

Prospective platform for the improvement of the competitiveness of the Colombian shipyard sector through the development of integrated logistical capabilities

Plataforma prospectiva para el mejoramiento de la competitividad del sector astillero colombiano a través del desarrollo de capacidades logísticas integradas

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Abstract

The Colombian shipyard sector is characterized by peculiarities that make it differ from other sectors that define its framework of operation, such as technical, technological, economic and institutional aspects and the dynamics of the shipyard market: a global competitive market; few local actors; difficulties to compete at the international level; financial, economic, technological and information asymmetries through its supply chain. Through the development of integrated logistic capabilities, as a mechanism for the articulation and promotion of regional clusters, it is possible to improve the competitiveness of the shipyard sector, from the articulation of logistic operations, to achieve competitive advantages that are sustainable over time and leverage the articulation potential of the public, private and academic actors that make up and participate in the sector. Integrated logistics capabilities represent how organizations can leverage their resources in conjunction with other members of their supply chain and the industry in general, to deploy organizational strategies and achieve joint benefits for members. In this research, a prospective and strategic platform is presented to promote the creation of the Colombian shipyard cluster through the development of integrated logistic capabilities, based on the utilization of the strategic resources of the sector's stakeholders and the analysis of the potentialities for their integration and development from the perspective of the theory of organizational resources in the context of supply chain management.

Key words: Logistical capabilities, competitiveness, cluster.

Resumen

El sector astillero colombiano se caracteriza por particularidades que lo diferencian de otros sectores y que enmarcan su operación, como aspectos técnicos, tecnológicos, económicos e institucionales y las dinámicas propias del mercado astillero: un mercado de competencia global, bajo número de actores locales, dificultades para competir a nivel internacional, asimetrías financieras, económicas, tecnológicas y de información a través de los eslabones de su cadena de suministro. A través del desarrollo de capacidades logísticas integradas, como mecanismo para la articulación y promoción de clústeres regionales, es posible mejorar la competitividad del sector astillero, proponiendo desde la articulación de las operaciones logísticas, el alcanzar ventajas competitivas que sean sostenibles en el tiempo y exploten el potencial de articulación de los actores públicos, privados y académicos que conforman y participan en el sector. Las capacidades logísticas integradas representan la manera en que las organizaciones aprovechan sus recursos conjuntamente con otros miembros de su cadena de suministro y del sector, en pro de desplegar las estrategias organizacionales y conseguir beneficios conjuntos para sus miembros. En esta investigación, se presenta una plataforma prospectiva y estratégica para promover la puesta en marcha del clúster astillero colombiano a través del desarrollo de capacidades logísticas integradas, con base en el aprovechamiento de los recursos estratégicos de los actores del sector y el análisis de las potencialidades para su integración y desarrollo desde la perspectiva de la teoría de los recursos organizacionales en el contexto de la gestión de cadenas de suministro.

Palabras claves: Capacidades logísticas, competitividad, clúster.

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Introduction

The maritime sector is composed in large part by the transport of goods, the shipbuilding industry and the services associated with these activities, represents the engine of the economy of many developed countries and an opportunity for the emerging economies with the geographical conditions and infrastructure necessary for its development.

Maritime trade has increased its share of global cargo transport in recent years, marking a historic record by passing 10 billion tons in 2015, although it reported a slowdown in growth of (2.1%) compared to previous years as a result of the decline in exports and imports, mainly in developed countries (*UNCTAD, 2016*). With the growth of the maritime industry, the global delivery of offshore vessels tripled between 2004 and 2009 driven by the rise in oil prices and the renewal of the fleets, however in 2015 it slowed down and is expected to decline over the coming years (*OECD, 2015*).

The sector is currently experiencing a deceleration as a result of the fall in oil prices and trade associated with developed countries, which slowed the ship and naval artifacts building industry. Countries with the greatest participation in shipbuilding are China, the Republic of Korea and Japan, with 91.4% of the global production, in gross tonnage, while Bangladesh, India, Pakistan and China represents 95% of the market of naval artefacts in 2015 (*UNCTAD, 2016, p. 29*). In the case of Latin America, Brazil and Chile are the largest participants in the sector.

