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AN INTEGRATED PORT COMMUNITY SYSTEM CONNECTED TO THE WORLD: ADDING VALUE AND SAVING TIME

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ABSTRACT: Port Community Systems play a key role in port industry by integrating and connecting the involved actors, modernizing and speeding up the processes, adding value to the port services and as a consequence increasing port community efficiency. Most ports have developed such IT community systems but still few of them have at their disposal a fully efficient, modern and integrated port community system opened to the world. The development of an integrated Port Community System providing the port stakeholders and customers with as many automatic and effortless services as possible is a key factor of competitiveness and success in the port industry, as it smoothens and homogenizes procedures, saves valuable time and makes the port more attractive to customers. This modern concept of community system will be analyzed in the paper as well as its added value on port services and its impact in terms of time reduction and hence, on costs.
Keywords: port community systems, port efficiency, information systems, quality services, time reduction, port competitiveness.

INTRODUCTION

Relations among the different actors of a port community are often both complex and complicated and may jeopardize the efficiency and profitability of a port. This main obstacle to port efficiency can only be solved through the adoption of a modern and as integrated as possible community information system. In fact, IT systems and procedures used by port actors use to be partially unconnected and unstandardized, and the port processes along the supply chain are inefficient and even in many cases still manual. If we think of mega projects, we think of mega-ports with a constant growth of traffic and a permanent increase of traffic-related services and also land transport. Mega port projects cannot be viable without a widely integrated and state of the art port community systems.

This paper is intended to analyze the above described topic in the framework of main ports (equivalent to mega projects) and it is mainly based on the successful process of integration achieved by the Port Authority in Valencia through its Port Community System[1]. The paper is structured into two main sections. The first section analyses the concept of *Integrated Port System connected to the world* in order to clarify what it is exactly meant by *integrated* and by *connected*. An evolution perspective of how a port is getting integrated and connected while it

is growing is given in a first sub-section while a second sub-section illustrates a state-of-the-art port community system model. Instructions on how should a Port Authority proceeds to move from one stage to another are given. In subsequent subsections, the paper presents the services that the author regards as essential to be integrated in the port community system to make it competitive, describing them in four sub-sections linked to land, maritime, port and horizontal services. In the second main section, the paper focuses on the added value brought by the integration and opened connection of a Port Community System. Both qualitative and quantitative benefits are addressed. As the scope and size of this paper would not allow for a full detailed analysis of cost reduction, the paper will focus on the reduction of cost through time cuts in two decisive operations in ports, the trucks at the gates and the customs procedures.In fact, although the direct economic impact of a Port Community System is difficult to evaluate[2], due to its complexity and the number of involved stakeholders, as we all know, time is money.

AN INTEGRATED PORT SYSTEM CONNECTED TO THE WORLD

Evolution Stages

In comparison with the common Community System concept, anIntegrated Port Community System connected to the World is a more ambitious concept with a wider scope. It goes further in its objectives and also in its use of technologies. The result of such a full integration is a port system connected to all the port stakeholders, including maritime and land actors.

From an evolution perspective, the system that enables connecting the port to its users, customers and stakeholders usually goes through several phases, generally at the same time that the port itself is growing. The primary stages in the process of innovation undertaken by a Port Authority are usually the Isolated Port and the Connected Port.

The first phases is the Isolated Port whichworks on various information management systems. Both the Port Authority and the leading companies in the sector start to computerize their internal processes but it is still a non-connected environment and the efficiency in port operations is still very low. During the second phases, which we call the Connected Port, there is a high interest in implementing electronic data interchange (EDI) procedures. The existence of bottlenecks are strangling the port's growth possibilities. At this stage, the port procedures are characterized by the following common features: i) a private company presents documents or declarations to one or various public authorities, ii) the same or similar information must be given to several authorities, iii) authorization is required from some of these administrations, which are by no means granted immediately, iv) all these procedures are based on presenting documents in paper format at a window, v) all the information have to be manually incorporated into the public authorities' information systems.

