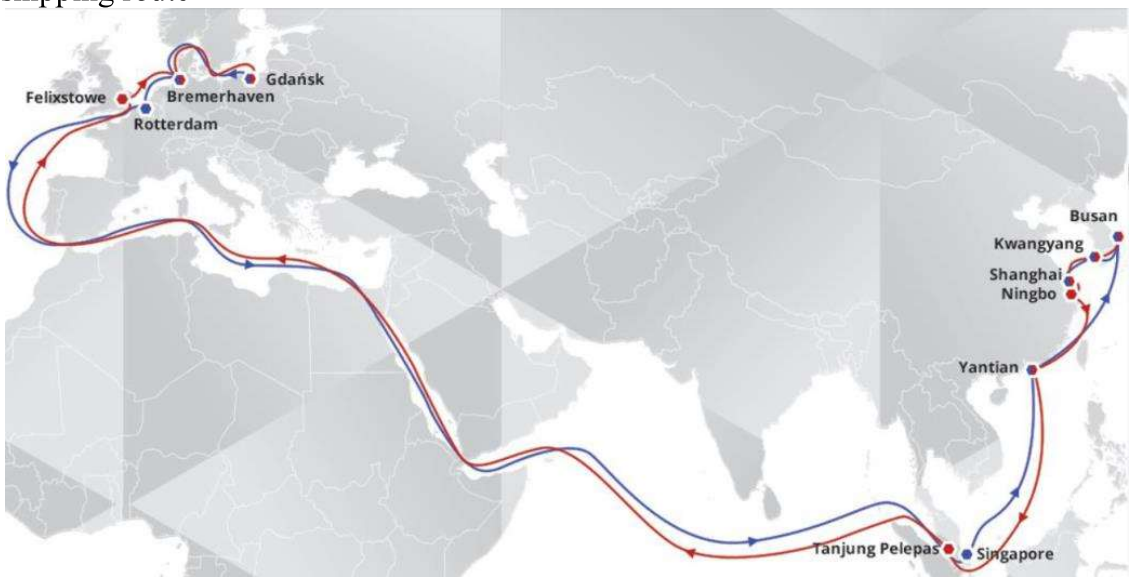
Source: European Commission Portal. Mobility and Transport. Maps [available at http://ec.europa.eu/transport/sites/transport/files/ten-t-country-fiches/ten-t-country-fiches-pl_pl.pdf, access May 12, 2017]

[1] The first promotional cruise by a barge loaded with containers was held in April this year. See: Zieliński, P. (2017). Promocyjny rejs barką z Gdańska do Warszawy! (eng. Barge promotional cruise from Gdansk to Warsaw) [available at http://gdansk.naszemiasto.pl/artykul/promocyjny-rejs-barka-z-gdanska-do-warszawy-zdjecia-wideo,4090277,artgal,t,id,tm.html, access May 12, 2017]

East Asia - North Europe container shipping route, serviced by 2M Alliance[2], which takes the world's greatest market share of about 28% (Rau & Spinler, 2017, p. 156), with DCT in Gdansk as a transhipment or destination port (Figure 4). Another example of the port important place at the global supply chains is of potential meaning. Namely, looking at the map (Figure 5), which illustrates China's conception of "One Belt One Road" corridors, it is relatively easy to formulate a thesis that good transportation connections with the rest of country create a very large potential for DCT to function as a logistics regional centre for goods traded between Poland and China as well as a transhipment point for foreign trade. And last but not least, the DCT location should be mentioned at the aspect of a regional port for feeder relations, mainly to Finnish ports and St. Petersburg (Russia) (Urbanyi-Popiołek & Klopott, 2016, p. 521).

A good location was one of many factors, which DCT used to develop its services to the actual range, which expands from ships services via transhipment or warehousing to educational courses. Speaking more detailed, DCT services can be classified into two groups. The first one contains standard market offers with fixed prices, while additional services, including the ones not specified explicitly, stand for the second group. The list of standard services with their prices is presented at the Table 1. The other services offered by DCT are: cargo unstaffing/staffing at Container Freight Station (CFS), external parking lot, vessel operations or storage space renting.

