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The Autonomous Port of San Pedro, Toward Sustainable Management of Its Activities: An Exploratory Study

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ABSTRACT: *More and more, ports are moving towards environmental protection as economic performance is no longer the only criterion for competitiveness. Although contributing to global economic development, port activities can have negative impacts on coastal areas and marine biodiversity. This article presents the actions taken by the Port of San Pedro in the context of sustainable development. A qualitative methodology was used to study the port's sustainable practices, with the environmental manager being interviewed. The results show that the port, as a state authority, implements sustainable practices such as tree planting, environmental impact assessments, and the valorization of port waste into clean energy. In addition, several actions taken have resulted in the port obtaining various ISO certifications. Furthermore, the Port Autonomous de San Pedro is contributing to the momentum for environmental protection.*

KEYWORDS: ports, environmental protection, sustainable development, San Pedro, Côte d'Ivoire.

INTRODUCTION

Sustainable development emerged from mankind's dramatic realization of environmental destruction. This bitter realization of the reduction of renewable and non-renewable natural resources has become a real challenge that humanity faces. Climate change, air pollution, biodiversity loss, famines, floods, desertification of agricultural land, threats to the ozone layer, rising sea levels, and more are all problems that are undermining planet Earth. After realizing this, state leaders held several meetings, which eventually led to the publication of the "Club of Rome Report" by Meadow in 1972, followed by the Stockholm meeting the same year, and finally, the "Brundtland Report" in 1987, named after Gro Harlem Brundtland, the chair of the commission and Norwegian Minister of Environment. This marked the birth of sustainable development. "*Our Common Future*" report was published, defining sustainable development as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland Report, 1987, p. 40). Sustainable

development is a glimmer of hope and a lifeline in the face of multiple ecological, social, and economic crises that threaten the future of life on Earth. Therefore, it is based on three pillars: economic, environmental, and social.

For centuries, ports have played a strategic role in the process of globalizing the market economy, contributing to global, national, and regional economies (Abbes and Guillaume, 2008). Despite their importance, port activities have negative impacts on the environment and communities, such as water and air pollution, destruction of natural habitats, disturbance of marine species, risks of heart and lung-related illnesses, cancers, and premature deaths (Marcadron, 1999; Liu et al., 2021; Alamoush et al., 2021). In the context of sustainability, port authorities are obliged to participate in the implementation of international, national, and local rules and agreements (Marcadron, 1999) as they are under pressure to implement sustainable practices globally (Alamoush et al., 2021). Thus, many ports around the world are taking steps towards environmental protection (Acciaro et al., 2014; Bergqvist and Monios, 2019; Liu et al., 2021; Ogara et al., 2023) because they have a crucial role to play in promoting sustainability (Bjerkan and Seter, 2019). The environmental issue is also a key factor in competitiveness for these ports (Brunila et al., 2023). To this end, ports have undertaken several initiatives to reduce CO2 emissions and operational noise, manage waste, and provide green energy to ships (Cunha et al., 2023).

According to Ogou et al. (2019), the impact of industrial port activities in the city of San Pedro is significant. Indeed, industries release dangerous dust and gases such as methane (CH4) and carbon dioxide (CO2) into the air, which quickly spread under the action of the wind, causing problems for human health. However, few studies on environmental protection management in the Ivorian port context have focused on the PASP, the country's second economic pillar. Given recent developments in ports and maritime transport aimed at reducing emissions and improving energy efficiency (Alamoush et al., 2021), it is timely to closely examine the sustainable management of the PASP, which is part of the strategic role of ports in the global economy and environmental protection. In this context, the questions raised by this study in light of the findings are: How does the PASP contribute to environmental protection for sustainable management of its activities? What actions have been taken by the PASP in terms of environmental protection? The objective of this research is to identify the concrete actions taken by the PASP in terms of sustainability and to contribute to knowledge on sustainable management in ports.

Due to the exploratory nature of our article, the use of case study is particularly appropriate (Yin, 2003) and widely used in the field of port economics and management (Acciaro, 2014). To do so, we adopted a qualitative methodology for data collection and used a manual analysis using the summary synthesis method (Gavard-Perret and Helme-Guizon, 2018).

This research shows (1) that the Port of San Pedro is not lagging behind the movement of ports for environmental protection and community well-being as it is crucial for its competitiveness, and (2) that it is very active in making every effort to follow in the footsteps of ports in developed countries.

The first section outlines the literature review, while the second section details the research context and methodology. The third and fourth sections present the results, discussion, and conclusion, respectively.

LITERATURE

Ports

Ports serve as connection points that link maritime and land routes through various modes of transportation. The number of ports has grown between 1890 and 2008 in tandem with the increase in the number of ships, which is attributed to the expansion of global trade (Alix and Ducruet, 2015). According to the United Nations Conference on Trade and Development - UNCTAD (2022), over 80% of the volume of global trade is transported by ships. Maritime trade increased by 3.2% to reach a total of 11 billion tons, slightly below pre-Covid-19 levels. It is widely recognized that ports are key factors in the economic development of coastal countries. Road transport activities contribute significantly to the development of maritime transport, regional economic growth, and direct and indirect employment (Hossain et al., 2020).

