PILOT ACTION FINAL REPORT – PP07 GDY PORT OF GDYNIA AUTHORITY

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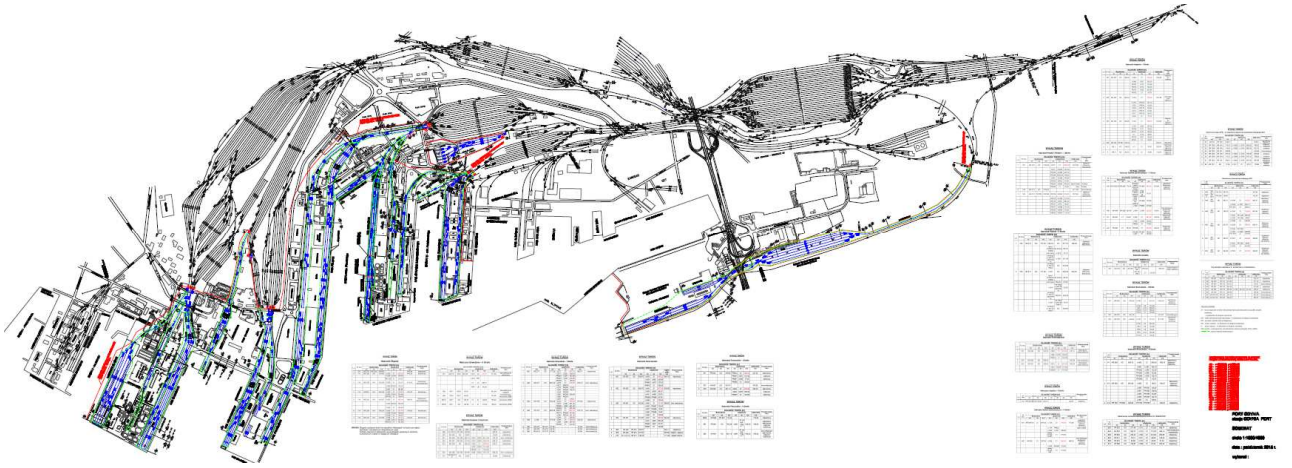
1. Ex-ante situation

Gdynia port is still in the first stage of digitalization of its multimodal transport environment. There is no PCS at Gdynia Port and most of the communication and data exchange among the players acting in intermodal chain are conducted manually. The old fashion procedures still exist as well as the exchange of paper documents. Phones, faxes, radio-communication and e-mails are the means used for communication and traffic coordination.

The big players have its own operational systems, but they are not open to the external environment. Only minor electronic data interchange are performed among them. Systems are designed to satisfy their internal needs and not for external communication. The SMEs usually has no access to highly developed technology due to high costs and limited access. In conclusion, the digital community is very small and fragmented.

The level of digitalisation of the operation of railway processes by the operators on the quays of the Port of Gdynia is slight. Only Port of Gdynia Authority and BCT have IT solutions supporting train notification and railway traffic management processes. Other operators do not use IT systems to support the rail transport operations. For this purpose, they use simple tools such as simple logs, e-mail, or a phone. A good example of the development of an attempt to digitalise the rail traffic management processes in the context of the intermodal transport is the solution proposed by BCT called INCOS, which is currently implemented in the context of the logistical supply chain from the sender to the recipient within the process of introducing train formations to the Port of Gdynia. A critical analysis of this solution confirms its dedicated character for intermodal transport operators, but also the possibility of implementing it after certain modifications by other operators. In terms of responsibility for the safety of cargo and transport processes, the use of this system by a wider group of users is the condition for Port of Gdynia Authority to accept such a solution.

