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Port Community System Problems and Challenges – Polish Case Study

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Abstract:

Purpose: *The aim of this paper is to identify the main challenges affecting the implementation and development of the Polish Port Community System (PCS) and to examine the legal, organisational and technological conditions that influence its effectiveness. Particular attention is given to the integration of existing information systems and the coordination of stakeholders involved in maritime logistics.*
Design/Methodology/Approach: *The study adopts a case study approach to examine the Polish PCS model. The analysis draws on a review of PCS concepts and definitions, an examination of the system's organisational and information-exchange structure, and an assessment of the challenges associated with integrating existing systems operated by port stakeholders and public authorities.*
Findings: *The analysis identifies several key challenges to the effective implementation of the Polish PCS: determining an appropriate legal and organisational framework, establishing clear rules for data and document exchange, ensuring information and transaction security, and integrating the PCS with existing public administration systems. The findings also highlight the importance of coordinating stakeholders that operate independent information systems within the wider maritime logistics chain.*
Practical Implications: *The study provides a basis for improving the organisation and implementation of PCS in Poland. It highlights the need to clarify governance arrangements, define data-sharing responsibilities, strengthen information security and develop effective interfaces between the PCS and existing systems. These measures may support better information exchange and cooperation among port community stakeholders.*
Originality/Value: *The paper examines the Polish PCS model from the perspective of coordinating multiple strategically important seaports within a common information framework. Its contribution lies in identifying implementation challenges arising from the coexistence of independently developed information systems and the need to integrate public and private stakeholders across maritime logistics chains.*

Keywords: *Port community system, scope of port community system, micro-pcs of terminal operators, micro-pcs of Customs Authority, micro-pcs of Maritime Authorities.*

JEL codes: *A29, L91, M53.*

Paper type: *Research article.*

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1. Introduction

Seaports nowadays, in addition to their traditional functions, also serve as a logistics and distribution center, and deal not only with the coordination of the transport chain but also the logistics chain. In the past, the development of the seaport and the entities cooperating with it was determined by the development of technical infrastructure (port infrastructure) and the technological level of services provided. However, at the end of the twentieth century, a new factor in the competitive struggle - information infrastructure, which, properly used, has become a condition that determines the rapid and effective exchange of goods (Abt and, Woźniak, 1993).

Information infrastructure in the area of port and maritime trade, has shifted its focus from information infrastructure assigned to a specific entity using it to information infrastructure that connects by its reach and scope the entire community of entities participating in the logistics chain - the Port Community System (PCS).

Port Community System in Europe has a long tradition. The first systems of this type were created in Germany, France and the United Kingdom (there they started in the late 1970's and early 1980's) (EPCSA, 2016). In contrast, countries such as the Netherlands, Spain, Lithuania and Latvia began creating Port Community System at the turn of the 21st century.

The key factors in the establishment of the PCS were both the need to standardize a communication platform to improve cargo movement in terms of punctuality, reliability and cost, and on the other hand the need to improve the competitive position among other seaports. Seaports complexes that have implemented PCS have increased their turnover, by at least 15%, and at the same time reduced the cost of their operation in the transport market and reduced cargo handling time (EPCSA, 2016).

Of particular importance in the operation of the Port Community System is the integration of all participants in port-sea trade, by means of an information system based on computer technology that solves business problems. Port Community System can consist of several integrated information systems.

At the same time, the system is based on cooperation between information systems in cooperating entities regardless of whether they are part of the system of a single enterprise or groups of enterprises, for example - marine container terminals. The mutual cooperation of the stakeholders of port-sea trade within the port community system is based on the two-way exchange of data and information between the stakeholders of the logistics chain.

Despite these potential benefits, the implementation of a PCS is not merely a technological task. It also requires agreement on governance arrangements, the scope and standardisation of shared data, responsibility for information security, and

the integration of systems operated by public authorities and private port stakeholders. These issues are particularly relevant in Poland, where port-related organisations have developed their own information systems and where the proposed PCS is intended to serve seaports of strategic importance within a common framework.

Consequently, the central research problem concerns the conditions that influence the effectiveness of implementing such a system and the specific legal, organisational and technical barriers that may hinder its development. Addressing this problem provides the rationale for examining the Polish PCS as a case study.

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From the perspective of collaborative logistics, the development of a Port Community System represents a transition from the exchange of information within individual organisations towards the coordinated sharing of information resources across organisational boundaries. The participating entities retain their legal independence, operational responsibilities and economic interests, while relying on common arrangements for exchanging information and coordinating port-related activities.

Consequently, the implementation of PCS involves not only the integration of information systems but also the establishment of conditions that enable effective collaboration between stakeholders. These conditions include agreed rules for data access, interoperability, information security, organisational responsibilities and the distribution of implementation and operating costs.

The Polish case therefore provides an opportunity to examine PCS implementation challenges as both technological and organisational problems associated with sharing information resources in a multi-stakeholder logistics environment.

2. Literature Review

The importance of the Port Community System to the development of seaports and the entire port and maritime trade community has been recognized by the European Parliament and the Council of the European Union. As a result, the European Parliament and the Council of the European Union issued a directive on October 20, 2010 on reporting formalities for ships entering or leaving ports of the Member States (repealing Directive 2002/6/EC).