At the beginning of the 20th century, the analysis of the integration of ports into their economic environment took shape in order to propose functional classifications of these ports. Three types of functions emerged: regional, industrial, and commercial. The regional function corresponds to the handling of goods for the hinterland. This function involves the transport of goods by sea, which are then distributed by land to the region's various markets and industries. Ports play a critical role in supporting the economic development of the regions they serve and can act as a catalyst for growth in the surrounding areas. The industrial function responds to the needs of industries located in the immediate vicinity of the port. Ports with a strong industrial function are often located in close proximity to major industrial centers, and they play a critical role in supporting the growth and competitiveness of these industries. The industrial function of ports can have significant economic benefits for the surrounding region, including the creation of jobs, the attraction of new industries, and the generation of tax revenue. And the commercial function stems from trading activities located near the docks, relying on the exchange of rare and sought-after products. The commercial function of ports refers to their role in facilitating trade and commerce between different regions and countries. This function involves the handling and storage of goods that are traded internationally or between different regions, as well as the provision of a range of related services, such as customs clearance, freight forwarding, and ship agency. This simple and practical typology made it possible to clarify traffic and compare port economies (Abbes and Guillaume, 2008). The port plays a crucial economic role as a showcase for a country on the global commercial stage. Its competitiveness compared to other ports in the same geographic area can attract investors and stimulate imports to the country, making it more attractive. In addition, the port can promote the competitiveness of national businesses by enabling them to export their goods and create added value. This attracts many industries due to their proximity to international markets. Setting up in these coastal areas allows industries to reduce transport costs to foreign markets and benefit from proximity to ships for loading and unloading of goods. This situation offers a competitive advantage for these industries as well as for the territory in which they are located (Lorek, 2012).

However, maritime and river ports are at the heart of many industrial, economic, environmental, and social challenges due to their potential impacts. These challenges include compliance with environmental legislation, reduction of environmental impact, and adequate integration with surrounding cities and the entire supply chain. Ports must therefore strike a balance between their crucial economic role and their environmental and social impact. This requires effective management of port activities and collaboration with stakeholders to promote a sustainable approach. At a time when 90% of international trade is carried out by sea, ports are particularly sensitive targets for achieving sustainable development goals (Chouquet and Motte-Baumvol, 2021; Cunha et al., 2023). The development of a port is a public interest objective that depends, in particular, on the relevance of development projects in relation to reasonable prospects for increasing maritime or river traffic, sufficient availability of financial resources, reconciliation with environmental preservation, and respect for competition (Rézenthel, 2021). Whether for fishing, commercial, or leisure purposes, maritime ports are at the heart of a reflection aimed at reconciling the various social, security, political, economic, and environmental issues at stake.

Environmental issues in ports

Ports have always been centers of industrial activities, and as essential gateways in national, regional, and global economies, most ports continue to allocate land for industry and production. Environmental conditions can be integrated into concession agreements to influence industrial activities (Bjerkan and Seter, 2019). From a historical perspective, emissions from maritime and port transport have had a significant impact on the greening and environmental sustainability of businesses. However, it is only recently that ship and port equipment emissions have been perceived as a problem and corresponding research has been conducted (Darvazani et al., 2016). The scale of port activities as nodes in global supply chains generates environmental and social externalities in relation to economic growth (Dinwoodie et al., 2012). Ports, according to the "Third IMO GHG" report, had a significant impact on the environment in 2015 due to their CO2 emissions amounting to 796 million tons. About 300 million tons of fuel are consumed each year by international maritime transport. This corresponds to around 3% of total CO2 emissions of human origin (Bergqvist and Monios, 2019). According to Lindstad and Eskeland (2016), the maritime sector, often considered an environmentally friendly mode of transport, is responsible for about 10-15% of global anthropogenic emissions of sulfur dioxide and nitrogen oxides, as well as about 3% of carbon dioxide emissions. Pollutant emissions such as sulfur oxides (SOx), nitrogen oxides (NOx), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOCs) resulting from traffic and port operations contribute to the deterioration of ambient air quality (Alamoush et al., 2021). Additionally, ports are a source of noise pollution due to the handling of goods, temporary dredging, and land transport, which can pose risks to human health and impact the lives of marine mammals and fish. Moreover, ports are significant water consumers for bulk ship cleaning and washing operations and for supplying cruise ships with water (Alamoush et al., 2021).

The American Association of Port Authorities (AAPA) defines port sustainability as the implementation of strategies and business activities aimed at meeting the current and future needs of port stakeholders while protecting and supporting human and natural resources.

According to Acciaro (2015), green ports are those that engage in proactive development, execution, and monitoring of practices aimed at reducing environmental impacts beyond mere regulatory compliance. For Rainaud (2021), a "clean port" is a port that refrains from being a source of pollution and develops constructive actions in favor of environmental protection. A clean port transitions to more virtuous models of sustainable development for multi-environmental protection. Ports tend to have multiple sustainability and environmental management needs but often lack sufficient resources to implement environmental efficiency improvement tools (Brunila et al., 2023). To guide ports towards sustainability, there are port plans as a potential tool. Bjerkan and Seter (2019) list several plans, including the port energy environmental plan, the green port program, environmental protection plans, climate protection and climate initiative plans, pollution prevention and reduction plans, green port plans, and clean air plans. These plans aim to reduce CO2 emissions from ships at sea calling at ports, explore ways to reduce CO2 emissions related to port operations, inland navigation, and other modes of transport, explore ways to promote alternative energy sources, and calculate the carbon footprint of ports. It is important to establish a "clean port" certification due to the very real environmental impacts. To this end, the measures put in place include risk planning associated with port areas, prevention plans, emergency management, and personnel training in environmental management (Rainaud, 2021).

Furthermore, Brunila et al. (2023) propose tools for measuring the environmental performance of ports: environmental management, responsibility, impact assessment, and self-monitoring. Additionally, the sustainable development goals proposed by the United Nations (UN) in 2015, known as Agenda 2030, also serve as guidance for ports in making decisions related to their policies and contributions to reducing their environmental footprint (Wang et al., 2020; Alamoush et al., 2021; Cunha et al., 2023). There are 17 sustainable development goals that collectively serve as a normative framework for governments, civil societies, and private sectors, including the maritime sector (Wang et al., 2020). Sustainable development goals (SDGs) are systemic and ambitious objectives that require decentralized implementation. Targets are defined to guide decisions at the national level, while various stakeholders and companies strive to establish more modest goals and tasks within their daily operations and strategies (Brunila et al., 2023). Furthermore, Brunila et al. (2023) emphasize that sustainable development goals are too vast for ports. The following table lists some of the goals.

Table 1: Some Sustainable Development Goals. Adapted from Wang et al. (2020), Alamoush et al. (2021), and Cunha et al. (2023).

Sustainable development objectives	Explication
7	Access to clean energy: Ports use vehicles and shuttles that generally run on fossil fuels, generating environmental and social externalities.
8	Decent working conditions and economic growth: Occupational risks linked to physical or psychological health, as well as those affecting safety due to human or contextual factors, are major challenges for the maritime industry.
9	Industry, infrastructure and economic growth: The maritime industry can play an important role in creating a sustainable maritime ecosystem. To this end, it can invest in improving logistics infrastructure to facilitate transport, while putting in place initiatives to design innovative ships and terminals, as well as more efficient operating systems to increase its operational efficiency.
11	Sustainable cities and communities: This objective concerns the relationship between the port and the city.
12	Responsible production and consumption: Waste management and responsible ship recycling for responsible consumption and production. The shipping industry faces a major challenge in managing the waste generated by shipping activities on board, as well as those that take place in terminals and shore-based support offices. It is therefore essential that the maritime industry takes its responsibilities in terms of waste management to contribute to the achievement of responsible consumption and production objectives by reducing ship operating waste and discharges of waste at sea.
13	Actions to combat global climate change by controlling greenhouse gas emissions.
14	Protection of aquatic/marine life: Port-related transport activities also have ecological, environmental and social impacts, such as the risk of oil spills from tankers or the production of large quantities of waste and sewage by cruise ships.

Ports adopt environmental measures and actions within the framework of accredited environmental management systems that are subject to regular reporting. These systems include, among others, the ISO 14001 standard for environmental management, the European Union's Environmental Management and Audit Scheme (EMAS), the ESPO self-diagnosis method (SDM), and the Port Environmental Review System (PERS) developed as part of the EcoPort initiative. The PERS system is more commonly used in EU ports, while ISO standards are more common in Asian ports. These systems allow companies to effectively monitor and manage their environmental impact and comply with relevant environmental standards

(Alamoush et al., 2021). Relevant legislation concerns energy, waste and circular economy, noise, water, air, soil, CO2 and greenhouse gases, nature and research, and financing (Brunila et al., 2023).

The environmental issue has become a major concern for ports worldwide to the extent that reports are produced to publish activities related to sustainable development goals (Cunha et al., 2023). Environmental standards, both mandatory and voluntary, have multiplied to meet the need to protect coastal areas and reduce the environmental impact of port activities. Port authorities are becoming aware of the importance of environmental protection and are implementing measures to meet these standards and the expectations of stakeholders, including residents and environmental protection associations. In fact, these stakeholders are increasingly vigilant and are not hesitant to take legal action to overturn decisions that could have a negative impact on the environment (Rainaud, 2021). Ports are therefore seeking to implement ambitious environmental policies to limit their ecological footprint and promote sustainable development of their activities. These policies often include investments in clean technologies, specific arrangements for managing waste and pollutant emissions, and partnerships with local stakeholders to promote environmental responsibility throughout the logistics chain (Rainaud, 2021). To achieve this, ports such as Antwerp, Venice, Rotterdam, Shanghai, and others have invested in a number of management policies for the transition towards sustainability. Various actions on the use of wind energy, solar energy, wave and tidal energy, geothermal energy, biofuels, methanol and hydrogen, liquefied natural gas, and low-sulfur fuel are being undertaken (Bjerkan and Seter, 2019). Moreover, by studying the experiences of two European ports, Hamburg and Genoa, which have already attempted to coordinate and streamline their energy needs, Acciaro et al. (2014) argue that for the ports of the future, active energy management can offer significant improvements in terms of efficiency, contribute to the development of new alternative revenue sources, and ultimately improve the ports' competitive position. Indeed, the Port of Genoa has adopted the Port Energy Environmental Plan for its port with the aim of promoting and developing activities related to energy production from renewable sources while limiting energy consumption within its territory. This initiative, based on the principle that port activities have an impact on the host city, allows for the saving of 10,000 tons of CO2 per year. As for the Port of Hamburg, it plays a key role in promoting renewable energies and has implemented a support program to encourage the development of solar installations on warehouse roofs and in terminals as well as wind energy. In addition, several other actions are being taken to guide daily maritime activities such as reducing ship speed near ports to reduce pollutant emissions and noise generated by ships (Bjerkan and Seter, 2019; Alamoush et al., 2021), practices related to industrial ecology (Cerceau et al., 2014), and circular economy (Poulsen et al., 2018; Alamoush et al., 2021; Kadio, 2023).

METHODOLOGY

Context of study

The Port of San Pedro is located on the southwest coast of Côte d'Ivoire, approximately 350 km west of Abidjan. It is the second-largest port in Côte d'Ivoire after the Port of Abidjan. It resulted from the Ivorian authorities' desire since the 1960s to reduce regional disparities by creating a development hub in the southwest of the country. It is a deep-water port, which means it can

accommodate large vessels. It has several quays for container handling, as well as terminals for petroleum, mining, and agricultural products, which are the main exports of the region. The Port of San Pedro includes a commercial and fishing port with a quay length of approximately 800 meters and a depth ranging from 9 to 12 meters, allowing for the simultaneous operation of 2 to 3 vessels. It also has 10 hectares of storage areas, including 13,800 m2 of covered warehouses, for storing export products such as cocoa, coffee, cashews, palm oil, cashew nuts, and cotton before loading onto ships. The San Pedro port facility is also authorized to receive products such as frozen meat and chemicals. The PASP is responsible for all port functions, including operation, ship services, maintenance, renewal, and extension of port infrastructure in San Pedro. In 2021, the San Pedro port platform recorded a total cargo volume of 5,275,598 tons. Therefore, the PASP is a key player in the region's economic activity and contributes greatly to the country's development. The Port of San Pedro, a transit port, is the driving force behind the economic development of neighboring countries such as Guinea, Mali, Burkina Faso, and Liberia (Figure 1).

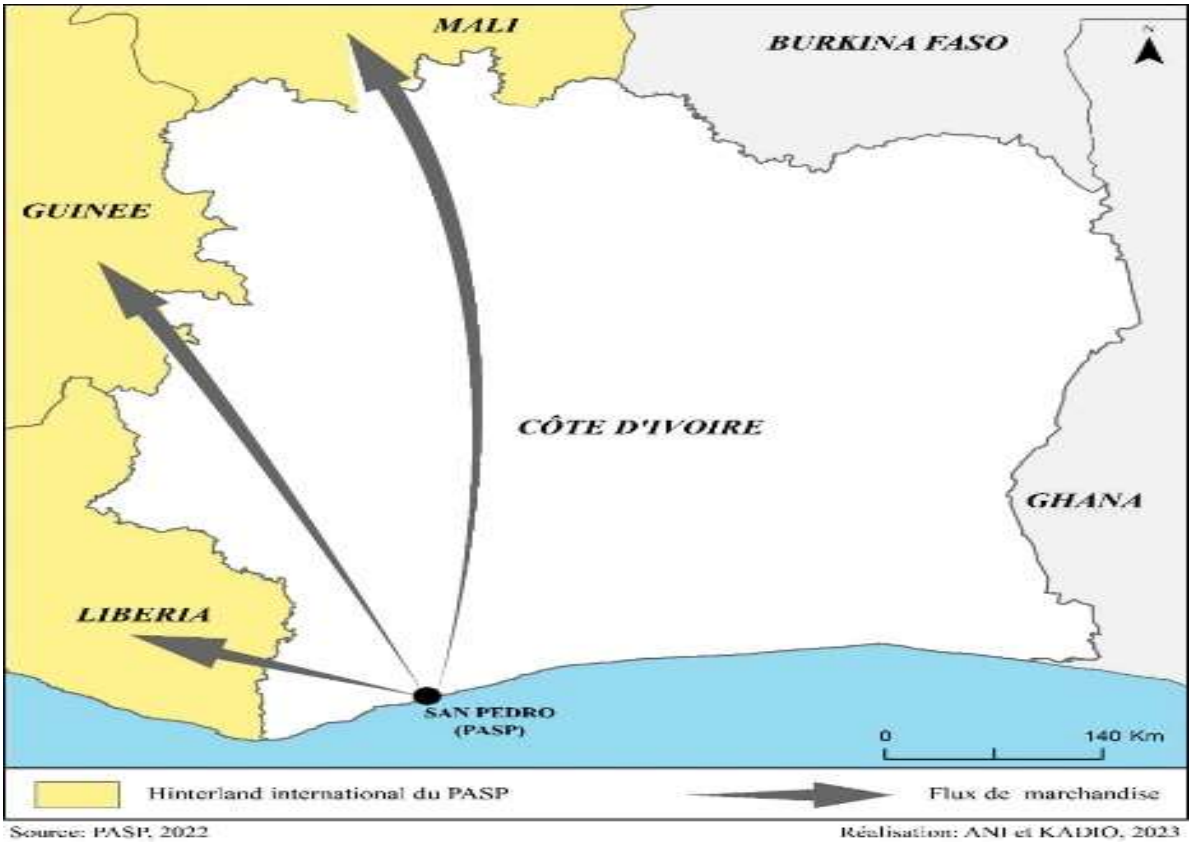

Figure 1: Transit port. Source: authors

Data collection and analysis

Primary data was collected through a qualitative method using a semi-structured interview guide. The qualitative method typically favors exploration (Giordano, 2003). Miles and Huberman (2003, p.172) note that qualitative studies are often undertaken to explore a new domain and to construct or emerge a theory related to that domain. Furthermore, the exploratory nature of this research allows for the use of a particularly appropriate case study approach (Yin, 2003), which is widely used in the field of port management (Acciaro et al., 2014). A one-hour semi-structured face-to-face interview was conducted with the head of the Quality, Health, Safety and Environment Department of the PASP. In addition, secondary data collection was done through literature review (press articles, websites, port magazines). Data was manually analyzed using the summary synthesis method, a simple method of interview analysis (Gavard-Perret and Helme-Guizon, 2018).

RESULTS

The PASP, the state authority managing the port domain.

The Port of San Pedro is built on 2000 hectares of land, currently only occupying 25% of its space. It is a widely recognized and renowned port in the world as one of the largest exporters of raw materials. It is a port that is fully owned by the state of Côte d'Ivoire and the world's leading exporter of cocoa beans with 1,140,149 tons in 2021. Its main activities are maritime and port operations. The PASP has a capital of two billion and currently employs 218 people. The presence of the port in the city of San Pedro has generated 40,000 direct jobs and 80,000 indirect jobs. The San Pedro port facility accommodates large vessels with tanks often having a capacity of 30,000 tons of fuel oil.