Schematic plan of the railway system of the Port of Gdynia



Moreover, in terms of infrastructures, a number of barriers which hinder the operation of individual operators on the quays of the Port of Gdynia can be observed. Based on interviews with operators in the context of railway traffic, the following dysfunctions were defined:

- the complexity of transhipment processes requires the involvement of infrastructures and superstructures, which in the context of railway traffic should be taken into account; the transhipment processes on the quays are characterised by a different specificity than on railway sidings,

- on many quays, the phenomenon of shared track system by several operators is observed; this generates frequent collisions in the use of the rail system, which significantly increases handling time and thus reduces the capacity value,

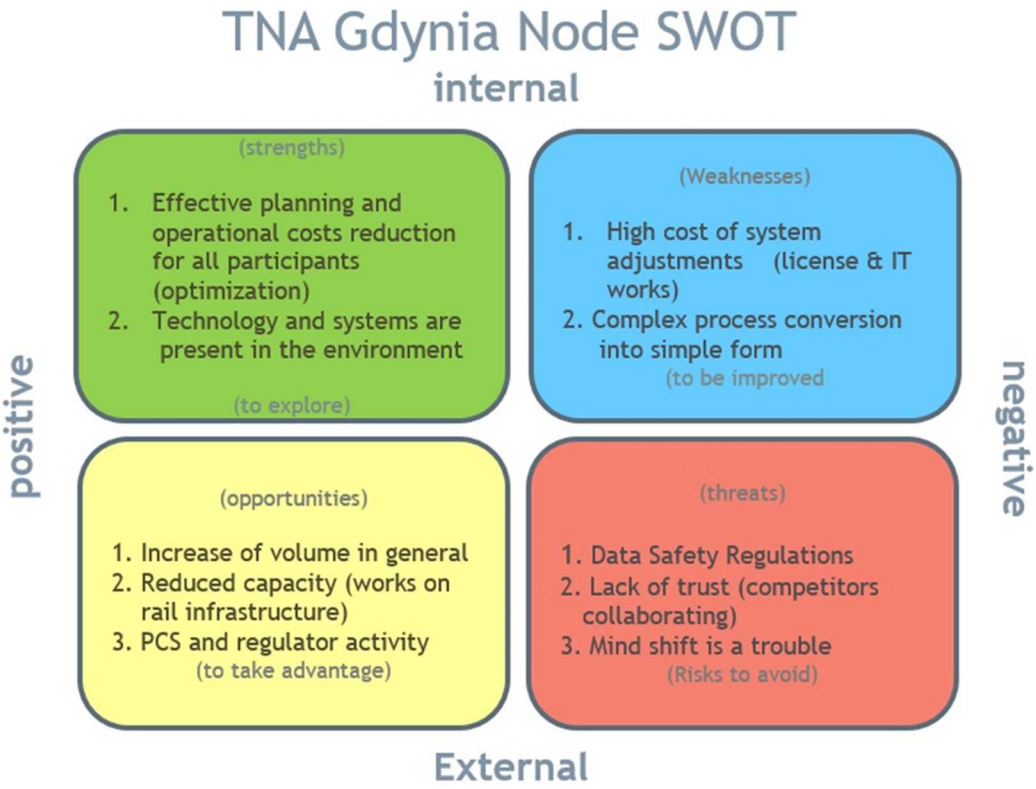
- due to the nature of the complex track system, the bottlenecks of the current track system were identified, including the location of railway scales and associated manoeuvring processes, the crossing of track systems with simultaneous operation of the port superstructure (e.g. cranes), overlapping of users' needs in relation to the use of the same track system,

- the unsatisfactory provision of services by manoeuvring operators is observed in the context of insufficient availability and service times, which significantly affects the temporary extension of the manoeuvring work,

- the railway traffic on the Port of Gdynia Authority sidings is organised on the basis of data on train notifications to the port within the framework of the SZiPS programme, but their operational nature is not supported by any IT tool. The so-called manual control is onerous for the railway traffic coordinator at the Port of Gdynia, as well as for operators and undertakings using the track system of the Port of Gdynia,

- currently, reaching a minimum level of railway traffic flow to, from and at the Port of Gdynia is based on the commitment of the Head of the Railway Section in the Department of the Chief Port Dispatcher,

- the core problem of servicing rail operators is the unsatisfactory punctuality of trains according to timetables, lack of coordination of manoeuvring works on arriving and departing trains, an inadequate information management system in the process of operating trains, the order in which they are dispatched to specific directions to individual quays, as well as the intersection of traffic flows between quays, stations adjacent to the Port of Gdynia and railway lines.



