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The Chilean medium-sized port companies in knowledge management: diagnosis, challenges and trends

Felisa M. Córdova[a,*], Claudia A. Durán[a], Raquel Galindo[b]

[a]Department of Industrial Engineering, Faculty of Engineering,
University of Santiago de Chile. Av. Ecuador 3760, Santiago 9170124, Chile
[b]University Autónoma de Madrid, Km 15 Carretera Colmenar 2804, Spain

Abstract

This paper presents a study of the behaviour of companies participating in Chilean ports of medium size in the processes of creation, transmission and dissemination of knowledge. A diagnosis of the current situation and the identification of the relevant requirements of knowledge management, through surveys and interviews, were carried out by the main actors of the community. The knowledge management processes related to the intellectual, structural, and social capital that have been developed by the different actors involved in the medium-sized port communities are identified. Also, the stage of externalization of knowledge is examined to find the critical factors of knowledge transference. Meanwhile, the role of the knowledge creation process in innovation, generated by public a private institutional systems, is acknowledged. The results of the analysis show that the competitive and efficient management of a port is mainly based on: knowledge sharing and dissemination, collaboration and team work, knowledge storage and best practices. Then, a model that establishes the stages of development for achieving knowledge management in medium-sized port companies is proposed. With respect to information management and learning, the need of a virtual space with available and continuously updated information and knowledge, that will be useful to the members of this community, has been detected. Finally, the challenges and trends related to integrated logistics, port community and collaborative learning networks, logistic platforms and inter-modality, and creation and dissemination of knowledge are observed.

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Keywords: Knowledge management; Medium-sized ports, Port community, Collaborative systems

* Felisa Córdova Tel.: +56-02-23260268; Fax: +56-02-23260268.
E-mail address: felisa.cordova@usach.cl

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1. Introduction

The complexity and volume of world trade is growing every day; the number of competitors, products and distribution channels is constantly growing. Companies, under the influence of the development of information technology and communications, are strongly forced to accelerate their competitive role in larger, more complex and more competitive markets [1-2]. In today's globalized world, much of the trade is done by sea. Because of this fact, to act together in order to collaborate with the development of ports is responsibility of the port companies themselves, regulatory agencies, operators, ship operators, service providers companies and workers [3-4-5-6]. In this context, the current political, social, economic, technological and environmental system in emerging countries aims to modernize the state port sector, now classified worldwide only as medium, defining a strategic framework for its development [7-8-9-10]. This way, competition, quality of services, private investment and coordination between private and state agents are well promoted.

This acceleration in an uncertain scenario makes the organizations involved in port activities ask themselves: what do we know? Who knows it? What should we know that we do not? Who needs to know what? Does the organization acquire knowledge outside itself? Is cognitive asset measured and assigned a value? [11-12]. It is therefore important to identify the knowledge management processes that are performed by the actors of the middle-sized port relating to intellectual, structural and social capital.

In relation to the structural capital, strategic plans of medium port companies define the development of port business platforms as one of their (major) objectives since it benefits foreign trade, prioritizing key initiatives towards improving the level and quality of port services, and the development and business generation [13]. Several authors have investigated the existing connectivity in port systems, identifying the mechanisms and operations sub-systems and the ICT communication interconnected systems required, they have also developed simulators to determine and select a port according to its capacity to use critical operational resources [14-15].

The process of knowledge creation plays an important role in the innovation process, thus proposing a process of knowledge generation by spirals of epistemological and ontological content, which allows classifying knowledge along these two dimensions into four phases: socialization, externalization, combination and internalization [16].

In an integrated system of technological innovation is difficult to generate synergy between technological and institutional innovation, since political factors can operate eventually affect the core of competition [17]. With respect to competition for information technology (IT) that is generated in a network of organizations, it is positively associated with the synergy of knowledge [18].

In terms of social capital, several authors propose that the Port Authority should lead the collaborative management of the Port Community in order to allow all of its members to progress together toward common goals that improve the competitiveness of the port [19-20]. Creating clusters is also promoted, where either the local government or port authority coordinate the actors and stimulate research. There, the leading firms take the head and make investments to improve coordination, innovation networks and the transfer of knowledge to improve the intellectual and structural capital of all companies and organizations involved in the port community and its supply chains [21-22]. Some authors suggest models that consider relevant the relationships between two neighbouring countries in which the export of goods / services is limited by geography, cultural difference, the few assumed commitments because of the resources they possess, licensing, strategic alliances, joint venture, subsidies to foreign companies, foreign investment and activities of international businesses [23]. In some ports, the outsourcing of certain services is carried out through a change in the organizational model, shifting from a public to a private structure and defining mechanisms to facilitate the cultural transformation associated with that change [24]. The port then integrates its actors, aligning its organizational structures, policies and resources with the business strategies.

