

Sustainability Practices to Achieve Sustainability in International Port Operations

Sihyun Kim* · BongGyu Chiang**

Abstract : Sustainability is a broad concept involving economic, social and environmental issues in operational and managerial processes. To assist ports to implant sustainability practices into their operations, this paper conceptualizes the structure of sustainability practice in port operations, based on interviews undertaken at Busan port in early 2013. Results revealed that, as a strategic practice to improve their internal business processes, sustainability practices necessitate the simultaneous pursuit of container traffic growth, low environmental impacts and corporate responsible image making, operational efficiency, efficiency of the use of the port area and sustainable growth. Through thematic analysis, the relevant practices were clustered into four sub-dimensions incorporating environmental technologies, continual monitoring and upgrading, internal process improvement, and cooperation and communication. Further, reporting the relevant issues such as barriers and challenges in carrying out sustainability practices, the findings provide useful insights for strategic agenda to assist ports to incorporate sustainability practices in their operations.

Key Words : Sustainability Practice, Port Operation, Environmental Technology, Monitoring and Upgrading Port Activity, Internal Process Improvement, Cooperation and Communication.

▷ 논문접수 : 2014. 07. 15. ▷ 심사완료 : 2014. 08. 18. ▷ 게재확정 : 2014. 08. 28.

* International Shipping and Logistics Group, Plymouth University, Cookworthy Building, Drake Circus, Plymouth, UK, PL4 8AA, bud1111@nate.com, +447710241893

** Corresponding author, professor of International Trade(senior researcher of Business and Economics Research Institute), Gyeongsang National University, chiang@gnu.ac.kr, 055)772-1545

I. INTRODUCTION

As port functions change to act as an economic catalyst and take on a central position in industries engaged in international trade, issues of economic stability and corporate responsibility shed new light on port operations (Cheon and Deakin, 2010). Moreover, the increasing environmental consciousness stimulates ports to improve their operational sustainability within the bounds of the environmental regulations, by accommodating stakeholder expectations (Dinwoodie et al., 2012; Adams et al., 2010). To accommodate the current and future needs of ports and their stakeholders, ports need to find a balance between valuable land, labor and technology, as well as to perform as a multifunctional business center which can produce value-added and growth in their host cities (Lun, 2011; Wang and Cheng, 2010).

Amidst intensified port competition in NEA (Northeast Asia), there has been a great deal of practitioner interest in improving competitiveness by implementing sustainability practices. This focus is not surprising, as operational sustainability in commercial port operations critically depends on competitiveness and attractiveness to shipping lines (Yeo et al., 2011; Cheon and Deakin, 2010). As claimed by Adams et al.(2010), new opportunities to achieve competitive advantage and/or to sustain a competitive position are critical issues for sustainable port development and operations in sophisticated port competition. Therefore, integrating the consideration of sustainability into all port activities is the aim of sustainability practices in port operations. Organizations and industries related to port operations have progressively begun to translate sustainability issues from a sideline management concern into a core issue directly related to efficiency and competitiveness (Denktas and Karatas, 2012; Lun, 2011; Cheon and Deakin, 2010). While prior studies on port sustainability (e.g. Seuring and Muller, 2008; Menguc and Ozanne, 2005) provide broad implications for practice and policy, the focus was on environmental impact minimization and environmental index development (Denktas and Karatas, 2012). Such a restricted view is insufficient to conceptualize the role of sustainability practice in sophisticated port competition, in that the objectives of sustainability practices have to be harmonized with the viable

commercial sustainability of the port' s performance (Cheon and Deakin, 2010).

With expanded port functions which are central to industries engaged in international trade, the needs for sustainability practices that aim to achieve sustainable port development and operations has become widespread across the world' s ports without limitations to a particular country or region (e.g. Los Angeles /Long Beach, Rotterdam, Antwerp, Seattle, Hong Kong, Singapore, etc...). Notwithstanding the higher demands for sustainability practices in promoting sustainable development and operations, the major container ports in NEA have reported two challenges in carrying out such practices. At first, only limited studies have been focused on this sustainability strategy/practice in this region, compared to the region of Europe and the USA. Secondly, a lack of evidence due to limited studies impedes taking a proactive attitude towards implementing sustainability practice in port operations. Moreover, due to highly intensified port competition in NEA, Ports in NEA are still concerned about eroding their competitiveness if they implement sustainability practices, as well as being reluctant to take a more proactive attitude. Responses have been late and unfocused, compared to the regions of Europe and the USA.

Therefore, in order to provide useful insights to guide policy and strategies for sustainable port operations and a strategic agenda to assist ports to incorporate sustainability practice, this study aims to conceptualize the structure of sustainability practices in port operations. To achieve research aims, strategic goals in implementing sustainability practice and attributes of sustainability practice that clusters the relevant practices were investigated and analyzed, undertaking face-to-face semi-structured interviews. In order to enhance the validity of the findings, the interviews were composed of the four groups of stakeholders include internal stakeholders (port operator) and three groups of external stakeholders including economic/contractual external (e.g. terminal operators), public policy (e.g. government bodies) and community/academic groups. The interviews were undertaken at Busan port in early 2013 and analyzed by using thematic analysis (Smith et al., 2012; Virginia and Clarke, 2006). After reviewing prior studies on port sustainability and its practices, research design, data collection processes and data quality issues are presented. The findings underpinning the related practices are discussed and displayed in the following sections. This paper ends with a

discussion of the results, drawing conclusions and recommendation for future work. The findings are expected to be utilized to provide and develop guidance for the port industry in its future improvement strategy, as well as for further research on sustainable port operations and management.