Intermodal transport has been developed very dynamically and needs desperately digitalization for further development and growth. There is no way to tranship more volume with the given capacity following the inefficient and slow communication of coordination. Old fashioned procedures, complicated model of communication and lack of advanced tools started to become a great obstacle for further development.

Al these considerations led us to the conclusion that there is a strong need to create an electronic common platform for the intermodal and rail transport business with very flexible integration module enabling all the partners to use and develop system to system integration at low costs and with relatively small effort.

2. Pilot action description

The purpose of the Pilot action was to elaborate the concept with the elements of the preliminary feasibility study of the railway traffic management system to increase the capacity of track systems and the integration of the port with the hinterland as part of the technical and organisational improvement of rail access to the Port of Gdynia.

The objective and scope of the study is the optional feasibility of using the railway traffic management system in the Port of Gdynia, including systems for exchanging information with port users and integrating the port with the hinterland, possible organisational, technical and technological improvements in terms of increasing the capacity of track systems within the administrative boundaries of the Port of Gdynia, in accordance with the requirements of the TEN-T network and interoperability in terms of technical parameters and functionalities of Gdynia Port Station modernised by PKP PLK S.A.

The document was based on thorough analyses, interviews with users/operators of the Port of Gdynia, multi-dimensional studies of legal acts, design documentation, studies and analyses devoted to rail transport issues and indirectly related to rail transport, analysis of secondary documents and design works. The project is complex and covers a wide range of areas concerning legal, economic, and technical issues related to the development of the digital economy, as well as the progress made in the digitalisation of rail transport. In the course of multidimensional work, a great number of solutions, recommendations, conclusions and suggestions were created to improve the railway traffic management system dedicated to the operation of the Port of Gdynia. Cooperation with the hinterland, especially in the field of rail transport, is fundamental to seek the solutions expected in terms of the development of the Port of Gdynia compared to other competing ports of the Baltic Sea and Europe. The effective development of the Port of Gdynia requires the structure of the railway system from the perspective of the geometry and form of the track system, the area of railway traffic management regarding railway traffic control and command, the area of IT solutions supporting the railway traffic management system, which will ensure that the potential of rail transport is fully exploited in the operational processes of the Port of Gdynia. Only a multidimensional approach to a complex transport system in the context of railway traffic management conditions will improve operational processes and thus change the intermodal structure of the modes of transport used with a prioritisation of rail services. As regards economic, environmental, technical and social conditions, rail is characterised by optimal performance compared to road and air transport. The proposed solutions, described in this document, helped to indicate the directions of action in the area of improvement of the railway traffic management system, identify potential development options with specific solutions, both in the area of modernisation of track systems and IT solutions supporting rail transport operations.

The study consists of many analyses that gave us a wider perspective of the determining factors:

- The railway areas of Gdynia Port station and pre-port areas in the pre-investment state, the contact points between Gdynia Port station and the Gdynia Port quays in order to locate the “bottlenecks” of the track system were analysed;
- The Port of Gdynia and its operators were described;
- Infrastructures, superstructures and facilities in the Port of Gdynia were defined and barriers and needs of quay users in to perform capacity calculations and propose modifications in track system were identified;

- As a result of the interviews conducted with the port users, a number of operational barriers hindering the operation of individual operators on the quays of the Port of Gdynia were highlighted;
- Barriers in this area were identified, divided into infrastructure, technical, technological, organisational and administrative and legislative elements that depict a very large number of dysfunctions of the rail system and prevent the full potential of rail transport in the logistics of the Port of Gdynia;