According to this directive, EU member states are obliged to introduce the Port Community System. It is a kind of e-platform that allows faster circulation of documents electronically. The guidelines of EU Directive 2010/65/EU are based on the Convention on Facilitation of International Maritime Traffic adopted by IMO in 1965.

The Port Community System operates under the guidelines of the European Union Commission attempting to create a single digital market in all member countries. Stakeholders of the Port Community System are all entities directly and indirectly involved in port and maritime trade.

As a result of the implementation of the aforementioned directive and the need for real-time data and information, many ports around the world have built and implemented a sector-specific platform for electronic data and information exchange at home. An overview of port community system definitions is presented in Table 1.

Table 1. *Overview of port community system definitions*

Autor	Definition
J. Rodon i J. Ramis-Pujol (2006)	"A Port Community System (PCS) is an electronic platform that connects the multiple systems operated by a variety of organizations that make up a seaport community".
Global Institute of Logistics (accessed on: 17.02.2025).	"Port Community System (PCS) or an electronic platform that connects the multiple systems operated by a variety of stakeholders that comprise a port, or Gateway, community. As defined by Capgemini a Port Community System is "an entity delivering information to supply chains operating in the port".
International Port Community System Association (IPCSA)	"A Port Community System: -is a neutral and open electronic platform enabling intelligent and secure exchange of information between public and private stakeholders in order to improve the competitive position of the sea and air ports' communities. -optimises, manages and automates port and logistics processes through a single submission of data and connecting transport and logistics chains".
Chandra D.R., van Hillegersberg J., (2018)	"a Port Community System (PCS), which is the state of the art in information systems and connects SC actors in port

	environments using inter organizational services".
Smit (2004)	"a central point for an organization to deliver/receive information, as well as to improve the communication efficiency and effectiveness in the port".
Simoni, M.; Schiavone, F.; Risitano, M.; Leone, D.; Chen, J. (2020)	"Acting as a digital platform, a PCS facilitates the intelligent and protected exchange of information between public and private port users in seaport communities, affecting the sustainable business".
Caldeirinha, V.; Felício, J.A.; Salvador, A.S.; Nabais, J.; Pinho, T., (2020)	"It is an effective, real-time, flexible, and complex information system which enables improved efficiency at all stages of the cargo process in the unloading and loading of ships, customs clearance, etc. inside and outside the seaport terminal".
Tijan, E.; Agatić, A.; Jović, M.; Aksentijević, S., (2019)	"The higher the level of collaboration and integration between the port and supply chain stakeholders, the greater the sustainability of both the overall supply chain and the port".

Source: *Own elaboration.*

As can be observed from international literature, the port community system is implemented by the majority of seaports of strategic importance to the country and even the region.

Rodon and Ramis-Pujol (2006) explain port community system as an electronic platform that connects multiple systems used by the numerous organizations that make up the seaport community. IPCSA (2024), on the other hand, defines PCS as a collaborative platform that facilitates the electronic exchange of trade and administrative information, creating a B2B relationship in the port environment.

The European Port Community System Association (EPCSA, 2014) details this definition, defining a port community system as a neutral and open platform that enables the intelligent and secure exchange of information between public and private stakeholders, in order to increase efficiency and strengthen the competitive position of seaports and airports. It should be noted that the definition of port community system places special emphasis on such key elements of the system as openness, neutrality, security and intelligence.

The openness of the system can be understood to mean that any stakeholder in port and maritime trade can join the system after paying an operating fee associated with the maintenance of the electronic platform. The neutrality of the system means that the entity responsible for its maintenance must be neutral, that is, uninvolved in port and maritime trade activities and at the same time guaranteeing that data and information will not be transferred to unauthorized persons.

In the event that the port community system is administered by an entity directly involved in port-sea trading activities, there would be an asymmetry of information,

as a result of which the system operator would have an advantage over its competitors.

Therefore, the administrator of this system cannot be any maritime container terminal, as this is an essential condition for other competing terminals to join the system.

By system security, one means guaranteeing the confidentiality of data and information in such a way that it does not get to unauthorized persons. The intelligence of the system is based on the automation of data processing. In the definition presented does not appear the concept of system reliability, and this is a very important element of its functioning.

The reliability of the system must be guaranteed by its operator, as the port community system must function 24 hours a day, year round. In the event of a system failure, it must be repaired in a very short period of time, as it limits the ability of all participants in port and maritime trade to carry out business operations, and thus can contribute to generating costs.

For the purposes of this study, a Port Community System (PCS) is understood not simply as an electronic channel for transmitting documents, but as a neutral, shared and interoperable platform that supports the coordinated exchange and use of operational, commercial and administrative information among the different public and private stakeholders of a port community.

This distinction is important because an individual electronic data interchange (EDI) connection, a single-purpose application or a bilateral interface usually supports a specific transaction or connects a limited number of parties.

A PCS, by contrast, aims to connect multiple organisations and their existing information systems within a common framework, using agreed data standards, access rules and security arrangements. It can therefore integrate or exchange information with existing sectoral and organisational systems rather than being synonymous with any one of them. The defining feature of a PCS is consequently not the mere existence of electronic data exchange, but the coordinated, multi-stakeholder and governed exchange of information across port-related processes.