Additionally, some authors suggest that in the environment there may be synergistic relations between innovation, politics and inter-organizational interaction, specifically in the transfer of geographic information,

technological information and information related to the organization. The strategies related to the capacity of acquiring technology may particularly generate synergy between the way in which use of technology is learned and technological capabilities that companies have generated; we observe different stages of evolution in learning that are important for organizations since advanced technologies can be used and consequently enhance innovation [25]. Organizations learn when sharing information and knowledge, since knowledge is regarded nowadays as an organizational asset that must be managed strategically [26]. Some argue that knowledge management has evolved through various stages from the exchange of information and knowledge to reach a stage of collaborative development that is synergy of knowledge [6]. This synergy of knowledge is positively associated with the transformation of organizations, creation of value, cultural exchange, innovation and measurable indicators and with degrees of existing synergy [11-16-17].

Once we have identified the main factors involved in the development of intellectual, structural and social capital arising from coordination and collaboration among actors, the collaborative construction of knowledge between actors and collaborative learning, it becomes necessary to propose a model that establishes the stages of development for achieving knowledge management in medium port companies.

2. Diagnosis of the current situation

2.1. Characteristics and Actors participating in the medium-sized port

We chose the port of Valparaíso as a representative of medium-sized ports to be characterized in this study. This port mobilized more than 1 million TEUs, transferred a total of 9.6 million tons of cargo during the year 2014, only transferring general containerized dry load, as well as cargo. The port has an internal port Terminal operated by "Port Enterprise" under a multi-operator scheme, possessing a mobile crane (100 ton capacity) and two cranes MAN (50 ton capacity); it also has an outsourced Terminal Port (TPS) that has fixed and mobile equipment consisting of 8, maximum capacity, 100-tons mobile cranes and 12 yard RTG cranes.

The port has developed a Prior Logistics Area (ZEAL) which is under concession, and where they develop logistics activities that increase the productivity of the port. ZEAL uses technologies that enhance the operational efficiency of carriers and terminals. This port is located in the city of Valparaíso, declared by UNESCO as a world heritage site, which provides great opportunities for the port in its relationship with the city.

In the case of the port of Arica in northern Chile near the border with Peru, showed that 68% of the goods that transfers the port have source/destination Bolivia and only 17% of national export and import load is.

In order to meet the challenges of competitiveness associated with knowledge management, ports have focused on the creation of port communities, which are formed by all public and private actors involved in the activities of exporting and importing goods and associated services.

The port community comprises a set of actors and stakeholders who link together and communicate through a Logistic Forum. Among the main actors we can identify: Port Company, Leasing Companies, Port Terminals, National Fishing Service, Region Health Service, Sea Port Chamber, Export Associations, Customs Chamber, Agriculture and Live-stock Service, National Association of Customs Officers, Truck Owners Federation, Logistics Associations, Regional Customs Board, Shipping Association and Port Captainship.

As regards the major participants, a lack of territorial, environmental and customer concern is detected. The port community does not care about the companies providing transport services. The major participants fail to introduce the intellectual, structural and relational capital.

2.2. Intellectual, Structural and Relational Capital

Intellectual capital includes knowledge, skills, motivation and training of employees of the companies as well as the remuneration system and recruitment policy of the enterprises that enable to have an adequate staff in the future. Structural Capital considers the following types of capital:

- Capital of internal processes, where the main objective is to understand the quality that the company has in its processes, products and services that enable a competitive advantage.
- Capital for research, development and innovation, considering the potential of the company to continue to innovate in the future. It requires knowledge of the investments made to develop new products, new technologies, and improvements in the systems.

Relational capital includes the following types:

- Relational or commercial capital. It focuses on the relationships with suppliers and customers, as well as their degree of satisfaction, customers that are gained or lost, market share, etc. It determines how customers see the company.
- Communicational capital. Those resources intended by the company to communicate with the external context within its marketing activities: advertising, sales promotion, public relations and personal selling. Table 1. It shows a diagnostic of the medium-size port in relation to the types of capital.