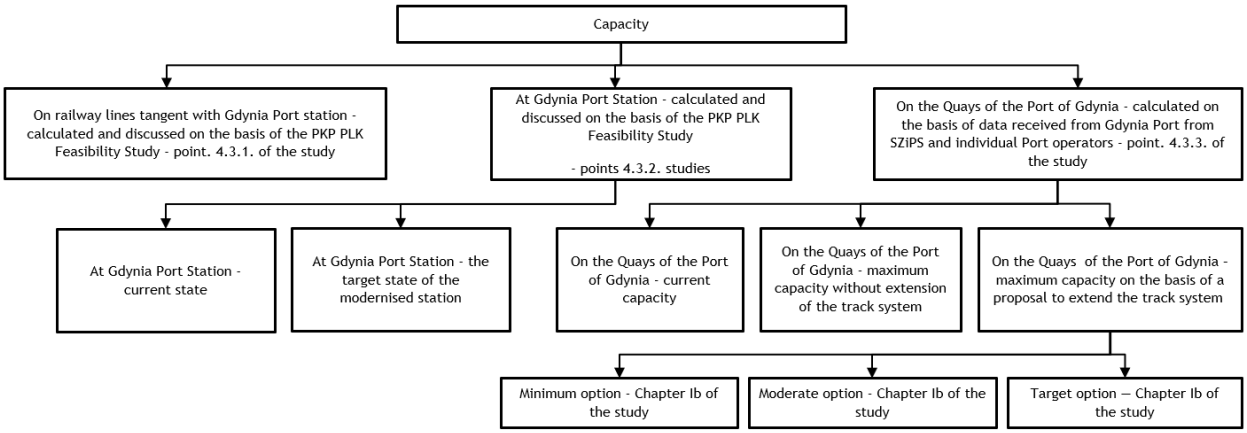
In order to develop a railway traffic management system in the Port of Gdynia, the study suggested different configuration and functionality of the IT system. This will lead to an improvement of the effectiveness of the operation by enlarging the railway traffic capacity and the efficiency of the railway infrastructure and the superstructure of the Port.

In the context of the proposed IT solutions, the railway traffic management system was designed in terms of three options:

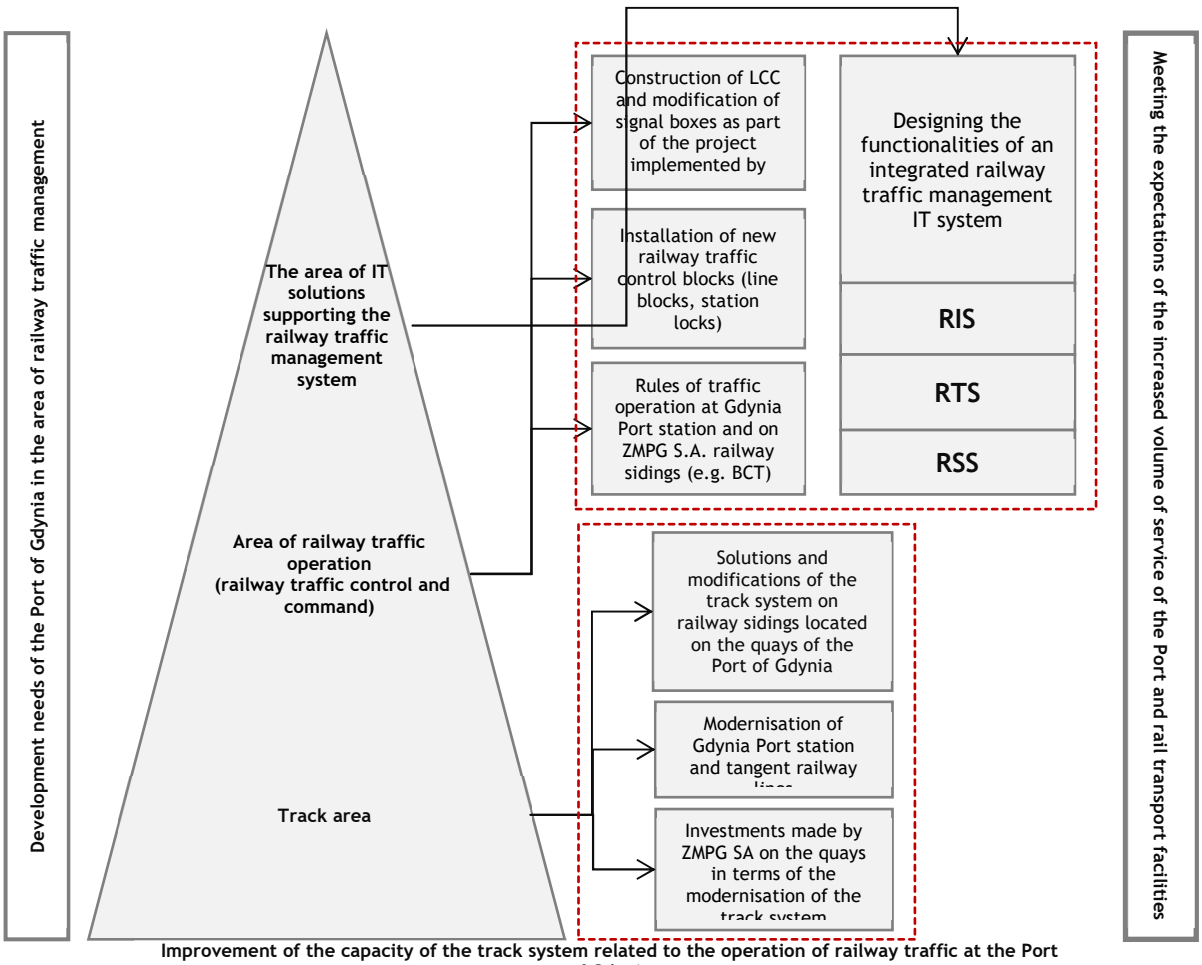
1) Option 1 - building an IT system architecture based on three key IT programmes that together form a comprehensive and coherent system. All three programmes therefore shape that architecture of the IT system. To highlight the programmes, they were given the following original names:
   1. RIS reference model — Rail Integration System,
   2. RTS reference model — Rail Terminal System,
   3. RSS reference model — Rail Siding System.
2) Option 2 - building an IT system architecture based on three key IT programmes, which together form a comprehensive and coherent system, contained in Option 1, extended by SEPE and SWDR/EDR interfaces, operated by the PKP PLK S.A Infrastructure Manager.
3) Option 3 - building an IT system architecture based on three key IT programmes, which together form a comprehensive and coherent system, contained in Option 1, extended by SEPE and SWDR/EDR interfaces, operated by the PKP PLK S.A Infrastructure Manager as Option 2 and extended by the interface between systems related to customs processes. An appropriate interface should be prepared for each of these programmes.

The core variable that determines the capacity and it is crucial to improve the railway traffic in the Port of Gdynia through the implementation of IT solutions, is the handling time. It directly affects the capacity level of the track system. It was assumed to reduce handling time to 80 % of the base time for option 1 and to 70 % of the base time for the second and third options, the value of the technical reserve coefficient $\alpha t = 1$ and the coefficient of uneven train traffic $\beta t = 1.6$. On the basis of an assessment of the functionality of the various options for the implementation of the IT systems, it was assumed that, as a result of the implementation of the functionality of the first option, which consists of achieving the integration of activities related to planning departures of trains from dispatching points (inland terminals, logistic hubs), the integration of activities and the flow of information about the intended arrival at the port (functionality of the RTS system) and other supporting functionalities of RIS and RSS programmes the time of handling platforms would be reduced by 20 %. Since in option 2, the additional information necessary for the planning of the reception of wagons on the quay to unload them is to have, at the earliest possible stage, information on its location and operational difficulties that may affect the completion of train timetables, and as a result of the implementation of this system handling time will be reduced by 30 %. In option 3, the shortening of train handling time at the quay will not change compared to the option 2. As a consequence, reduced handling time will improve the capacity in the area of railway traffic management in the Port of Gdynia.