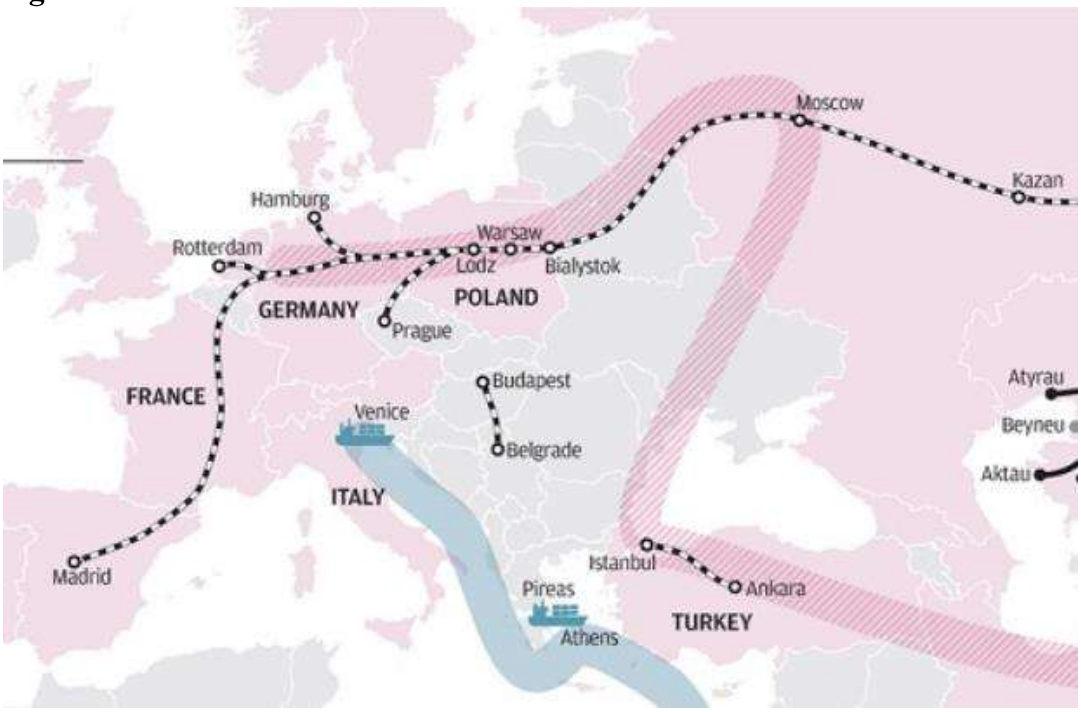
Figure 4. Location of DCT Gdansk at the East Asia - North Europe container shipping route



Source: DCT Gdansk Presentation. January 2017 [available at http://dctgdansk.pl/wp-content/uploads/2013/03/DCT-Gdansk-Presentation.pdf, access April 22, 2017]

[2] 2 M Alliance includes two world's largest container carriers, Maersk Line and Mediterranean Shipping Co., which signed a 10-year vessel sharing agreement on the Asia-Europe, Transpacific and Transatlantic routes in July 2014 and launched their operations in January 2015. Source: World Maritime News Portal [available at http://worldmaritimenews.com/archives/149314/2m-alliance-officially-launched, access May 12, 2017]

Figure 5. Location of DCT Gdansk at "One Belt One Road" corridors



Source: Polish-Chinese Cooperation Forum [available at http://chpcf.pl/en/blog/one-belt-one-road, access April 22, 2017]

Regarding the key performance indicators (KPI), two main measures were available. First of them is efficiency of DCT calculated according to DEA method of relative productivity evaluation. This indicator value is 100% in 2016 (Wiśnicki & Chybowski & Czarnecki, 2017, p. 13). Interpretation of this value can be quite different, because 100% can indicate very good efficiency if all the resources are utilised in full, but on the other hand, it can be stated that there are no reserves, or no safety margin for instance for unexpected grow in demand or equipment failure, what means the resources can limit DCT Gdansk activities and stand for a bottle neck. The second indicator is the turnover of TEU, which is presented at the Figure 6. A quick analysis of this measure allows to claim that there is a steady growth at the container operations.

