Value Creation Within Port Supply Network: Methodological Issues

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Abstract

The paper proposes a theoretical model based on the concept of Supply Chain Management in port environment, aimed at identifying the sources of value creation in an innovative way. The model views the port as a network of actors, resources and activities - the Port Supply Network (PSN) - which co-produce value by promoting a number of interdependencies. It assumes that the competitiveness of PSN increasingly depends on its "*organisational* component" as it affects the quality of services including: range of logistics services, Information and Communication Technology solutions, know-how, and relationships in the PSN itself. The innovative aspect of the model consists in the introduction of the concept of Port Focal Net meant as interrelated groups of actors pursuing a joint strategy within the port. By the analysis of actors bonds, activities links and resources ties involved in the Port Supply Network, it is possible to identify and qualify those relationships that configure its different Focal Nets. The model is aimed at supporting Port Authorities (PA) in defining their Strategies in a growing complexity context affecting both the Port Community and the external competitive arena.

Key words: Value creation, port strategy, supply network

INTRODUCTION

Although ports are not considered simple transport nodes since long time, only in last years an increasing number of studies have addressed the new role of ports as part of supply chains.. Indeed, consistent with the spread of the new paradigm by which "*real competition is not company against company but rather supply chain against supply chain*" (Christopher, 1992), it has been stated that "*competition is not unfolding between individual ports but between logistic chains"* (Meersman and Van de Voorde, 1996).

On this basis of a such innovative view, the Supply Chain Management (SCM) approach has been applied in port environment. As known, SCM, as managerial philosophy, supports the development of partnerships between actors of the supply chain and considers the integration of activities and resources of these actors along business processes as potential sources of competitive advantage. According to this perspective, ports are considered part of networks of organisations involved, through upstream and downstream linkages, in various processes and activities that create value to the final client.

With the aim to contribute to the current debate, it is believed that models based on a network perspective, adopting the concept of *value chain constellation*, better represent the complex port environment including all the possible interaction among actors within and outside the port itself. In particular, the network approach would be particularly helpful in the context of port operation and management as it allows to overcome obstacles of channels' identification and conflicting attitudes among the myriad of actors and operators in port business.

Moreover, such a perspective is suitable for defining a more pro-active role of ports in this new scenario as it considers all the sources of port value creation, potentially arising from the network of actors, resources and activities. Under this perspective, the port can be considered an important springboard for the economic development of its hinterland.

Following this approach, De Martino and Morvillo (2008) proposed a general framework for port value creation. In particular, this model takes into consideration all the possible modalities of interaction among port network actors, by analysing the development of inter-organisational relationships in the management of business activities and resources in the process of creating value for clients.

This paper further elaborates this model, focussing on methodological issues related to its application. To this end, the concept of Focal Net is used in order to represent effectively port complexity through the identification of narrower and more local "networks" that, although interdependent, have the capability to autonomously explain the sources of port value creation.

To this end the paper is structured as follows: in the first paragraph a literature review on port studies adopting a SCM approach has been presented with the aim to highlight the main problematic issues for its application in the port context. Then in the second paragraph, the network model for port value creation is described in its main features, while the third paragraph is dedicated to the definition of the methodological pathway in order to apply the framework. Finally in last paragraph some conclusions are provided.

SUPPLY CHAIN MANAGEMENT WITHIN PORT ITERATURE

Within port literature adopting a SCM approach, Robinson (2002) proposes a new paradigm for port positioning and strategies based on the conceptual categories of the value constellation (Normann and Ramirez, 1993). The author considers port as a Third Party Logistics (TPL) provider, that intervenes in a series of different companies' supply chains. Specifically, the port is a market focused firm, where all businesses are managed to provide superior value to target customer. By using theoretical considerations elaborated by Cox et al. (2002), he believes that also with reference to ports, strategic positioning choices involve two key issues: what supply chain resources a port should own or control and how it should defend its ability to accumulate the value

so derived. The proposed framework, innovative for the conceptual categories on which it is based, offers interesting insights on port value creation process in the supply chain; however, it neglects the great number of interactions within the port context. Indeed, the framework application only focuses on the shipping companies practices aimed at integrating their complex logistical services, from intermodal transport to the handling of goods.