The diagram used for the range of capacity calculations included in the study.



Proposed model of railway traffic management system at the Port of Gdynia.



Improvement of the capacity of the track system related to the operation of railway traffic at the Port of Gdynia

Functionalities of the proposed systems

No.	System	System functionalities
1.	RIS Rail Integration System	– Registration of wagon formations entering/leaving and all manoeuvres carthey do on the territory of ZMPG S.A. siding – The creation of new railway notification, – Viewing and editing currently open railway notifications, – Viewing the list of registered railway notifications, – Module of handling and reporting dispatching meetings, – Dedicated transshipment statistics, – Transshipment data collection module, – Export of data in Excel and HTML format as well as dedicated summaries and reports, – "Track and trace", i.e. monitoring the current position of the train to be handled on the ZMPG siding, – Visualisation of location information and other information on driven trains.
2.	RTS Rail Terminal System	– Presentation of a plan for handling trains/wagon groups, – Ordering wagon arrivals, – Collecting information on wagons and transshipment containers, – Informing about the current traffic and handling status, – Enabling and acquiring data by: a) user interface (system integration) b) mass upload/download of excel files c) via web-based manual on-screen operation)
3.	RSS Rail Siding System	– familiarizing oneself with the normative acts, – Document repository, – Management of railway siding logistics, – Application of RFID automatic identification system radio technology, – OCR optical character recognition system, – Event management, – Management of repairs and inspections, – Reports, – Mobile version.

3. Conclusions

Pilot action did achieve the expected results; the study conducted as a multidimensional analysis provided many answers regarding: rail infrastructure investment plan (mostly on Port of Gdynia sidings), technical, technological and organisational improvements of the terminal capacity and an increment in transhipment.

All the solutions which affect the management of the railway traffic were directly and indirectly described, including the INCOS software, the SZIPS programme for train notifications and ship calls and the handling of intermodal processes. An IT solution concept was developed, which should be integrated into the interfaces of SEPE 2 and SWDR programmes operated by PKP PLK. The concept of an integrated IT system was designed, which underlies one of the pillars of the railway traffic management system in the Port of Gdynia. The digital platform was built on three IT solutions, where the main advantage of this solution is to simplify the process of information exchange between rail transport stakeholders, and where communication takes place electronically in real time and its results are visible to all the participants. A model of the integration of the proposed IT systems was developed, identifying the different functions, information, interfaces and staff involved in the operation of the digital platform. The project identified the individual information to be circulated and communicated to the individual users, operating staff and communication within the digital platform supporting the railway traffic management system in the Port of Gdynia.

The result of the Pilot action will be the basis for further works on the technical design (including digital architecture, functional and non-functional requirements, components, services and usability) and implementation of the intelligent rail traffic management system. The framework of the next project will consist of three main activities:

1) Pre-feasibility study for an intelligent rail traffic management system (with preparation of assumptions and guidelines for the technical executive designs);

2) Technical executive designs documents including development of the integrated digital platform intelligent rail traffic management system;
3) Final feasibility study for an intelligent rail traffic management system (that includes outputs from technical executive designs documents).

The next steps will be performed in close cooperation and inter-dependence with the system users (future beneficiaries) of the integrated digital platform (governance and approaches for traffic data sharing in common operational environment of the Gdynia Port, addressing data security and data protection issues of the involved private and public stakeholders), including BCT as one of the most efficient terminal operators.