The Maritime Sector faces challenges from technological advances, the data revolution, the growth of e-commerce and the deployment of the fourth industrial revolution. These changes create risks and opportunities that require the development of new business models, to improve logistical performance and develop capabilities that allow access to new business opportunities (*UNCTAD, 2016, p. 25*). Within the maritime sector, the construction of offshore ships implies a high level of flexibility in production processes, high level of coordination, continuous processes

of innovation and development, and the strict compliance with norms, regulations and International standards (*OECD, 2015*).

To improve the competitiveness of the sector, it is necessary to develop new ways of interpreting its characteristics and the economic situation that surrounds it, taking advantage of the current strengths and proposing long and medium-term actions that allow its development, leveraged in research components, knowledge and logistical capabilities. This article analyzes the particularities of the Colombian shipyard sector from the perspective of logistical capabilities integrated as a mechanism to improve the competitiveness of the sector through collaborative work schemes that integrate the actors of the local and regional supply chain of the shipyard sector. Below the context is presented for logistics in the sector, the potential of integrated logistical capabilities and the guidelines to improve its competitiveness.

Logistics and the competitiveness of the sector

Due to the complexity of the naval artifacts a wide variety of materials are needed from different suppliers, both national and international, increasing the complexity of supply management by requiring delivery time limits for assorted materials that conform to the schedules of the projects in progress, so as not to generate downtime or cost overruns as a result of changes in exchange rates, in addition to other aspects. Product development in the ship building industry is characterized by complex processes that involves high volumes of information between multiple tasks, teams and suppliers that converge and act interdependently (*Gronau & Kern, 2004*).

Analyzing the competitiveness of the Norwegian maritime cluster, under the survey based study of Porter, Benito, Berger, De La Forest, & Shum (2003) it is found that the competitive environment of the sector is widely influenced by the demand conditions which pressures the industry towards continuous improvement, innovation and meeting the customer needs, promoting rivalry among the sector's stakeholders.

This is also the case in Colombia as customers in the sector recognize the degree of personalization of the products and the technological capabilities of the large shipyards to access to their services, motivating the development of capabilities and the increase of the efficiency of the market players. In the wake of the competitive landscape, the actors have specialized their services and have focused on the market segments where they have competitive and comparative advantages over the other actors, such as institutional markets, repair services, design, construction, remodeling and painting among others.

This specialization in market segments gives rise to the creation of new joint business strategies that allow other segments to be serviced that each actor has left behind individually, but what could be addressed by connecting several actors in the supply chain, and even generating new businesses or integrating processes vertically or horizontally. In the country, the ship building industry is largely made up of small dedicated workshops dedicated mainly to the repair and construction of small boats and larger size shipyards dedicated to the design, construction and repair of ships, vessels and naval artifacts. The sector has its own dynamics for each type of business according to its size and availability of their own resources and the region where they are, such as human talent, physical and telecommunications infrastructure, support and surveillance of the regional agencies and territorial promotion and control.

The Colombian shipyard sector is characterized by productive configurations according to each project and requires raw materials from national and international suppliers, in a supply chain where each actor makes decisions of provisioning and management of inventories in an autonomous manner and with little information (*Adarme Jaimes, Arango Serna, & Balcázar, 2011*), which is reflected in the absence of policies for the supply and control of inventories generating high supply costs, delays in the execution of projects and decreased service levels (*Otero, 2012*).

Therefore there is great potential for the reduction of the costs of the shipyard sector stakeholders

by performing the joint planning of their supply chain, sharing information, generating strategies to share benefits through alliances and contracts (*To be with Jaimes, Arango Serna, & Balcázar, 2011*) and to use an intermediate link in the chain to centralize the supply needs and generate the purchasing plans jointly (*To be with Jaimes, Arango Serna, & Balcazar Camacho, 2011*).

It is necessary to confront the current challenges of the sector, the Productive Transformation Plan (*PTP, 2013*) identifies the low capacity of the Colombian shipyards along with the low productivity of the workforce and the high costs of raw materials, as a result of the lack of integration and the failure to access economies of scale, such as the main causes that affect the performance of the sector.

