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Stakeholder inclusive design for Sustainable Port Development

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Abstract

It is being increasingly recognized that sustainable port development requires an integrated planning approach which includes working with nature, a stakeholder inclusive design and co-creation of values, as well as an adaptive design that can cope with future uncertainties without losing its functionality. The multi-disciplinary character of port design whereby engineering, ecological, economic and governance aspects are integrated, makes the implementation of this approach very challenging. Not surprisingly, concrete examples of port projects incorporating and demonstrating these principles are rare. This paper proposes that pilot case studies would go a long way towards the acceptance and implementation of the approach. It discusses the desirable characteristics of pilot studies (with opportunities for creating economic value), which could establish the effectiveness of this approach for sustainable port design. The ongoing UDW project "Integrated and Sustainable Port Development in Ghana" funded by NWO-WOTRO exemplifies such an inclusive pilot study and represents a significant step in bringing about a paradigm shift from a traditional approach of port development, to a stakeholder inclusive, integrated approach for sustainable port development.

Keywords: Integrated port development, sustainable port, stakeholder-inclusive, pilot project

1 Introduction

Need for sustainable development of ports

Seaports provide an essential link to the world market, enabling countries to trade their goods and strengthen their economy. The impacts of a port development project are economic, environmental, social, and are not limited to the port, but propagate over a chain of logistic processes that are not bound by geographic borders. A port project can involve reclaiming land, thereby disturbing the ecosystem, and sometime even cause displacement of the urban population. The vessel traffic and construction activities translate into air quality, water quality and noise issues, environmental management issues, and often accessibility issues for the adjacent areas. Ports are being pressured to respond to problems related to negative impact resulting from activities in the entire logistics chain, both in the maritime leg and in the hinterland. Sustainability has become a fundamental requirement.

Sustainable development recognizes that growth must be both inclusive and environmentally sound to reduce poverty and build shared prosperity for today's population and to continue to meet the needs of future generations. The question facing development organizations today is not *whether* to embrace sustainable development but *how* [i]. Sustainable development of ports requires designing, building, and operating ports in ways that preserve or improve the social, economic, and ecological processes required to maintain human equity, diversity, and the functionality of natural systems, and deliver both immediate and long-

term benefits for people, planet, and prosperity.

Research gap and the proposed solution

As the world around is changing rapidly, traditional problem solving approaches relying on knowledge and skills from individual disciplines are incapable of addressing multi-faceted problems and difficulties. There is a need for more holistic, pluralistic and participatory approaches in order to survive in a highly interconnected, complex, turbulent environment (Baudhanya 2016). More than ever, large infrastructure projects denote thinking in terms of uncertainty, flexibility and adaptability (Taneja 2013). A paradigm shift is required in our approach to large scale infrastructure development including ports, whereby the emphasis is on achieving our objectives in an ecosystem and societal context, in an uncertain environment confronted by challenges of climate change, resource depletion and energy transition.

There seems to be a general agreement over this fact, as well as a common vision over the need for a shift from a traditional to integrated and sustainable approach to port development. Increasing awareness and changing mind-set, focus on a lifecycle perspective, new and emerging technologies as well as innovations in many associated fields support this trend. Nevertheless, examples of port development projects incorporating and implementing this approach are rare.

In this paper, we begin by presenting the key features of an integrated stakeholder inclusive approach to sustainable port development and its benefits not only for the planet, but also for ports and port-related organizations. We examine the reasons for lack of sustainability initiatives in general as well as the challenges for the adoption of such an approach.

We propose that pilot studies followed by a widespread dissemination of created knowledge can stimulate the acceptance, implementation and the eventual institutionalization of such an approach.

The ongoing UDW project “Integrated and Sustainable Port Development in Ghana” funded by NWO-WOTRO exemplifies such a pilot project (NWO-WOTRO 2015). This research project is expected to provide a great stimulus to the envisaged ground-breaking change from a traditional approach to a stakeholder inclusive and integrated approach to sustainable port development.

2 Stakeholder inclusive approach to sustainable port development

Increasing attention for people and planet

In the past, profitability and economic impact have been the focus in a port system, however nowadays, port authorities provide services beyond their classical role, whereby profitability is one of the lesser strategic goals (van der Lugt, de Langen and Hagdorn 2013). In additional to a reasonable return on investment, serving public concerns plays a role in corporate decision-making. Therefore, international and national legislations related to ports are incorporating these issues with strict regulations aimed at creating infrastructures with minimized environmental impact and sustainable operations in the long term. The regulations are enforced through a system of permits in which certain construction and operation methods are pre-defined and often include large-scale mitigation and compensation measures (PIANC 2014).

In 2010, five of the world’s largest port operators participated together with the Port of Rotterdam Authority in the first ever joint industry initiative to promote environmental awareness and make a sustainable difference in the communities in which they operate. The Go Green project[ii] (2010-2102) launched by HPH in conjunction with DP World, APM Terminals, PSA International and Shanghai International Port Group (SIPG), was the first project of such magnitude.

In recognition of the fact that ports must secure the ‘license to operate’ and the ‘license to grow’ by operating and undertaking investments in a sustainable manner, International port-related organizations such as AAPA, IAPH, ESPO, OECD, PIANC, EPA, UNEP, UNCSD, USACE, WWF [iii] etc. are developing and regularly updating guidelines and codes of practice for Green Port development (AAPA 2007, UNEP 2011, ESPO 2012). The increasing awareness of the Green Growth concept has also motivated port planners and policy makers to aim for a more sustainable port (PIANC 2014). Banks and credit agencies that finance port development projects are also setting up performance standards on environmental and social sustainability (ECA 2006, IFC 2012, FMO 2016, World Bank 2012).

Sustainability as a source of competitive advantage

Sustainability is increasingly being seen as an integral part of value creation and a source of competitive advantage for an organization. Sustainability can contribute to strategic goals of ports through increased revenue and market share; reduced cost of operations; reduced environmental and financial risk; more efficient use of financial, human and natural resources; enhanced brand image; enhanced access to capital; increasing employee productivity; easier hiring and retention of best talent; improved relationship with key stakeholders; more efficient approval of regulatory permits, and an enhanced ability to maintain 'license to operate' (Berns et al. 2009, Goldman 2007).

The Convention on Biological Diversity [iv] also acknowledges that though substantial investments are required to conserve biological diversity, there is the expectation of a broad range of environmental, economic and social benefits from those investments.

As a result, numerous ideologies for sustainable development as well as new conceptual planning frameworks as an alternative for traditional method of port planning are being suggested. Most of them share a common vision over a stakeholder-inclusive and integrated approach to sustainable or Green Port development.

Key features of an alternative approach

PIANC working group WG150 (PIANC 2014) arrived at the following insightful conclusions in their study over sustainable seaports:

- Ports are in a unique and privileged position in the global logistic chain to capture and evolve their roles to initiate and consolidate the needed change, for their own benefit and the prosperity of the region that it serves.
- A sustainable port develops in harmony with its environment to match limited and decreasing environmental space and resources.
- Sustainable ports follow a new growth paradigm that is truly sustainable with Green Growth as an economic driver.
- Sustainable port development is based on a long term proactive vision irrespective of actual regulations.

Literature related to sustainable ports (EPA 2007, PIANC 2008, Vellinga 2014) advocates the following sustainability guiding principles for an alternative approach to sustainable port development:

- A more sustainable port can be realized through embracing the four perspectives of engineering, economy, ecosystem services and governance in an integrated approach to port development.
- Intrinsic to this approach is working with nature (PIANC 2008) with a focus on achieving project objectives in an ecosystem context that not only minimize the potential long-term negative impacts of port development, but seek win-win cost-effective design solutions.
- Such an approach incorporates business models which include the valuation of sustainability strategies by taking into account all external factors and system effects. Analysis is at a higher spatial level than the port area and an integrated value assessment includes ecological, social and economic aspects.
- Early and transparent engagement of a broad range of stakeholders is required from the start to give meaning to the term 'sustainable port' in their specific context, to identify opportunities for added value and to facilitate implementation. (Traditional port development, in contrast, is associated with long lead times due to conflicting interests and lack of mutual understanding of involved stakeholders).
- Co-creation with stakeholders to identify their values, seeking opportunities to create or enhance biodiversity, and encouraging open dialogue, collaboration, and commitment of the stakeholders throughout the project, highlight the approach.

Other salient features include:

- Integration of multi-disciplinary knowledge to arrive at innovative solutions,
- Developing flexible and adaptive master plans and designs that are robust and functional in many plausible futures (Taneja 2013).
- Incorporating sustainability and uncertainty considerations in all port activities across the supply chains. This requires communicating the goals of sustainability across the entire supply chain; allocating resources for implementation and building upon and sharing existing sustainability best practices, keys to success, lessons learned and approaches for implementation.

Therefore a number of parties need to be involved and include (PIANC 2014):

- Key players such as port authorities and port and terminal operators, who can acts as a front-runner to bring about a paradigm shift;
- Government organisations to recognise, facilitate and follow-up with legislation,
- Consultants and contractors who must incorporate sustainable design principles in all aspects of a port development project,
- Financiers of Green Port development projects,
- NGO's to stimulate the Green Port concept, and
- Academic institutions to answer the challenges through research and development of new knowledge

3 Shift to Green Port development

Barriers to adoption of the new approach

Despite the recognition of its potential contribution to a sustainable economy as well as the benefits for port organizations, practical application of a stakeholder inclusive and integrated approach to port are lacking. Some of the barriers to the implementation of an integrated approach are mentioned here.

In a traditional approach to port development, the mitigation and compensation measures are taken ex-ante. These have generally not been tested to their full potential, and frequently, their effectiveness has not been monitored in the field. This lack of evidence of effectiveness of sustainability related initiatives, combined with lack of sufficient data or information to implement these initiatives is a hurdle to their implementation.

The measures to create economic value come with a cost but also create socio-economic welfare. Therefore, the socio-economic feasibility of the planned port development project needs to take into account the value of ecosystem services, as well as the socio-economic effects on the surrounding region. This is not common practice in a traditional approach to port development. A project may therefore not have a viable business case. Even when the project is economically viable, it may still be difficult to attract investors. This may be due to unfounded perception of risks or regulatory risks (Schipper et al. 2015).

Some of the other hurdles to the implementation of the alternative approach are:

- the multi-disciplinary and complex character of port design,
- the difficulties related to transparent and inclusive design of environmental and social measures in a multi-actor setting;
- the difficulties associated with enabling and enforcing actual implementation of these measures, and
- issues with ensuring transparent and planned monitoring of environmental and social measures (ECA 2006).

Due to the above reasons, the frameworks and tools proposed in recent times have not be validated and refined based on learning from practical experience. Organizations also need the evidence that sustainability is a source of value creation before embedding it holistically into their strategy and all relevant aspects of their operations, while supporting it through strong, top down commitment from the executive leadership team (Berns et al. 2009).

Need for front runners or pilot projects

To enable and stimulate common implementation of new improved approaches, there is a need for frontrunners (Vellinga et al. 2014). The refinement and testing of the new approaches and even their gradual implementation can take place in pilot projects, which then serve as starting points for large-scale societal changes or policy innovations (Vreugdenhil 2010). Pilot projects are popular policy instruments, because they enable decision-makers and innovators to try out new things under conditions of reduced or eliminated risk (Cabinet Office 2003).

Pilot projects are commonly applied in diverse policy domains. Research pilot projects focus on knowledge development to fill knowledge gap. while management pilot projects are used for communication, problem mitigation, policy implementation and as insurance. Pilot projects have the advantage of a special status reflected in a learning attitude and tolerance of the participants, greater flexibility in not to have to follow standard procedures and the possibility of enhanced resource allocation in the form of people, access to information and through provision of study sites. Moreover, pilot projects are often in the spotlight and enable the development of knowledge on policy impacts and encourage participation (Vreugdenhil 2010).

A pilot project can introduce innovation(s) in a

confined or protected setting in which a large variety of actors participate. The participants gain experience in applying the innovation and cooperating with other actors, learn about interdependencies between various (engineering, social, ecological and governance) aspects. Actor-learning has high priority in these pilot projects, gaining practical experience, overcoming their fear of change can ultimately contribute towards policy processes intended to achieve societal change. However, pilot projects can only fulfil this promise if the knowledge does not get lost with the termination of the project (Vreugdenhil 2010), which is why inclusive pilot projects need to include knowledge dissemination and a research uptake strategy.

Though pilot projects in relation to Green Port development are becoming more common, most are geared towards testing and stimulation of technological innovations, by developing substantive knowledge and getting insights into current and possible future developments related to the new technology. Some recent endeavors:

a. Five pilot projects have been chosen for development as part of Norway's Green Coastal Shipping Program which aims to encourage the research and implementation of green technology concepts in the country's shipping sector [v].
b. The National Weather Service of Florida has launched a project to provide enhanced decision and ecosystem support services to help to mitigate future risk and impact from hurricane storm surge, environmental and ecological effects in the Tampa Bay area. Port of Tampa is one of the largest cargo ports in the country while Tampa Bay offers a rich and diverse ecosystem [vi]
c. Port-related companies in Rotterdam are co-operating in a pilot for 3D printing with metal printers in order to development new knowledge and get insights into current and possible future developments related to new technology [vii].

Process innovations are addressed rarely as in the pilot study initiated by United states Environmental Protection Agency (EPA 2016) to supports the goals to improve environmental health outcomes for communities affected by ports and associated goods movement facilities and. The study aims to improve environmental performance at ports by equipping industry and community stakeholders with information, skills and guidance to effectively develop and implement collaborative actions that reduce environmental pollution.

This section concludes that developing a framework for port development through a stakeholder inclusive design process based on knowledge and practical experience, making visible the value of sustainability, and advancing the implementation processes on the best practices for the development of sustainable ports requires pilot studies. The characteristics and requirements of the such a pilot project are discussed in the next section.

4 Characteristics of the envisaged pilot project

The characteristics of the envisaged pilot project are as follows:

The identified project/problem scope is very broad and requires a systemic view. Therefore, the pilot study must aim to cross boundaries of knowledge. The scale too, is beyond the normal scale of pilot projects and the field setting should be representative of a sufficiently large area to be useful for deriving conclusions generic to the region.

The pilot project should have broad objectives and focus on knowledge development to fill knowledge gaps as well as on co-creation with stakeholders. These includes internal stakeholders (consortium partners) and external stakeholders (non-project partners), as well as those who are intended to benefit or may be affected by the port development, end users, and finally the target groups who will play a role in bringing about change in practice. Co-creation requires interaction and joint learning throughout the process of port development. The diversity of perspectives and of the type and level of knowledge is seen as an asset that can support a constructive way of mutual learning and design.

The pilot project must take on an *action based* research approach and an *applied research* perspective.

In addition to developing (hard) substantive knowledge, (soft) process learning through the interaction of different actors in a participatory setting needs to be a focus of the pilot study. Substantive knowledge relates to four disciplines of engineering, ecology, economy and

governance while the process related knowledge. relates to integration across disciplines, stakeholder engagement in various phases of the project, knowledge dissemination and research uptake.

Projects are embedded within a particular biophysical, societal and institutional context (Vreugdenhil 2010). Thus the knowledge created and the learning from the pilot will be context dependent in addition to being related to the local situation and policy. This generalized knowledge will need to be made generic (to the region or the area) with input from additional case studies.

Though the knowledge development in the project is demand-driven, in addition to direct contact between users and researchers, collaboration from a vast range of stakeholders is required to address the problem effectively. Contact is required with local stakeholders for informing them, obtaining their input to capture their relevant wishes and concerns and finally co-creating with them.

Since identifying, demonstrating and estimating the various values that ecosystems and the associated ecosystem services provide to human welfare and wellbeing, the selected pilot studies should be set in an ecologically rich delta region with diverse ecosystems, with substantial potential for adding economic value.

A port development project in a preliminary or tender phase, with sufficient and easily accessible data over the reference situation, baseline studies such as EIA (Environmental Impact Assessment) and ESIA (Environmental Social Impact Assessment (ESIA), and preliminary port designs in place, would provide an ideal setting for pilot study.

The level of innovation of a pilot can range from ‘radical’ to ‘incremental’. the pilot project is expected to make incremental contribution to application of knowledge in the four sub-disciplines of as well as in the integration of interdisciplinary knowledge.

The pilot project must include the facilitation of diffusion of new knowledge and practices developed. Replication of the pilot project at other locations, in different social-ecological contexts, but at similar scale is anticipated to be followed by institutionalization of the pilot project approach at higher organizational, sectoral or cross-sectoral levels (NWO-WOTRO 2015).

Funding is required for implementation of a pilot project at practical level. If the pilot project receives the support from a governmental agency, has potential to develop links with the ongoing green growth initiatives (of agencies such as World Bank, UN and OECD), is designed conform the above criteria, and the multi-disciplinary project team includes academia, applied research institutes, knowledge institutes, practitioners and potential users that co-create with a broad range of local stakeholders, the likelihood of achieving the objectives is high.

5 Pilot project funded by NWO

Call May 2015

NWO-WOTRO [viii] funds and monitors innovative research on global issues such as sustainable development. The research projects are realized by interdisciplinary teams of researchers in close collaboration with non-academic stakeholders. These partnerships yield solutions for development challenges and strengthen the bridge between research, policy and practice. The impact of the research projects on levels of understanding, knowledge and attitude, as well as the instrumental use of research information that results in changes in practice and policy making. The themed program Urbanizing Deltas of the World [ix] (UDW) aims to increase knowledge about river Deltas worldwide and to contribute to water safety, food security, and to sustainable economic development in these areas

NWO, in cooperation with The Ministry of Foreign Affairs of the Netherlands published a Call in 2015 inviting business driven research projects that support innovation and are developed in public-private partnerships. Projects were required to combine knowledge co-production in an iterative process with stakeholders being engaged from the beginning, and with the participating research and business partners directly interacting with each other. Projects could include the generation of fundamental knowledge (to solve knowledge gaps encountered in the practice of doing business), as well as the development of tools, techniques, products or services. Sustainable and inclusive development was mentioned as one of the key objective.

Clearly, the pilot study proposed in this paper

fits ideally in the framework of the call.

The Project Consortium

The setting offered by NWO seemed conducive to bring about the envisioned change towards the practical implementation of the approach described in this paper. Subsequently, a Dutch-African consortium comprising the Delft University of Technology, VU – IVM (Institute for Environmental Studies), WUR/ IMARES (Wageningen Reserarch Institute), UNESCO-IHE, University of Ghana, Deltares, National African Business Council (NABC) and Ghana Ports and Harbour Authority (GPHA) and supported by partner organizations including Ghana Shippers' Authority, WWF, FMO, MER commissie, Witteveen and Bos, Portside International, CWT Commodities, Damen Shipyards, Deep BV, Koninklijke Boskalis Westminster BV, