

# Inter-firm cooperation strategies to develop environmental best practices in the Colombian shipyard industry

Estrategias de cooperación inter-empresa para el desarrollo de mejores prácticas medioambientales en la industria de los astilleros colombianos

Ana V. Céspedes<sup>1</sup>  
Alejandro D. Sejnauí<sup>2</sup>  
Milena M. Ortega<sup>3</sup>

## Abstract

The present work aims to develop strategies that allow implementing environmental best practices in the Colombian shipyard industry, a sector that has been growing for the last decade and that is identified as a potential world-class industry in the country. Collaborative work was carried out with four of the biggest Colombian shipyards and an international firm to identify legal and operational issues regarding the industrial activity, to reach unified consensus to represent the whole sector. Finally, an environmental best practices document was elaborated to guide shipyard operations in the country, with the potential to be constituted as an official guide of the Colombian Ministry for the Environment.

**Key words:** Best practices, environmental management, shipyard, Colombian shipyard industry.

## Resumen

El presente trabajo tiene como objetivo desarrollar estrategias que permitan incorporar buenas prácticas ambientales en la industria astillera Colombiana, sector que ha mostrado un crecimiento significativo en la última década y que representa una apuesta productiva para el país. Se efectuó un trabajo colaborativo con cuatro de los astilleros más representativos en el país y una empresa internacional para identificar los aspectos legales y de operación de la actividad industrial que impactan el medio ambiente, de manera que se lograra unificar criterios que tuviesen una representatividad sectorial. Finalmente se consolidó un documento de buenas prácticas ambientales para orientar la operación de astilleros en el país, con el potencial de constituirse como una guía oficial del Ministerio de Ambiente, Vivienda y Desarrollo Territorial colombiano.

**Palabras claves:** Buenas prácticas, gestión ambiental, astillero, industria astillera Colombiana.

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<sup>1</sup> COTECMAR. Environmental Analyst. Cartagena, Colombia. e-mail: [acespedes@cotecmar.com](mailto:acespedes@cotecmar.com)

<sup>2</sup> COTECMAR. R&D Program Manager. Cartagena, Colombia. e-mail: [asejnauí@cotecmar.com](mailto:asejnauí@cotecmar.com)

<sup>3</sup> COTECMAR. R&D Programs Management Division Chief. Cartagena, Colombia. e-mail: [mortega@cotecmar.com](mailto:mortega@cotecmar.com)

## Introduction

The Colombian shipyard industry represents an emerging sector of the national economy, with significant progress during the last decade that has led to its establishment as a strategic sector in the department of Bolívar, one of the principal coastal regions in the country.

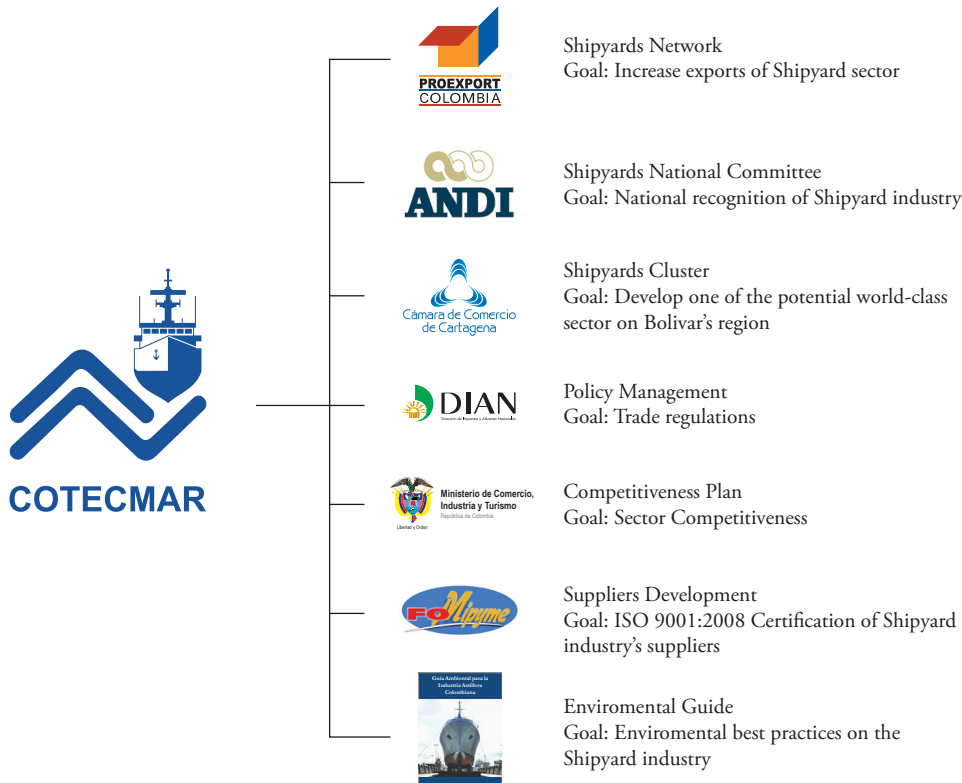
Shipyard operations involve a broad range of processes like abrasive blasting and vessel maintenance and materials like Marine Coatings and Antifoulants, which are both especially prone to polluting the surrounding air, water, and soil (PPRC, 2008). Shipyards and related industries can significantly impact the environment of many coastal cities. Based on this, it is important to develop Environmental Best Practices (EBP) in the industry, parallel to technological and economic growth, to manage pollution, evaluate impacts, study recycling/treatment and disposal alternatives, and review regulatory compliance.