By way of illustration, in the case of the Port Authority of Valencia, at that stage,three single windows for the following procedures were used: i) summary declarations and bills of lading: presentation of summary declarations and bills of lading to Customs and the Port

Authority, ii) call requests and reporting formalities for vessels in port: presentation of port call requests to the Port Authority and the Maritime Authority (Harbor Master) and other organisms that require information regarding the arrival of a vessel to port (police, customs, port services...), iii) dangerous goods notification: declaration of dangerous goods onboard a vessel and the notification of arrivals and departures of dangerous goods to the Port Authority and Maritime Authority (Harbor Master). The aim of these three single windows created was to simplify the administrative procedure of presenting the required documentation to several authorities and obtaining the relevant authorizations from them and to tighten the control and improve the quality of the data presented by declarants.

After the connected port, the next logical step, that is, the third phases, is the Port Community. In keeping with the ongoing process of improvement, a Port Authority comes to the natural conclusion that a tool is required to attend the main information exchanges in the Port Community. In most cases, the problem is extremely complex and cannot be solved by means of individual tools and projects. To this end, the Port Authority must undertake a deep analysis of the port procedures in export and import operations of containerized goods, gather the best practices that are being developed worldwide to ensure it will use a state of the arte system and finally it must start working on the concept of a Community Information System (SIC).

This information system must encompass all the work flows between the various members of the port community, including export, import and transfer procedures. On covering work functions, information became continuous, that is, all the data and documents were mutually linked following a work procedure.However, despite overcoming many bottlenecks at the time and adding value to port activities, the rigidity of the system by work flows prevents utilization from extending when this planned flow was interrupted for various reasons.The SIC lays the foundations and paves the way to an opened and fully integrated Port Community System, which is the last stage on the evolution cycle of the port. This fourth phases will be analyzed in the next section. The figure 1 shows how this evolution cycle happened in the specific case of Valenciaport.

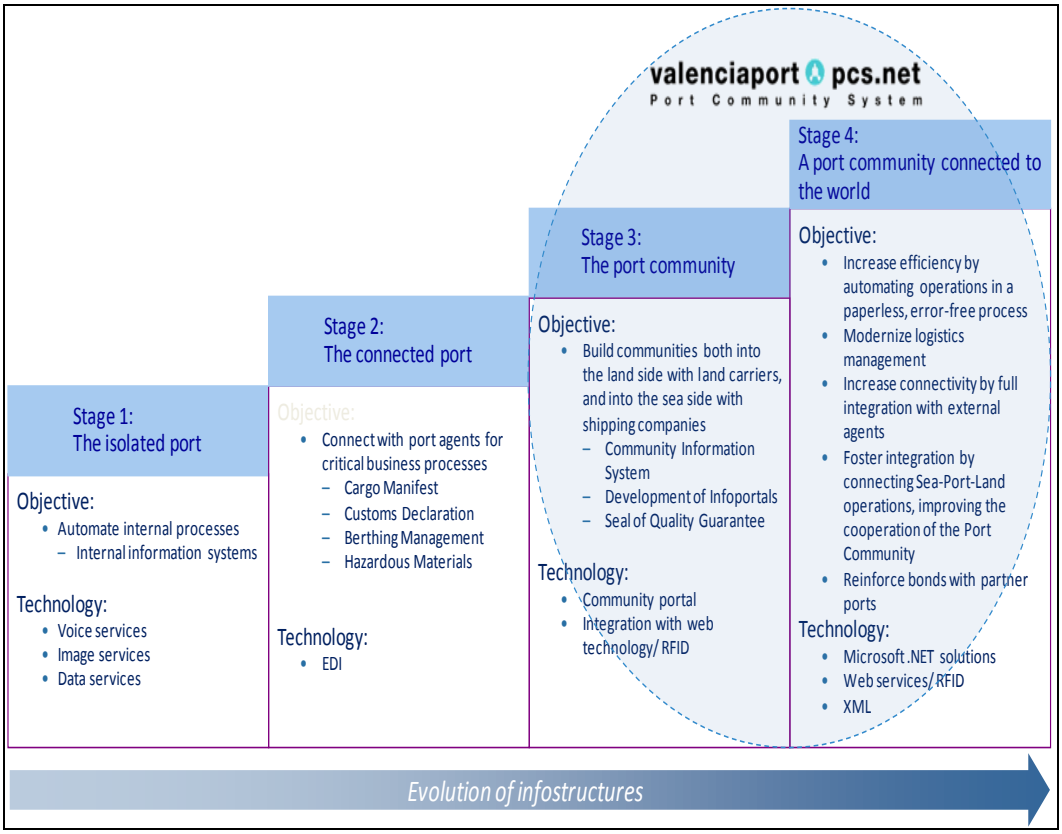

Figure (1) The evolution of the Port Community System from an Isolated Port to a port connected to the world