The characteristics of openness, neutrality, security and reliability can also be interpreted as conditions supporting the sharing of information resources in collaborative logistics. Openness concerns the possibility of participation by eligible stakeholders, whereas neutrality is intended to protect the interests of organisations that may compete with one another. Security establishes the conditions under which information can be shared without compromising confidentiality, and reliability supports the continuity of inter-organisational processes.

From this perspective, PCS is not merely a technical interface connecting separate information systems. It constitutes a shared digital infrastructure through which participating organisations can coordinate selected logistics activities while maintaining their organisational autonomy. The effectiveness of this arrangement depends on the alignment of technological capabilities with appropriate organisational and governance mechanisms.

The creation of a port community system in many ports around the world has contributed to various solutions for its creation and maintenance. For example, Srour, van Oosterhout, van Baalen, and Zuidwijk (2008) conducted a categorization of typical PCS architecture. Their research focuses in particular on the content of the environment and the activities that led to the development of the port community system in the ten seaports studied. In turn, the research conducted by Rodon and Remis-Pujola (2006) on the established communication system in Spain's seaports, points to the need to integrate various information systems into a central communication platform.

On the other hand, Córdova and Durán (2014) created a conceptual analysis of the solutions of the port community system and developed a set of indicators that enable the development of knowledge management of the main actors participating in this electronic platform. In the results of his research, GIL pointed out the different characteristics of the PCS platforms studied.

In addition, he pointed out that the natural leaders in the creation of the port community system are the Seaport Authorities. It seems that the leadership status of the Seaport Boards is due to the high level of trust of the community participating in the port-sea turnover, due to their high degree of neutrality, as they are non-profit organizations with a high level of trust of the stakeholders of the electronic platform.

In contrast, other authors studying the port community system have focused their attention on the benefits achieved by its users as a result of cooperation. As a result, van de Voorde and Vanelslander (2014) focused their research on cooperation between logistics stakeholders by referring to both vertical integration and horizontal cooperation among its participants. This research distinguished the concept of vertical integration as cooperation between logistics service providers, within a specific supply chain.

Other researchers such as Leitner, Meizer, Prochazka, Sihn, and Wang (2011) focused their research on the integration of services, the sharing of equipment /equipment by cooperating entities and gave little attention to the issue of cooperation within the IT platform. At the same time, these authors pointed out the existence of horizontal cooperation between logistics players, which mainly focus on freight consolidation and the exchange of best practices.

Cruijssen, Cools, and Dullaert (2007) in their research pointed out the benefits

achieved by logistics service operators as a result of horizontal cooperation. Also, Leitner, Meizer, Prochazka, Sihn, and Wang (2011) revised his views on the structural concept of horizontal cooperation, pointing out that the right business strategy and key factors that enable successful cooperation between port and maritime participants.

The indicated literature distinguishes two types of cooperation, that is, vertical and horizontal. At the same time, it indicates that the port community system as an electronic platform integrates both types of cooperation, and thus accumulates the range of benefits achieved by all participants.

As demonstrates in their research, Keceli (2011), Keceli, Choi, Cha, Aydogdu, and Kim (2008) cooperation platforms bring much greater benefits when they are used on a larger scale and bring tangible benefits to each participant in the port community system.

The main benefits achieved as a result of implementing a port community system are streamlining efficiency and strengthening the competitive position of the seaport. Therefore, the goal of the PCS is to integrate the different operating systems of many organizations in such a way that they achieve higher added value and thus increase their competitive position. Once the port community system is developed, the best practices of its implementation and maintenance can be transferred to other sectors of the national economy.

3. Research Methodology

Modern conditions of the economy force seaports to constantly improve their level of competitiveness. Without this, they are unable to survive and develop in today's uncertain, volatile and unpredictable environment. As a result of these processes, both in management theory and practice, new concepts are being developed to support managers in managing seaports.

Practice verifies their usefulness, and the leading ones quickly find followers and become popular and are implemented around the world. One of the more well-known and recognized is the port community system.

The main objective of the study is to investigate the determinants of the implementation of the Polish port community system and to identify the problems of its implementation. In order to correctly implement the process of scientific inquiry, the following research problem was formulated:

What specific determinants accompany the process of implementation of the port community system in Poland, and which affect its implementation to the greatest and which to the least extent.

In connection with the primary purpose of the work, a research hypothesis was formulated, an aid to solving research problems of an empirical nature. In Poland, there are factors that positively and negatively affect the implementation of a central (national) port community system for all seaports of strategic importance.

In order to answer the research problem and verify the hypothesis put forward, the author conducted a survey in 2024, among the Seaport Authorities responsible for the implementation and development of the port community system.

General methods of logical inference, such as analysis and logical construction, as well as deduction, induction, analogy and reduction, were used in the results development phase. However, the main pillars of the study were: self-observation and a categorized interview conducted with managers responsible for the establishment and operation of the Polish port community system. The concept of the study was designed and implemented in accordance with the spirit of research studies characteristic of this type of research.

The empirical component of the study was based on information collected in 2024 from seaport authorities involved in the implementation and development of the Polish PCS. The study also drew on the literature on port community systems, relevant legal and policy documents, and publicly available information about the Polish PCS. These sources were used to establish the institutional and technological context for the case analysis. The empirical evidence should be distinguished from contextual information obtained from documentary sources.

The material was analysed using a qualitative case-study approach. First, the literature and documentary material were reviewed to identify recurring issues associated with PCS implementation.

Second, information obtained through self-observation and categorised interviews with managers responsible for the system was examined in relation to the research question.

Third, the findings were organised into thematic categories covering legal and organisational arrangements, data and document exchange, information security, and integration with existing public and private systems.

The categories were then compared across the available sources to identify converging observations and areas requiring further investigation. This procedure supports a structured interpretation of the case; it does not, by itself, establish statistical relationships or causal effects.

The study has also same limitations. The findings should be interpreted in light of several limitations. The analysis concerns the Polish PCS and therefore reflects a specific national and institutional context; its conclusions cannot automatically be

generalised to all port systems. The empirical material was collected in 2024 and reflects the information available at that time.

In addition, the evidence relies on a limited group of stakeholders directly involved in the system, together with self-observation and documentary sources. The perspectives of all PCS user groups may therefore not be represented equally, and some observations may be influenced by the position of the participants.

Finally, unless supported by independently verified performance data, the study identifies perceived determinants and implementation challenges rather than measuring their relative impact quantitatively. These limitations indicate the need for further research involving a wider range of stakeholders and, where available, operational performance indicators.

4. Research Results and Discussion

4.1 Diagnosis of the Seaport System and Problems with PCS Implementation in Poland

In a developed port system, a fundamental problem and at the same time an asset is the creation by major players of their own micro port community system. As a result, such players as container terminals, customs authorities and maritime authorities have their own created systems through which they communicate with their broad stakeholders. Container terminal operators have created their micro pcs based on their operational terminal systems (TOS), called here terminal community system, see Figure 1.

Figure 1. *Micro PCS of Container Terminal Operator (Terminal Community System)*



Source: *Own study.*

As can be seen in Figure 1, with the help of TOS there is a flow of data and information between its many users. The container terminal operating system is assigned to a specific user by logging into the system. For example, a user, after logging into the TOS system, can search for a single container and cargo, or get a list of all containers and cargo released to a particular customs agency, at the same time he can get information about the release of single containers and cargo by the Customs Agent.

This operating system provides information on: the date of entry and exit of the container/cargo from the container terminal, its seal, status, customs clearance number, type of customs detention, DSK number and many other relevant information about the container/cargo, indication of containers in the terminal yard.

At the same time, assigning a code to the Customs Agency allows it to access the container card and allows the use of simplified clearance procedure. It is also possible to assign the container card to the Customs Agency account by the Forwarder.

The Container Card allows the system user to check all container data. It contains information such as the container's entry and exit date, weight, seal, status, customs clearance number or type of customs detention, and much more. The Container Card is visible only when a container is released to a particular Customs Agency.

The container card contains such information as: container number, ISO type, symbol of occurrence of damage; its status - full/empty, name of operator, weight; transit - category (export, import, storage), indicated port of discharge, trip number, date of entry and exit of the container from the container terminal; description of goods, net weight, details of dangerous and oversized cargo; type, location and degree of damage (light, serious); source of information in the system; cargo declaration clearance numbers, container history; internal operational information; seals and general information about the container; clearance number can be assigned collectively to a group of containers or a single container. Once the above steps are completed, the container will be cleared.

At the same time, the status of containers and cargo under import and export is determined by the following cooperating entities: Customs, Shipping Line, Container Terminal, Veterinary Sanitary and Epidemiological Inspection, State Plant Protection and Seed Inspection, Inspection of Commercial Quality and Agriculture and Food Products, Fisheries Inspection (Klopot and Miklińska, 2016; Marek, 2017). All import containers that have not been released by the Shipping Line; release occurs when the terminal receives a PIN from the Shipping Line.

In turn, when a forwarder logs into the system and enters the password assigned to him, he can perform numerous operations related to organizing container and cargo handling operations located within the administrative boundaries of a marine

container terminal. Within this system, the forwarder can search for a single container or a list of all containers released for a given forwarding, view bills of lading, make advisories of export and empty containers, make bookings, and make a list of additional orders for cargo, such as issuing bills of lading, submitting a list of pledged general cargo takings, and a list of cargoes in the general cargo warehouse located at the marine container terminal.

At the same time, the container card contains all relevant information about the container and the cargo in it. In particular, this information includes: container number, date of entry and exit of the container/cargo, name of the container operator, seal, customs clearance number or type of customs detention, DSK number, storage order assigned to the container, storage order number assigned by the system, and a lot of other relevant information to better organize the handling of the container and/or cargo within the administrative boundaries of the marine container terminal.

At the same time, the container terminal's operating system allows the shipper to create his own list of containers/cargoes that he is currently interested in. The Container Card is visible to the forwarder when a container is released. The Container Card is divided into sections that provide the user with numerous information about the container, its equipment and cargo.

Container information: container number, ISO type, damage incidence symbol, status - full/empty, operator name, weight, booking, storage orders placed and numbers assigned to them, hazardous cargo classification; categories (export, import, storage), port of discharge, trip number, date the container entered and left the marine container terminal.