For which, the prospective focus based on integrated logistic capabilities, could help identify the strategic skills of each organization and the possibilities for their integration through the conformation of collaborative structures, such as a regional cluster for the sector, that facilitates the articulation of the actors by overlapping the asymmetries of information and capabilities of each organization.

Integration of the logistic capabilities in the shipyard sector

The resource-based vision (RBV) emphasizes the organizational strategy linked to organizational capabilities as a more stable basis for the formulation of the business strategy that the perspective based on the demand or the external customer (*Grant, 1996*) presenting an alternative approach to the mainstream of conventional competitiveness based primarily on external forces and competitive context.

Organizational capabilities are routines or mechanisms that allows the Organizations to Acquire and deploy resources to facilitate the production and delivery of goods and services (*Rungtusanatham, Salvador, Forza, & Choi, 2003*). The term "capabilities" reflects the role of strategic management in adapting, integrating, and reconfiguring organizational resources,

competencies, and skills to respond to changes in the environment (Gligor & Holcomb, 2012).

The logistic capabilities are unique skills that are learned, maintained and improved in terms of time and quality to compete, being able to become key competencies of the companies (Mentzer, Min, & Bobbitt, 2004).

Logistical capabilities help companies to collaborate with their supply chain partners in the coordination of supply and demand to generate added value to customers (Mentzer et al., 2004). Logistical capabilities are relational and related to the logistic network and arise as a product of inter-organizational learning processes (Pfohl & Buse, 2000).

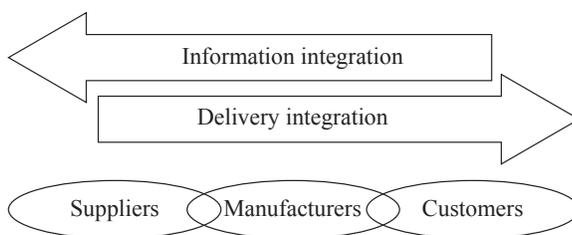
In the supply chain of the shipyard sector, the resources, capabilities and knowledge of multiple organizations converge to achieve the development of a project, so that the chain can be seen as a dynamic network of capabilities that must be integrated to meet the project objectives, with it being necessary to research the mechanisms of integration of these capabilities (Ruuska, Ahola, Martinsuo, & Westerholm, 2013). It is important to study that processes or capabilities allow companies to leverage joint knowledge and complementary resources outside of long-term strategic relationships (Zacharia, Nix, & Lusch, 2011).

The current competitive scope has shifted from the level of individual organizations to supply chains, so organizations must integrate their logistical capabilities with those of their supply chain members (Gligor & Holcomb, 2014) therefore the development of process integration capabilities in supply chains, makes it easier for the company to make improvements in its performance, specifically in operational excellence and increased revenue (Rai, Patnayakuni, & Seth, 2006).

In the study of Frohlich & Westbrook (2001), through the International Manufacturing Strategy Survey of 1998, identified that the most successful manufacturers seem to be the ones who have carefully linked their internal processes with their External vendors and customers in unique supply

chains (Fig. 1). In order for this integration to be successful it is necessary to identify the concordant and redundant processes throughout the supply chain and to determine at which point the highest value is added in the chain (Balcazar, 2014).

Fig. 1. Supply Chain Integration



Source: Adapted from (Frohlich & Westbrook, 2001, p. 186).

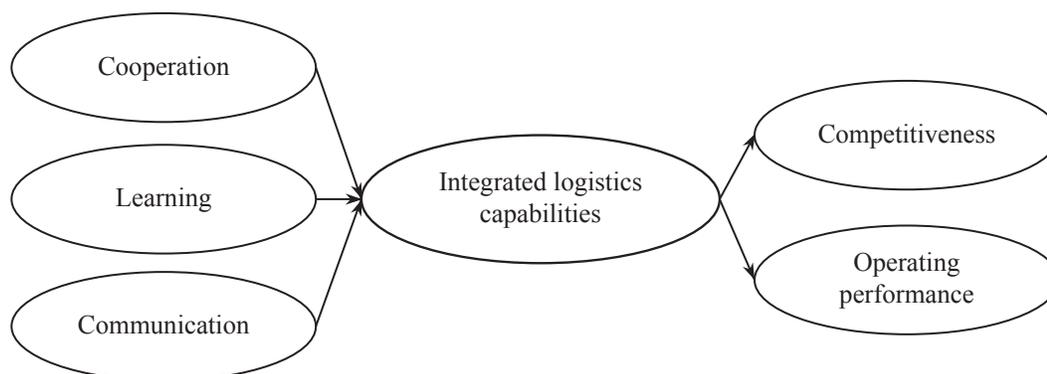
In the context of organizational capabilities, the integrated logistic capabilities represent the ability of a local company to have the skills of the organizations that make up its supply chain, so that it can positively affect their performance and that of the organizations that make up their network.