Paixão and Marlow (2003) provide a framework for the development of a proactive rather than reactive role of ports in the supply chain. More in detail, the paper deals with the agile strategy in the port sector, starting from managerial strategies undertaken by port players (mainly terminal operators) aimed at tackling the high levels of market uncertainty. The methodology, based on strategic logistics tools already experimented within other industrial sectors, is structured into two different stages: the first concerns internal integration, while the second relates to the external integration of ports with other actors of the supply chain. also in this case, the analysis focuses on terminal operating company both with reference to the internal and external integration.

Carbone and De Martino (2003) contribute to the scientific debate on Port Supply Chain Management through an empirical analysis carried out by interviewing various port operators involved in the Renault supply chain. The purpose of the study is to analyse the contribution of the port of Le Havre in the Renault supply chain, according to the model developed by Lambert (2001). It is an innovative paper because it takes user perspective different from a shipping company (the Renault) as well as it proves how performance of the traditional components of the port (infrastructure, superstructure, and services to the goods and vessels) are set exclusively as pre-requisites and not sufficient any more to guarantee its competitiveness. Indeed, more relevant, is the ability of the port operators to form relationships (in particular, CAT, a logistics operator, who is responsible of the distribution of vehicles in Europe) in the process of satisfaction of Renault's requirements.

A further conceptualisation of port from SCM perspective, is from Bichou and Gray (2004), who define a new framework for measuring port performance. To this end, they identify three different channels: the trade channel, the logistics channel and the supply chain channel[1]. The interaction of these three channels affects the level of port integration and, hence, the level of its performance. As to the results of their exploratory investigation (carried out on a sample of 100 experts in the port field), it is interesting to note that respondents belonging to the port community showed a lack of familiarity with logistics and SCM concepts, especially those related to logistics integration. This is mainly due to the lack of a "*competitive community spirit*" among the actors, both public and private. Some authors have indeed demonstrated (Bichou and Gray, 2004; Carbone and Gouvernal, 2007) the scarce sensitivity of port operators and public authorities towards the pursuit of new forms of integration entailing cooperation with other actors and hence mutual trust

A recent empirical work on the port of Incheon (South Corea) analyses port's supply chain orientation by different perspectives: port's services providers (the terminal operators) and port's services users (the shipping companies) (Tongzon *et al*, 2008). The authors measure the extent to which the shipping companies perceive terminals to be supply chain oriented and investigate whether there is a convergence of perceptions between terminals and shipping companies. According to our point of view, shipping companies, although are key actors, cannot represent the only subject of the analysis, because the port should build its success by developing activities and resources that not exclusively favour the shipping company's distribution network, but also others port users, including freight forwarders, third party logistics and manufacturing companies of its own hinterland.

[1] The logistics channel consists primarily of specialists that facilitate the efficient progress of cargo through a supply chain (e.g. shipping companies, freight forwarders). The trade and supply chain channels are both related to the ownership of goods moving through a system of interacting organisations; but while the trade channel is perceived to be at level of the sector or industry (e.g. the oil trade), the supply chain is at the level of the firm.

This consideration is even closer to reality if we consider the port - marketplace relationship, i.e. the function of centrality and inter-connection that the port can play (Genco, 2000). In particular, the concept to centrality refers to the flow of goods that originates in the regional economic system to which the port belongs (local hinterland). The concept of inter-connection, instead, refers to the position of the port within the intermodal routes. In this case, the flow of goods does not depend on the conditions of the regional economic system, but on the relative position of the port in the distribution network of large shipping companies and multi-modal transport operators. Origins and destinations are outside its sphere of influence; this kind of traffic is more volatile and footloose and depends solely upon the strategy of shipping lines with respect to their service networks (Notteboom and Rodrigue, 2005).