Despite of good business position, DCT suffers some problems. Of course, there are so called constant problems regarding market competition, changing political, economical, technical and socio-environmental, but these kinds of troubles touches all business organisations, and methods of managing them are known, generally. However there are some specific problems touching intermodal hubs. Because it is just intermodal hub, the main problem is integration of different transportation modes with handling and warehousing operations on containers. Speaking more detailed, for a long time DCT could not manage the problem of truck congestion caused by not synchronised notification about containers to pick up or drop off. In results some dramatic scenes could be observed, where truck drivers

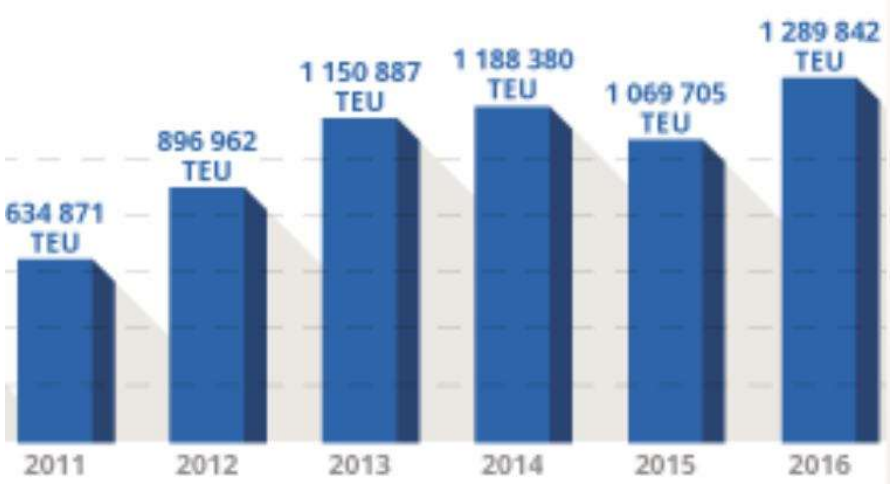
Table 1. Price list of DCT standard services

Service name	20'	40'	% of surcharge to the basic rate				
			Sat	Sun	Holi day	Non-ISO	IMO 1-5
Unloading/loading full ISO container in ship's hold via ship's rail to yard or truck/wagon relation or vice versa	€97	€112	50%	100%	150%	75%	100%
Unloading/loading empty ISO container in ship's hold via ship's rail to yard or truck/wagon relation or vice versa	€90	€100	50%	100%	150%	-	-
Reefer container's power supply and monitoring (for started calendar day)	€25	€25	-	-	-	-	-
Reefer container's Plug in or plug out on yard (per 2 actions)	€18	€18	50%	100%	150%	-	100%
Full containers' storage in export/import (per calendar day per container) for the first 5 days	-	-	-	-	-	-	-
Full containers' storage in export/import (per calendar day per container) for the day 6 - day 14	€3,80	€7,60	-	-	-	-	100%
Full containers' storage in export/import (per calendar day per container) for the day 15 - day 30	€5	€10	-	-	-	-	100%
Empty containers' storage in export/import (per calendar day per container) for the first 5 days	-	-	-	-	-	-	-
Empty containers' storage in export/import (per calendar day per container) for the day 6 - day 14	€1,10	€2,20	-	-	-	-	100%
Empty containers' storage in export/import (per calendar day per container) for the day 15 - day 30	€1,30	€2,60	-	-	-	-	100%
Container manipulation on yard	€60	€65	50%	100%	150%	75%	100%
Container inspection with cargo turn out	€16/t	€16/t	50%	100%	150%	-	100%
Railway service manipulation fee (per TEU)	€3,50	€3,50	-	-	-	-	-
Issuing R-25 and R-27 rail wagon hand over documentation (per wagon)	€7,10	€7,10	-	-	-	-	-
Issuing railway bills (per container)	€1,50	€1,50	-	-	-	-	-
Train staying at rail siding (per train/hour)	€80	€80	-	-	-	-	-

Source: Standard Tariff DCT Gdańsk 2017. [available at http://dctgdansk.pl/upload/files/standard-tariff-dct-gdansk-2017-.pdf, access April 22, 2017]

were protested against huge queue, and loss of time and money. This abnormal situation led the DCT managerial board to develop and implement a pre-notification system at the form of computer and internet application. Despite the system is relatively new, because it started as an obligatory application on 20 March 2017, its functionalities and users opinions can be researched to answer if it is innovative or not.