The PASP is responsible for the administration and management of the port area and all port-related activities that take place there. It is responsible for the management of the port area, maintenance of facilities and equipment, and regulation of port activities. As a state entity, the PASP is responsible for all tasks related to the management of port activities. Therefore, any economic actor called a " Occupancy rights holders" wishing to establish themselves in the port area must obtain a Temporary Occupation Authorization (AOT) from the PASP because only the port has the power to grant sites for the installation of industries. Its operation is organized in processes. The system of its quality approach is represented in the following figure:

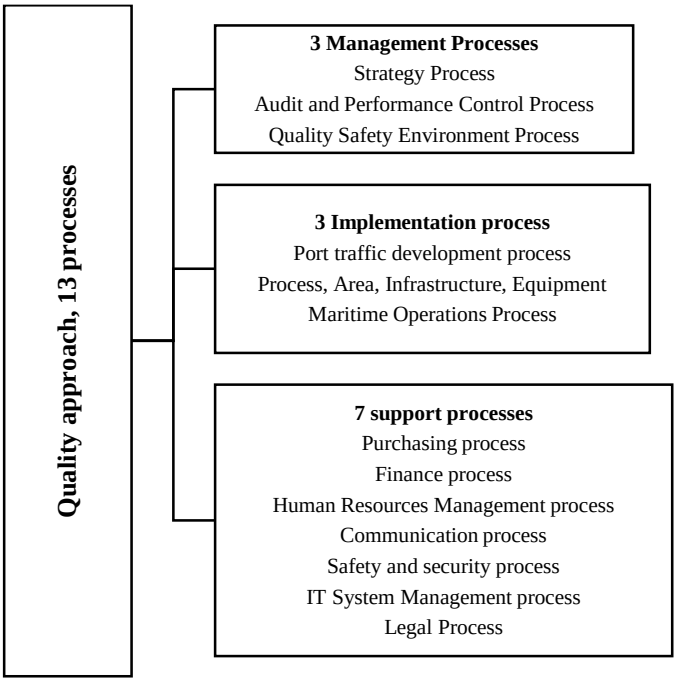

Figure 2: PASP's quality system

Since November 2022, the PASP has started dredging, modernization, and extension works on the basin and access channel. The objective of the works is to increase the port's capacity to accommodate large vessels of up to 90,000 tons instead of the current 45,000 tons.

The Port of San Pedro, a player in environmental protection

The PASP, having early recognized the importance of environmental protection, has dedicated a special department responsible for environmental and sustainable development issues. The port aims to be both a showcase and a champion in terms of ecology. To achieve this, it aims for a 0% carbon objective as required by local and international commitments. It is committed to managing environmental risks through its certification to the ISO 14001:2015 standard. Additionally, the PASP benefits from strengthened safety and security of its facilities and vessels in accordance with the International Ship Port Security (ISPS) Code. The ISPS Code was designed following the tragic events of September 11, 2001 in the United States to enhance maritime safety and security. Adopted in December 2002 at the diplomatic conference of governments contracting to the International Convention for the Safety of Life at Sea (SOLAS 74/78), it entered into force on July 1, 2004. Since its date of entry into force, the Port of San Pedro has been certified to the ISPS Code, making it a safe port facility. In this continuous improvement dynamic of port facility safety and security, PASP has enrolled in the Western and Central Africa Port Security (WeCAPS) project, which supports civil security through prevention, risk management, handling, and storage of hazardous materials.

In addition, the port has a Quality, Safety, and Environmental Policy based on ISO 9001 standards. To this end, it obtained ISO 9001 certification for its quality management system in 2018. The achievement of this certification positions it as the first certified West African port

(Website). The PASP also obtained ISO 14001 and ISO 45001, 2018 version, concerning the health and safety of personnel at work. Today, the PASP is implementing a Corporate Social Responsibility (CSR) policy to complement the management's environmental commitments.

Some actions undertaken by the PASP linked to sustainability

In terms of practical actions, the PASP has systematically included environmental and social impact studies (EIES) requirements in the contracts of occupation for "Occupancy rights holders". In this management plan, "Occupancy rights holders" must carry out additional studies on pollution and protection, Personal Protective Equipment (PPE), and take care of the health of their personnel. The PASP ensures compliance with these requirements through inspections and audits carried out with service providers such as the Ivorian Anti-Pollution Center (CIAPOL). Sanctions are often taken against "Occupancy rights holders" who do not comply with these requirements. Furthermore, there is a more demanding environmental, social, and strategic study (EESS) that is superior to the EIES. This study allows the port authority to take its own measures in terms of developments in compliance with requirements before the arriving operator completes with other specific actions.

Currently, the PASP is encouraging "Occupancy rights holders" to create landscaped green spaces and implement measures to improve environmental quality. This includes tree planting, conducting environmental assessments, as well as monitoring air, soil, and water quality. Environmental assessments conducted so far show the port's stability in terms of water and soil protection because the port does not discharge waste. However, air quality is not optimal due to suspended particle emissions from cement industries. To address this, the PASP requires the use of covered conveyors for the transport of dusty materials and conveyor belts for the transport of bulk goods, as well as waterproof tarps during bulk operations at the quay. Furthermore, at the cement plant, it is mandatory to use a dust collector hopper that has a system for recovering dust, which is then returned to the circuit instead of letting it remain in the air

Furthermore, the Marine Pollution Response Plan (POLLUMAR Plan) is an annual and rotating exercise of high importance for all stakeholders to improve crisis management and protect the environment in case of an oil spill at sea. The main objective of this exercise is to test the operational readiness of the oil spill response plan, while strengthening the capacities of the involved stakeholders. The exercise aims to enhance the professional skills of members of public and parapublic administrations of the Inter-ministerial Committee for the Fight (CIL), oil, port, and airport companies, administrative and customary authorities, as well as local environmental protection associations and non-governmental organizations (NGOs). It allows each stakeholder to better understand their roles and tasks within the different cells involved in the implementation of the POLLUMAR Plan. This exercise creates an environment conducive to training, sharing experiences, information, and collaboration among the various stakeholders involved in the POLLUMAR Plan. This improves coordination and communication between stakeholders and strengthens the effectiveness of actions taken in case of an environmental crisis related to an oil spill at sea.

The POLLUMAR Plan falls under the International Convention for the Prevention of Pollution from Ships (MARPOL) agreement. The MARPOL Convention is an international convention

adopted in 1973 by the International Maritime Organization (IMO) to prevent marine pollution from ship activities. The convention aims to prevent marine pollution by regulating oil spills, liquid and solid waste, hazardous substances, and ship exhaust gases. It establishes standards for ships in the treatment of wastewater, storage and treatment of waste, management of oil and hazardous chemicals, and reduction of exhaust gas emissions. IMO member states are required to implement the MARPOL Convention rules in their territories. The MARPOL Convention is an important international standard for the protection of the marine environment, and its implementation is essential to minimize the negative impacts of ship activities on the environment.

Ships are a significant source of energy consumption even when they are docked. To address this issue, the PASP has considered a solution that involves creating a kind of green energy from waste received at the port. A receptacle would be set up to process this waste and transform it into bio-methane or biogas. This approach would allow for the valorization of waste while reducing greenhouse gas emissions and resource consumption. This biogas will also be used to power the ships that arrive at the docks during loading and unloading. These ships will be connected to terminals throughout their stay. The objective is to significantly reduce emissions and decarbonize activities.

Furthermore, in terms of environmental protection, the port has set up a port HSE committee bringing together all the HSE personnel in the port area, with whom the PASP deals with issues of safety, security, and environment. A waste management process is in place to address all types of waste that go through a controlled pathway and an approved circuit, whether it be hazardous waste or waste from electronic equipment. Indeed, there is a categorization of port waste: ordinary waste, hazardous waste, and waste from electrical and electronic equipment. Ordinary waste concerns household waste that is removed by a structure approved by CIAPOL. Hazardous waste includes soiled rags, grease, and used drain oil. The company responsible for this task collects waste and provides a removal note to the PASP, but better yet, it must also provide a certificate of destruction of waste at a treatment center approved by CIAPOL. Electrical and electronic equipment waste (DEEE) is collected by a non-governmental organization that destroys it. The PASP disposes of its waste in safe circuits in exchange for treatment or destruction certificates from approved structures. Hazardous waste is treated in accordance with the IMDG Code (International Maritime Dangerous Goods).

Any project that may have a negative impact on the environment, whether it be on wildlife, flora, air, or water, requires the completion of an Environmental and Social Impact Study (ESIS). This study provides an environmental management plan with a set of requirements to be met. For example, for dredging work in the access channel and turning basin, environmental provisions have been put in place with the contractor. Samples are taken from the basin to ensure that the impact on water turbidity and aquatic species populations is limited. Although some impacts are inevitable due to the disturbance of water and seabed, it is important to ensure that these impacts are as minimal as possible. The PASP does not compromise on biodiversity protection. Therefore, during the construction of the Bulk Terminal, the Multipurpose Industrial Terminal of San Pedro, which has been in operation since 2022, the contractor was asked to recover a sample of the species living in this environment and protect them. The company

installed cages to protect the species, and after the work was completed, they were released back into their natural environment. This measure was particularly important because endangered species of turtles and fish were living in this area.

On the social front, the PASP has adopted a CSR policy for years. It is in a city-port relationship that involves holding meetings with municipal authorities in an approach to city development. Several actions are taken by the port to materialize its territorial belonging to the city of San Pedro. For example, the PASP participates in the promotion of the rule of law by donating computer equipment and supplies to the San Pedro court. Furthermore, as an actor committed to promoting educational excellence, the PASP demonstrates its commitment to the year dedicated to youth, initiated by the Ivorian government, by establishing a partnership to provide school supplies. This gesture demonstrates the PASP's involvement as a responsible corporate citizen and its willingness to actively contribute to the improvement of education and the future of young people in the region.

Furthermore, the Action and Resettlement Plan (ARP) is a plan that allows for the identification of affected residents, even in terms of culture, in major construction projects such as the port's extension and modernization project. This plan seeks to find solutions in accordance with Ivorian legislation as well as with the World Bank's Operational Policy (PO4.12) on involuntary resettlement of populations. The overall objective of this plan is to take into account all the impacts associated with the project, prevent negative impacts, and treat any consequences in an equitable and fair manner for all parties involved. Additionally, the port conducts periodic and mandatory medical check-ups for all personnel as part of its actions related to employee health. These various actions are listed in the table below.

Table 2: Summary of PASP sustainable actions

Convention signée	Certifications obtenus	Plans	Actions réalisées	Projets en cours et futurs
MARPOL: Convention on the protection of marine basins and waters. **(ODD 14 ; ODD 6)**.	ISO 14001 version 2015 ISO 9001 version 2018 ISO 45001 version 2018 Code International Ship Port Security (ISPS)	Environmental and Social Impact Assessment (ESIA) Environmental, Social and Strategic Assessment (ESSA) Action and Resettlement Plan (ARP) Environmental and Social Management Plan (ESMP) Environemental Management Audit Plan (EMAP) Plan to combat marine pollution (POLLUMAR Plan) **(ODD 14; ODD 6)**	Creation of a green space through tree planting **(ODD15)**; Environmental assessment campaigns; Air quality, water quality and carbon footprint measurements every six months; Ensuring compliance with environmental standards; Establishment of a port HSE committee; Introduction of a CSR policy to complement management's environmental commitments; Donation of school supplies and IT equipment **(ODD 12).** Carrying out periodic and compulsory health-related medical check-ups for all staff **(ODD 8)**	Creating green energy from waste to power ships at berth (renewable energies) **(ODD 7)**; A policy of recovering plastic waste and bottles as part of the circular economy is planned.

Source: authors

DISCUSSION

This study demonstrates that the PASP is a West African port that shows a strong commitment and significant progress in environmental preservation. The Ivorian government's desire to position the PASP as one of the modern and sustainable ports in the world is a reality. Under the leadership of its management, the PASP is working to improve its image and preserve its competitiveness compared to other ports on the African continent. In this regard, various initiatives have been undertaken to meet its commitments both at the local and international levels. The PASP implements several concrete actions that enable it to meet the sustainable development goals set by the United Nations.

Obtaining ISO 45001 certification allows the PASP to align with Sustainable Development Goal (SDG) number 8, which advocates for decent working conditions. Indeed, the port implements various initiatives related to employee health, such as periodic and mandatory medical check-ups for all personnel (Wang et al., 2020). Moreover, obtaining ISO 14001 offers numerous benefits to the PASP as it allows it to cost-effectively integrate environmental issues into its management system and also strengthens its environmental awareness (Brunila et al., 2023). Like several ports worldwide, the PASP uses the ISO 9001 quality management system in its daily operations.

Respect for Sustainable Development Goals (SDGs) 3, 6, and 13, which relate to good health, clean water, and greenhouse gas control, respectively, is ensured at the PASP through the implementation of regular monitoring measures for water, air, soil pollution, and carbon emissions. Obtaining ISO certifications guarantees the performance of activities carried out to meet the expectations of all stakeholders, ensure the well-being and safety of employees, as well as protect the environment. Furthermore, obtaining the ISPS code attests to the PASP's level of maritime security, which gives the port the status of a safe international port in accordance with the criteria of the International Maritime Organization.

The initiatives implemented by the PASP in the treatment, recovery, and recycling of waste, as well as the traceability and monitoring of waste management within the circular economy framework, demonstrate the port's compliance with Sustainable Development Goal (SDG) number 12, which encourages the reduction of ship-generated waste and the promotion of responsible production and consumption (Alamoush et al., 2021). As a state institution, the port collaborates with waste management structures for different types of waste for effective port waste management. The waste management takes into account any type of waste that goes through a controlled process in an approved circuit, whether it be hazardous waste or waste from electronic equipment.

The measures and actions taken under the POLLUMAR plan, in accordance with the IMO's MARPOL Convention, allow the PASP to maintain optimal marine water quality to promote marine life. Thus, the POLLUMAR plan enables the PASP to align with Sustainable Development Goals (SDGs) 6 and 14. As a result, the PASP plays an important role in the application, compliance and monitoring of the MARPOL Convention (Alamoush et al., 2021). While the POLLUMAR plan allows for testing of the crisis management system and protection of the environment in the event of oil spills at sea, it is essential for the Ivorian government to

provide the PASP with adequate human, material, and financial resources to enable all stakeholders to respond effectively in the event of oil spills at sea. In other words, the PASP must be capable at all levels of dealing with an oil spill crisis to avoid potential large-scale pollution.

Furthermore, the social aspect of the port connects it with the city. Several actions are carried out in collaboration with the city's institutions and administrations for the economic development of the city of San Pedro. This shows a territorial anchoring of the port that is not separate from the social and economic actions of the city. These actions align with SDG 11, which advocates for a sustainable port-city relationship (Cunha et al., 2023).

Implication to Research and Practice

Theoretical contributions

This article fills theoretical gaps on the management of environmental issues related to port activities by providing new insights in the context of developing countries. The PASP is one of the many ports in the world that implement environmental management systems. It serves regional functions (transit port for some neighboring countries), industrial functions (houses several industries on its premises), and commercial functions (95% commercial port). However, the port cannot be considered an exception to the multiple industrial and environmental challenges that result from its impact on the environment. The challenges to be addressed include issues related to environmental preservation and compliance with national and international legislation.

In view of the concrete actions taken by port authorities, no matter how small, the PASP is a green port that is working hard to align with Sustainable Development Goals (SDGs) 3, 6, 8, 11, 12, 13, and 14 (Acciaro et al., 2015; Rainaud, 2021; Wang et al., 2020; Alamoush et al., 2021; Cunha et al., 2023). In addition to following global orientation plans, the PASP shows creativity by drafting several internal plans, based on international plans, which enable it to orient itself towards sustainability. These plans include not only port operators and users but also local community leaders. The PASP implements its internal environmental policy to demonstrate its commitment to environmental protection.

Managerial contributions

Actions such as air, water, and soil control help to reduce the environmental impact of industrial activities in the San Pedro port area. These actions contribute to the health and well-being of populations and the conservation of biodiversity. Moreover, the San Pedro region is a forest area that is gradually disappearing in favor of crops. Through its tree-planting initiative, the PASP contributes to the development of the port area as well as to forest restoration. The port authority promotes the sustainable management of resources by coordinating all aspects of waste management, marine and terrestrial biodiversity, energy, air, carbon footprint reduction, etc.

The environmental protection actions of the PASP, although insufficient, should be commended and become a source of inspiration for ports in the sub-region (Brunila et al., 2023). Furthermore, this study shows the port's practices in environmental protection measures, the

means implemented, and the mobilization made to become a clean port. The results of this study can be used by port companies and port institutions with similar potential and facing similar issues. These results will help them develop their strategic development plans.

CONCLUSION

The study highlighted the PASP's environmental protection efforts by examining the concrete measures put in place to minimize the environmental impacts of port activities, such as waste management, greenhouse gas emissions reduction, and marine biodiversity preservation. As a major contributor to the Ivorian economy, the PASP is not on the sidelines of the global movement towards ecological transition. It is aware of the importance of environmental protection and strives to develop sustainable practices. To do so, it plays a leadership role in environmental protection to serve as an example to other ports and promote responsible activities. The PASP is also a vigilant watchdog that constantly monitors and evaluates the environmental impact of its activities and takes measures to minimize this impact. The PASP's efforts in this area have been recognized by obtaining ISO certifications, including ISO 14001 for environmental management and ISO 45001 for staff health and safety. These certifications demonstrate the PASP's commitment to environmental protection and the health and safety of its personnel. Furthermore, through its alignment with international conventions and Sustainable Development Goals, the PASP contributes to the momentum for environmental protection. However, much remains to be done, notably the clean energy action plan, which could certainly contribute further to its competitiveness.