Equipment information: container number, ISO type, degree of damage, description of goods, their net weight, details of dangerous and oversized cargo, type, location and degree of damage (light, serious),source of information in the system, declared cargoes - several customs clearance numbers, container history, internal operational information, seals and general information about the container.

At the same time, containers and general cargoes that have been previously booked into the terminal's operational system can enter the marine container terminal. Advising of export containers is done automatically by sending information about the given booking by the Shipping Line directly to the terminal system. The forwarder does not perform any system activities related to container advising.
In this case, the forwarder only needs to provide the container and booking number to the driver. On the other hand, the deposit of an empty container does not require additional notification. The exception to this is the deposit of an empty container that enters at marine container terminal by rail, as the forwarder must manually advance the container in the TOS.

The forwarder can also make advisories of general cargo in various transhipment relations. As a result, transhipment in the relation:

- truck-warehouse-container,
- truck-container can be carried out.

Transhipment in the relation truck - warehouse - container consists of the following activities:

In order to deposit general cargo at the CFS warehouse in the truck - warehouse relation, the shipper should announce the cargo in the form of an email to the terminal operator, providing the following information: date of cargo deposit, quantity/volume/weight of general cargo, packaging unit, bill of lading number.

The indicated flow of various data and information between the terminal operator and its stakeholders illustrates how these business entities have greatly developed their businesses based on developed information systems.

The Tax and Customs Authorities have also developed their own unique IT and information systems, which can also be described as micro pcs – Customs Community System, through which they communicate with various stakeholders.

A paper customs clearance documentation is becoming a thing of the past, and electronic documentation is becoming the basis. At present, there are many users of the information system created by Tax and Customs Authority, as shown in Figure 2. The Customs information system is based on the unique - dedicated information program. It is oriented towards the implementation of terminal single window and one stop shop (Marek, 2018).

The first solution is focused on the marine container terminal, within this system the terminal operator manages and records containers entering, storing and leaving the temporary storage warehouse located within its administrative boundaries.

Within the framework of this information system, other inspection services can carry it out against the designated container. This allows other inspection services to annotate the inspection of the container and any decision to assign the correct destination of the goods.

Records of the decision are carried out online by all inspection services. As a result, the importer, exporter, shipper, logistics operator and other interested participants in the port and sea trade receive information in real time. This type of information flow creates the possibility to make a notification taking into account all data and information obtained from all control services.

The one stop shop formula, on the other hand, focuses on carrying out inspections by

all concerned services at the same place and time. Most often, at marine container terminals, one inspection location is designated and the inspection time by all inspection services is 1 hour.

The shipper, when placing an order for the cargo to be inspected by a particular inspection service, applies to the relevant Customs Office for permission to transport the container to the designated inspection site and at the same time orders the terminal operator to carry out these activities. It should be noted that the inspection site within the administrative boundaries of the marine container terminal must be clearly marked and no terminal operations on stored containers may be carried out there.

This inspection involves both the shipper/logistics operator, a representative of the container terminal operator and relevant officials of the inspection authorities. Concentration in one place of all interested participants in the port-sea trade allows efficient handling of cargo made available for inspection, supervision of cargo during the inspection.

Particularly important is the participation of a representative of the marine container terminal operator in the process of inspecting the container and the cargo in it because the operator of the temporary storage facility is responsible for the condition of the cargo in it (Marek, 2018).

Figure 2. *Participants of the Tax and Customs system (Tax and Customs Community System) in Poland.*



Source: *Own study.*

The presented flow of information between the controlling entities and the forwarder and the operator of the maritime container terminal contributes to improving the efficiency of the flow of containers in the entire transport and logistics system. The forwarder submits a notification for control through the terminal single window and receives the control results through it.

In turn, the operator of the maritime container terminal, thanks to the quick control of the container in the temporary storage warehouse, can carry out its intra-terminal operations more effectively. The average time from the arrival of the container to its release is about 3-4 hours. Thanks to this, the operator of the maritime container terminal can better manage its dwell-time, which shapes its competitiveness in relation to other operators of maritime container terminals, as well as its operational profitability.

At the same time, the logistics operator, who manages the flow of containers, related information and cash flows, decides to remove the container from the maritime container terminal. Of course, such a decision by the logistics operator is based on the economic calculation of its client and can be implemented in the just-in-time concept, where containers can be taken from the temporary storage warehouse depending on the needs of the importer (e.g. manufacturer, seller, etc.). This means that, depending on its logistics concept, the logistics operator can keep containers in the temporary storage warehouse for 45 days, because until then it does not have to pay customs and tax duties.

Customs agents and AEO agents are authorized to use simplifications in the scope of customs controls concerning security and protection and/or simplifications in the application of customs regulations. However, in the case of selecting an inspection of a container cleared by a customs agent or an agent with AEO authorization, such a container inspection is carried out as a priority.

The shipowner or maritime carrier submits a loading manifest to the Tax and Custom Authority, which contains all the necessary information regarding the goods and the container. Based on the loading manifest, the customs services conduct a risk analysis and, depending on the risk assessment, prepare reactions and methods of checking the container and the cargo contained therein.

The importer, knowing that the cargo being transported does not require control by services other than customs, may submit a declaration for customs clearance of the container before its arrival at the maritime container terminal.

This type of procedure is called clearance at sea, because the declaration for clearance of the goods is submitted to the Customs Office when it is still physically on the ship at sea (Marek, 2018).

