SMART ARCITIC LOGISTICS ROADMAP IN SEAPORTS

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ABSTRACT

In the digital world, a smart concept became an essential feature for port organizations to serve as intelligent hubs in the world transport networks. Smart ports are the trend for the future long-term strategies. Henceforth, ports aims at contributing to sustainable growth by establishing the appropriate conditions for the adoption of new management energy models based on low environmental impact and triggering innovation of both technologies and processes. The scope of this paper is to examine three main issues of smart ports; smart port arctic logistics roadmap, smart port challenges and obstacles in arctic port areas, and the criteria and Key Performance Indicators guiding the assessment of ports against this concept. The main purpose is to develop a smart arctic logistics road map for the future.

Keywords: Arctic logistics, smart port, logistics road map, smart intelligence

INTRODUCTION

The importance of the smart port concept is strategically increasing in the last years as a future trend in the maritime industry. The new trend of smart port will lead to rely on the new management energy models, which are based on the low environmental impacts and prompting the innovations of both the processes and technologies. Consequently, the smart ports will contribute to the sustainable growth. Nowadays, most of the countries and unions, such as the European Union, have released new transport infrastructure policies. The purpose is to enhance the transport networks around the world, remove bottlenecks and the technical barriers, and

reaching remote markets in less times. All these trends rely on investing in the new technologies (Hamalainen, 2015).

The investment in the new technologies will lead to a greener and smarter transport systems, globally. Thus, the future trend for governments is to conduct 'technology platforms' that contributes to defining the future transport strategies, including the integration of the supply chains and providing the needed innovation.

On the other hand, the Green Corridors became an important feature for denoting the smart transport corridors, where advanced technology and co-modality are used to achieve energy efficiency and reduce environmental impact. The characteristics of a green corridor include, for example:

- Sustainable logistics solutions.
- High safety.
- High quality.
- Integrated logistics concepts.
- Optimal utilization of all transport modes.
- Harmonized regulations with openness for all actors.
- A concentration of national and international freight traffic.
- Efficient and strategically placed trans-shipment pointes.
- Supportive infrastructure.
- Innovative logistics solutions, including information systems.

Those green corridors will lead to smart corridors where an intelligent transport services can be provided. Ports are considered the main members within those smart corridors. In other words, smart corridors require smart ports. The aim is to improve the commuter services, enhance the traffic safety and make the traffic flow smoother, especially at the borders.

RESEARCH PROBLEM

This paper aims to address the following problem;

What is the logistics roadmap for the future smart seaports?

This requires to discuss those criteria that affect the transformation of seaports to be smart in the future. In turns, the paper will explain the

challenges and obstacles facing the smart ports. Also, smart port and the 2050 visions will be illuminated in order to highlight the required road map for both the authorities and stakeholders.

METHODOLOGY

The objective of the SMART ARCTIC logistics roadmap in seaports is to formulate a future vision and discussing the required roadmap for the ports. Hence, the approach of this paper is including the Arctic context; including arctic competence and policy making, Environmental informatics and mobile technology, and smart logistics and transport. Explanatory methodology will be applied in this paper and the philosophy is objectivist ontology. It aims to discuss the nature of reality, where the objectivist ontology deals with what is physically real, with no regards to the social objects, and where the results are based on the facts of the findings derived from real investigation (Maylor and Blackmon, 2005).

The SMART PORT CONCEPT

The smart port concept can be displayed as the port where the environmental impacts, operations, and the energy consumption are addressed. The main concern for the future maritime industry is to transform ports into Smart Sustainable Cities (SSC) in the global supply chains. ITU (2015, p. 8) defined the SSC as " *is an innovative city that uses information and communication technologies and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects*". This concept can be applied in the seaports with certain criteria.

Smart Port KPIs and Criteria

Med (2015) has discussed 23 criteria and 68 key performance indicators (KPIs) against the smart port concept in relative to the environmental impacts, operations, and the energy consumption dimensions. Figure 1 displays some criteria in relative to the smart port concept.

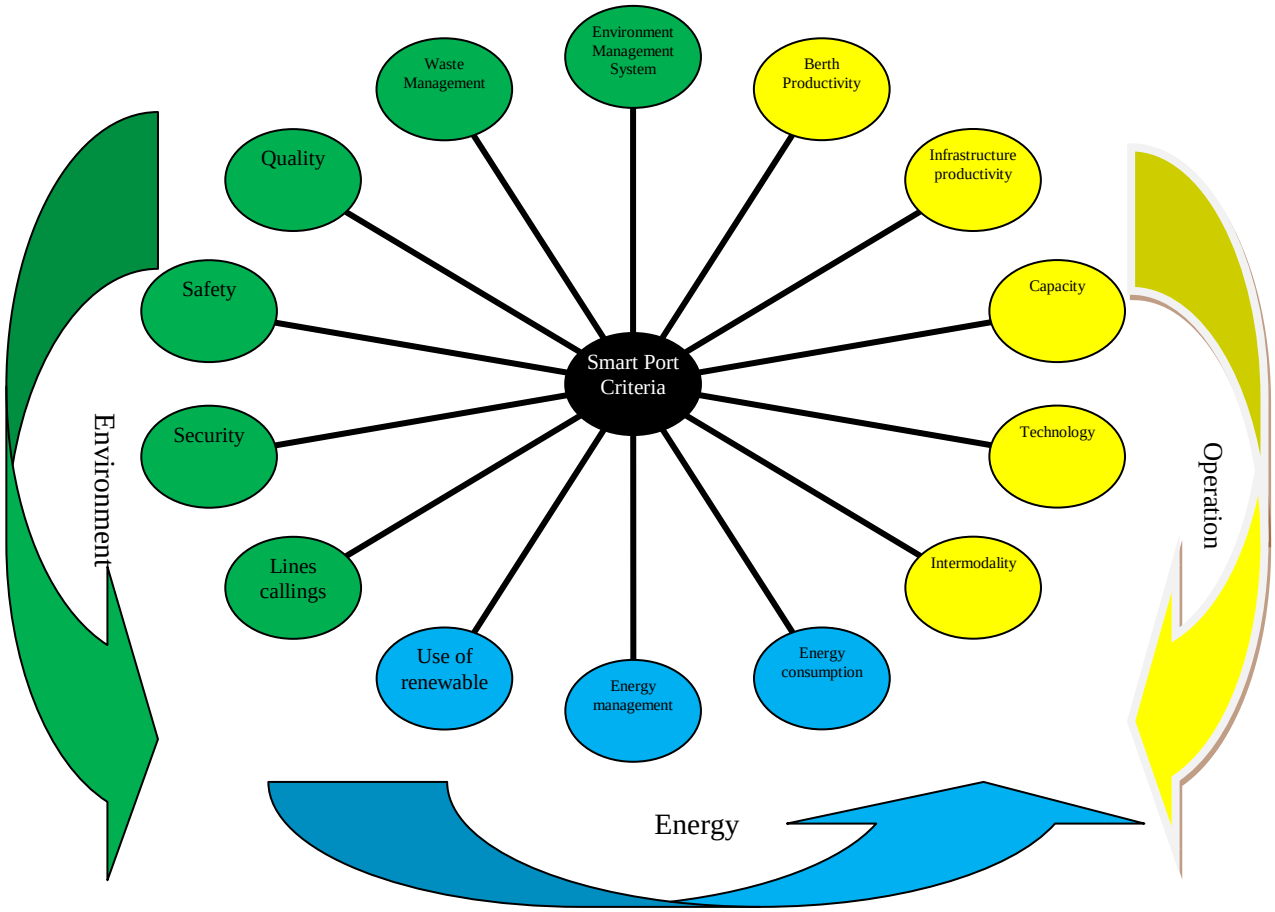

Figure 1. Scheme of some criteria in the different topics defined in the smart-port concept

Source: Med (2015)

In ports operations, measuring productivity is the most common performance measurement criteria (Cullinane et al., 2004). It includes sub measures such as berth productivity and berth efficiency where they can be used to measure the productivity of the smart ports. The infrastructure productivity is another criteria where it ensures the cost-effective yard operations. Also, the capacity of infrastructure and equipment are important in order to accommodate an increase of the ships' sizes. Its availability helps enhance the ports' competitiveness. From the operational point of view, the reliable, accurate and secure flow of information is essential in order to provide quick, reliable services and operations at seaports.

For the intermodality criteria, it helps to speed up the flow of goods within the logistics chains, reduces cargo handling and preventing damage or loss of the handled cargoes at ports (Matajic, 2010).

In ports' energy context, the energy consumption presents an important criteria for improving the smart port performance, enhancing the ports' sustainability and strengths the competitiveness (CISCO, 2003). Energy efficiency and savings can take place in ports at the various operations, buildings, equipment and warehouses. Hence, some technologies can be applied at ports such as wind technology, photovoltaic and marine technologies.

In ports' environmental context, different maritime activities can lead to the environmental pollution. Hence, different environmental performance indicators can be particularly useful for both to the authority and to a wide range of stakeholders in providing evidence of progress and the achievement of environmental objectives. Those indicators include, for example, soil waste, air pollution and water contamination (Puig M., 2012). Waste management is a highly required philosophy by the new trend of smart ports in the future.

Smart ports have to adopt their strategies to provide such services that raise the service quality provided at ports, such as repair, replacement and repositioning the equipment at different terminals. Also, an attraction towards the investment in port is a mandatory requirement in smart ports, where the investment in research innovation and development will incur an updated the security systems (Piniella 2009; Trelleborg 2010).