II. LITERATURE REVIEW

1. Port Sustainability

The concept of sustainability in a port necessitates the simultaneous pursuit of economic prosperity, environmental quality and social responsibility (ESPO, 2012; Cheon and Deakin, 2010). In the shipping and ports industries, with broadened port functions as an economic catalyst for revenue and employment and a central position for industries related to international trade (Low et al., 2009; Notteboom and Rodrigue, 2008), economic stability and corporate responsibility have progressively framed in port operations and development literature (Dinwoodie et al., 2012). Sustainable port development means: “Not only address problems in port areas including safe handling of goods or environmental management, but also includes the actual capacity development for the ports and the establishment of related training capacities in the region, aiming to develop a port and the area surrounding the port through a systematic approach working with the ports and addressing their specific needs (Asean-German Technical Cooperation, 2012)” .

Accordingly, the concept of port sustainability includes three main perspectives: 1) an economic perspective including returns on investment, efficiency of the use of the port area, and provision of facilities for companies to maximize their performance; 2) a social scope such as the direct contribution to employment in port companies and activities connecting to the port (indirect employment, the interaction and relationship between port and city, the contribution to knowledge development and education, and the livability of the area surrounding the port); and 3) an environmental performance and management including noise pollution, air quality, dredging operations, dredging disposal, dust (Adams et al., 2010). In the same vein, it appears that the concept of sustainability in commercial port

operations shapes not only the character of success in the real dynamic competition between ports, but also the role and responsibility as a central position in industries associated with international trade (Wang and Cheng, 2010; Low et al., 2009).

Studies of sustainable development (Bansal 2005), sustainable management (Seuring and Muller, 2008; Branco and Rodrigues, 2006), and sustainable operations (Dinwoodie et al., 2012; Cheon and Deakin, 2010) have wide-ranging implications for developing port practices, activities and procedures. However, prior studies on port sustainability not only focused on environmental risk management, but also dealt with strategic objectives focused on environmental impact minimization which is insufficient to define sustainability practice due to difficulties to reflect the character of success in the real dynamic competition between ports. Therefore, to assist ports to incorporate sustainability practices in their operations, this study investigates and conceptualizes sustainability practices in the real dynamic competition between ports.

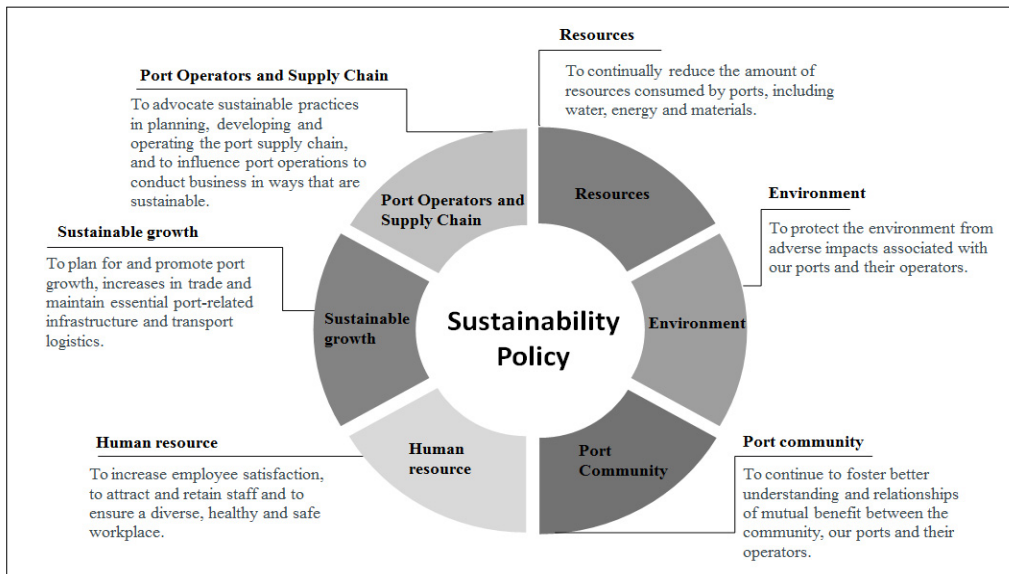
2. Port sustainability practices

The increasing attention to “sustainability” has resulted in steadily developing policies, regulation, and a guidance in order to promote sustainable development. In the shipping and port industry, sustainability practices have applied over a wide range of spatial and temporal scales (Cheon and Deakin, 2010; Seuring and Muller, 2008), including many types/routes for implementing practice such as resource, environmental, community and human resource management, continuous growth, and port operators and supply chain management (Sydney Ports Corporation, 2011). These wide-ranging implications obtained from sustainability principle, policy and strategies laid the foundations for developing port practices, activities and procedures. For example, figure 1 describes the objectives of sustainability policy.

On the other hand, numerous case studies have identified the benefits resulting from sustainability practices (e.g. Dinwoodie et al., 2012; Cheon and Deakin, 2010; Seuring and Muller, 2008; Francisco, 2007), including reductions in operating costs, production and process improvements, reduced liability and risk, enhanced brand

image, increased employee morale, increased opportunity for revenue generation—new markets and price premiums, better supply chain management, and better relationship with customers. Leading ports also aims to implant sustainability issues into their practice for achieving such benefits that generates long term value (Adams et al., 2010). Particularly, literature maintained that sustainability strategy and practices can enhance the sustainability of competitive advantage (Rodriguez et al., 2002), simultaneously reducing the negative effects of their performance on the natural environment (Lun, 2011).