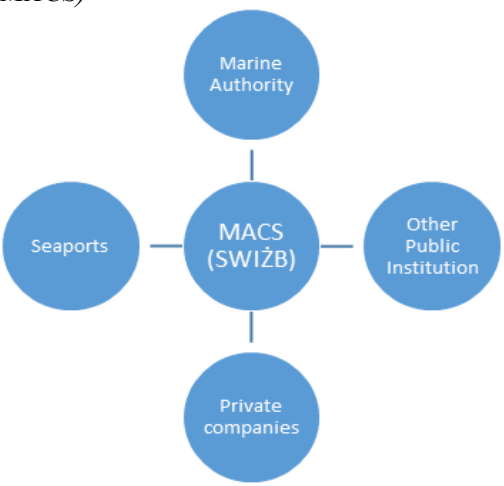
After the arrival of the container ship and unloading of the container at the maritime

container terminal, a message about the customs presentation is sent electronically to the customs system. If the customs office has no objections, the container and the goods are automatically released by the customs system for the free circulation procedure within the European Union. Maritime Authority also has their own system solutions that also enable them to communicate with their stakeholders, creating a kind of micro PCs.

Figure 3 clearly demonstrate the wide range of stakeholders who are within the existing Maritime Authority system. The stakeholders and the main tasks of the system identified here are based only on the interviews with persons employed by the Polish Marine Administration Authority.

In reality, a much wider range of stakeholders and theirs tasks have been described in the system. Unfortunately, many of the system stakeholders' use it's from time to time (Marek, 2016). Exchange of data and information is run by the following public and private organization, see Figure 3.

Figure 3. *Micro PCS of Polish Maritime Authorities (Maritime Authorities Community System - MACS)*



Source: *Own study.*

Table 2. *Classification of state and private entities participating in the Maritime Authorities system in Poland*

Seaports	**Government**	**Other Public Institution**
Gdansk seaport	Ministry of Maritime Economy and River Transport	Centrum of Navy Operation of Polish Marine
Gdynia seaport	Gdynia Marine Authority	Centrum of Pomeranian Crisis Management
Szczecin and Swinoujsce seaport	Szczecin Marine Authority	Marine Mobile Group of Customs Administration
Hel seaport	Slupsk Marine Authority	Centrum of Survey Radio

		localization
Wladyslawowo seaport	Gdynia Harbour Master Office.	National Coordinator of Navigation Protection
Leba seaport	Ustka Harbor Master Office.	
Ustka seaport	Darlowo Harbor Master Office.	
Darlowo seaport	Gdansk Harbor Master Office.	
Kolobrzeg seaport	Hel Harbor Master Office.	
Trzebiez seaport	Wladyslawowo Harbor Master Office.	
Swinoujsce seaport	Kolobrzeg Harbor Master Office.	
Dziwnow seaport	Trzebiez Harbor Master Office.	
Elblag seaport	Swinoujscie Harbor Master Office.	
	Dziwnow Harbor Master Office.	
Private companies*	Wladyslawowo Harbor Master Office.	
Marine pilots	Elblag Harbour Master Office.	
Tugs companies	Special departments of Marine Administration	
Crewing companies		
Marine training companies		
Shipowner's agents		

Note: **Private companies are passive stakeholders of SWIBŻ system. For example shipowner's agents may only put data into the system and no more. Crewing companies and marine training companies may put data or check some information in data base of PHICS. Data put into the PHICS are automatically collected, processed and transmitted by SWIBŻ system to some stakeholders whose has decision-making powers. Marine pilots and tugs companies are not interesting in using the SWIBŻ system (Marek, 2016).*
Source: *Own study.*

Many data and information as well as connection among public marine institution and some private organization just exist in the closed informatics system. Maritime Authority information system like any other management information system is primary a tool to increase the present and future efficiency of the stakeholders, to utilize resources more effectively to reduce costs of traditional documentary flow.

Comparing this advanced system with the traditional manner of data collection and processing, the benefits achieved are obvious. The scope of data reporting is enlarged and a faster processing is possible, that means more and more actual facts concerning vessel traffic, cargo traffic and passenger traffic will be continuously a the disposal of the management.

Besides status reports based on data and information in stock which can easily reduce to essential, re-grouping etc. special figures can be compiled with view to monitoring and controlling. Hence the author recommended to the Maritime Authority system should be used in creation a polish port community system

because it gives many opportunity and besides of this save money and time for company who will be create the information system.

As can be seen, many public and private entities have their own extensive systems, through which they communicate with their stakeholders. With the help of these systems, the major public and private players in the seaport area have created specific and unique information and IT systems that act as a community system.

On the one hand, micro pcs created by separate entities constitute a serious challenge for the construction of a central port community system, this concerns the issue of convincing private participants of the benefits of functioning within a single operating system pcs, as well as operational systems, especially when it comes to private entities, because most often container terminal operators are not owners of operating systems, but use them on the basis of a purchased license, so any changes to the operating system are both capital-intensive and time-consuming.

The advantage is that these participants have extensive IT units, and it is easier to conduct talks at the operational level about including their system solutions within the central port community system.