The Port Community connected to the world

The fact that a port is connected to the global supply chain means that some bottlenecks cannot be removed by one sole Port Community. For this reason, a port must build a more ambitious community project. A whole Port Community System fully integrated with all port actors, either internal or external. The decision to embark onthis kind of last generation PCS must emerge from a wide Strategic Plan at Port Authority level to ensure that the investment needed will be profitable, and from a long and deep reflection on the current situation of the port and where it is heading.Part of this analysis must address the use of ICT in the Port Community, focusing on the degree of commercial implementation, future growth capacity and, of course, the value that the information system contributes to the Port Community. The key elements that need to be improvedat this stage to evolve from a Port Community to an Integrated Port Community System are mainly four: i) efficiency: greater functional flexibility in procedures and faster incorporation of new functions, ii) integration of systems: easier integration of user systems into the platform by means of a versatile, fast and reliable message system, iii) connectivity: possibility of connecting beyond the Port Community and simple migration of users from the original system to the new system, iv) modernization: more versatile interface adapted to the characteristics of documents and business.

As a result, an integrated port community connected to the world is designed to procure services aimed at speeding up trade, operating and administrative procedures in the Port Community, constituting a mainstep forward within a Port Authority's commitment to enhancing competitiveness.The services provided are aimed at making the operating processes used by the Port Community companies a lot easier and constitutes a clearcommitment to make these companies more competitive. Besides, the fact that the Integrated Community System must covers business and operating transactions for sea, port and land operations constitutes yet another step forward in the evolution of port information systems. The figure 2 illustrates the services that an Integrated Community System should include to be fully competitive.