Future Research

This research focused on the PASP, which is one of the ports in Côte d'Ivoire, which is a limitation. Therefore, the results cannot be generalized. Furthermore, due to difficult access to information, only the department head was interviewed. It would be interesting to also involve industrial actors known as permit holders and engage with other internal actors of the port

REFERENCES

Abbes, S. and Guillaume J. (2008) *Ports de commerce et économie portuaire in Mare Economicum- Enjeux et avenir de la France maritime et littorale*, Presses Universitaires de Rennes (PUR), 361-389.

Acciaro, M., Chiara, H., and Cusano M.I. (2014a) *Energy management in seaport: a new role for port authorities*, Energy Policy 71, 4-12.

Acciaro, M. (2015) *Corporate responsibility and value creation in the port sector*, International Journal of Logistic Research and Application, 18 (3), 291–311.

Alamoush, A.S., Ballini, F. and Ölçer, A.I. (2021) *Revisiting port sustainability as a foundation for the implementation of the United Nations Sustainable Development Goals (UN SDGs*, Journal of shipping and Trade, 6 (19), 1-40.

Alix, Y. and Ducret C. (2015) *Histoires maritimes et portuaires : leçons pour l'avenir de l'économie circulaire*, in Économie circulaire et écosystème portuaires Édition EMS Management & Société. 73-90.

Bergqvist, R. and Monios, J. (2019) *Green ports in theory and practice*. In: Bergqvist, R., Monios, J. (Eds). Green Ports; Inland and Seaside Sustainable Transportation Strategies. Elsevier: Cambridge, MA.1-17.

Bjerkan, K.Y and Seter, H. (2019) *Reviewing tools and technologies for sustainable ports: Does research enable decision making in ports?* Transportation Research Part D, 72, 243–260.

Brunila, O.-P., -Hyrkki, V. K.and and Tommi, I. (2023) *Sustainable small ports: performance assessment tool for management, responsibility, impact, and self-monitoring*, Journal of Shipping and Trade, 8 (14), 1-24.

Chouquet, M. and Motte-Baumvol J. (2021) *Les ports maritimes face aux défis de développement durable*, Institut Francophone pour la justice et la démocratie, 264 pages.

CNUCED (2022) *Review of maritime transport*, 195 pages.

Cunha, D.R., Pereira, N.N., de Santana Porte, M. and Campos, R.C (2023*) Sustainability practices for SDGs: a study of Brazilian ports*, Environment Development Sustainability.

Davarzani, H., Fahimnia, B., Bell, M., and Sarkis, J. (2016) *Greening ports and maritime logistics: a review*. Transportation Research. Part D 48, 473-487.

Dinwoodie J, Truck S, Knowles H, Benhin J. and Sansom, M. (2012) *Sustainable development of maritime operations in ports*. Business Strategy and the Environement, 21, 111-126.

Gavard-Perret, M.L and Helme-Guizon, A. (2018) *Choisir parmi les techniques spécifiques d'analyse qualitative* in Méthodologie de la recherche en sciences de Gestion, 3ème édition, Pages 241-272.

Giordano, Y. (2003) *Les spécificités des recherches qualitatives*, in Conduire un projet de recherche. Une perspective qualitative. Éditions Management & Société, 11-39.

Hossain, T., Walker, R.T. and Adams, M. (2020) *Role of sustainability in global seaports*, Ocean and Coastal Management, 1-11.

Kadio, A.K.C. (2023) *The Benefits of the Circular Economy for Companies' Circular Supply Chains in A French Port Area*, European Journal of Logistics, Purchasing and Supply Chain Management, 11 (2), 31-47.

Lorek, M. (2012) *Éco-industrie et reconversion du territoire industriel et portuaire : le cas de Gdansk*, Marché et Organisation, 2 (16), 129-152.

Lindstad, H.E. and Eskeland, G.S. (2016) *Environmental regulations in shipping: policies leaning towards globalization of scrubbers deserve scrutiny*. Transportation Research Part D: Transportation and Environment, 47, 67–76.

Liu, J., Kong Y., Li, S. and Wu, J. (2021) *Sustainability assessment of port cities with a hybrid model-empirical evidence from China*, Sustainable Cities and Society, 75, 103301.

Marcadon, J. (1999) *Les ports de commerce, l'environnement et la gestion intégrée du littoral*. In: Bulletin de l'Association de géographes français, 76e année, 2, 204-211.

Ogou, A.W.A. and Bidi, T.J (2019) *Port, Aménagement et Développement Durable à San-Pedro (Sud-ouest de la Côte d'Ivoire*), European Scientific Journal Edition, 15, (8), 110-131.

Poulsen, R.T., Ponte, S., and Sornn-Friese, H., (2018) *Environmental upgrading in global value chains: the potential and limitations of ports in the greening of maritime transport*, Geoforum 89, 83–95.

Rainaud, A. (2021) *La question environnementale dans les ports*, in Les ports en France : quelle stratégie portuaire pour un développement de l'activité ? " Collection Stratégie, Management et Organisation. CROS S., LERIQUE, F., Édition ESKA, 139–149

Rézenthel, R (2021) *L'intérêt général, un fondement incontournable des activités portuaires*. in Les ports en France : quelle stratégie portuaire pour un développement de l'activité ? " Collection Stratégie, Management et Organisation. CROS S., LERIQUE, F., Édition ESKA, 129-138.

Report of the World Commission on Environment and Development: Our Common Future. 300 pages.

Wang, X., Yuen, K., Wong, Y., and Li, K. (2020) *How can the maritime industry meet Sustainable Development Goals? An analysis of sustainability reports from the social entrepreneurship perspective*, Transportation Research Part D, 5, 78102173.

Lutte contre la pollution marine : l'édition 2023 de l'exercice « Plan POLLUMAR » s'ouvre à San Pedro - Infodirecte- Information à l'instant T