Organisational model of the Polish PCS. The Polish PCS differs from the conventional port-specific model because it is intended to provide a common information framework for the three seaport authorities of strategic importance: Gdynia, Gdańsk and the Szczecin–Świnoujście port complex. According to the model described in this study, the three port authorities established a capital company that acts as the PCS operator.

This arrangement separates the system's operational management from the individual activities of the participating organisations and provides a dedicated entity responsible for developing, implementing and maintaining the platform. The model also requires cooperation between public port authorities, private terminal and logistics operators, carriers, shipping agents and public administration bodies.

The operator's role is therefore not limited to maintaining software: it also involves coordinating participants, managing access to information, agreeing data-exchange rules and supporting the integration of systems that remain under the control of their respective owners.

Implementation problems arising from the model. The same features that make the Polish model distinctive also create implementation challenges.

First, the participating organisations have different responsibilities, business priorities and decision-making procedures, so agreement on governance, financing, service levels and responsibility for data quality may be difficult to achieve.

Second, many stakeholders already operate their own information systems, including terminal operating systems and systems used by customs and maritime authorities. Connecting these systems requires compatible data formats, stable interfaces and clear rules for access, security and accountability; it does not necessarily mean replacing the existing systems.

Third, private companies may be reluctant to fund or modify systems that they do not own, particularly where changes require licence-holder approval, specialist work or operational downtime.

Fourth, sensitive commercial, operational and regulatory data create concerns about confidentiality, cybersecurity and the permitted use of information.

Finally, the benefits of a common platform depend on active participation and consistent data provision by the different stakeholders. If some organisations do not join, provide incomplete data or use incompatible procedures, the overall value of the network may be reduced.

Analytical implication. For this reason, the Polish PCS should be assessed as both an information-technology project and an inter-organisational governance arrangement. Its implementation depends on the alignment of the operator's responsibilities, stakeholder incentives, legal requirements, technical interoperability and data-security arrangements.

These dimensions provide a framework for interpreting the implementation barriers identified in the Polish case. The description should not be read as evidence that every listed challenge has the same severity; their relative importance requires confirmation from the empirical material and the views of the stakeholders examined in the study.

4.2 Legal and Organizational Forms of the Port Community System

The creation of a port community system is inextricably linked to the definition of the legal and organizational form of the operator. The choice of the form of the port community system operator is, on the one hand, the effect of the conditions and good market practices within which the future system operator is to operate, and on the other hand - the effect of the concept adopted and outlined by the initiators-owners.

Undoubtedly, the legal and organizational form of the port community system operator is directly related to the type of local organizations (stakeholders) supporting the development of this system.

Taking into account the ownership criterion, the following legal and organizational forms of the port community system operator can be distinguished:

- private;
- state;
- mixed.

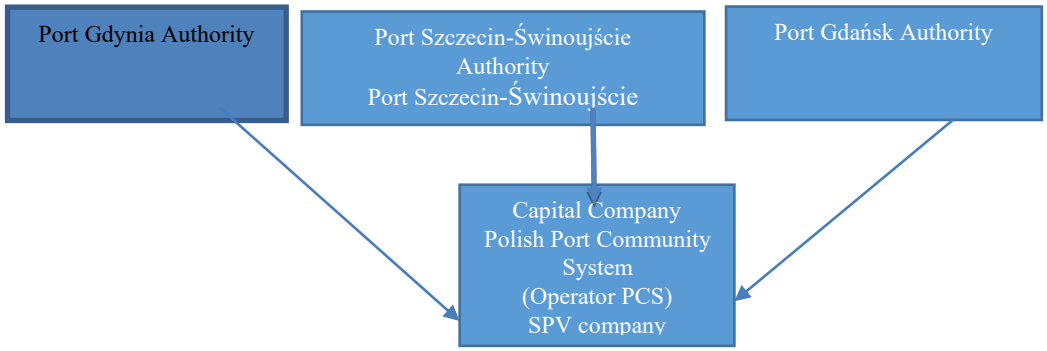
The first legal and organizational form involves the establishment of a private enterprise - the system operator, which is responsible for its creation, implementation and maintenance. Most often, the PCS operator is organized as a capital company. In this case, the port community system is created as a grassroots initiative, although it has broad support from the main stakeholders of this system, i.e., the Seaport Authority, sea and land terminal operators, shipping companies, customs office, maritime office and other important players operating in the port and sea environment.

In some seaports, the development of the port community system is also supported by private business associations (e.g., chambers of commerce) and financial institutions (including commercial banks and insurance companies). In Poland, the Port Community System was created on the basis of a special purpose vehicle – a capital company established by three entities.

The Polish port community system serves all three Polish ports of strategic importance for the national economy, i.e.: the Seaport Authority in Gdynia, the Seaport Authority in Gdańsk and the Seaport Complex Szczecin Świnoujście, Fig. 4. Seaport authorities are public entities, subordinate to the relevant state ministry.

The creation of a Polish port community system by a state entity is a top-down initiative undertaken by the relevant state body - the sectoral ministry, through the seaport board. The established special purpose company acts as the system operator, i.e. it creates, implements and maintains the port community system. Let us note that in the traditional sense, in other countries, each seaport has its own port community system.

Figure 4. *Structure of the Polish port community system.*



Source: *Own development.*

In Poland, through the adopted company and the involvement of all three strategic Seaport Authorities in the creation of one central port community system for all ports, we are dealing with a solution unprecedented on a global scale. This type of solution creates better operational possibilities for all stakeholders involved in seaports and for central authorities in the field of control and obtaining real-time data and information on all cargo, passengers and processes passing through Polish main seaports.

As can be seen, the exchange of information between participants is carried out by means of a specially established special purpose vehicle (SPV). The SPV must manage information for the users of the port community system. Information management should include: generating information, collecting information, storing it (remembering, archiving, storing), transferring, processing, sharing, interpreting information and using information.

Therefore, the costs of information management will be borne by the port community system, and the costs of its maintenance will be distributed among the entities participating in this information system. In the Polish solution, PCS adopted a radial structure of information flow between participants.

The radial structure of the port community system is presented in Figure 5. As can be seen, the exchange of information between participants is carried out by means of a specially established special purpose vehicle (SPV). The SPV must manage information for the users of the port community system. Information management should include: generating information, collecting information, storing it (remembering, archiving, storing), transferring, processing, sharing, interpreting information and using information.

Therefore, the costs of information management will be borne by the port community system, and the costs of its maintenance will be distributed among the entities participating in this information system.

The created Polish company PCS acts as an operator, which deals with the administration and maintenance of the Port Community System, where PCS is the business basis of this organization (Polski PCS | digitalizacja usług portowych, access: 15.04.2025).

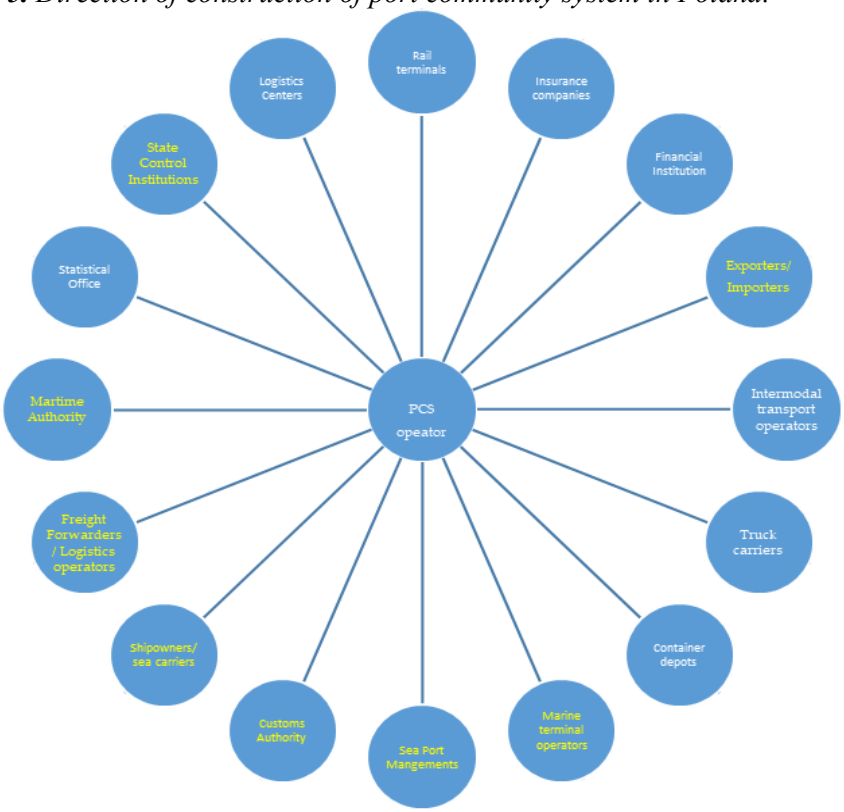
5. Conclusion

For greater analytical clarity, the problems identified above can be grouped into three interrelated categories:

- The first is the legal and governance barrier, covering the choice of organisational and legal form, the allocation of decision-making powers, and the rules governing cooperation among public and private participants.

- The second is the data governance and security barrier, involving the definition of data and documents to be exchanged, access rights, confidentiality, and the protection of transactions and information.
- The third is the interoperability barrier, arising from the need to connect the PCS with systems already used by port community members and public administration.

Figure 5. *Direction of construction of port community system in Poland.*



Source: *Own study. Entities currently operating in the Polish PCS are marked in yellow.*

These categories are connected: decisions about governance influence data-sharing rules, while both affect the feasibility and cost of technical integration.

The findings suggest that PCS implementation should not be treated solely as an IT deployment. In practical terms, the participating organisations should first agree on a governance model, responsibilities, decision-making procedures, and sustainable financing; then establish common data definitions, access rules, security requirements, and service-level expectations; and subsequently plan the integration of existing systems in stages, with clear responsibilities for testing, maintenance, and incident response. This sequence can help reduce uncertainty, duplication of effort, and resistance to data sharing.

For port managers, the key task is to align operational needs and incentives across the port community while maintaining the autonomy and legitimate interests of individual organisations. For policymakers and public institutions, the practical priority is to provide a clear and compatible regulatory environment and workable interfaces between administrative systems and the PCS.

The relative importance of each barrier should, however, be interpreted in line with the empirical evidence collected in this study; the categories presented here are an analytical synthesis of the issues identified, rather than a quantitative ranking of their impact.

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