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Comparative analysis of the environmental impacts of port activities in Pernambuco ports

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ABSTRACT

Port activities can create serious consequences to human health, coastal ecosystems and socioeconomic activities. The panorama of the port sector shows a scenario of intense transformation, whose environmental impacts should be analyzed carefully. The main impacts are due to the port operation and infrastructure deployment activities to promote the transit of cargo. In this sense, the objective of this work is to identify the main environmental impacts from port activities in the state of Pernambuco (Suape and Recife's). Through this, the proposed methodology was based on conducting research and synthesis from bibliographic material of the area to generate this literature review. It was found that port implementation activities can cause the following impacts: the hydrological pattern and sediment dynamics of natural coastal areas (habitats, ecosystems, changes in the coastline), vegetation removal, modification in the layout and channel changes at the bottom of water bodies, water pollution, soil, subsoil and air. On the other hand, port operation activities can generate environmental problems, such as changes in water quality, air pollution due to the emission of gaseous and solid particles, various disorders due to the traffic of heavy vehicles in the urban environments, generation of odors, noise, change of landscape, disturbances in fauna and flora, the increase of endemic disease vectors in man, and the introduction of exotic species. All these problems have been identified both in Port of Suape and Port of Recife as based on previous survey studies. It is concluded that these activities are necessary for the operation of ports, and in this sense the monitoring of these areas becomes necessary to monitor the risks and environmental impacts so that the actions of the ports do not compromise the ecological balance.

Keywords: port activities, environmental impacts, ports

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INTRODUCTION

With the occupation of the territory, population growth and the need for marketing goods with other states and countries contributed to the emergence of Brazil coastal ports, as a form of regional development.

According to Federal Law nº. 12.815 conceptualizes "port organized the public good built and equipped to meet the navigation needs, handling of passengers or movement and storage of goods, and where traffic and port operations are under the jurisdiction of the Port Authority" (BRASIL, 2013). Thus, from the beginning of the emergence of ports, their trade relations act as a production chain link, being central to the implementation of significant changes during the evolution of port activities, such as, for example, the construction of railways, expansion of the road network, expansion of telephone systems, energy, as well as providing environmental and social changes in their regions (DIAS, 2013).

Port operations, even being considered activities of strategic nature and indispensable for economic, social development and high economic importance, are not exempt from environmental implications (LOURENÇO; ASMUS, 2015). Thus, the execution of this activity can not occur without due impaired physical and anthropic environment, that is, under a social and environmental development (SA, 2008).

The carrying capacity of a port is based on the determination of the carrying capacity of vessels based on density and pollutant load capacity of such in the environment (SILVA; SOUZA, 2010).

It is therefore necessary to take into account that when the limits of carrying capacity are exceeded in the environment, economic development returns can become withering (LIRA et al., 2015).

Instruments boosted discussions about the environment and that linked changes in the control of marine pollution are directly associated with the development of international agreements, codes and instruments, such as the Oil Pollution Preparedness, Response, and Co-operation (OPRC) London Dumping Convention, the Ministerial Conference of the North Sea, MARPOL 73/78 (SILVA, GOMES, 2012).

The full awareness of environmental issues in port environments is of fundamental importance for the port to be operated correctly in order to avoid and/or mitigate environmental impacts of their activities.

According to ANTAQ (2016), "it is considered an environmental impact any physical, chemical and biological properties changes of the environment caused by any form of matter or energy resulting from human activities that affect directly or indirectly the health, safety and welfare of the population, social and economic activities, the biota, aesthetic and sanitary conditions of the environment and the quality of environmental resources".

These effects can be divided into two groups in view of their triggering events. On one side, there are environmental impacts related to new construction/installation and expansion of the port area and on the other, the impacts of the port operation.

In the State of Pernambuco there are two important ports, which has been increasingly consolidating as an attractive and strategic space with regards to the installation of large enterprises and service to passengers. Both are for public and maritime flow. The Port of Recife has been in operation for 98 years and the Port of Suape for 33

years, the latter causing the most diverse impacts, being the main problems related to the use and occupation of the land (socio environmentally) and environmental degradation.

Environmental impacts in port areas continues since the creation of ports, but some works have had audits covering environmental monitoring allowing greater control and responsibility in the environmental context (SILVA, 2014).

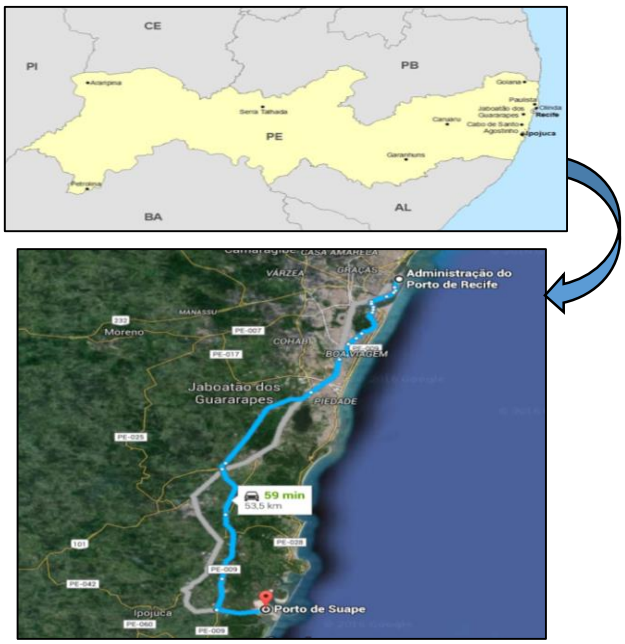
Based on this, the purpose of this paper is to present the relationship of port activities with impacts on the environment in the ports of Pernambuco: Recife Port and Port of Suape.

REVIEW

1. Port of Suape x Port of Recife

The selected ports were the ports of Recife and Suape, which are located in the state of Pernambuco, in northeastern Brazil, eastern portion of this region, being bathed by the Atlantic Ocean and is fully inserted in the Tropical Zone (Figure 1).

Figure 1 – Location of the ports of Recife and Suape.
Source: IBGE, 2016 and Google Earth, 2016.



The Port of Recife is located in the capital of Pernambuco, in Recife, where it functions providing services, taking long-haul and cabotage vessels (Cabotage is the navigation between the same country ports using sea routes or routes inland) for the import and export of domestic cargo, in addition to receiving cruise ships and having a Terminal Passenger Ferry. Its activities are: providing calm waters for berthing, the availability of cots and places for storage (warehouses and courtyards), and the security required to carry out the port operations (Port of Recife, 2016).

The Suape Port is located in the Metropolitan Recife, occupying areas in the municipalities of Ipojuca and Cabo de Santo Agostinho, having an area of 13,500 hectares, distributed in sectors such as: Port, Industrial, Administrative and Ecological Conservation Services and Cultural Preservation.

The Special Environmental Sector (or SEA) contains a special area inserted in ZPC, where the Agricultural Production Center of Excellence will be installed for research and sustainable experimental production. The Cultural Preservation Zone - ZPC include sites of special architectural and archaeological interest, and encompassing other areas at SUAPE, which should be protected and explored for its singular characteristics for research and dissemination of its cultural patrimony (MEDEIROS et al., 2014).

The port of Recife can be classified as classic port or city-port, as it is located in a metropolitan area, housed in the continent, with maritime access to low depths and narrow land, very close hinterland and general cargo handling is not utilized (CASTRO; ALMEIDA, 2012).

And the port of Suape as a modern port is characterized for its logistics, with international

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routes, mostly in coastal areas, which moves cargo in specialized form, has little relation to its surroundings and distant influence areas, and has industrially developed maritime regions, large backyard and ease of development for land access (CASTRO; ALMEIDA, 2012).

Its design is of an industrial port that offers ideal conditions for the installation of projects in various segments. The Suape Port also has activity: receiving ships for import and export. Table 1 shows the main differences between the ports under study.

Table 1 – Possible environmental problems due to port operations (Author, 2016).

Characteristics	Port of Recife	Port of Suape
Location	City of Recife	City of Ipojuca
Rating	Classic port or city port	Modern port or industry port
Main activities	-Receiving of Long course vessels -Navigation of Cabotage -Passenger ferry terminal	-Receiving of Long course vessels -Industrial center -Navigation of Cabotage
Environmental controls	-Synanthropic Fauna -Control of water supply -Cleaning and disinfection of water reservoirs	- Synanthropic Fauna -Monitoring and environmental control -Construction and critical local Environmental Inspection System
Developed programs	-Paperless port program	-Environmental education program

In Figures 2 and 3, it can be visualized the difference on size of the ports where Suape has a greater presence of containers than in Recife. It is also seen that the port of Suape has a larger green area which does not exist at the Port of Recife, which is urban with few green areas.

Figure 2 – Panoramic view of Port of Suape. Source: Author, 2016.

Figure 3 - Panoramic view of Port of Recife. Source: Porto Digital, 2015.

2. Historical events

In the searches conducted, it was found only an environmental accident in Port of Recife, in 1985, when there was the explosion of a tank with 1,500 tons of product in the petrochemical terminal, causing a fire with flames as high as 20 meters. This accident served as a motivator for the construction of the Port of Suape, in order to minimize operations with chemicals in the urban center of Recife (POFFO, 2011).

It is important to remember that not only negative impacts characterize a port, the issue of local and regional development, in an orderly fashion, has positive impacts mainly in the socio-economic aspects. There are reports of successful cases in the Industrial Port Complex of Pecém - Ceará, such as the labor-local insertion in port activities, after a training program, which led fishermen to change their profession and improve their living conditions (HOFMANN, 2015).

That differs from the ports of Pernambuco, which have not reported any similar case. Related to environmental issues, both ports have developed environmental management, showing the conduct, direction and control of the use of natural resources and environmental risks to the environment,

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seeking to meet the compliance established in the current legislation.

The resolution CONAMA 01/86 established the definitions, the basic criteria, responsibilities and general guidelines for the use and implementation of Environmental Impact Assessments (BRAZIL, 1986).

The same resolution also established the need for completion of the EIA (Environmental Impact Assessment) and its EIR (Environmental Impact Report) for the licensing of substantially environmental modifying activities.

Based on this, the Risk Analysis Study began to be incorporated in the process for certain types of projects, so that, in addition to issues related to pollution, prevention of accidents also to be considered in the licensing process.

According to federal Law 9.966/2000, the ports must develop an internal procedure manual for managing the risk of pollution, as well as for the management of various waste generated from the movement activities and oil storage and harmful or dangerous substances (art. 6).

3. Port Activities and Its Impacts

According to ANTAQ (2016), the main impacts are related to port projects, port operations and navigation of ships.

Regarding the installation of the ports, it is important to highlight the activities resulting from implementation of under construction and new fronts docking, dredging of berths and access channels, embankments, storage infrastructure, buildings overall, land access and others, that when scaled improperly (ANTAQ, 2011).

Generally the implementation of a port requires large areas, which will be completely disfigured physically through earthworks, destruction of vegetation, dredging and landfills that affect the resilience of the ecosystem from an environmental point of view, such as mangrove forests that are considered large nursery for a variety of species (Almeida 2003).

Soon after the establishment of the Port of Suape, Koenig et al. (2002) conducted an ecological study in the estuary of Ipojuca, in order to verify the possible changes, in which it was found that the construction of jetties for berthing of ships in the Port of Suape blocked the communication of Ipojuca and Merepe rivers to the sea, causing flooding in areas used by sugarcane agribusiness.

The amendments also caused a strong siltation and large deposition of suspended sediments in the estuarine area, increasing the turbidity of the water and turning the entrance of Ipojuca river estuary in a coastal lagoon, which as a result of the local depth decrease, caused the increase of salinity (NEUMANN 1991; NEUMANN et al 1998 cited by Koenig et al., 2002.).

Braga, Uchoa and Duarte (1989) observed from the mapping survey in the area that in 1974, the coverage of mangrove vegetation in the estuarine complex of Suape was 2,874 ha. After fourteen years, in 1988, 598 ha of mangroves were destroyed and another 27 ha were found in an advanced process of degradation due to the installation of the ports.

Regarding the Port of Recife, it was found that the environmental legislation was installed before, and is characterized by having a port-city relationship where the impacts of the installation began to take place over the centuries, from its origins in the sixteenth century (SA, 2008). This

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point makes it difficult to verify which impacts were caused by their deployment.

But in a study on erosion problem on the coast of Pernambuco it was found that due to the construction and expansion of the Port of Recife, there was modification of coastal currents that reach the city of Olinda (FERRAZ, 2014 apud Manso et al., 2006).

According to ANTAQ (2011) on port operations, it can be highlighted the following activities: handling, transportation and cargo storage, and infrastructure maintenance services (rockfill and dredging), the supply and repair of vessels, machinery, equipment and vehicles in general, and navigation when done improperly and without any supervision can generate some environmental problems (Table 2).

Table 2 – Possible environmental problems due to port operations (Author, 2016).

POSSIBLE ENVIRONMENTAL PROBLEMS	PORT OF SUAPE	PORT OF RECIFE
Leakages, ruptures and overflows or oil spillages during fueiling operations and transfers between vessels or between vessel and terminal	It was verified by Silva (2014) a small incident in which an electric excavator crashed into the sea, with one small landslide during removal of the equipment from the water. In this occasion, they utilized oil slick control with the building of a containment barrier with the objective to reduce its propagation. And for the collection of this oil it was used absorbent blankets.	In a study to investigate the contamination of aromatic hydrocarbons dissolved oil (HAPDDS) and / or dispersed in water estuarine complex pina basin - port basin (Port of Recife) it was observed there was a greater influence of domestic than oil drains (Favrod, 2012)

cont. Table 2 – Possible environmental problems due to port operations (Author, 2016).