Figure 6. Turnover of TEU at DCT



Source: DCT portal [available at http://dctgdansk.pl, access May 12, 2017]

4. ANALYSIS OF TRUCK PRE-NOTIFICATION SYSTEM AT DCT GDANSK

DCT Gdansk uses an information system "NAVIS" to manage its operations. One of modules of Navis is a truck pre-notification system called "e.GATE", which was introduces to daily operations on March 20, 2017. It is dedicated to drivers, transportation companies and forwarders to plan truck visits to DCT Gdansk, effectively. It is optimised for mobile devices as smartfones or tablets. This system allows the above mentioned users to decide when they would like to pick up or drop off full containers (the system does not concern about the empty ones). After choosing a suitable time slot, what is possible by logging into the e.GATE system, a driver creates an appointment and declares his or her arrival in the chosen time frame. Before implementing e.GATE (e.GATE, 2016):

- 15 meetings were organised for the future users to learn the system in May 2016,
- 10 external training sessions were hold with 113 attedences, who had been instructed on the system in December 2016
- 382 drivers were trained in internal trainings when visiting the terminal's pre-gate building,
- 25 trucking companies were testing the application with positive results.

Actually, the main functionalities of the system are (e.BRAMA, 2017):

- creating/deleting transportation set (driver, truck, trailer),
- choosing containers,
- linking containers with a transportation set,
- choosing time slot to enter DCT Gdansk,
- sending SMS with a number of visit,
- downloading and printing a confirmation with the number of visit,
- previewing and edition of data.

Some additional characteristics of the system are as follows (Aktualności, 2017):

- 669 trucking companies, 2523 drivers and 2449 transportation sets were registerd on 6 March 2017,

- 73% of all gate transactions were done by e.GATE, the rest of 27% of trucks had to wait about two hours more,
- 69% of time slot utility, of which 63 were used in accordance with the chosen time slot, while 6% - out of the slot.

In edition to these above mentioned functions, drivers opinions on the e.GATE functions have appeared. Some of them are (DCT Gdansk, 2017):
- the system can not offer to choose longer than one hour time slot,
- still lack of time slots at peak hours,
- one hour free parking place is not enough for trucks.

Taking into account all the pro and cons characteristics of e.GATE system it should be stated at the context of innovation that pre-notification or vehicle appointment systems are used on a daily basis by majority of large container ports, which were cited for instance at the literature review chapter. So, in comparison to these ports, the implementation of e.GATE by DCT Gdansk would be difficult to name as innovative. However, on the other side, in comparison to the previous situation at DCT Gdansk, when no such a system of controlling gate transactions was applied, what resulted at operations disorder for trucking companies, forwarders, drivers as well as for DCT, the development of the truck appointement application called e.GATE, should be found as innovative, but with stipulation that only for DCT Gdansk itself or in comparison to the other container terminals, which operate without such a system.

5. CONCLUSION

Final results presents that the above analysed truck pre-notification system at DCT Gdansk called e.GATE is one of many similar sytems, which are to cotroll the truck flow at terminals effectively. There is still a problem of assessing if implementation of such an application can be named as an innovation or not. Regardind the case of e.GATE application, the obtained results indicate that the positive or negative assessment depends on the point of view. So, taking the DCT Gdansk perspective, with no doubt, this system can be treated as innovative, because it enables gate operations to be more effective for all the stakeholders, including mainly DCT Gdansk, truck drivers, truck companies and forwarders. However, there is still a space for the open questions/issues in order to better demonstrate the possibilities for further research directions. Namely, it is suggested to monitor new gate control systems and trends they are evolving for improvement purposes, and at the innovation contex, to elaborate a formaly accepted assessment methodology of innovative applications at the area of transportation, logistics, supply chain and forwarding.

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