In the light of these considerations, the SCM approach is mainly suitable for the development strategies of ports that are at service of their own hinterland and that can potentially strengthen their market positioning and gain more market share by extending service orientation to supply chain final clients. With reference to the ports that deal exclusively with transhipment, the port development options will be lead by other purposes, aimed at primarily satisfying global players' needs in the management of their distribution networks.

At this regards, De Martino and Morvillo (2005) believe that the SCM determines the differential competencies and services' features that the port must foster, so as to promote the economic development of its own hinterland.

All reviewed contributions have the merit for triggering the debate on the use of an innovative perspective - SCM - that proves to be particularly complex to apply in the port environment. In this regard, Bichou and Gray (2005) have identified a set of motivations: (1) multi-firm dimensions, namely the wide range of actors involved in and across port supply chains (shippers, ocean carries, port operators, logistics operators, etc); (2) multi-functional dimensions, that is the differences of operational/strategic viewpoints in a traditional port setting often typified by institutional fragmentation and conflict over channel control and management; (3) multidisciplinary dimensions of port research and SCM, with the first extending across manufacturing, trade and service industries, and the latter intersecting wide subjects ranging, inter alia, from engineering and operational research, marketing and quality management

NETWORK MODEL FOR PORT VALUE CREATION

A general model based on the concept of Supply Network has been recently proposed by De Martino and Morvillo (2008). Supply network, in the SCM literature, is "*the set of supply chains that describe the flow of goods and services from its original source to its end customer*" (Lamming *et al*., 2000). This concept considers the companies to be like open systems, influenced by the other actors in the environment in which they operate and dependent on the resources supplied by other organisations; through different forms of interactions the companies can have access to and make use of external resources owned by other network actors. The actors are defined by the activities they carry out and by the resources they control; they are connected to the other network actors through relationships. The identity of an actor is therefore made of the unique combination of resources it owns and the activities it manages.

Every company is a member of a set of supply chains with different roles and decision-making power. In this environment, the inter-organisational relationships are considered to be the most relevant strategic resources (Hakansson, 1982), "*bridges of value*", as they give companies access to other actors' resources in the network and they strongly contribute to the *value co-production* (Normann and Ramirez, 1993).

In an effort to analyse the complex patterns of supply networks, Dubois *et al.* (2003) suggested a framework consisting of: products, activities and resources, firms (or business units) and relationships. Such a framework is based on two major assumptions: (1) individual firms try to optimise their respective sets of resources and activities by taking interdependencies across