POSSIBLE ENVIRONMENTAL PROBLEMS	PORT OF SUAPE	PORT OF RECIFE
Air pollution caused by combustion, ventilation charge, resulting from operations with dry cargo such as cement, grain, ore and charcoal.	Freitas (2006) conducted an experiment using lichens as bioindicator which showed morphological and physiological changes the assignment of different levels of air pollution in the port of Suape.	It was not found any specific study in the area of the Port of Recife. But it appears that in ports which there are integration of industries, that there is the presence of hydrocarbon vapors (SA, 2008), which is not the case of the Port of Recife.
Transfer of harmful aquatic organisms and pathogens by means of the ballast water and fouling of the hull	ANVISA (2003) assured that it carried out ballast water analysis on vessels berthed in the Port of Suape which showed the presence of microorganisms such as *Vibrio cholerae,* an agent that cholera.	A study was conducted evaluating six port regions to check for water quality. And in the port of Recife it was pointed out the presence of *Salmonella sp* (SERAFIN; Henkes, 2013).
Effects of toxic paints used in vessels	In such cases, what happens is the supervision on construction sites in order to verify that the material used is appropriate. What often happens is that some companies try to make up reusing the container.	
Residues	Both ports already have plans for Solid Waste Management for the control of the waste generated in the administrative buildings. Waste from industries and boats are the company's responsibility and the ship's respectively. But the fact Suape contain the most varied projects make it necessary that the port authority is ready with the most modern and efficient waste management systems in order to meet the new demands and maintaining environmental quality (FLORO NETO, 2012).	

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cont. Table 2 – Possible environmental problems due to port operations (Author, 2016).

POSSIBLE ENVIRONMENTAL PROBLEMS	PORT OF SUAPE	PORT OF RECIFE
Attraction of disease vectors (rats, pigeons, bats, mosquitoes)	The port of Suape does not perform the mapping of these vectors, but specific locations have been identified to carry out the control of these species (COSTA, 2013). The port carries out pest control and disinfecting services through a specialized company.	But the port of Recife was observed critical places with high population presence of pigeons, but the port does not perform any kind of control due to the presence of a natural predator in the region (COSTA, 2013). Today, it performs control of the sinatropic fauna through disinfestation and disinsectization services.
Interaction with other activities (fishing, tourism, recreation, etc.)	Related to fishing, the main conflicts with port activities stem from the prohibition of activity next to the port activity or with the insertion of a physical barrier to stop the passage of fishing vessels, lack of signage, increased water turbidity, fish scaring, lack of accompanying representatives of the project with the fishermen (HOFMANN, 2015).	

One point that is much discussed is related to the correlation between the Port of Suape and the tiger shark attacks in Recife. According Hazin et. al (2013) some of the species responsible for the attacks could be following the coastal currents to the north and the maritime traffic of the Port of Suape would be attracting the animals along the coast. This demonstrates that in periods of greater intensity in activities, there have been shark attacks in Recife.

"It is noteworthy, it can not be compared in absolute terms, the impacts / risks of a wide range environmental issues (for example, compare the impacts of noise from a construction with the impacts of the spill of chemicals or the ecosystems degradation impacts of marine caused by an oil spill), Therefore, the consequences of it should be judged according to different parameters, relevant to each case "(GOIS, et. al, 2015).

Due to the consequences that port activities can cause, responsible parties and stakeholders in port management began to consider new measures to support environmental sustainability. These measures are an extensive list that includes environmental certification according to ISO 14001: 2015 and refers to the environmental management system, an environmental agenda, the implementation of programs and or environmental management systems, environmental monitoring and environmental licensing (ROMERO et al., 2014).

4. Environmental Monitoring

Overall, the environmental impacts should be systematized on the basis of its aspects, taking into account the environmental and social components existing in the local context (LORENZO; ASMUS 2015).

For the identification of aspects and environmental impact assessment for a specific project, there should be, initially, a selection of all activities, products and services related to activity by separating the most possible number of environmental impacts, actual and potential beneficial and adverse, resulting from each identified aspect considering, always, whether they are positive or negative (SILVA, 2014).

This identification and compilation of factors is the first step in the decision-making of the search for an efficient and effective environmental control that can support the implementation of technical tools in the environmental suitability of the port systems (LORENZO, ASMUS, 2015).

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To perform port activities in accordance with the environment that enters the port is a huge challenge. The change of port culture must be present with a logistic plan, implementing structures and port operations that can absorb efficient parameter settings to local natural aspects with environmental protection and management.

It can be concluded that although the two ports have obeyed the procedures established by ANTAQ, both have different procedures as it refers to environmental control. From what was observed in these studies, the port of Suape has some actions that port of Recife does not. It is observed the focal point of the studies, the surveillance and investments are turned towards the port of Suape due to its size and the types of industry in it, which should not happen, since both ports are potentially polluting and need to be monitored and controlled in similar ways.

This study demonstrated that this type of projects have generated enough environmental degradation in the environments they are inserted and if there is no control over port procedures, the problems with environmental pollution will generate local consequences that may interfere with resources and the state's heritage and certainly will affect the population's quality of life.

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