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Developing Hai Phong Port with Green Economy Orientation

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ABSTRACT: Hai Phong Port is the largest seaport of northern Viet Nam, annually accounting for, on average, 25% of total container throughput in the country and second only to the port of Ho Chi Minh City. It has recently experienced rapid growth, which has, in turn, contributed considerably to the city's economic development and improvement of local people's income. However, the rapid expansion of port-related activities in Hai Phong has also come along with a variety of negative impacts on the local environment including significant loss of biodiversity, which is of great concern, as Hai Phong is located in an estuary with valuable and sensitive ecosystems of mangrove forests, coral reefs, seagrass and aquaculture. Base on the study of secondary data (2010 - 2020) on the impacts of activities at Hai Phong Port on the local environment, and the green-development experiences of port cities around the world, this paper proposes a number of recommendations to the local authorities and relevant parties in order to encourage sustainable growth in the port and to fufil the green economy goals of Hai Phong.

Keywords: Green economy; Green port; Sustainable development; Hai Phong port.

I. INTRODUCTION

Historically, generating economic welfare has been the principal objective of seaports. More recently, however, contribution to sustainable value added and low environmental impact have become new requirements, and ports are increasingly developing green portfolio analysis, with measurement of environmental impacts and calculations of the potential benefits of shifting cargo to environmentally friendly modes (OECD, 2011). While the economic benefits of port activities are widely shared with the hinterland, the environmental impact is mostly borne locally. Ports have a variety of environmental impacts, related to shipping activity, activity on the port land and the environmental impact of hinterland transport to and from ports. The main impact involves air emissions, water quality, soil, waste, biodiversity and noise. These environmental side effects can have severe consequences for the health of a port-city's population, especially on less affluent neighbourhoods (OECD, 2014). Port activity can account for a large share of a city's overall environmental impact, as is the case in Hong Kong and Los Angeles/Long Beach (Table 1). Greening port activity can significantly improve a city's environment and well-being.

Table 1: Shipping-related emissions as a share of total city emissions

Port	SO_2 (%)	NO_x (%)	PM_{10} (%)
Hong Kong	54	33	n.a.
Shanghai	7	10	n.a.
Los Angeles/Long Beach	45	9	n.a.
Rotterdam	n.a.	13-25	10-15

(Source: OECD (2014), The Competitiveness of Global Port-Cities)

No concrete environmental action plan for port activities in Hai Phong appears to have been drawn up, although some environmental issues have been reported. Commitments from some port operators have been formulated, in particular Haiphong Port Joint Stock Company, in terms of environmental impact assessment, oil pollution control, hazardous waste management and sewage treatment, but further investments of this kind are needed. In addition, such commitments are not

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made uniformly across port terminals. These issues require timely solutions in order for Hai Phong to realise its green economy vision.

This paper is going to look at the relevant literature on green development and the development of green ports in cities around the world. Besides, a number of environmental impacts of activities in Hai Phong port are being discussed in the next part of the paper, which is then followed by the authors' recommended solutions in order to promote the development of Hai Phong port in compliance with the city's green economy vision.

II. LITERATURE REVIEW, THEORETICAL FRAMEWORK AND METHODOLOGY

The concept of the Green Economy was first introduced by Pearce et al. (1989), who established that the economy and the environment are not separated, but are interdependent concepts. The United Nations Environment Program defines the Green Economy as one that "improves human well-being and social equity, while significantly reducing environmental risks and ecological scarcities". It seeks to implement economic models able to generate profit while avoiding damage to the environment, considering eco-innovation, improved resource and waste management, the reuse of raw materials and the transition towards sustainable consumption and production. Green economy has become an inevitable direction for the global economy and the consevation of natural capital, such as air, water, soil, geology and all living organisms, whether renewable or not, is essential to ensure the future of humanity. If we continue to reduce reserves of natural resources without replenishment, we run the risk of ecological collapse. Badly managed natural capital becomes a social and economic liability and sustainability depends on its maintenance. Consequently, our economy cannot be based on a "take, make, consume and dispose" model, and consumers, governments and businesses must be aware of this reality. The importance of this issue has led to its inclusion in worldwide agendas, for example, "The 2030 Agenda for Sustainable Development", which seeks to promote countries' commitment to a better future. The United Nations has established seventeen goals for sustainable development, which should be addressed by all member countries. In 2011, the United Nations Environment Programme (UNEP) issued a 631-page report, Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication. A green economy in the context of sustainable development and poverty eradication was one of the two themes for the 2012 United Nations Conference on Sustainable Development (Rio+20). In 2012, the World Bank issued its report on green growth, Inclusive Green Growth: The Pathway to Sustainable Development. In 2012, GGGI, UNEP, OECD, and the World Bank jointly launched the Green Growth Knowledge Platform (GGKP), "a global network of international organizations and experts that identifies and addresses major knowledge gaps in green growth theory and practice … and offers practitioners and policymakers the policy guidance, good practices, tools, and data necessary to support the transition to a green economy."

Up to present, the concept of green economy has has attracted extensive attention from scholars due to its effects. Not only federal governments but also municipal authorities are making considerable efforts to encourage the green economy, in order to achieve sustainable development. A number of cities around the world, especially port cities, are trying various solutions that simultaneously targets key aspects of economic performance, and those of environmental sustainability, such as mitigation of climate change and biodiversity loss and security of access to clean energy and water. In the meantime, academic interest in port green development has been addressed from a variety of viewpoints: the ecology of port logistics system (Li and Yang, 2010; Martinsen and Björklund, 2012; Psaraftis, 2016); the environmental impact costs of shipping operations (Ng and Song, 2010; Lun et al., 2016a); the analysis of exhaust emissions from vessels activities (Abrutytė et al., 2014; Winnes et al., 2015; Papaefthimiou et al., 2016); and the viability of regulatory and political frameworks in terms of environmental port management (Wooldridge et al., 1999; Gilman, 2003).

The methodology used in this work was the review on literature about green economy as well as empirical researches about the variety of solutions that have been implemented to bring about greener growth of port cities around the world. The literature review is a stage that brings knowledge subsidies and provides scientific support for the research. This study is based on papers and scientific material on the green port theme. Based on the existing literature, semi-structured interviews were conducted with the relevant authorities. Open-ended questions were asked at the end of the semi-structured interview to obtain further insights into the impacts of port activities on the local environment. The theoretical reference was supported basically by documentary and international journals. Fieldwork was also used

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in this study since data were collected from people who contributed to the understanding of the problem and the prospect of sustainable operations in Hai Phong Port. Therefore, in general, we used the exploratory research involving review on pertinent literature and empirical researches, interview with people with practical experiences with the subject and analysis of examples that contribute to the understanding of the problem.

III. ENVIRONMENTAL THREATS FROM SEAPORT-RELATED ACTIVITIES IN HAI PHONG

Air pollution, low seawater quality and loss of biodiversity are primary environmental concerns which come along with the development of Hai Phong port in recent years.

First of all, air pollution is one of the important environmental concerns which have been increasingly acknowledged as an economic issue. Among the greatest concerns are maritime and inland cargo traffic emit pollutants such as CO, SO2, NOx, and particulate matters which are generated as a consequences of seaport-related activities. Most key industries in Hai Phong, including shipbuilding, are still highly energy-intensive and result in high air emissions. Levels of PM_{10} in Hoang Dieu, Chua Ve and Tan Vu terminals are on average 142 µg/m^3, 136 µg/m^3 and 141 µg/m^3, respectively, while dust pollution is also a negative consequence of port activities and development. This is particularly intense near the Tan Vu terminal, due to construction work and road traffic. Those dust particles poses threats to human's health as they can penetrate the human respiratory tract and exacerbate respiratory conditions such as asthma. Also, it has been calculated that, for a city with a population of 100.000, a single tonne of PM2.5 has social costs of approximately EUR 33.000, or social costs of EUR 495.000 for a city of several million people. The same applies to SO2, whose costs vary from EUR 6000 per tonne emitted to EUR 90.000 respectively (Holland and Watkiss, 2012, cited in Castells Sanabra, Usabiaga Santamaría and Martínez De Osés, 2018). Air pollution from ports can therefore present large external costs.

Recent figures from Institute of Marine Environment and Resources also suggests that seawater quality has been decreasing: port activities in Hai Phong result in 3000 to 5000 tonnes of waste oil annually, and only 900 to 1000 (20-30%) are collected. Port activities produce solid and non-solid waste, especially from oil terminals, fuel deposits and dry dock operations, which produce oily and toxic sludge. Waste also comes from other sources, such as ships and, illegal dumping in containers by foreign businesses. Shipping activities are responsible for around one-fifth of global discharges of waste and residues at sea (EMSA, 2019). In Hai Phong, only 20% to 30% of oil waste is collected, the rest being discharged into the sea. Oil spills result from normal activities, accidents and illegal dumping practices, such as port run-off, unloading and loading of oil tankers, removal of bilge water and leakages. Although tanker accidents are thought of as an important source of water pollution, some estimates indicate that normal shipping operations are responsible for over 70% of the oil discharged into the sea from marine transport (Miola et al., 2009). Other types of waste are also often released into the sea. Also, given the number of shipyards for repair and new builds in Hai Phong, it is likely that the dredged masses are highly contaminated. Record pollution of sea water was reported in 2018 in Hai Phong.

Furthermore, loss of biodiversity is another major environmental impact (Table 2). This is a consequence of deteriorating seawater quality, oil spills (especially from small gasoline-powered fishing boats) and also dredging activity. From 2015 to 2020, nearly 3 million cubic metres of materials were dredged yearly, in addition to 14.5 million cubic metres of sediments in the Lach Huyen and Ha Nam channels in 2018 - 2019. Sediment appears to have negatively affected the ecosystems in the vicinity and biodiversity in both the source and the sediment destinations. Waste from port activities, including oil, has also contributed to the disruption of local ecosystems. Mangrove ecosystems, seagrass, tidal sands, lagoons and coral reefs, in particular, have been heavily affected. Many aquatic animals, such as shrimps and crabs, which are important fishing resources, are disappearing. Also, the upgrading of the old ports and building of the new deep-sea port in Lach Huyen has also affected local biodiversity. Significantly, Hai Phong is located in an estuary with valuable ecosystems of mangrove forests, coral reefs, sea grass and aquaculture areas, and the new international port is adjacent to the Cat Ba biosphere reserve area, which might worsen the environmental impacts of seaport-related activities in Hai Phong.

Table 2: Port impacts on biodiversity

Source	Effects	Species affected

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TBT paint	Morphological change, change in population structure	Marine invertebrates
Anchoring	Sediment resuspension, reduction of capacity for photosynthesis	Marine organisms living in harbours, seagrass
Oil discharge	Genetic damage, oxidative stress, behavioural abnormalities	Marine vertebrates, birds
Gas emissions	Ocean acidification	Plankton, coral, organisms with calcification process
Chemicals	Accumulation of substances in organisms that cause disruption of the endocrine system	Predators at the top of the food chain
Waste	Eutrophication	Seagrass, fish
Debris	Death by ingesting floating plastics	Seabirds, turtles, whales
Ballast water	Introduction of invasive non-indigenous species, extinction of native species	Entire ecosystem
Noise	Problems of communication for animals, collisions	Cetaceans, marine mammals
Collisions	Death	Cetaceans, other marine vertebrates (whales, dolphins, turtles)

(Source: OECD (2014), The Competitiveness of Global Port-Cities)

Last but not least, solid waste from shipping activities is another growing problem for the Port of Hai Phong. Illegal waste is found in containers disposed of by foreign industrial businesses that do not want to pay for the high cost of treating and disposing of such waste, and hazardous waste in particular. It was recently estimated that the port houses around 5000 containers containing several thousand tonnes of illegal waste, including plastic waste, electronic parts and used rubber tubes.

These impacts are felt locally, and must be addressed by any green growth strategy, especially given that the rapid growth of the port may exacerbate these problems. However, this has not been appropriately addressed so far, and, the Hai Phong Green Growth Promotion Plan, in particular, makes almost no mention of port activities, including their environmental impact.

IV. SOLUTIONS TO GREENER DEVELOPMENT OF HAI PHONG PORT

4.1. The establishement of an accurate port environmental monitoring system

First and foremost, Hai Phong authorities need to address the lack of an accurate environmental monitoring system for the port's activities (including its impact on local ecosystems). Most of the issues mentioned above have not been thoroughly measured, precluding concrete action and consensus among the diverse stakeholders on what is at stake. Despite recent commitments from Hai Phong Port JSC to carry out environmental monitoring and impact assessment, no accurate time-series data on waste oil generation is apparently available. Neither are recent data on air quality in port terminals, and a clear understanding of the impact of the port on biodiversity. In addition, no data is available on other traditional environmental externalities of port activities, such as greenhouse gas emissions and the generation of solid waste. One of the strategies of the Green Growth Promotion Plan is to develop environmental monitoring systems in the city, but none of the three planned stations will be located in the port.

Hai Phong city and port authorities should thus build environmental impact inventories in each critical area of concern. One suggestion is that the authority in the port areas work in partnership with environmental institutes and NGOs, relevant port companies and the central government in order to construct a comprehensive set of environmental impact indicators and publish regular sustainability reports which present all such indicators.

4.2. Developing a Port Clean Air Action Plan

In addition to environmental monitoring system for the port, specific policies could be taken for each environmental challenge, starting with air pollution. Hai Phong city could start by developing a Port Clean Air Action Plan to tackle air pollution from port activities comprehensively, with port operators, shippers, NGOs, etc. The plan should also include measures to reduce greenhouse gas emissions from port activities. The Action Plan should contain complementary measures to

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improve air quality and reduce greenhouse gas emissions, such as the creation and monitoring of an Environmental Ship Index (ESI). This is the most common way for ports to incentivise the use of ships that are most environmentally acceptable, and consists in determining the environmental performance of ships with respect to air pollutants and CO_2. The aim would be to reward ships that score high on the index by offering them lower port dues.

Besides, the port authority might also consider setting up targets for modal split and complementary fiscal incentives. Decreasing reliance on cargo transport by trucks will not only help to improve the competitiveness of the port but also reduce its environmental impact since missions generated by rail transport are roughly equivalent to a third of those generated by road haulage (OECD, 2014). Similarly, fiscal incentives should complement the use of rail or inland waterway transport.

Hai Phong port should also progressively turn to the production of cleaner and renewable energy, in association with broader city-wide energy policies. For instance, Rotterdam's Port Vision 2030, published in 2011, is based on a strategy to link the port to its emerging sustainable energy sector (OECD, 2014). As the new port of Lach Huyen is a greenfield construction and by definition located away from where people live, wind generation could be suitable. This energy could be used for onshore power supply, as practiced in the Port of Gothenburg, Sweden. This will help to reduce the burning of diesel by idling ships. Waste-to-energy plants could also be used to turn port solid waste into electricity. Besides, the Hai Phong city should also extend energy efficiency measures contained in the Green Growth Promotion Plan to port buildings and facilities, perhaps as a separate targeted sub-programme.

4.3. A fixed-fee system and green bunkering programme can reduce waste and discharge of sludge

Hai Phong already has several measures in place to limit solid waste and non-solid waste pollution. Port handling companies sign contracts with Hai Phong Solid Waste Management Enterprise to use the solid waste collection service. One unit in the company is responsible for treating waste collected from the port. Waste is directly transported to landfill sites. The fee is determined by the local government and depends on the volume of waste collected (for toxic waste, the fee depends on the type of waste). An environmental fee is levied in the port, but is only used to finance the cost of basic port cleaning. Such measures are, however, obviously insufficient, and given the growth of port activity, the need for financial and human resources capacities will only increase. The city faces the risk that environmental impact assessment will become harder and harder to enforce, and that solid waste treatment facilities will struggle to deal with increasing amounts of solid waste. The port, generally speaking, lacks consistent control of solid waste and contaminated mass. The Green Growth Promotion Plan, for instance, acknowledges the need to reduce wastewater from industries and residences but does not mention port activities.

The port should thus develop a cleaner production strategy to minimise waste, and control and manage the quality of the ships that enter the port and the process of loading goods. The single most effective policy option that local and port authorities could consider is imposing on ships a fixed-fee system for waste. The countries in the Baltic Marine Environment Protection Commission (HELCOM) in northern Europe adopt the "no special fee" system for collecting waste and sludge generated by ships. Under this agreement, ports are not allowed to charge ships based solely on the amount of sludge and waste left in port but rather a fee for all ships calling in ports that is based on gross tonnage. The rationale for this policy is to remove the incentive for the shipping line to dump waste and sludge in the ocean. If ships are required to pay for waste and sludge regardless whether they leave it in the port or not, they have no economic reason to dump it in the water. Introducing this system in Hai Phong port could thus reduce the waste, especially illegal waste, and sludge dumped in the water. It might, however, be necessary to harmonise such a policy throughout Viet Nam and even the region, to ensure that Hai Phong port does not receive too much waste, if other ports base their fees on the amount of waste. The national government could play a critical role in this regard. The fee should be set high enough to avoid this problem.

One other policy option would be to create a "green bunkering programme" along the lines of the one in force in Gothenburg. This port, which handles half of Sweden's oil imports, has undertaken a range of measures to ensure that gases and oil are not inadvertently discharged into the environment during bunkering. The port introduced a stringent set of rules in 1999 covering a wide range of activities, including requiring the installation of electronic overflow alarms, the carriage of at least 50 metres of oil booms with absorptive material, and the vetting of all bunker

barges by the port authority. The port has also mandated oil-spill prevention equipment for bunker installations and that all bunker operators attend training programmes to learn safe bunkering techniques. Gothenburg has argued for the expansion of green bunkering practices to the rest of Sweden, supporting a 2011 bill to require regular pressure testing in Swedish bunkers to prevent oil spills (OECD, 2014).

4.4. Creating no-discharge zones to protect local biodiversity

Port activities can impact local and global biodiversity (Table 2). In Hai Phong, oil discharge and sedimentation are most frequently quoted in studies as contributing to a loss of local biodiversity. Mangrove losses, in particular, are a source of concern, and local authorities have undertaken a series of measures to protect these important natural assets. Programmes and projects investing in environmental conservation in Hai Phong for the period 2012 - 2025 include coastal mangrove protection and recovery projects with an estimated budget of around VND 85 billion.

Restoration of biodiversity is critical, and Hai Phong city should adopt pro-active policies and reinforce current biodiversity protection policies. No-discharge zones in and around the city could be set up, where biodiversity is particularly high and sensitive. The objective would be to forbid the discharge of certain liquid waste into the sea. Three different mandates for protection can be used, including: protecting aquatic habitats where pump-out facilities are available; protecting special aquatic habitats or species; or protecting drinking-water intake zones to protect human health. Similar initiative has been carried out in the United States with the establishment of the largest no-discharge zone in the United States along the coastline of California (2.600 km), which is found to be able to reduce the annual discharge by over 76 million litres of sewage by cargo and cruise ships calling at California's ports within 6 years. [11]

V. CONCLUSIONS

So far, although the "green port city" is the central vision of both Hai Phong Green Growth Promotion Plan (GGPP) and Green Growth Action Plan (GGAP), environmental consideration of port activities has been not sufficiently provided for under current policies. The specific issues associated with the port that are obstacles to green growth in the city haven not been clearly defined and recognised in the wider city-scale green growth policies. This calls for urgent solutions to minimise the harmful impacts of port-related activities on the local environment and, hence, bring about more sustainable development to the city. Based on some initial insights into the current polution situation in Hai Phong ports' areas and review on relevant literature and empirical findings about measures to tackle environmental issues in port cities around the world, this paper puts forward a number of recommendations to alleviate the environmental impacts of port related activities in Hai Phong city. The recommendations should especially be integrated into Hai Phong's Green Growth Promotion Plan and Action Plan, either in a specific green port section, or incorporated into the sectoral policies of these plans (in particular in the sections concerning solid waste management, decentralised energy systems, air quality monitoring, transport and energy efficiency in manufacturing). Besides, as Hai Phong city does not own the port terminals (which may also explain why specific port activities are not included in the GGPP and GGAP), designing and implementing green port strategies will also require the involvement of private port operators. Green port strategies should benefit all stakeholders, and by closely involving port operators, Hai Phong city should be able to make its policies more inclusive, with greater impact on the whole city.

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