In order for capacity integration to take place, it is first necessary to identify the distinctive logistic capabilities of each organization that forms the network and supply chain, and then establish collaborative, integration and coordination mechanisms that can configure forms of joints action and allow organizations to positively affect their competitiveness and performance.

Fig. 2 presents a construct of how integrated logistic capabilities can be achieved through the capabilities of learning, cooperation and communication (Esper, Fugate, & Davis-Sramek, 2007; Morash, Dröge, & Vickery, 1996). It also shows how the integrated logistic capabilities can influence operational performance and competitiveness (Lynch, Keller, & Ozment, 2000; Shang & Marlow, 2005).

A mechanism to facilitate the integration of logistic capabilities, is the conformation of logistical communities or regional clusters. Through a shipyard cluster it is possible to achieve advantages for the sector and the region. The experiences of other countries show the importance of this

Fig. 2. Construct of logistic capabilities and competitiveness



Source: Adapted from (Gligor & Holcomb, 2014, p. 220)

type of integration strategy by facilitating the communication of the members of the cluster with other sectors (Benito *et al.*, 2003) and its potential to initiate collaborative engineering processes (Gronau & Kern, 2004).

Through a shipyard cluster it is possible to mitigate the negative effects on the overall performance of the supply chain, caused by the asymmetries of the sector and its supply chain. By acting as a central node in the sector, to channel, align and promote the standardization of information flows, action mechanics and good practices in the sector, the cluster figure facilitates the communication and information flows between stakeholders in the sector and the collective construction of strategic positions.

Prospective platform to improve the competitiveness of the sector

The ship building industry has been developed as a knowledge-intensive industry with high contributions from the service sectors, so the prospective technology can be used to analyze possible scenarios and define sectoral priorities by contemplating the perspectives of industry and supply chain experts to identify problems and propose solutions that respond to the challenges of the sector (Vishnevskiy, Karasev, Meissner, Razheva, & Klubova, 2015).

For the construction of a prospective platform focused on competitiveness, it is possible to