International experiences support the creation of a network to develop EBP. For instance, in 2003

the US Environmental Protection Agency (EPA) in partnership with the Shipbuilders Council of America (SCA) created a pilot group of shipyards to generate Environmental Management strategies, providing a customized implementation guide, training workshops, a forum for discussion, and technical support. As a result, a lot of the US shipyards have adopted the implementation guide, accomplishing significant improvements in their operations.

In Colombia, the Science and Technology Corporation for the Development of the Naval, Maritime, and Riverine Industries – COTECMAR is the leading company of the shipyard industry and has initiated several strategies with the support of the national government and the academy to strengthen the sector with regards to aspects like technological capabilities, local supply chain, trade regulations, and environmental management, as shown in Fig. 1. COTECMAR also coordinates the International Ship Design and Naval Engineering Congress (ISDNEC) and the *Ship Science & Technology* journal, the most representative journal in Latin America regarding Naval Engineering.

Fig. 1. Sector initiatives where COTECMAR participates



The aim of this work is to present the experience of the Colombian shipyard industry in developing an EBP guide with a pilot group of local companies.

## Inter-firm cooperation strategies

The conventional business model of organizations with an individualist focus has emerged to a new concept that associates openness and cooperation, where terms like cooperation networks, strategic alliances, and clusters are a new language for organizations to enhance development and sustainability (*Christopher, 2009*).

Based on this, special interest has emerged in literature and policy systems to create mechanisms that enable the growth of industrial sectors and their integration with government and academy, seeking to increase technological capabilities and competitiveness (*Dewick and Miozzo, 2004; Felzensztein, et al., 2010*), allowing innovation to occur within the company's products and processes (*Brioschi et al., 2002; Nieto and Santamaria, 2007; cited by Zeng, et al., 2010*).

Several authors argue that one of the principal factors that influence learning and innovation capabilities among companies is geographic proximity (*Porter, 1998; Freel, 2003; Felzensztein, et al., 2010*), which is why some countries have developed regional strategies around technologies or industrial sectors.

In Colombia, the government has led diverse cluster initiatives during the last decade, like regional competitiveness plans and the Productive Transformation program, both created to develop world-class industrial sectors and generate employment.

## Brief history of the Colombian shipyard industry

The first shipyard in Colombia was founded in Barranquilla in 1929, named Industrial Union and Shipyards (UNIAL, for its name in Spanish). Then, in 1942, the first Naval Shipyard was created, fully-

equipped to repair Colombian Navy ships and privately owned ships.

To boost the Naval construction in the Caribbean, the Shipyard Company and Naval Services (EDANSCO, for its name in Spanish) was founded in 1956. This firm created a decade later in association with the Institute of Industrial Promotion the Colombian Company of Shipyards (CONASTIL, for its name in Spanish). CONASTIL penetrated successfully onto the market, building a fully-equipped facility in Cartagena's industrial sector (Mamonal) with 3600 tons of lifting capacity and operating until 1994, when the company was closed because of administrative problems. This fact introduces the Colombian shipyard industry into a crisis that affected the national maritime power and other related industries.