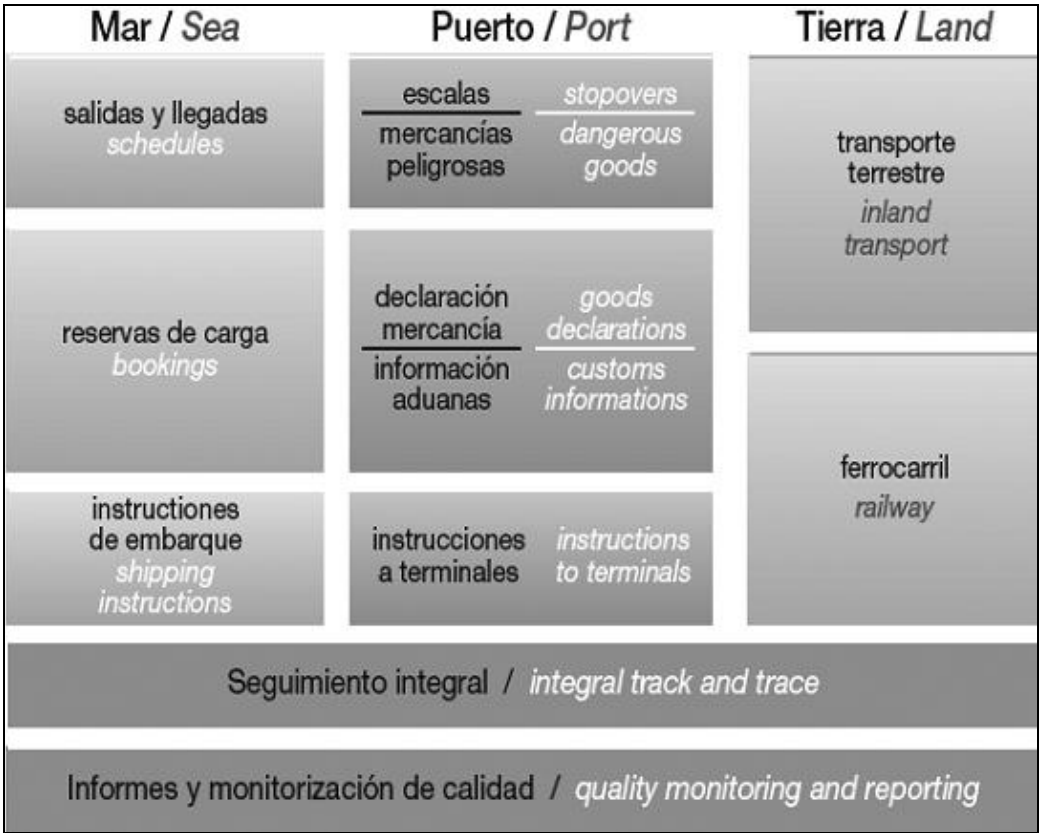

Figure (2) Services included in an integrated port community system

As most ports first develop a PCS focused on delivering competitive services to port users, the main extra value of the integrated PCS is to integrate services aimed at maritime and land actors. Figure 2 shows the main services to be included in sea, port and land operations.

Sea Services to include in an Integrated PCS

Integrated PCS has enlarged the traditional Port Community System concept by adding services related to ocean transactions and carriers. It must be integrated with the world's major

ocean carriers through the most advanced technologicalplatforms. The services of these platforms will be brought together, thereby offering a single gateway to the world's main carriers. This service provides the clients of the port with a single source of information on the ocean carriers that best suit their transport needs based on the frequency of departures and/or transit times.Among other, the Integrated PCS must offer: i) departures and arrivals / schedule: a single source of information about the world's leading carriers' departures and arrivals from and at the port. This service will be a unique source of information enabling the port customers to find out which carrier's suit their transportation needs best according to departure schedules or transit times. ii) booking: freight forwarders can ask carriers to book space for the containers they wish to send and receive the corresponding confirmation.After sending their booking,users must immediately receive the ocean carrier booking numbers and can also check the status of their shipments in real time. iii) shipping instructions: enables the paperwork involved in goods manifests to be carried out and the bill of lading to be generated.

The benefits of offering port users sea services are many. The port is getting connected with the world´s major ocean carries and there is a single and unified communications gateway to send cargo bookings and shipping notes for all ocean carriers. The control on processed information and documentation increases, the errors inherent to manual processes are reduced drastically and tracking and tracing information for cargo is made available. All in all, the optimization of the process means a considerable reduction of costs.

Land Services to be included in an integrated PCS

An integrated PCS enables the agents involved in overland goods transportation to draw up and handle transport orders, including cargo acceptance and delivery orders required to transport goods inside the port premises managed by the Port Authority, and likewise the delivery and receipt notification of containers at the terminal and/or at the container warehouse. Finally, inland transport services to cover railway transport as well.

As for the sea services, land services mean an important extra value for the port community. Among the most noticeable, the following advantages can be highlighted: i) integration with the 'Closing Time' of the Port Authority, ii) ability to produce any document separately, iii) automatic compilation of cargo acceptance and delivery orders, iv) ability to provide tracking and tracing information to all parties involved, v) increased control of the information and documentation processed and reduction in errors vi) availability of historical data in real-time on companies' loadings.

Port Services to be included in an integrated PCS

The Port Authority must be converted in a one-stop administrative gateway in the electronic handling of the documents required by the Port Authority itself and by other official bodies such as the Harbormaster's office and customs. The Port Community System will be integrated with the port authority systems to make it easier for their users to handle their requests in the following services:

- declaration of ports of call enabling shipping agents to deal with the necessary information when asking the Port Authority and the Harbormaster's office for mooring and port of call permits for vessels operating in the ports run by the Port Authority and also the reception of the permits related to such requests.
- declaration of dangerous goods: facilitates shipping agents' requests to the Port Authority and the Harbormaster's office for loading, discharge and transit authorizations of dangerous goods in the ports run by the Port Authority, and likewise the execution of the respective notifications about dangerous goods which remain on the vessel during its port of call at the PAV ports.The presentation and acceptance of the declarations of dangerous goods by electronic means and the use of a single window towards both Administrations must also be established, being the Port Authority the responsible entity of receiving such declarations and relying them to the Maritime Authority. The Port Authority must authorize or deny the arrival or departure of dangerous goods in the port enclosure and the Harbor Master Office must submit a favorable report on this matter. When both acceptances have taken place, a response is submitted to the agent.
- handling of manifests enabling shipping agents to submit loading cargo manifests and summary declarations to the Port Authority and the Tax Authorities to be dealt with and also amended pursuant to the established procedure. As for the Customs procedures, the response given by the Customs Authorities, after the reception of a message declaring the goods for import, export or transit, can be a technical rejection or an acceptance. The acceptance can be:Green Circuit: Merchandise authorized for import, export or transit.Orange Circuit: It is required to inspect all the documentation related with the electronic declaration.Red Circuit: It is required a physical inspection.The Port Authority assumes the responsibility of receiving such declarations through a single window system and establishes maximum periods for their presentation based on the vessel arrival or departure.When an electronic declaration arrives, the Port Authority checks the correctness of the information based on pre-agreed controls jointly defined by Customs and Port Authorities. If the message is not compliant an error message is submitted to the agent and the message is not relayed to Customs. If the message is compliant it is relayed to Customs, which accepts or rejects the declaration based on its own controls and submits a response to the Port Authority. Finally the Port Authority notifies the agent the response.
- terminal management: enables shipping agents to send the loading and discharge lists of vessels to the container terminals and also to obtain the respective confirmation of the loading and discharge of the containers on said lists from the terminals.
- customs information provides agents with information about container clearance and the items declared in the cargo manifests drawn up by the customs authority. The Integrated port community system must cross-check the data of the Entry and Exit Authorizations with the other services to offer information of greater use to users of the platform. Users of the Inland Transport Service can check in real-time the customs status of the containers they are importing. Shipping agents have access to export paperless clearances through the Customs Status Enquiry function of the terminal instructions service of PCS.

General and Horizontal services to be included in an integrated PCS

A PCS connected to the world also offers other general services, developed to provide users with integral track and trace information about the status of goods in transit and to ensure quality control.

An integral Track and Trace service will enable platform users to obtain track and trace information about their shipments such as the current status of their cargo, transshipments carried out or documents processed. It also allows them to integrate this information into their systems to make it available to their customers. In addition to being accessible from the client application and via electronic messages, this service should be available also in the private section of the PCS webpage, enabling users to obtain information about their shipments anywhere and at any time.

A quality control service will provide information from the different agents involved in transportation about compliance with the guarantees offered by the Quality Mark and also the quality management provided by users of the platform themselves. A series of activity reports will be designed to provide graphs of the volume of use of each service and the number of transactions carried out with the PCS.

Integrated PCS and technology

All the services included in the PCSmust be developed using a modern architecture able to grow and adapt to meet users'requirements whilst complying with secure information guarantees, ensuring absolute confidentiality about user data and implementing encryption mechanisms into communications. To be efficient the PCS should comply the following IT requirements: i) it has a service-oriented architecture enabling new services and functions to be incorporated with a minimum of effort for all. ii)Its development must be based on programming standards (web services, XML, .NET, "no touch deployment", etc...) and security (HTTPS, transaction control, etc...) making it easier to integrate users' applications with access to PCS services from any system. This setup ensures the integrity of both communications and transactions. iii) it is supported by servers of the latest generation enabling a high volume of operational transactions to be handled in a record time.

Moreover, the PCS platform must guarantee the security of the information it handles, ensuring absolute confidentiality of user data and implementing encryption mechanisms in communications.In order to improve the operations of all the Port Community agents, the following interfaces and mechanisms must be developed to access the PCS services and information: customer application: this innovative application enables users to manage and carry out any service available in the PCS in a simple, intuitive manner, with transaction and information services, operational and handling enquiries and handling utilities and applications.

Another key IT aspect of an integrated PCS is electronic messaging. Via electronic messaging services, agents can integrate their handling application with the PCS services by using standard communication interfaces between systems: web services, FTP and multiple message formats (XML, EDI and flat file) which make it easy to integrate any system. At the

same time, a free and easy to configure application will help simplify the conversion of electronic messages generated by user applications to XML messages as used by the PCS.

Besides, Web services allows users to track and trace their cargo loadings, transport operations and obtain information related to vessel port calls through their own application. Users can receive this information when they prefer, requesting it in a dynamic (receiving notices as they occur) or static (through specific enquiries) manner. Thanks to this service users no longer have to store all the data in their system.

Before closing this section, we would like to highlight some IT general features of an integrated PCS like its ability to send transactions immediately and/or save them as drafts, automatic installation and updates, the capacity to store all documents and information in the server´s databases offering the guarantee a secure and reliable storage solution, temporary storage of data on the computers of users allowing such information to be accessed rapidly for regular use, the access to master files that are fully updated and the use of document templates to automate the sending of information needed for multiple operations

The resulting PCS Application must provide users with powerful, efficient and fast graphical interfaces to introduce data and manage information through the several services of port community system.

ADDED VALUE OF AN INTEGRATED PORT SYSTEM CONNECTED TO THE WORLD

This section emphasizes on the many added-value that integrating the Port System and connect it to the world might bring to any port, in particular, main ports. Not only with the aim of increasing efficiency and reducing costs is thought the development of an integrated PCS but also and simply for a port to be and stay at the vanguard of the sector and offer the clients state-of-the arts and competitive services.

From a qualitative point of view and on the basis of the results achieved by Valenciaport afterit implemented an Integrated Port Community System entering in the fourth phases described above, we may summarize the key added-value elements of the PCS integration as follows:

- Easy access to all integrated logistics information: sea, port and land, allowing status, track and trace information and records of operations to be obtained and access by other agents involved in the process to be authorized.
- Better service quality and improved customer service. The real-time, quality information the system provides enables forwarders to offer their customers a better service.
- More efficient transactions. Costs can be reduced by up to 50% by making handling easier and speeding up response times. Direct connection via the Internet. No need for added value networks.
- One-stop access and communication with carriers. A single gateway that integrates and unifies communications and information with carriers and ocean transportation platforms.
- Fewer mistakes by eliminating the errors inherent to manual systems in which the same data has to be entered several times in different systems (telephone, fax, etc.).

- The system is easy to use thanks to two methods of integration: electronic messaging integrated into the user's applications and an exclusive customer application.
- Secure information and communications. Complying with all information security standards.
- A container list orders for upload and unload permits shipping agents and carriers to send the vessel loading and discharge list to the container terminals and obtain the respective confirmations of the loading and discharge of the containers figuring on these lists form the terminals.
- An independent Terminal Operation System (TOS): each carrier can work with any terminal with the same link and standards. Work becomes TOS independent.
- Rich data: Cargo lists are fed with additional information to carrier ant terminal ones: customs status, DG authorizations, Port Authority Permission.

From a quantitative point of view, we may approach the cost reduction by the analysis of one of its key variables, the reduction in waiting times[2]. One of the most important factors that affects customer satisfaction is related to port waiting times (ships, trucks, customs, etc.). It seems reasonably obvious that Port terminals with low average waiting times will attract more ships and customers than their competitors with higher waiting times. In this paper, we will focus on the two specific kinds of time reductions: the time employed by port agents to carry out customs procedures and the waiting time of trucks at both port and terminal gates.

Reduction of times in customs procedures

One of the biggest challenge of an integrated Port Community System is to convert the port community into a custom paperless environment by introducing new methods for simplifying customs formalities. This enables increasing the level of security and safety in ports by automating the control of operations and facilitating the detection of inconsistencies. Furthermore, it makes possible to take full advantage of the information existing on customs procedures life cycles that affect freight and containers stored in the port facilities (terminals, warehouses, free zones and other areas of temporary storage) and it enables combining customs traceability information with other port traceability sources of information to provide higher added services for both governmental and commercial purposes.

As a consequence, it has meant important efficiencies and benefits by reducing congestion and delays, reducing resource intensive labor, increasing customer satisfaction and has improved the positioning of Valencia as key competitive port. Table 1 shows how much time can be saved in customs procedures through this integration process.

Table 1. Cost reduction during customs procedures expressed in time savings after the integration of the Port Community System in Port of Valencia

Process	*Agent involved*	*Previous situation (minutes/consignment)*	*Current situation (minutes/consignment)*
Prepare Customs Documentation	Shipping Agency	5.4	0.4

Check Customs Documentation	Customs' Police	4	0.3
Prepare Customs Documentation	NVOCC	6.6	0.6
Solving Errors	All agents	30	0.5
Total		9.4 to 46.2	0.9 to 1.1

Reduction of times in automated gates

Another key criteria to assess the economic value of a PCS integration is the reduction of time that the trucks employ at the port and terminal gates. Port and terminal operators are under increasing pressures to increase efficiency, increase security and reduce labor costs. All that can be reached by the current gate technologies that enables to do more with less while improving turnaround times, reducing truck emissions and improving customer services. Table 2 shows how the introduction of the automated gates integrated in the PCS reduced truck waiting terminals in port and terminal gates in the case of Valenciaport.

Table (2) Cost reduction at gates expressed in time savings after the integration of the Port Community System in Port of Valencia

Process	Previous situation Manuel Lane Minutes/Truck	Current situation Manuel Lane Pick Hours Minutes/Truck	Current situation Automatic Lane Minutes/Truck
Complete necessary processes to leave the terminal gate	2	15	0.4
Complete necessary processes to leave the port gate	2	15	0.3
Total	4	30	1.10

According to terminal operators and truck drivers, this overall waiting time saving can bedecisive to be able to make one additional journey during the day within theallowed driving hours. This is an important improvement for the last mile distributionof goods, as sometimes the last mile distribution costs can represent around30-40% of the overall costs of the transport.

PORT COMMUNITY SYSTEMS: FUTURE OF INTEGRATION

Information technologies progress extremely quickly. Constant and wide technology innovations make ports forced to permanently analyze the market and the new technologies

available in port services. An approach of continuous improvement is fully necessary.Relations and feedback from PCS users must be analyzed on a regular basis in order to integrate the PCS with new service version that fits new expectations or needs of the port clients. As far as security is concerned, the challenge is to maintain the standards of security and protection of the information received through the PCS and in particular, the protection against cybersecurity.Processes should be permanently optimized. There will always be a need to improve the efficiency in terms of flexibility, capacity of reaction, variety of services offered, etc. The quality of the information. The PCS holders need to encourage among the logistic chain actors the exchange of the most accurate information, in order to eliminate errors. There is also a need to adapt the processes and the services to the new modifications in Customs Law. Finally, the cooperation with other PCS is essential to encourage the interconnection with other platforms so that the services offered to the users improve.

We have seen that information flows around a modern seaport are very complex and involve a large number of agents and stakeholders. Shipping agents, freight forwarders, customs and customs agents, port authorities and other authorities, carriers, container terminals, container depots and truck companies exchange a huge amount of information on a daily basis. This diversity of actors around a port requires the harmonization of procedures for organizing and standardizing operations in the logistics chain as each TEU movement requires multiple communications among members of the port community, thus creating a complex information web. In a few words, all the Port Community must sit at the same Virtual Table if it wants to be competitive in a more and more connected sector.In such a context, the maximum challenge for ports in the future will be to respond to the increasing demand of interconnection from the port community by permanently updating and improving its Port Community System and to quickly adapt it to the evolution of the market.

CONCLUSIONS

1. Highly integrated port community systems connected to the world are key success factors of competitiveness for ports
2. Such port community systems add value to port services and strongly increase port efficiency by drastically reducing waiting times, increasing flexibility and reducing errors inherent to non-integrated systems
3. Ports may develop their integrated port community system on a step-by-step basis, passing to a more integrated approach once justified by their own growth and strategy
4. An efficient port will include as many services as possible in its Port Community System, integrating port, land and maritime services, and will be connected with the world most important carriers
5. Ports may obtain substantial reduction of costs through the integration and worldwide connection of their port community system and subsequently increase their attractiveness for customers

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