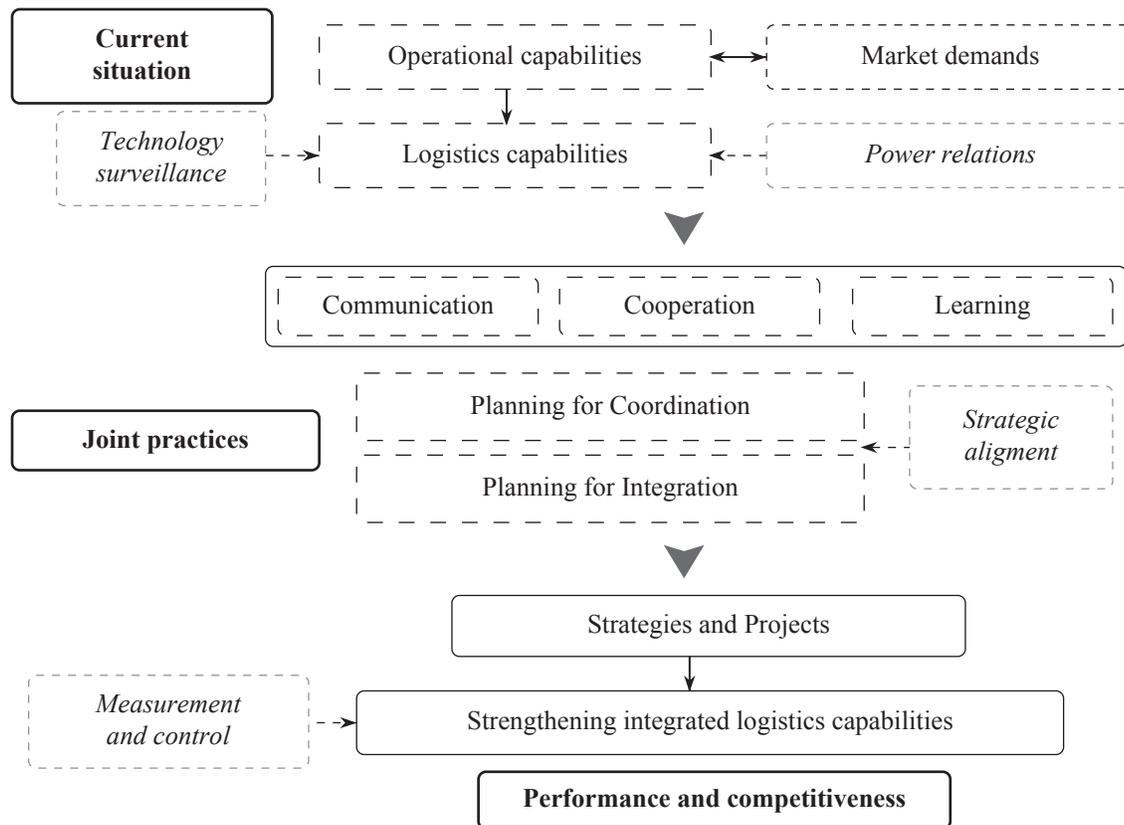
appropriate elements of the technological vigilance. From the methodologies for the formulation of technological strategies reviewed by Castellanos, Ramírez, Fúquene, Quintero, & Fonseca (2013) common phases are identified that can be applied to the construction of the prospective platform of the shipyard sector: 1) Evaluation of the current situation, 2) Evaluation of capabilities, 3) Project identification, 4) Definition of the strategy and 5) Implementation and control. Phases that can be aligned by the construct of integrated logistic capabilities presented in Fig. 3.

Assessment of the current situation

In the first phase of the prospective platform to improve the competitiveness of the shipyard sector, the characteristics of the supply chain of the shipyard sector are identified, together with the different companies that constitute it and their degree of specialization, as well as the roles they play within the chain. At this stage, public, private, educational and institutional actors are identified that directly influence, through their actions, or indirectly through the establishment of limiting conditions or that encourage and promote the activities of the sector.

After the recognition of the actors, it is necessary to determine the strategic relationships between the companies of the shipbuilding cluster in terms of Interaction with other actors in the supply chain and the degree of influence of the actors within the sector and the local economy. The main

Fig. 3. Prospective platform of the Colombian shipyard sector



Source: The authors based on Balcazar (2014, p. 24) and Balcazar Camacho, López Bello, and Jaimes (2016)

actors should be identified, as well as the possible strategies for their integration and support of the cluster's plans, such as the strategic providers of services, information, knowledge, training, inputs, raw materials and technologies, as well as local and regional institutional actors.

Including elements of the Porter diamond, the phase of the current situation also includes the identification of the external elements of the sector as well as the requirements of the international market and the current panorama of the competitors of the region, their services, capabilities and added values that generate competitive advantages in the market.

Using techniques of collective knowledge construction, through prospective processes with industry experts, from different perspectives: academic, business and institutional, it is possible to evaluate these elements and identify common

points and interests as well as the concerns of stakeholders and other elements that will guide the identification of project opportunities.

Capacity assessment

Starting from the identification of the local resources, geographical, economic, and social conditions and internal and global demand, the resources in conjunction with the cluster organizations can be aligned to provide competitive advantages in the face of the market needs. To this end, the resources must be hard to imitate, valuable and rare (Barney, 1991). These resources can be articulated through the deployment of integrated logistic capabilities.

Capabilities include the identification and recognition of tangible and intangible resources that can be used to generate them, such as the routines, strategic values, operations policies,

shared practices, among others. In order to measure these capabilities it is necessary to develop measuring scales that allow the degree of group and individual advancement of the organizations to be evidenced with regard to the capabilities.