Amid this situation in the industry, the Colombian Navy decided to reactivate the CONASTIL facilities, creating the Science and Technology Corporation for the Development of the Naval, Maritime, and Riverine Industries (COTECEMAR), a milestone that initiated a new period of growth for the industry.

Nowadays, the shipyard industry is consolidated in the Colombian Caribbean region, with around 20 shipyards and naval workshops. One of the main achievements is that the industrial activity has been established in Bolivar's regional competitiveness plan (2008) as a potential world-class sector, which brings national recognition and enables the possibility to develop policies regarding trade regulation, incentives, environmental management, etc.

## Adoption of environmental guides in Colombia

Environmental guides are instruments that seek to include environmental factors in the process of planning and developing operations in industrial sectors, acting as a technical reference in projects or other activities regarding the nation's main industries.

These guides were created by the Colombian Ministry for the Environment and were adopted through Resolution No. 1023 of July 28, 2005, as an instrument to undergo self-management and self-regulation, and also as a conceptual and methodological reference. There are 45 guides operating, impacting five industrial sectors: Oil, Energy, Agriculture, Manufacture, and Transport.

On this Resolution, the paragraph in the third article established that the Ministry can adopt new guides, offering an opportunity for other sectors to properly manage the environmental impact of their processes.

### Environmental management in the colombian shipyard industry: the sectorial process

The environmental guide for Colombian shipyards is part of the sectorial initiatives coordinated by COTECMAR, promoting the development of the industry on scientific, technological, and productive aspects. It addresses one of the main problems that most enterprises encounter: environmental impact of industrial processes. Ignoring this can affect the company's relationships with the stakeholders and its expansion plans, but managing it properly can increase productivity and support social responsibility programs.

Several players have participated in this collaborative process, including national and international companies, the academy, and associations, enabling the elaboration of a preliminary document to be presented to the Ministry for the Environment and its eventual adoption by the companies of the industrial sector. The process is shown in Fig. 2.

### Baseline

The process started with the construction of a Baseline of the environmental activity of the national shipbuilding sector. A pilot group was selected for this phase, including four of the most representative shipyards in Cartagena (2), Barranquilla (1), and Urabá (1), along with a world-class shipyard located in Chile . These companies were selected by taking into account their production processes, products and services portfolio, and the environment where they operate. Every facility was visited to analyze processes and their impact upon the environment, as well as to learn of the EBT actually being developed by each company.

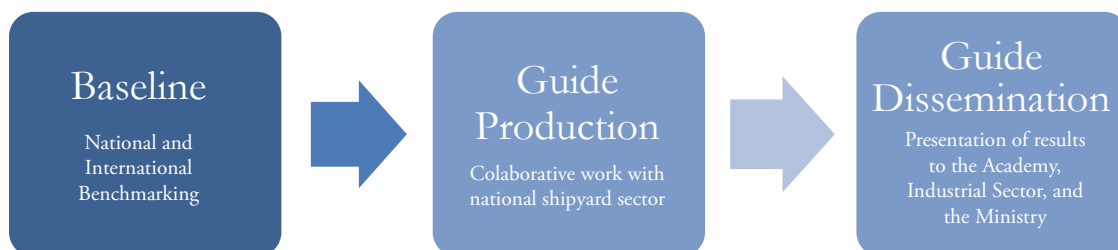
### Guide Production

With the baseline defined, the production process was performed via three workshops: Law and Regulations review, identification of Environmental Impacts, and Environmental Management Plan. The discussion was developed by considering shipyard construction and operations. The methodology and main results obtained from each workshop are presented below.

### Workshop 1: Law and Regulations review

Shipyards in Colombia are not obligated to have Environmental Licenses, but they need to secure certain permissions and authorizations from the environmental authorities (forest utilization, water concessions, liquids dumping, dangerous and/or solid residues, etc.). In this process, all the procedures and templates required were identified. A special chapter was developed in the Guide reviewing this aspect.