Figure 1 Sustainability policy



Source: Sydney port annual report, 2011:3

This in turn generates the opportunities to improve their competitiveness in a highly competitive environment (BuyUkozkan and Berkol, 2011; Lun, 2011; Porter and van der Linde, 1995), as the following elements: savings (time, costs and energy efficiency); security (risk reduction); quality (service process improvement); market (capturing new customers); image (reputation); ethics and social responsibility (low environmental impact); intention to continue and survive in the future; and new business opportunities (management and application of

technologies aimed at preventing, mitigating and restoring, in order to resolve environmental problems) (Francisco, 2007). Besides, Tan et al.(2011) argued that through corresponding improvements in sustainability, ports can achieve more economic stability and continuous improvements in subsequent performance within the bounds of the environmental regulations.

All these motivations and opportunities are encouraging ports to review and adopt sustainability practices. In order to investigate the details for sustainability practices adopted in port operations, we reviewed “annual sustainability reports” published by ports and international organizations such as ESPO and OECD. Table 1 presents ‘sustainability practices in port operations’ .

Table 1 Sustainability practices: descriptions and details

Objectives	Description	Details
Reducing financial and environmental risks in ports	<ul style="list-style-type: none"> - Banks are concerned about their own legal liabilities, so they are taking a closer look at borrowing companies’ eco-efficiency records - More investors are becoming interested in investing in environmentally responsible ports 	<ul style="list-style-type: none"> - CO2 emission assessment - Green gas emission assessment - Water quality assessment - Air pollution assessment - FDI (foreign direct investment)
Upgrading port facilities and equipment to cut operation costs	<ul style="list-style-type: none"> - Facilities and equipment improvement - External cost down including pollution, climate change, and other biological damages driving from transport 	<ul style="list-style-type: none"> - AMP(Alternative maritime Power) - Tandem spreader - DPF(Diesel particulate filter trap) - e-RTGC(e-rubber tired gantry crane) - Cold ironing (from inland) - LED street lamp - Solar power cranes
Sustainable building construction in a port/hinterland	<ul style="list-style-type: none"> - Reducing environmental impacts from construction method - Long-term viability of port facility 	<ul style="list-style-type: none"> - Green building standard (LEED) - Use of noise reduction equipment
Enhancing long-term viability of operations	<ul style="list-style-type: none"> - Using renewable and alternative energy sources for less environmental impacts 	<ul style="list-style-type: none"> - Solar, wind, and tidal energy. - Use of CNG(compressed natural gas) - Use of bio-Diesel, hydrogen fuel - LED street lamp - Solar power cranes - Dredging for securing water depth
Safety and security in a port	<ul style="list-style-type: none"> - Reduction of accidents (oil spillage) and noise/light pollution - External cost down including pollution, congestion and accidents 	<ul style="list-style-type: none"> - Reduction of accidents from using electronic transport - Public lighting - Auto Monitoring System (AMS)

Resource efficiency	<ul style="list-style-type: none"> - Cutting waste and using natural resources more efficiently can save costs and boost profits 	<ul style="list-style-type: none"> - Resource recycling in a port - Sustainable purchasing
Eco-friendly and socially responsible image	<ul style="list-style-type: none"> - Improving 'Green' image, and transparency of port operation 	<ul style="list-style-type: none"> - Sustainability report - Incentives to shipping companies and stevedores with eco-friendly equipment
Improving relationships with key stakeholders	<ul style="list-style-type: none"> - Collaboration for minimizing environmental impacts - Environmental groups and businesses are working together more to find solutions 	<ul style="list-style-type: none"> - CSR(Cooperate social responsibility) - EMS(Environmental Management System) - Cooperation between stakeholders
Port infrastructure utilization	<ul style="list-style-type: none"> - Improving port infrastructure utilization to minimize congestion in a port - External cost down (congestion, accidents) 	<ul style="list-style-type: none"> - Optimum use of space - Efficient gate processing system - Extended gate operating hours
Optimizing the routing of vehicles	<ul style="list-style-type: none"> - Energy/ cost efficiency from optimizing the routing of vehicles - External cost down (congestion, accidents and other biological damages driving from transport) 	<ul style="list-style-type: none"> - Reduction in road transport - Idling time reduction of ship/truck - AGV(Automatic Vehicle System)
Vehicle utilization (Modal shift)	<ul style="list-style-type: none"> - Repair and maintains a harbor-side road and introduction of new transportation modes - External cost down including pollution, congestion and accidents 	<ul style="list-style-type: none"> - Shift in modal split - Parking space operations - Clean truck program - Electric trucks
Employee productivity	<ul style="list-style-type: none"> - Employee training/education - The best and brightest young people are more willing to work for environmentally responsible ports 	<ul style="list-style-type: none"> - A combination of learning and working activities - Training/education
Recruitment and retention of employees	<ul style="list-style-type: none"> - Job creation - Improving employee's satisfaction 	<ul style="list-style-type: none"> - Employee's satisfaction
The hinterland social and working environment	<ul style="list-style-type: none"> - Creation of a pleasant life environment 	<ul style="list-style-type: none"> - Air quality and climate - Visual impact reduction - Open space and park development
Expansion of the coastal region facilities	<ul style="list-style-type: none"> - Prevention of ocean pollution caused by land activities 	<ul style="list-style-type: none"> - Expansion and improve the sewage disposal plants, sewage landfills, waste water disposal plants
Providing incentives for green practices	<ul style="list-style-type: none"> - Encouraging eco-friendly practices in port activity area 	<ul style="list-style-type: none"> - Green ship certification System - Incentives on the new cleaning technology - Green flag incentive program

Source: Adapted from annual port sustainability report(ESPO, 2012; LA/Long Beach, 2011; OECD, 2011; Sydney, 2011; Vancouver, 2010; Antwerp, 2010; Rotterdam, 2009; Massachusetts, 2008).