boundaries into account; and (2) the relationships between firms provide them with means to coordinate their activities and to interact in the development of the resources activated by, and of the products resulting from, their respective activities.
This framework proves to be particularly useful in representing the port value creation in supply chains and it inspired the definition of the Network model for port value creation presented in this paper.
In this model, the port is represented as a network of actors that carry out a number of activities in close collaboration, sharing different resources. The higher the level of collaboration (integration) among actors, the greater the benefits that they will perceive in promoting interdependencies also among various supply chains. In this way, the features of the supply chain composing the network play a key role in both assessing, and than eventually redefining, the port development policies, because they determine the importance of the resources to be controlled and the activities to carry out in the port in order to improve port value creation. Only through an understanding of these needs, the port can exploit the chance of becoming an active part of the supply chains to which it belongs and thus, gain the advantages of better integration. In more detail, the analysis of *activities*, *resources*, and *inter-organisational relationships* allows determining port actors' interaction in the management of port activities and the relative resources exploited in the value generation process. Naturally, resources and activities are completely intertwined, because resources are necessary for the undertaking of activities and have no value unless they are activated. And the way in which resources are "activated" and activities performed depends largely on the inter-organisational relationships among port operators and others actors of the supply network. The activities carried out by these actors can be divided in three macro-categories (Teurelincx, 2001): (1) activities related to its foreland (maritime transport and maritime access), (2) activities within the port sector itself (such as transhipment, warehousing, value added logistics, manufacturing, forwarding and distribution) and (3) activities in relation to its hinterland (road transport, rail transport and inland navigation).
With reference to resources, some of these prove to be more important than others, as they are necessary to create and supply services to the customer. These key resources, defined in literature as *critical assets* (Cox *et al.*, 2002), hold a central position for the acquisition and accumulation of value in the supply chain. Within ports, resources are those necessary to perform both port and value-added logistics activities.
These can be subdivided in (Huybretch *et al.*, 2001): infrastructures, such as terminal, quay, modal connections, etc; superstructures : assets for the supply of transport and logistics services (cranes, depots, equipment, etc); human capital and competences; Information and Communication Technologies solutions. Traditionally, terminals have represented the key resource for creating value, especially from a shipping company's perspective. However, in combination with these physical resources, the intangible (i.e. human capital and IT systems) are becoming increasingly source of competitive advantage, as they determine competencies hard to imitate (Winkelmans, 2003) and encourage the development of collaborative relationships in the port community, and between port actors and other actors of the competitive scenario.
Finally, with reference to different types of relationships that can be developed among port actors, recent literature on Third Party Logistics tends to prove how outsourced logistics activities, ever less limited to traditional transport and warehouse activities, now include a wide range of additional and added value activities and how they are increasingly managed by long term collaborative relationships and strategic alliances (Marasco, 2008). Typically, the relationships between shipping companies and terminal operators can be consortia and conferences, joint ventures, strategic alliances, mergers and acquisitions, aimed at optimising management of intermodal and maritime transport services (Heaver *et al.*, 2000). Although the transport and storage remain the main activities managed in the port, these are not sufficient to guarantee its active role, increasingly dependent on the ability of Port Authority to strengthen its linkages with

the economic hinterland; this can be achieved by encouraging port actors to form relationships for the management of a wider range of added value logistics activities. "*Collaborative spirit*" and mutual trust are therefore fundamental in order to create reciprocal benefits and a higher level of involvement of the port in the supply network.

METHODOLOGICAL ISSUES

In order to apply the above framework, a methodological pathway has been defined on the basis of the scheme of analysis of development effects of business relationships proposed by Hakansson and Snehota (1995) that put together the dimensions of a business relationship: substance and function. As known, the former regards who is affected by the relationship: single company, dyad and network; the latter concerns what is affected in the relationship: activities, actors and resources. Indeed, according to the authors, this scheme can be used as a conceptual framework to analyse the factors that affect the possibilities of development of a relationships as well as to identify where and how to intervene in relationships in order to get some desired effects.

According to our point of view the port should build its success by developing relationships concerning activities and resources not exclusively with shipping companies, clearly key port actors, but also with all the other port actors, including intermediaries such as freight forwarders, multimodal transport operators, logistics operators, other services suppliers, and finally manufacturing companies of its own hinterland.

Therefore, given the complex nature of the port environment, the analysis in an first phase will be developed by using the concept of Focal Net; subsequently the single focal nets will be analysed within the broader relationship context of the supply network.

According to Moller and Halinen (1999) a focal net is a central construct that describes the environmental context of actors. From the perspective of an individual firm, a focal net consists of those actors that the management perceives as relevant, that are within its network horizon. From strategic perspectives, the focal net concept also is used to refer to an interrelated group of actors pursuing a joint strategy within a network

Tikkanen (1998) emphasises that a focal net is always part of a broader network and thus could be viewed as a local network or micro network. However, the difference is that a focal net is studied from the viewpoint of a certain, single network actor, which usually is a company. The central aim in focal net analysis is to take into account all parts of the broader network that are relevant from the single actor's perspective.