The resources of cluster organizations can be directed towards building Integrated Logistics capabilities that impact logistical performance (Ralston, Grawe, & Daugherty, 2013) and the overall performance of the sector's supply chains. For example, the articulation of business information systems and the application of information and telecommunications technologies enables the development of information-based logistical capabilities that directly influence the logistical performance of the supply chain (Zhao, Dell, & Stench, 2001).

The logistical capabilities can be classified in: demand-oriented, such as customer service, time and capacity of response to the market; oriented to supply or operational such as the availability of products and the total cost of distribution (Morash et al., 1996) and learning-oriented (Esper et al., 2007), such as routines, knowledge and shared assumptions.

By identifying these capabilities and their degree of individual development by the members of the cluster, it is also possible, with the interdisciplinary and inter-company participation of experts, to propose mechanisms and strategies for their development and integration.

Project identification

The potential of the shipyard sector and its supply network to take advantage of market opportunities and develop new services and solutions, based on the generation of joint action strategies, can be contemplated from several capabilities: Communication, Cooperation, Coordination and Integration. For the deployment and implementation of joint projects, the shaping of an organizational scheme, such as a cluster, can facilitate the design and adoption of mechanisms that facilitate the communication, cooperation, coordination and integration, by defining predetermined procedures, rules, and agreements that serve as the basis for and establish

the minimum requirements for each type of action between cluster members and the supply chain.

The collaboration schemes in the shipyard sector are not new strategies, when the market requires large projects, the organizations go to other specialized firms to collaborate on specific aspects of the projects, without these being considered as direct competitors. These trust-based relationships provide high degrees of flexibility and enable organizations to focus on their core competencies (Lechner & Dowling, 2003).

Through mechanisms to improve communication among sector participants, organizations can improve their competitive advantages by investing in research and development or through their inter-organizational linkages, such as alliances and networks that facilitate knowledge flows and collaborative learning processes (Caiazza, Richardson, & Audretsch, 2015).

Project opportunities are not limited only to the use of new market and operational opportunities. The technological appropriation and the adoption of standards within the sector requires first of all the adoption of change management strategies, organizational learning and knowledge management that facilitate the adoption and transfer of technologies, practices and experiences among the members of the sector to boost the growth of the sector (Paine et al., 2013), and projects for the internal strengthening of industry organizations can also be evidenced. Customised training processes, dissemination of standards, appropriation and technology transfer are identified at this stage.

In terms of information and communications management, the shipyard cluster can facilitate the creation of market networks. Through market networks, focal companies can leverage their relationships to gain more information about market demands and new product requirements, to reach new markets or customers (Lechner & Dowling, 2003).

Defining the Strategy

The definition of the sector's strategy is part of the

identification of the goals of the organizations that make up the sector and can become integrated goals of the shipyard cluster. It is necessary to contemplate the objectives that overlap the individual interests and allow global benefits for the supply chains and organizations of the sector to be achieved. The benefits must be deployed throughout the supply chains, through mechanisms such as contracts to share benefits or periodic renegotiations that improve the initial offers in accordance with the benefits derived from the deployment of communication, cooperation, coordination and integration mechanisms.

For the coordination and integration of capabilities of the shipyard sector based on logistical operations, it is possible to use strategies to share information about the supply and the requirements of materials and means of transport and production, among others. By identifying coincidences in the projections of purchases, and/or use of means and procurement of services, it is possible to develop integrated planning strategies, or at least those coordinated from operations focused on the not generating interferences and non-overutilization of resources in the region, as a result of the convergence of major projects. These phenomena can induce periods of shortages of qualified human talent, inputs or logistic services of supply, transport and storage, among others, and even provoke artificial spikes in prices as a consequence of the momentary scarcity or lack of availability, which negatively affects the sector.

The strategic alignment of the cluster must overlap the power relationships identified in the supply chains of the sector and determine stratified strategies that can be adopted to fit the capabilities of each one of the actors of the chain as they are developed.

Cluster strategies should promote the development of integrated logistics capabilities based on identified resources.