III. METHODOLOGY

1. Research design

This research aims to investigate strategic goals in implementing sustainability practice in port operations and review the attributes of sustainability practice underpinning the relevant issues. In order to achieve research objectives in this topic, this study employed interview survey that offers an exploratory tool. As the first stage of the main survey, semi-structured face-to-face interviews were developed, differing from the informality of unstructured interviews and predetermined questionnaire used in structured interviews (Smith et al., 2012). By comparison, semi-structured and unstructured interviews are the most advantageous approach to obtain data from a large member of questions to be answered, complex and open-ended questions, and a question needed to be varied in order or logic. Although both semi-structured and unstructured interviews offer exploratory tools for this study, unstructured interviews were rejected for this research because questions without a planned sequence and too-open questions can deviate from the research objectives.

In interviews, the respondents were individually interviewed for 90 minutes. During the interviews, the respondents were asked to review the interview questionnaire to check the contents. The agreement on strategic goals was evaluated by yes or no questions. Further, the sustainability practices were investigated.

In analysis, to identify strategic goals agreed by all different stakeholders, the frequency analysis was employed. Further, the relevant practices recorded were clustered using thematic analysis which emphasizes pinpointing, examining, and recording patterns within data (Virginia and Clarke, 2006), following a three-stage process including data reduction, data display and conclusion drawing. In addition, to provide useful insights, barriers and challenges in the adoption and/or implementation of sustainability practice are also investigated. The results of interviews are displayed and discussed in the following sections.

2. Interview composition

Integrating the consideration of sustainability into all activities in and around a port underpins aims to be sustainable and efficient ports. However, the achievement of sustainable port operations and development is a complex problem to be addressed, in that ports have a complex organizational and technical structure and a number of stakeholders engaged in port operations. As argued by Dinwoodie et al.(2012), a large number of stakeholders engaged play a significant role in the governance of the port cluster, having a huge impact on adopting sustainability programs. For example, port activities and development driven by port extension meet with growing resistance, particularly by local community groups who oppose the negative externalities of port activities (Dooms and Macharis, 2003). Therefore, how ports can achieve sustainability is a crucial issue for port operators, as well as for all stakeholders associated. Under these considerations, the interviewees were composed of various interests in sustainability issues to accomplish sustainable port development.

The interviewees were selected on the basis of in-depth knowledge in port activities to accomplish sustainable port development and operations. In order to select appropriate interviewees with significant knowledge, this study employed the technique of the key informant method which gathers information through a selected limited number of respondents (Cousins et al., 2006; Phillips, 1981). Job position, working experience and involvement level were used to select interviewees as selection criteria. In addition, the snowball sampling method adopted to collect data. Twelve interviews comprised four groups of stakeholders with three in each group spanning internal stakeholders(port operators) and external stakeholders including economic/contractual external (e.g. terminal operators), public policy (e.g. government bodies) and community/academic groups. Experts in various high positions engaged in the port industry for over twenty years were selected as advised by Phillips(1981) to avoid deficiencies of knowledge. They included vice presidents or above, board members of a port, managers of departments, operations directors and supervisor.

3. Appropriateness and creditability of qualitative research

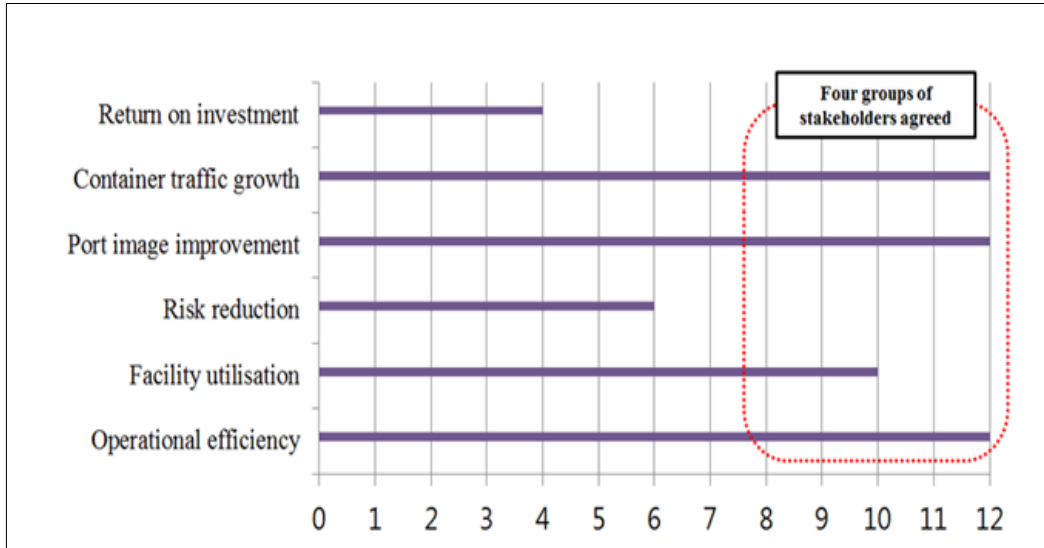
The validity and reliability of interview qualitative research is commonly associated with the creditability of the research process and its appropriateness to the phenomena investigated, as there is no standardised empirical test for qualitative data (Bryman and Bell, 2011). This study attempted to enhance the appropriateness and creditability of the findings of interviews as following. At first, the technique of the key informant method to select interviewees was employed, which enhances the validity of the findings (Smith et al., 2012). Secondly, in terms of the interview data, the transcriptions of interview results were sent back to the interviewees for obtaining their endorsement, as appropriateness and creditability can be reviewed by the respective respondents (Bryman and Bell, 2011). As a result of it, there was no significant feedback from sending back the transcriptions. Additionally, with respect to validity of interview content, during the interviews, the respondents were asked to review the interview prompt sheet to see whether the contents are acceptable or not (Smith et al., 2012).

IV. DATA ANALYSIS

Establishing strategic goals can be interpreted as the decision making factors for strategic initiatives and introduction, which provides detailed guidelines to achieve the potential benefits from implementing certain practices. In face-to-face interviews, as the first step, to identify the background of strategic initiatives of sustainability practices in port operations, the goals were grouped into three principal perspectives. Each was defined by grouping comments which identified the same concept, into the groups discussed in literature review.

In analysis, a single goal mentioned by only one or two groups was insufficient to justify adoption because the goals for sustainability practices must accommodate generic stakeholder expectations, as well as each group evaluates performance from a different perspective. For example, in government body and academic group perspectives, return on investments include various benefits such as job creation, good working environment, and value-added creation which port operators and terminal operators classify as financial profits. Further, risk reduction was also excluded because it embraces all three perspectives and can be categorized under other related issues such as reliability classified into port image improvement. Therefore, in order to enhance content validity of the findings, the goals in this topic were adopted based on agreement within all groups of respondents. The goals identified generated a high degree of overlap between the four groups of stakeholders. Figure 2 describes the number of answers to identify strategic goals. The goals that are agreed by all different stakeholders include: container traffic growth, low environmental impacts and corporate responsible image making as a marketing strategy, operational efficiency through internal process improvement, and efficiency of the use of the port area.

Figure 2 Strategic goals of sustainability practices in port operations



After identifying strategic goals, attributes of sustainability practices in this topic were identified and clustered. However, the list of attributes evaluated by the respondents did embrace diverse sub-attributes. For example, the most emphasized attribute, operational efficiency through internal process improvement spanned other attributes such as cost, energy and resource efficiency. A similar issue was also identified regarding cooperation and communication between stakeholders in which there are so many types/routes of communication and cooperation between different stakeholders. This issue highlighted the importance of effectively embodying each theme without overlap. To clearly identify the attributes of sustainability practices in this research topic, after checking the significance of each attribute, respondents were asked to identify any overlap between attributes and check that they were clustered exactly. The four clustered attributes finally emerged with the related issues(see Figure 4). This result shows that sustainability attributes in prior studies on sustainable development of maritime operations in Europe such as Murillo-Luna and Ramon-Solans-Prat (2008) and Dinwoodie et al.(2012) are utilizable in conceptualizing sustainability practice in port operations in NEA.

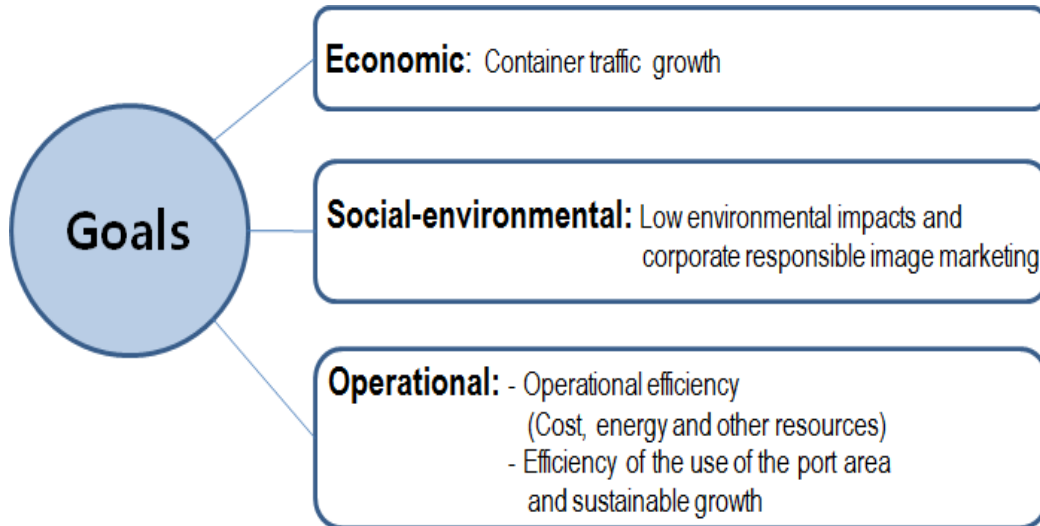
Additionally, during interviews, the challenges and barriers have revealed issues

in carrying out sustainability practices in Busan port. At first, only limited studies have focused on sustainability strategy/practices in this region. Second, various barriers impede adopting and/or implementing sustainability practices. In terms of environmental perspective, the main internal barrier is a perceived lack of evidence that the benefits exceed the costs of implementing these initiatives in highly competitive environment. External barriers include the high initial installation cost of meeting different demands and different systems of environmental regulation. Lastly, highly competitive business environment was claimed as the reasons why the responses have been late and unfocused, compared to the region of Europe and the USA.

V. RESEARCH FINDINGS

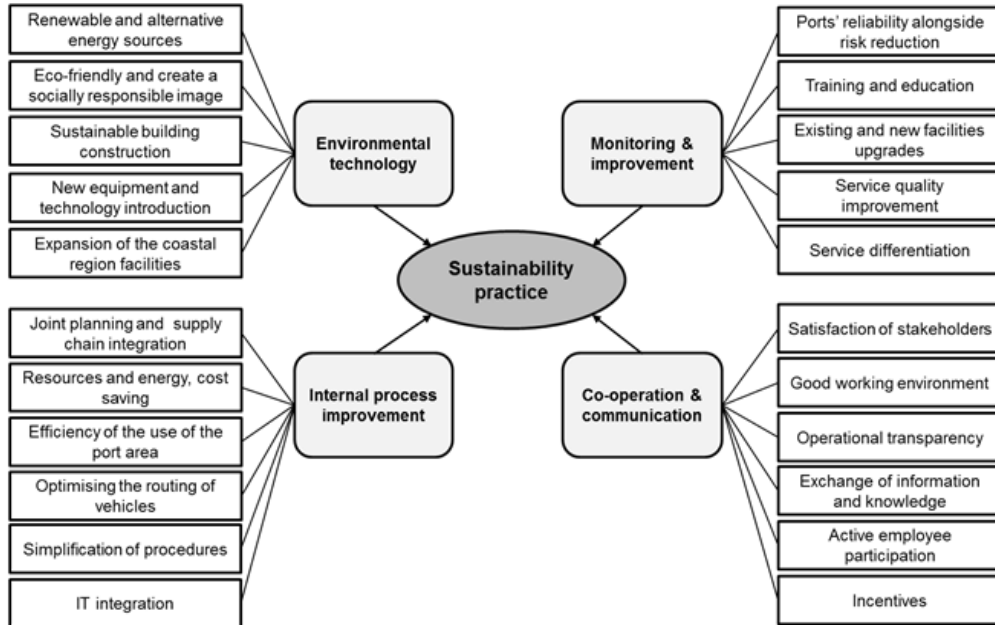
The concept of sustainability in Busan port in NEA can be represented as how they can sustain their competitive position as a regional hub with low negative environmental impacts. This implies a slightly different agenda in implementing sustainability practices from small and medium ports. For example, if ports lose competitiveness in regional port competition to be a regional gateway, they might fall back into being feeder ports. It means that they lose their sustainability as a hub port. Therefore, in implementing sustainability practices in Busan port, the identified goals generally focused on commercial visibility, operational efficiency, and marketing strategy to achieve regional gateway status. The identified strategic goals agreed were container traffic growth, low environmental impacts and corporate responsible image making, operational efficiency improvement, and efficiency of the use of the port area for sustainable growth(see Figure 3).

Figure 3 Goals of sustainability practices in port operations



Considering the goals, four significant attributes of sustainability practices in managing competitiveness have been identified and clustered: environmental technologies, continual monitoring and upgrading, operational efficiency through internal process improvement, cooperation and communication between stakeholders. The identified attributes have a slightly different view from prior studies due to different objectives to analysis and the unique characteristics in regional port competition in NEA. Therefore, the four attributes including sub-attributes can be clarified according to research topic and objectives. Figure 4 presents the structure of sustainability practices in Busan port, based on interview results.

Figure 4 Structure of sustainability practices in port operations



Environmental technologies

Environmental technologies incorporate equipment, methods and procedures, and delivery mechanisms that improve energy, cost, and resource efficiency (Shrivastava, 1995). In the shipping and ports industry, green port practices can be considered as new process innovation, in that innovation means significant changes that embody a new idea that is not consistent with the current concept of port business and aimed at shaping changes in the external environment. Greve and Taylor(2000) stated these innovative processes as “a catalyst for organizational change” . Moreover, Porter and van der Linde(1995) argued that process innovation leads to a more effective value chain for organizations implying resource productivity, abiding by environmental law and regulations. These corresponding improvements make companies more competitive and sustainable, reducing the negative effect on the natural environment. Environmental technologies in port operations embraces the relevant issues: upgrading port facilities and equipment to cut operation costs, sustainable building construction in a port and hinterland, enhancing long-term viability of operation through using renewable and alternative

energy sources, and expansion of the coastal region facilities.

Continual monitoring and improvement

Sustainability practice in a port means a continual process improvement by all parties engaged in port activities. Ports need to effectively respond to stakeholder concerns and to communicate the result achieved because ports must constantly find innovative solutions to respond to pressures from competitors, customers, and regulators (Dinwoodie et al., 2012). Therefore, the role of a port also includes continual monitoring and improvement for existing and new facilities, and measuring and reporting on continuous improvement in port operations. As argued by Dinwoodie et al., (2012), an accessible generic business process framework can mitigate potential risks in port operations, which improves ports' reliability alongside risk reduction, be eco-friendly and create a socially responsible image. From an operational perspective, potential benefits include service quality improvement and service differentiation. In addition, continual training and education of all sorts of internal stakeholders including employees, tenants, and managers helps to gain the potential benefits of providing a specific "port sustainability strategy" through improving environmental awareness, knowledge, skills and motivations towards the eco-friendly management.

Operational efficiency through internal process improvement

Through internal process improvement, ports can achieve greater efficiencies in their operations, which have a win-win relationship in terms of performance incorporating economic and environmental aspects. Various practices, which improves operational efficiency, include automation system, efficient use of the port area, optimizing the routing of vehicles (modal shift), and provision of facilities for companies to maximize their performance. Moreover, from integration processes such as IT or system, processes and procedures can be simplified (e.g. electronic data interchange, IT integration, joint planning, supply chain integration, and integrated ICT and joint ventures). Benefits related to ports' operational efficiency through internal process improvement include efficient use of resources and energy, cost saving from optimizing the routing of vehicles and waste reduction.

Cooperation and communication

The increased stakeholder pressures significantly affect the adoption of sustainability practises (Sarkisa et al., 2010). In order to respond to the increased pressures of all sorts of stakeholders including competitors, customers, and regulators, port authorities and other stakeholders including industries, governments, and commodity groups should effectively coordinate and cooperate with each other (Dinwoodie et al., 2012). Active engagement and communication with each other are not only crucial to carry out a sustainable model of seaports through better understanding of mutual benefits, but also promote continual improvement in cooperative practices in a port (Cheon and Deakin, 2010). Satisfaction of stakeholders, operational transparency, exchange of information and knowledge, active employee participation, and incentives are categorized under this attribute.

VI. CONCLUSION AND RECOMMENDATIONS

Relatively, every finding is supported by literature, not directly discovered and verified in the unique competition structure in Northeast Asia. This is the reason why this study is exploratory. Based on the case of Busan port, this study conceptualized the structure of sustainability practices in port operations. The relevant issues such as the strategic goals, attributes, and the challenges/barriers in carrying out sustainability practices were investigated. At first, sustainability practices were adopted to accommodate the current and future needs of ports and their stakeholders as operative/strategic practice. The goals of implementing sustainability practice in port operations incorporates container traffic growth, low environmental impacts and corporate responsible image making, operational efficiency, efficiency of the use of the port area and sustainable growth. Interview results revealed four attributes, clustering other related practices. The attributes include environmental technologies, continual monitoring and upgrading, internal process improvement, and cooperation and communication. From further discussion, it is reported that a lack of prior study and a highly competitive business environment are the main barriers and challenges in implementing sustainability

practice in port operations.

Providing useful insights for sustainability practice, this paper has practical implications. The goals and attributes mentioned in this paper can be utilized by the ports industry in its future improvement strategy and agenda to incorporate sustainability practices in their operations. Although the attributes are not completely exhaustive, they are meaningful in that they are explored by various groups of practitioners engaged in port operations. Academically, the findings have significant implications which place the case of NEA in a global context, as well as investigating the relevant issues required to understand the specific and general features of sustainability practice in NEA. Therefore, the finding in this paper can be utilized in future studies on port operational management, to contribute to relevant literature by presenting the first study of port sustainability practice in this region.

Notwithstanding the practical and academic implications of this paper, several limitations also exist in this paper. At first, the interviews were undertaken in only one port, which may imply a biased view in different business environments and operational systems. Accordingly, it is necessary to carry out a comparative study between two or more different industries and/or continents, as this would allow a great generalization of the findings. Secondly, the findings were identified by few respondents. Therefore, suggestions for future research to enhance the external validity of this research would include surveys in other ports in this region to verify the findings. Thirdly, to provide broad understanding to assist strategic agenda to incorporate sustainability practices in their operations, this study focused on investigating the goals of sustainability practice, and clustering the relevant practices. Therefore, to provide a detailed direction to sustainable operations and derive useful operational and political implications from the findings of this study, future study on a review of the practices implemented and/or planned to be introduced are required. Additionally, it would be interesting to focus on the performance of green port practices that is already adopted to simultaneously protect the environment and deliver economic benefits, an increasingly important topic, on port operations in this region.

Reference

- Adams, M., Quinonez, P., Pallis, A. A. and Wakeman, T. H., "Environmental Issues in Port Competitiveness", Working Paper 7, 2010, Centre for International Trade and Transportation. Online available at: http://www.dal.ca/faculty/management/schools_and_centres/centre-for-international-trade-and-transportation.
- ANTWERP, "Sustainability annual Report," 2010, <http://annualreport2010.portofantwerp.com>
- ASEAN-GERMAN TECHNICAL COOPERATION, 2012, <http://www.storesonlinepro.com>.
- Bansal, P. and Hunter, T., "Strategic Explanations for the Early Adoption of ISO14001," *Journal of Business Ethics*, Vol.46, 2005, 287-299.
- Branco, M.C. and Rodrigues, L.L., "Communication of Corporate Social Responsibility by Portuguese Banks: A Legitimacy Theory Perspective," *Corporate Communications: An International Journal*, Vol.28, No.2, 2006, 232-248.
- Buyukozkan, G. and Berkol, C., "Designing a sustainable Supply Chain using an integrated analytic Network Process and goal programming Approach in Quality Function Deployment," *Expert Systems with Applications*, Vol.38, No.11, 2011, 13731-13748.
- Bryman, B. and Bell, E., *Business Research Methods* (3rd ed.), Oxford: Oxford University Press, 2011.
- Cheon, S. H. and Dwakin, E., "Supply Chain Coordination for Port Sustainability," *Journal of Transport Research Board*, Vol.2166, No.2, 2010, 10-19.
- Cousins, P.D., Lawson, B. and Squire, B., "Supply Chain Management: Theory and Practice - the Emergence of an Academic Discipline," *International Journal of Operations and Production Management*, Vol.26, No.7, 2006, 697-702.
- Denktas, S. G. and Karatas, C. C., "Port Sustainability and Stakeholder Management in Supply Chains: A Framework on Resource Dependence Theory," *The Asian Journal of Shipping and Logistics*, Vol.28, 2012, 301-320.
- Dinwoodie, J., Tuck, S., Knowles, H., Benhin, J. and Sansom, M., "Sustainable Development of Maritime Operations in Ports," *Business Strategy and the Environment*, Vol.21, No.2, 2012, 111-126.
- Dooms, M. and Macharis, C., "A Framework for sustainable Port planning in Inland Ports: A Multi-stakeholder," The 43rd European Congress of the Regional Science Association(ERSA), Finland, August 27, 2003. Online available at: <http://www-sre.wu-wien.ac.at/ersa/ersaconfs/ersa03/cdrom/papers/201.pdf>

- ESPO, "Green Guide" . 2012, http://www.espo.be/images/stories/Publications/codes_of_practice/espo_green%20guide_october%202012_final.pdf
- Francisco J., Rodriguez, G. and del Mal Armas Cruz, Y., "Relation between Social-Environmental Responsibility and Performance in Hotel Firms," *International Journal of Hospitality Management*, Vol.26, No.4, 2007, 824-839.
- Greve, H. R. and Taylor, A., "Innovations as Catalysts for Organizational Change: Shifts in Organization Cognition and Search," *Administrative Science Quarterly*, Vol.45, No.1, 2000, 54-80.
- LOS ANGELES/LONG BEACH, "Sustainability Report," 2011, http://www.portoflosangeles.org/DOC/REPORT_Port_Sustainability_Report_2011.pdf
- Low, J. M. W., Lam, S. W and Tang, L. C., "Assessment of Hub Status among Asian Ports from a Network Perspective," *Transportation Research Part A*, Vol.43, No.6, 2009, 593-606.
- Lun, Y. H. V., "Green Management Practices and Firm Performance: A Case of Container Terminal Operations," *Resource, Conservation and Recycling*, Vol.,55, No.6, 2011, 559-566.
- MASSACHUSETTS, "Port Sustainability Progress Report," 2008, <http://www.massport.com>
- Menguc, B. and Ozanne, L. K., "Challenges of the "Green Imperative: A natural Resource-based Approach to environmental Orientation Business Performance Leadership," *Journal of Business Research*, Vol.58, No.12, 2005, 430-438.
- METRO VANCOUVER, "Sustainability Annual Report" , 2010, [http:// portmetrovanancouver.com](http://portmetrovanancouver.com).
- Millward, L. J., "Focus Groups: In Research Methods in Psychology" , edited by G.M. Breakwell, S. Hammond and C. Fife-Schaw. Ch.18 (London: SAGE), 1995, 274-292.
- Murillo-Luna, J. L. and Ramon-Solans-Prat, J. C., "Which Competitive Advantages can Firms Really Obtain from ISO14001 Certification?" , *Journal of Industrial Engineering and Management*, Vol.1, No.2, 2008, 104-118.
- Notteboom, T. and Rodrigue, J. P., "The Future of Containerization: Perspectives from maritime and inland Freight Distribution," *Geo Journal*, Vol.74, No.1, 2008, 7-22.
- OECD, "Sustainable Development" , 2011, <http://www.oecd.org/greengrowth/47445613.pdf>
- Phillips, L. W., "Assessing Measurement Error in Key Informant Reports: A methodological Note on organizational Analysis in Marketing," *Journal of*

- Marketing Research*, Vol.18, 1981, 395-415.
- Porter, M. E. and van der Linde, C., "Green and Competitive: Ending the Stalemate," *Harvard Business Review*, Vol.73, No.5, 1995, 120-134.
- Rodriguez, M. A., Ricart, J. E. and Sanchez, P., "Sustainable Development and the Sustainability of Competitive Advantage: A Dynamic and Sustainable View of the Firm Sustainable Development and Competitive Advantage," Blackwell Publishers Ltd, Oxford, Vol.11, No.3, 2002, 135-146.
- ROTTERDAM, "Annual Report" , 2009,
<http://www.portofrotterdam.com/en/Port-authority/finance/Documents/Annual%20report%202009.pdf>
- Sarkisa, J., Gonzalez-Torreb, P. and Adenso-Diaz, B., "Stakeholder Pressure and the adoption of environmental Practices: The mediating Effect of Training," *Journal of Operations Management*, Vol.28, No.2, 2010, 163-176.
- Seuring, S. and Muller, M., "From a Literature Review to a Conceptual Framework for Sustainable Supply Chain Management," *Journal of Cleaner Production*, Vol.16, No.15, 2008, 1699-1710.
- Shrivastava, P., "Environmental Technologies and Competitive Advantage," *Strategic Management Journal*, Vol.16, No.1, 1995, 183-200.
- Smith, M. E., Thorpe, R. and Jackson, P. R., *Management Research*, London, U.K.: SAGE Publications Ltd. 2012.
- SYDNEY PORTS CORPORATION, "Sustainability Report" , 2011, http://www.sydneyports.com.au/data/assets/pdf_file/0004/17752/Sustainability_Report_2010-11_Final.pdf
- Tan, Y., Shen, L. and Yao, H., "Sustainable Construction Practice and Contractor' s Competitiveness: A preliminary Study," *Habitat International*, Vol.35, 2011, 225-230.
- Virginia, B. and Clarke, V., "Using thematic Analysis in Psychology," *Qualitative Research in Psychology*, Vol.3, No.2, 2006, 77-101.
- Wang, J. J. and Cheng, M. C., "From a hub Port City to a global Supply Chain Management Centre: A Case Study of Hong Kong," *Journal of Transport Geography*, Vol.18, No.1, 2010, 104-115.
- Yeo, G. T., Roe, M. and Dinwoodie, J., "Measuring the Competitiveness of Container Ports: Logistician' s Perspectives," *European Journal of Marketing*, Vol.45, No.3, 2011, 455-470.

국문요약

국제항만 운영의 지속가능성을 확보하기 위한 지속가능활동

김시현 · 장봉규

지속가능성은 경제적, 사회적 그리고 환경적 이슈를 아우르는 광의의 개념으로 해석된다. 이 논문은 2013년 초 부산항에서 수행한 인터뷰를 기반으로 항만운영의 지속가능 활동을 개념화함으로써 국제항만 운영의 지속가능성 확보를 위한 전략적 의사결정을 돕고 또한 향후 관련 연구에 초석을 마련하고자 한다. 빈도 및 패턴 분석을 이용하여, 지속가능 활동은 환경친화적 기술, 지속적인 관리와 향상, 내적 성장, 대화와 협력 등을 포함하는 것으로 밝혀졌다. 분석결과, 항만 및 항만관계자의 현재와 미래 요구사항을 수용할 수 있는 전략적/운영적 활동으로서의 지속가능 활동의 역할이 확인되었다. 지속가능 활동을 실천하는데 있어서 나타나는 장벽과 도전과제를 보여줌으로써, 연구결과는 항만이 지속가능 활동을 도입하고 실천하도록 하는 전략적 과제에 대한 유용한 정보를 제공한다.

핵심 주제어 : 지속가능성 실천, 항만운영, 환경기술, 모니터링과 업그레이드, 내부 프로세스 개선, 협력과 소통.