Table 1. Diagnosis of Intellectual, Structural and Relational Capital

Capitals	Diagnosis of medium- sized ports
Intellectual Capital	Port Companies develop Programs of Continuous Education in the areas of: Operations Management and Logistics, Certification in Labour Competencies, Energy Efficiency and Training courses for port service providers. However, in learning, there is uncertainty related to the no explicit intangible assets. It is also perceived a lack of synergy of knowledge between the actors participating in the port community as well as of innovation networks involved in port activities. Public and private companies involved in port activities undertake to maintain an ethical conduct in the processes of decision making and daily operations.
Structural Capital Capital of Internal Processes	The companies involved in logistics chains undertake to contribute to the continuous enhancement of processes. It is perceived a lack operational coordination between the actors of the logistics chain. Public institutions involved in port activity declare that they wish to provide specialized services in transport and port transfer, and services related to the activity. However, this is not evidenced their actions. Some of the members of the port community develop innovative initiatives that add value to companies.
Capital for Research, Development and Innovation	The technology adopted is not available for customer service to improve their welfare or for other participants such as carriers to improve their productivity. ICT's have modified the role of the port managing and have increased the role of governance. Some ports lack a communications network for emergencies. The companies supporting port activities want to be recognized by the platform of logistics services that they offer, but are affected by bottlenecks in some of the services provided and by the difficult access to the platforms. A great deal of the population is unaware of the role of the port as an economic engine, its strategic role as infrastructure or its importance as an

	institution. Hence, society only considers the port when a negative externality that directly affects the population occurs.
Relational capital Relational or commercial capital	Companies part of logistic chains primarily use commercial criteria, and in some cases environmental and social criteria in steering, control and management systems of the company.
Communicational capital	The port community demonstrates a permanent concern on media communication. Logistics forums collaborate in communicating knowledge transfer between the different participants of the port community, as well as the participants who have business relationships with community members and society in general. The port of Valparaiso created the FOLOVAP logistics forum, whose main objectives are to analyze and optimize documentary exchange processes and those related to the entry and exit of goods to and from port. There are informal relations of actors involved in the port community due to border problems between countries (case of the port of Arica).

2.3. Transformation of tacit knowledge into explicit

Considering the four major transformations of tacit and explicit knowledge: socialization, externalization, combination and internalization [16], has been chosen to diagnose the exteriorization of knowledge corresponding to the conversion of tacit knowledge into explicit concepts and that is considered one of the essential in the knowledge creation activities. This means for the actors of the port community to make tangible such knowledge of otherwise difficult to communicate, sharing it and integrating it into the culture of the organization.

In some port we detected high times required for the development of improved document processes of international trade; process do not have integrated documentaries; also, we perceived a lack of understanding of the process of the logistics chain of international trade.

3. Critical Factors of Knowledge Management

The results of the assessment carried out in medium-sized Chilean ports enable identify the main critical factors in the management of knowledge: Knowledge Transference, Knowledge Dissemination, Collaboration and Team Work, Knowledge Storage, and Best Practices, which are detailed in Table 2.

4. Model of Knowledge Management and Associated Projects.

After making a diagnosis of knowledge management in medium-sized ports, considering the intellectual, structural and relational capital and the transformation of knowledge through the mechanism of externalization, we have identified the main factors involved in the development of that capital. These factors arise from the coordination and collaboration, the collaborative construction of knowledge between actors and collaborative learning. Thus, it becomes necessary to propose a model that establishes the stages of development for achieving knowledge management in medium port companies. A primary model and its associated projects are proposed in order to be used in this type of port communities. The proposal is oriented to projects and is divided into sub-models, each of them associated with an increasing level of complexity in the developed projects.

Table 2. Critical Factors of Knowledge Management in medium- sized ports

Critical Factors	Diagnosis of medium- sized ports
Knowledge Transference	There is a knowledge transference culture inside the companies but the knowledge transference among the enterprises is low. The documents exchange flow among these organizations presents some problems related to digital documentation, legal frameworks, and training.
Knowledge Dissemination	People surveyed requested the full spreading of the topics covered in the Logistic Forum meetings to the whole port community. Non-conformity with the Forum Web Site contents is detected. There exists dissatisfaction about the knowledge spread through this Web Site.
Collaboration and Team Work	It is perceived that there is much information enterprises would like to exchange but all of them need real time access to it. In this way information should be released to have a real exchange of it. The relevant information is not always transferred in real time
Knowledge Storage	The total number of people surveyed agreed to store the generated knowledge. The repository of information and knowledge is fed from utilities and from digital files that maintain the port companies
The Best Practices	Companies involved in the supply chain of the port and the associated public companies share the quality standards, the environmental and security standards. They require this knowledge be stored in a common, safe, dynamic, access-friendly virtual space, for everyone. It is detected that most of these enterprises care for them. Those enterprises that have not paid attention to them, agree on their value for future implementation.

