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How port community systems can contribute to port competitiveness: Developing a cost–benefit framework

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ABSTRACT

The trend towards collaborative innovation in the maritime supply chain implies a good understanding of the actors and their roles, and an efficient exchange of information. A Port Community System (PCS) increases port efficiency by connecting the ICT systems of each of its members, thereby facilitating their communication. To verify whether this type of collaboration and its benefits actually materialize, an understanding of the costs and benefits of such PCS is required. This paper recognizes the inconsistency in the existing literature with respect to PCS costs and benefits quantification. Therefore, after an in-depth literature review, interviews with experts of PCS were carried out, a comprehensive framework to quantify the costs and benefits was developed. Next, a case study was drawn-up to develop a discussion regarding the costs and the extra benefits that port stakeholders incur when using a module of a PCS. The case analysis suggests that there is a positive cost–benefit balance for every stakeholder adhering to a PCS. By covering the development and operational costs of certain modules, PCS operators seek to increase the port competitiveness. This way, PCS users manage to gain higher net benefits and have a competitive advantage over other port stakeholders outside the community.

1. Introduction

The trend towards collaborative innovation (also called co.innovation) in the maritime supply chain implies a good understanding of the actors and their roles, and an efficient exchange of information with the different stakeholders. Case analysis of 75 port-related innovation initiatives (Sys et al., 2015) allows mapping the efforts that the maritime and port sector makes to prepare itself for future trends. One conclusion is that in port-related innovation, there is often a positive benefit–cost balance for every stakeholder, however, the benefit is often not yet seen, and therefore the willingness to pay is usually very low. This innovation sample shows that 40% (29) of the cases are oriented towards the enhancement of the information flow throughout the maritime supply chain.

Enabled by the possibilities by newly developed technology, ICT developments are more and more present in business processes. This type of business innovation is now seen as a game changer. Analysing the services provided by the ports and maritime sector, the same types of developments are also pursued there. Van de Voorde and Vanelslander (2014) state that co-operation is a trend in the development of the future maritime supply chains. In extension, port community systems (PCS), as dedicated maritime ICT platforms, are further developed to enhance the co-operation between players that take part in the same maritime supply chains (MSC) within a certain area.

The review of the relevant literature shows that PCS have attracted the attention of researchers (see Appendix A). However, few have tackled the issue of implementing a PCS in the context of port and port stakeholders' competitiveness. At the same time, port competitiveness has not often been studied from the angle of ICT. De Martino and Morvillo (2008) did so and reviewed the activities, resources and inter-organizational relationships that most commonly have an impact on port competitiveness. Customer satisfaction and port competitiveness are used as independent variables by Lee, Tongzon, and Kim (2015) when studying the influence of the e-Transformation of container port management systems. The latest technological advancements in port business show that ICT is a further pillar that has a main impact on port competitiveness next to costs, geographical location and services (Meersman, Van de Voorde, Vanelslander, et al., 2010). The enhanced sharing of information between port stakeholders regarding cargo, the preannouncement of vessel/vehicle arrival at ports/terminals or the secure electronic transfer of official documents are only a few examples of functionalities provided by PCS that bring a competitive advantage.

PCS initiators or the later users should ideally perform a cost–benefit analysis and apply a consistent framework to support their decision of developing/adhering to this type of collaboration and create a more competitive position. The purpose of this paper is to question the influencing role of PCS on port actors' competitiveness in general and maritime stakeholders in particular. The latter is done by identifying the costs and benefits encountered by different MSC stakeholders

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from implementing or integrating pre-existing systems into an electronic platform connecting multiple actors making up a port community. To that purpose, a comprehensive framework is developed to identify the costs and benefits that each actor faces by setting or keeping up a PCS. The later in-depth view on a specific case illustrates the application and functionality of the framework.

The paper is organized as follows. Section 2 presents a review of specific aspects of PCS developments, not only in seaports, but also in airports, so as to find best practices to learn from for the seaport sector. Furthermore, an overview is given of scientific studies analysing PCS. Section 3 presents the typical architecture of PCS functions and application modules. In Section 4, the costs and benefits brought by setting up and joining collaborative PCS platforms are detailed from the perspective of the port-related stakeholders, and a view is given on whether a PCS contributes to port stakeholders' competitiveness. Section 5 focuses on the Antwerp Port Community System (APCS) case study and presents the costs and benefits that apply to each stakeholder when joining a specific implemented application. It shows to what extent the APCS administrator encourages the use of PCS and gives a competitive advantage to the community as a whole. Finally, Section 6 draws conclusions and provides recommendations for future research for this specific topic.

2. Community systems: A literature review

Most major seaports and airports have implemented some kind of community system. The next section firstly clarifies the understanding and role of community systems in seaports, followed by a brief comparison with airport community systems. For each of those, the operator is first defined. Secondly, the literature over the 2000–2015 period is reviewed to identify both cost and benefit elements of a PCS.