CHALLENGES FACING SMART PORTS

Applying the smart port concept is facing a number of challenges as the concept has to contribute to the sustainable development of sea and waterways activities, which is known as "blue growth". This can be achieved by improving the performance levels of navigation and harbour calls, within a transport chain between the sea/waterway and the land. These challenges are:

1. The first challenge is to enhance the competitiveness of the maritime industry as it involves numerous stakeholders in a wide range of activities such as shipbuilding, equipment, repair, and transformation of ships, offshore technology and the new on-going sector of renewable marine energies. It boasts renowned knowledge in complex high-tech ships. This industry must be capable, in an international competitive environment, of remaining competitive

in order to meet the demands of various users such as ship owners, importers, exporters, freight forwarders and shipping lines. Being a smart port leads to provide safe, environmentally friendly and economic operations.

2. One additional challenge involves the skills acquired by operators at the sea industry. In order to remains the sea industry attractive, it needs to rely on high-performance staff.
3. There is a challenge facing the intermodality and associated cost in term of transferring goods between different means of transport. There is a need for technological improvements on ships and at the port terminals.
4. The highly challenge is to eliminate the global CO2 emissions originate from sea transport.
5. Ship energy efficiency is another challenge due to a future context of rarefaction of oil and power.
6. Smart ports play an indispensable role in providing damage control, security control, and illicit acts control such as theft, piracy, immigration and terrorism.

Smart Ports Parameters

There are a number of parameters that should be considered in determining the smart ports roadmap. These parameters are:

1. The ship use; new generations of ships are released in the maritime industry according to the economic, technological, environmental and regulatory developments.
2. Re-structuring the main world economic centers and the new sources of growth will affect the role of the transshipment ports.
3. New kind of goods, such as drinking water, hydrogen, captured CO2, carried by sea requires developing urban logistics at seaports.
4. A new need for modular ship is highly required in order to reduce the total operating costs. Those modular ships can be used for several purposes such as fishing and scientific usage.
5. Structuring of industrial stakeholders within the maritime industry.
6. Fragmented and globalized value chains.
7. The industrial ecosystem.

SMART PORTS AND THE 2050 VISIONS

For the ports' future, the 2050 visions have been developed to presume an economic context. In the vision 1, ship owners replace orders to build ships with latest innovation and quality and accommodate high capacity. This requires the shipyards to deploy low-labor cost and to run fast production cycles. This will lead the shipyards to look for countries where they can get lower labor cost, optimized services, and modular maintenance. In turns, this vision explains the optimization of costs and the global fragmentation of the value chains.

In the Vision2, the ship owners will demand their ships to perform new uses. The purpose is to minimize the purchasing costs and to provide the competitive operating.

Table 1. The Smart Ports and the 2050 Visions

Future Uses	*Current Uses*	*New Uses*
Worldwide	Vision 1 Optimizing costs	Vision 2 New standardized market niches
A local-level industrial ecosystem	Vision 3 High-tech specialization	Vision 4 Complexity and customization

Source: ADEME, 2015

In the Vision 3, industrialists in the maritime industry aim to utilize the renewable energies for the ships' designs. They aim to reduce the materials costs and operating expenditures, especially when ordering mega ships. Extended engine life, energy savings and new energies such as green ships are examples of this vision. In the Vision 4, the maritime transport will move towards global integration. This will lead to improve the quality and performance levels of the ships. Sharing port facilities will result to reach the utilization of the available facilities at ports.

Obstacles facing the Transformation into Smart Seaports

ADEME (2015) discussed a number of obstacles that facing the future maritime transport. These obstacles can be displayed in two main groups as follows:

1. The lack of technological solutions

- To reduce the consumption of fossil energies.
- To reduce the environmental impacts of the ships.
- To resolve the safety/security challenges faced by ships, their crews, passengers and goods.
- The lack of permanent monitoring and adaptive maintenance technologies.
- The lack of efficient production methods to increase competitiveness.

2. Socio-economic, organizational and regulatory
   - The loss of national skills in certain key/strategy fields.
   - lack of guarantee funds to support the risk taken by the ship owner.
   - lack of research and testing capacities dedicated to sea transport.
   - The restrictions connected of port infrastructures.
   - The social acceptability of the new uses of ships.
   - The adoption of innovations by crews.

CONCLUSION

This paper aims to develop a logistics roadmap to identify future priority opportunities and capability needs for the ports to be smart in the future. It starts with discussing the most important criteria in relative to the smart ports as a roadmap template. The most important challenges and obstacles facing the smart ports were then highlighted. These challenges were based on the previous defined criteria.

In conclusion, there is a strong emphasis on a move towards an integrated intermodal transport systems, reducing emissions, implementation of track & trace solutions, and focusing on more automation and integration of data.

ECOMMENDATIONS

In reviewing the required KPIs for smart ports as a roadmap and discussing the challenges and obstacles facing the transformation of ports to be smartic logistics nodes, it is recommended for both the stakeholders and the authorities at seaports to:

- Promoting quality jobs and working conditions.
- Encourage investment in technology.
- Secure transport.
- Apply a ‘One-stop-shop’ concept.
- Spread over the tracking and tracing technologies.

- Adopt the legislation themes in the maritime industry.
- Enhancing the capacity and quality of the infrastructure.
- Improving the environmental and waste management systems.
- Adopting the corridor management strategies.
- Developing and implementation of Sustainable Energy Action Plans.

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