4.1. Primary Model

The Primary Model is composed of six general projects that gradually improve processes along its implementation through feedback; it is presented in Fig 1. These six general projects are: systems of conversation systems, knowledge inventory, and transformation of tacit knowledge, competence identification, document management and network usage.

- Conversation Systems: it is an initial stage recommended for all types of model, since it has to do with the motivation of workers through the communication and dissemination of what is being tried to do, what its benefits and required efforts will be. At this stage, feedback is searched from members, who will have to agree, as a network, to work under certain commitments and parameters that enable the successful implementation of future projects.
- Knowledge Inventory: a register with knowledge handled within the organization (and also that not handled, but required from the outside) is done. These can be divided into physical documents, virtual documents, processes and organization members. There is usually a high percentage of information that is not structured within the company, so it is important to map out the type of information handled, and above all, who generates it and what it is used for.

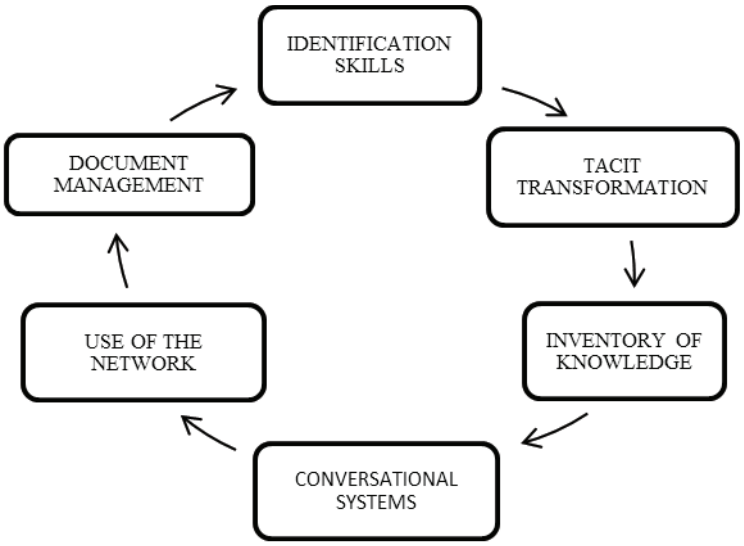

Fig. 1. Primary Model of knowledge Management

- Transformation of Tacit Knowledge: post mapping out of information will make it possible to identify the main sources of knowledge within the company; these people are identified as experts. The experts are renowned for their skills with regard to technique, skills and / or decision-making ability in a specific field. Therefore, they will be responsible for sharing their tacit knowledge with the rest of the organization, so they can socialise it and make it part of their own record. This process can be done by many ways, including expert groups, sessions on Know How about key methods, participatory methodologies, etc.
- Competences Identification: when the existing knowledge and the necessary knowledge within the organization become clearer it will be the time to certify the key competences for each area of work. To establish these competences, we propose the ORDIC model (Definition of Organizational Requirements for Systems of Capital), which operates through systematic comparison of what the organization wants versus what is actually being done to achieve it. This system helps to define the necessary and appropriate competences for each job by: the identification of key processes using flowcharts; the analysis and modelling of processes by making explicit the functional relationships between the tasks performed by the worker and the requirements at each stage, technical, material or intellectual; the preparation of Ideal / Real Matrix, it is set the necessary knowledge for the proper execution of each task from the analysis of functional relationships; the design of training systems, a career plan for the worker is designed from the requirements of knowledge; the technical skills and values, defining the objectives of the tasks, considering all the benchmarks to evaluate their performance; and training staff through programs designed to obtain or maintain the skills needed for optimal execution of tasks.
- Document Management: the document management process aims to organize existing documentation in the organization, either through the categorization of such documents, having available only one valid version, the use of e-mails with notifications and links, management of safe digital copies, increased speed search, etc. Therefore, it is possible to say that in document management is used a set of techniques, processes and programs which are designed for the creation, storage, management and retrieval of texts and images electronically and its correct processing in the organization.
- Use of Networks and Platforms: the use of technology and communication networks will be the form to distribute information and stored and organized knowledge in the previous processes. At this stage the

communication systems based on Internet or intranet are implemented, in order to enable cooperation, transfer and use of information. To implement such systems there are countless technological tools, either software, virtual platforms, networks, etc. that enable and facilitate an ordered and dynamic execution of knowledge-based activities.

4.2. Projects associated to knowledge management

The knowledge management projects are developed in the following phases:

- Capture and reuse of structured knowledge: This type of project recognizes that knowledge is embedded in the output components of an organization, such as product design, proposals, reports, implementation procedures, software code, among others.
- Capture and share lessons learned from practice: Such projects capture the knowledge generated by experience, which can be adapted by a user for using it in a new context.
- Identify sources and experience networks: This type of projects attempts to capture and develop knowledge content, allowing visualization and easier access to expertise, facilitating the connection between people who have the knowledge and those in need of it.
- Structuring and mapping needs knowledge to improve performance: This type of project aims to support efforts in developing new products or redesigning processes making the knowledge necessary for a particular stage of an initiative explicit.
- Measure and manage the economic value of knowledge: This type of project acknowledges that assets such as patents, copyrights, software licenses and customer databases, creating both revenues and costs for the organization, which are oriented to manage them more judiciously.
- Synthesize and share knowledge from external sources: Such projects attempt to take advantage of the information and external knowledge sources, providing a context for the large volume available.

5. Challenges and trends in knowledge management in medium-sized ports

It has been proposed the development of the primary model of knowledge management, according to the development achieved by the Chilean medium-sized ports. Models intermediate and advanced knowledge management that consider alignment of perspectives and the development of learning communities do not have been deepened in this paper. In this context, here are the trends that have been detected in future development planned for medium-sized port communities.

5.1. Integrated Logistics

There exists learning from diverse cultural transfer generated by globalization, changes in the paradigms of business models, the experience provided by the interaction with the market, *Know-How* knowledge, cluster developments and research in maritime safety. The interaction with multi-national companies and different organizational structures that have different objectives requires cultural transformation.

There is non-cooperative competition and a game between shipping companies (leaders) / ports (followers) and between governance and international organizations. Companies that manage port terminals are focused on the development of logistics solutions in terms of data, information, knowledge, payload and flows. The companies that are part of the logistics chain will aim to achieve global standards of performance.

Improving the synergy of knowledge between actors and networks of innovation still remains to be done.

5.2. Port community and collaborative learning networks. Logistic Platforms and inter-modality

Port communities are today facing many challenges, such as implementing new standards of safety and environmental management, improving processes and port procedures, exchanging information and knowledge between the members of the supplies chain port, new and better commercial and cargo handling practices, restructured transport services and traffic growth. The changing environment generates co-evolution and learning networks, which are fed from the formal and informal relationships established between different participants themselves in the port community. These relationships affect the generation of knowledge and must be capitalized to improve intellectual, structural and social capital.

There are key strategic positions in the port community on competition and supply chain, logistics centres are developed and there is competition for creation of value added. Strategies of transport networks that determine competitiveness are selected and there are no barriers to entry for the effectiveness of transportation. Influence due to economic pressure by part of private – public actors and games among the environment, transport companies and energy suppliers are detected. The governance structure of ports is consolidated and the political elite legally regulate the organizations and regulatory frameworks influence decision-making of stakeholders. The port manager learns and transfers the task of business, represents trademarks, follows strategies joint venture, interacts with a changing environment and is focused on both the institutional and regulatory frameworks.

Port development is a key factor to prolonging the life cycle of a port and to relate the core of the business with port activities. Logistics platforms and inter-modality produce patterns of development in a port.

5.3. Creation and dissemination of knowledge

All actors in the port community agree on the need to create and disseminate knowledge. Meanwhile, the management of a port cluster stimulates research and innovation and business leaders do take their leadership.

Companies involved in the logistics of the port and the associated public companies will continue sharing the quality, environmental standards and will incorporate corporate social responsibility and safety.

A trend in the development of an Observatory of port activity and document databases by public organizations that store and facilitate information and knowledge to the port community and close to her users is perceived in the near future. Although there are still limitations caused by cultural differences, geographic location, licensing, strategic alliances and joint ventures between the different participants in the port community, they are willing to assume the tasks of sharing lessons learned from practice.

6. Conclusions

It can be concluded that the dissatisfactions described in the medium-sized ports clearly reveal that a port stakeholder cannot by him / herself meet the needs required by other port members, neither the market nor the environment. Then, for the port system to operate efficiently and effectively should be composed by private companies and public organizations that may have some degree of relationship at the strategic, operational or business level so as to meet the market requirements and survive the life cycle of a port. It is noteworthy to mention the necessity for a port system to meet the needs related to market demand, managing resources, adaptation to environment, learning and evolution.

The model used in Chilean ports incorporates information and knowledge management in port terminals through private investment. However, as regards with facilitation of foreign trade, incorporating management and technology has not been as effective as in the case of port terminals.

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