2.1. Community systems in ports

The European Port Community System Association (2011) defines a PCS as a neutral and open electronic platform enabling intelligent and secure exchange of information between public and private stakeholders in order to improve the efficiency and competitive positions of the seaport communities. A Port Community System optimizes, manages and automates logistics-efficient processes through a single submission of data, connecting transport and logistics chains.

Literature review shows that the definitions of these systems have evolved together with the scope of PCS from connecting multiple communication systems (Rodon & Ramis-Pujol, 2006) and serving as information hub (Srour et al., 2008) to being used as a tool that facilitate the exchange of information regarding commercial or administrative matters so as to generate value added and offer new logistics value propositions (PORTEL, 2009). However, the main objective of a PCS remains to encourage the co-operation amongst logistics stakeholders and to increase their competitiveness as a community. This co-operation is based on the integration of communication procedures both within the same maritime supply chain (vertical integration) and across supply chains (horizontal integration) (De Borger & De Bruyne, 2011). Van de Voorde and Vanelslander (2014) define the term 'vertical integration' as collaboration between logistics service providers at a different level within a specific supply-chain. Studies referring to horizontal collaboration between logistics players (for example Cruijssen, Cools, & Dullaert, 2007; Leitner, Meizer, Prochazka, & Sihn, 2011) focused on partnerships for freight consolidation matters or sharing the same infrastructure capacity. PCS facilitate both types of integration.

In line with such integration, Keceli (2011) proposes a three-stage strategy for implementing a PCS. Firstly, he suggests integrating port operators and port authority (harbour master). Next, other ICT systems of other authorities or service providers (e.g. customs, pilotage) should be integrated. Finally, value-added services can be commercialized. By formulating this strategy, Keceli (2011) suggests that such collaboration platforms have a higher commercial success when used by port service providers.

The most frequent reasons for developing PCS are the following ones.

- To optimize the flows of information (efficiency and effectiveness) (Van Oosterhout, Veenstra, Meijer, Popal, & Van den Berg, 2007; Milà, 2007; Gustafsson, 2007; Duran & Cordova, 2012; Keceli, 2011).
- To allow for better control the import/export activity by customs services (Keceli, Choi, Cha, & Aydogdu, 2008; Aydogdu & Aksoy, 2015).
- To generate more competitive advantage for the port (Cuadrado, Frasquet, & Cervera, 2004; van Oosterhout et al., 2007; Córdova & Durán, 2014).

Port actors are known to have various relationships: some collaborate, while others compete. All are under the subordination of authorities like customs or port authorities, so they follow specific procedures. Port-related stakeholders are currently users of PCS. Undertaking their activity in a port environment, they have to comply with a specific sequence of operations for freight and information flows. When developing a PCS, best practices and already implemented community systems are often taken as examples from other sectors (e.g. air transport) or from other ports.

A PCS, when implemented, becomes part of the port management scheme. Heaver, Meersman, and Van de Voorde (2001) note that the managerial actions of a port authority are ultimately derived from its basic objectives, which are influenced by its ownership, structure and mandate. The port management scheme and the port organization type influence the objective of each PCS and consequently the type of benefits they are creating. Verhoeven (2010) argues that the port management is the responsibility of the port authorities. He identifies three types of port authority functions: landlord, regulator and operator function. Meersman, Van de Voorde, Vanelslander, et al. (2011) identify four types of port organization: service port, tool port, landlord port and fully privatized port. Hence, these managerial structures are later used to investigate the functional orientation of PCS.

2.2. Community systems in airports

In parallel to the maritime transport sector, the air transport sector also introduced airport community systems (often known as ACS, cargo community systems or CCS). Similar to a PCS, an ACS serves as an information exchange platform between the operators and authorities operating at an airport. UNECE (2012) understands an ACS as "a neutral and open electronic platform enabling intelligent and secure information exchange between public and private stakeholders in order to improve the competitive position of airport communities". In comparison with early PCS, airports have developed only recently such platforms, but they seem to feature a shorter implementation period. The development of collaboration platforms with the air communities is facilitated by the already implemented standards. UNECE (2012) notices that most airport community systems have their own internal standards, but they communicate with other such systems or trade communities using international air-specific standards, in particular IATA standards for EDI and for XML. The services offered by the ACS are often the same as those offered by PCS. Therefore, the types of benefits gained by the corresponding stakeholders involved in both types of systems are assumed to be similar.

The main difference between the establishment of community systems in the air transport sector and in the seaport sector, is the presence of specific IATA communication standards for the air sector. In the maritime sector, each stakeholder has individually developed its own type of communication platform with its customers to increase its efficiency (in terms of reduced costs, less errors and faster turnaround).