According to the ARA model (Håkansson and Johanson, 1992), the focal net can be constructed by analysing all the dyads considered strategic from the focal firm perspective. In the case, we consider the terminal operator as the focal firm within port context. Starting from this, in a first stage all the dyads between terminal operators and their direct clients (shipping companies) will be analysed. In the subsequent stages all the strategic dyads will be examined in order to highlight all the relationships identifying focal nets in terms of web of actors, activity patterns and resource constellations.

Table 1 describes three simplified configurations of Port focal Nets, characterised by a growing extension and complexity of web of actors, activity patterns and resource constellations. This extension reflects the importance of the port in the process of creation and appropriation of value through an increasingly complex set of services, the involvement of a growing number of specialised actors and the use and combination of a broader typology of resources. From a different perspective, these focal nets can represent a potential development path that a port can follow on the basis of the ability of port management to catch the opportunity offered by its economic and politic context.

More in detail, in the first case, the port shows an approach mainly focused on internal logistics, based on the supply of cargo handling services as the main client is represented by shipping companies. In this case, strategic options are aimed at maximizing throughput, improving shipping

companies' satisfaction and increasing the efficiency of port operations. This is the typical and traditional focal net in the port environment.
The focal net B, which obviously comprises the previous case, is characterised by a focus on the cargo flows optimization and on the improvement of transport chain's efficiency through the supply of handling, storage and inland transport services to Multimodal Transport Operator. Port's strategic options are oriented toward the improvement of modal connections so as to allow the supply of intermodal services and to expand the port hinterland. Examples can be found in an increasing number of ports such Genoa, Algeciras, Rotterdam, etc where Port Authorities have invested in adequate network of railway and road connections in order to favour the growth of container traffics and to overcome the lack of space in the port perimeter.
Finally, in the focal net C, the port approach is aimed at satisfying the needs of lLogistics operators and manufacturing firms through the supply of further services – the Value Added Logistics Services - other than the ones related to transport. In this case, port boundaries extends toward local hinterland, including activities, resources and actors of the economic context. In this scenario, ports represent the springboards for economic development of the hinterland and therefore their strategic options are oriented to strengthen the integration with the business actors of its territory that can perform more conveniently their supply chain activities in the port. For example, the port of Rotterdam established three distriparks in order to provide value-added logistics with comprehensive facilities for distribution operations at a single location, connected directly to container terminals and multimodal transport facilities for transhipment, employing the latest in information and telecommunication technology. The port provides a comprehensive range of value-added services to fulfil highly heterogeneous customer demand. These value-added services include assembly, labeling, testing/examination, packaging and repackaging, sorting and invoicing.

TABLE 1: PORT FOCAL NETS' EXTENSION

	A **Shipping Company**	**B** **Multimodal Transport Operator**	**C** **Freight Forwarder** **Logistics Operator** **Manufacturing firm**
Activities patterns	o Maritime transport; o Cargo handling and storage.	o Maritime transport; o Cargo handling and storage; o Inland transport; o Warehousing.	o Maritime transport; o Cargo handling and storage; o Inland transport; o Warehousing; o Value added logistics (VAL); o Manufacturing o Distribution
Resource constellations	o Infrastructures, such as terminal, quay o Superstructures: assets for the supply of maritime transport and cargo handling o Traditional competences in port maritime services and cargo handling	o Infrastructures, such as terminal, quay, modal connections; o Superstructures: assets for the supply of maritime, cargo handling and transport services; o ICT system; o Competences in different transport chain stages	o Infrastructures, such as terminal, quay, modal connections, logistics area, dry port, Distripark; processing area; o Superstructures: assets for the supply of transport and value added logistics services; facilities for import and export goods; o ICT system o Competences in VAL and highly skilled workforce
Web of Actors	o Terminal operating company; o Shipping company.	o Terminal operating company; o Shipping company; o Railway transport operator; o Road Haulier	o Terminal operating company; o Shipping company; o Railway transport operator; o Road Haulier; o MTO; o Freight forwarder

Source: Our elaboration

The different strategic options have impacts on all Focal net layers determining, from A to C:

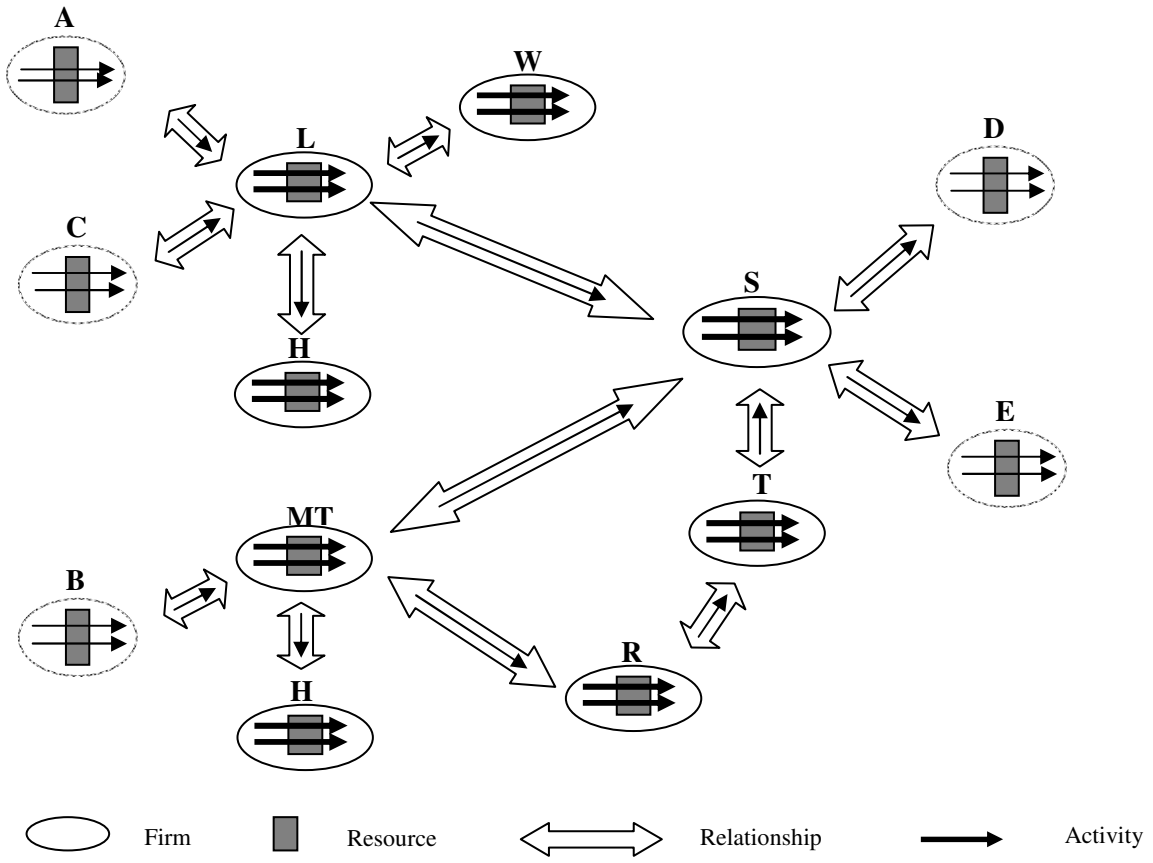
a) The development of new activities such as: warehousing, distribution, value added logistics and manufacturing;
b) The use and combination of different typologies of resources: terminal, quay, modal connections, logistics area, dry port, distripark; processing area; assets for the supply of transport and value added logistics services; facilities for import and export goods; ICT system; Competences in Value Added Logistics and highly skilled workforce;
c) The involvement of a great number of specialised operators in the filed of transport and logistics.

The focal nets described are not mutually exclusive as they can characterise contextually a same port.

Indeed, the set of embedded Focal Net constitute the Port Supply Network (PSN). This allows representing effectively port complexity through the identification of narrower and more local "networks" that, although interdependent, have the capability to autonomously explain the sources of port value creation.

Figure 1 provides a simplified representation of a possible configuration of a Port Supply Network.

FIGURE 1: A SEMPLIFIED PORT SUPPLY NETWORK



SC = Shipping Company; T = Terminal Operator; L = Logistics operator; H = Haulier; RO = Railway Operator; W = Warehouse; MT = Multimodal Transport operator

Source: Our elaboration

In particular, two main focal nets can be identified. In the first case, the availability of modal connections between the terminal T and road and railway network are critical resources that allow the Multimodal Transport Operator (MT) to provide intermodal services to firm B. In detail, the main relationships in this focal net are centred on the MT in charge of the transport chain organization by involving Haulier (H) for road transport services, RO for railway services and, SC for maritime transport services to the final destination. In the second case, the port provides also value added logistics service through a warehouse owned by a logistics operator L and located in the port area. More specifically, this actor collects different cargoes from the hinterland (A and C) and performs a number of transport and logistics activities through a set of relationships haulier and shipping company.

The use of focal net allows to identify those relationships having higher impacts on value creation and, at the same time, the lack or the particular configuration of some relationships can constrain the value creation process of the port. This approach is particularly effective under a strategic perspective as it provides Focal firms of both Port focal Nets (business operators) and Port supply Network (Port Authority) proper tools to diagnose their performance and to intervene in the networks according to a well defined strategic options.

In this respect, Port Authorities as main governance actor of the Port Supply Network (PSN) can affect significantly the role of single Port Focal Net in value creating process through the definition of policy actions. Only through the understanding of the whole Port Supply Network (PSN), the Port Authority can define Policies sustainable under economic, social and environment perspectives.

CONCLUSIONS AND FURTHER STEPS

The paper proposes a new theoretical Model based on the concept of Supply Chain Management in port environment, which considers the integration of actors, activities and resources along business processes as a source of competitive advantage. The model is aimed at supporting Port Authorities (PA) in defining their strategies in a growing complexity context affecting both the Port Community and the external competitive arena. It assumes that the traditional approaches to port competitiveness - strongly related to structure-type variables (geo-economic context, institutional model and the port-hinterland infrastructures) - are not enough to cope with the current market dynamics. Instead, according to a new systemic view, the competitiveness of ports increasingly depends on its "organisational component" as it affects the quality of services including: range of logistics services, ICT solutions, know-how, level and intensity of relationships. Indeed, the model allows viewing the port as a network of actors, resources and activities, which co-produce value by promoting a number of interdependencies in which the port itself is embedded. The innovative aspect of the model consists in the introduction of the concept of Port Focal Net meant as interrelated groups of actors pursuing a joint strategy within the port. By the analysis of actors bonds, activities links and resources ties involved in the Port Supply Network (the whole Port Community), it is possible to identify and qualify those relationships that configure its different Focal Nets.

The model application and validation will be assured by the participation at an international project involving a number of ports that are strategic for strengthening the Mediterranean area (Valencia, Marseille-Fos, Gioa Tauro, Koper, Igoumenitsa), due to their geographical positions as well as their current and potential role in sustainable regional development. All the ports involved in the project are characterized by different focal nets and the analysis of organisational component will allow defining different potential development paths.

Future research directions will be aimed at identifying a set indicators for the qualification and assessment of relationships at both Focal Net and Supply Network levels. In particular, these

indicators will be used to identify different components of port value generating process and evaluate the Policy actions impacts at different network layers.
This set of variables, of course, will take into account not only the economic but also the social and environment perspectives.

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