Fig. 2. Environmental guide production process



## Workshop 2: Environmental Impacts identification

The environment provides human beings important resources for development, like raw materials and energy. A small amount of these resources are renewable, which is why their proper management is required.

Every activity generates an impact on the environment. The level of these impacts depends on the vulnerability of the elements of the ecosystem where the industrial activity is being undertaken. The guide contains all the impacts identified and the plans to prevent, control, or mitigate them, as shown in Fig. 4.

Fig. 3. Workshop on Identification of Environmental Impacts



Identification of impacts was performed by using a cause-effect matrix that contained the activities and the possible impacts according to previously defined processes and aspects. Every environmental

Fig. 4. Environmental impacts identified

Environmental Element	Environmental Impact	Scope
Geo-forms	Shore Erosion	Changes or instability presented on ocean and river shores
Soils	Soil win/loss	Volume of material to be added or extracted
	Soil Contamination	Incorporation of unknown matter to soil that produces physical, chemical, and biological instability
Atmosphere	Air Contamination	Increase/Decrease of composite concentrations (e.g. CO, SO <sub>x</sub> , NO <sub>x</sub> ) and particulate material in the atmosphere
	Noise Level Alteration	Increase/Decrease of decibels according to standards
Water	Water Contamination	Incorporation of unknown matter to water
	Riverbed Alteration	Changes on riverbed morphology caused by dredging
Flora	Aquatic Flora Alteration	Damage caused to species of aquatic, marine, and riverine flora
	Terrestrial Flora Alteration	Damage caused to terrestrial flora
Fauna	Aquatic Fauna Alteration	Damage to aquatic fauna as a consequence of shipyard activities
	Terrestrial Fauna Alteration	Damage to aquatic fauna as a consequence of shipyard activities
Perceptual	Scenic Value	Alteration of shapes and elements that allows aesthetic enjoyment
Natural Resources	Resource demand	Refers to utilization of natural resources
Socio-economic	Social Conflicts	Conflicts that could emerge with communities or institutions
	Worker Health Alteration	Health alteration to workers as a consequence of their exposure to risks while they perform their job functions

delegate of the pilot group's companies filled out the matrix according to the specific ecosystem of their facilities.

### **Workshop 3: Environmental Management Plan**

Based on the results of Workshop # 2, the following activities were completed:

- a. Definition of Environmental Management Programs, including measures to be implemented to mitigate, control, prevent, and/or compensate environmental impact.
- b. Monitoring and controlling plan, with activities to audit the goals established in the management plans defined.
- c. Identification of efficiency indicators to accomplish the activities defined on the management plans.
- d. Elaboration of a contingency plan, based on the risk analysis and the actions aimed at guaranteeing proper management of technical, human, and economic resources to address potential emergency situations.

The results obtained on the three workshops with the pilot group allowed elaborating a preliminary document to work with other players from the national economy.

### **Guide Dissemination**

The document elaborated in the production stage was presented in two scenarios:

- The Academy, represented by the Colombian Network of Environmental Education (RCFA, for its name in Spanish). This network has the goal of creating cooperation scenarios to discuss topics regarding sustainable development. It also organizes the Environmental Science & Technology congress, and the guide was included as one of the main topics for discussion in the Integral Coastal Management Chapter.
- The industrial sector, represented by the Shipyard Committee of the National Association of Industrialists (ANDI, for its name in Spanish).

The document is currently being adapted with the feedback from the Academy and the Industrial Sector. Once this stage is completed, the document will be presented to the Colombian Ministry for the Environment to be incorporated as a formal guide representing shipyard operations.

### **Conclusions**

The Colombian shipyard sector is an industry that has been growing for the last decade and has the potential of becoming consolidated as a world-class industry in the long term. As the sector increases its industrial and technological capabilities, it is important to develop EBP to guarantee sustainability.

The existing mechanisms to develop EBP in Colombia are the environmental guides. There are 45 guides currently operating, and there is a possibility to develop new ones if the Colombian Ministry for the Environment considers it appropriate.

This project is part of the sectorial strategies led by COTECMAR to increase the competitiveness of the shipyard sector and its national recognition. The results obtained can be used to optimize operations and construction of national and international shipyards and, also, as a reference on network collaborative work.

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