Implementation and control

After identifying project opportunities through activities of communication, cooperation,

coordination and integration, and to define the minimum standards and mechanisms for their implementation in specific projects, it is also necessary to develop mechanisms for monitoring and controlling the strategy of the cluster and the achievement of the objectives of the sector when faced with changes in the market and the socioeconomic conditions of the region.

The central objective of the control of the deployment of the strategies and joint plans of the cluster is the improvement of the processes through the supply networks of the actors of the sector. It is necessary to develop a better understanding of how performance measures contribute to or limit the use of existing capabilities or the identification of new strategic skills (*Grafton, Lillis, & Widener, 2010*). By focusing on one indicator or another, it is necessary to monitor efficiency and resource utilization relationships in the processes rather than gross or aggregate results that simply focus on volumes, such as: Sales, revenue, profitability, indicators that show individual results, beyond the joint goals of the sector.

A shipyard sector performance management system should not only allow performance measurement, but also the policies, emotions, behaviors (*Gunasekaran & Kobu, 2007*) and joint actions of the members of the supply chain. The performance measures should not be limited to categories such as quality, time, flexibility and costs, but be inclusive, universal, measurable and consistent with the goals of the organizations and the supply chain of the actors in the sector (*Beamon, 1999*).

The development of a control and monitoring system for the prospective platform of the Colombian shipyard sector should consider the differences between the organizations that make it up and the use of measures that drive the improvement of processes, the adoption of good practices, the implementation of collaborative activities and the degree of use of joint resources for adding value among stakeholders in the sector.

Discussion

The Colombian shipyard sector presents great opportunities to increase its participation in economic development and that of the regions, with it being necessary to promote integration and joint action strategies that allow advantage to be taken of new business opportunities and joint research processes, obtain access economies of scale, development and transference. To do so the development of associative structures such as a regional cluster would facilitate the implementation of collaborative engineering communities for the design, construction, repair and development of services related to the main processes of the shipyard sector, promoting the creation of new businesses and the application of new technologies. To facilitate the implementation of these strategies, the study and development of integrated logistic capabilities in the context of a prospective agenda for the sector, can contribute to the joint improvement of productivity and competitiveness of the sector and facilitate its interaction with the institutions and the education sector through training, strengthening, research and transfer processes according to the consolidated needs of stakeholders in the sector.

It is necessary to study the way in which the current logistic capabilities of the members of the shipyard sector are configured, identifying the concordances and dissonances, as well as their potential to be integrated. It is possible to propose mechanisms for the gradual integration of logistical capabilities by initiating the least specialized ones until fundamental and distinctive capabilities are obtained. Project support processes such as the management of purchasing, acquisition of services and training processes, development, research and transference, show great potential for its integration within the sector.

International studies show that the shipyard sector faces great challenges involving the adoption of new technologies and improving operations in accordance with the ever-increasing demands of the market and standards. Addressing these challenges individually can lead Colombian shipyards to incur large costs and high levels of

risk to stay competitive in the international market. A consolidated shipyard cluster projects the joint action of the sector and dynamizes the improvement of its operations and interactions with other sectors. It could help address these challenges and gain access to new business opportunities, economies of scale, technological advances, and market and other information, increasing the competitiveness of the sector and achieving joint benefits for its members. Identifying and quantifying organizational and inter-organizational resources that can lead to the development of logistical capabilities is a work that requires customised research processes and the development of constructs that support their measurement. It is necessary to look for alternatives that promote the development of these research processes, linking the educational sector and the government agencies promoting science, technology, development and innovation for the construction of specific agendas in the shipyard sector.

In future jobs it is necessary to find ways to operationalize and verify the construct of integrated logistic capabilities in the shipyard sector (Figure 1.) and mechanisms for its measurement and control from the proposed prospective platform. Integrated logistical capabilities in the context of joint action and collaboration strategies as a regional cluster, can facilitate the development of collaborative engineering communities that are linked to the research processes of higher education institutions in articulation with the strategies of regional strengthening of the public institutions. It is necessary to propose research that studies the design of mechanisms to facilitate and promote these types of public-private partnership structures in supply chains with a large number of actors, high levels of uncertainty and asymmetries of information and resources, such as those of the shipyard sector.

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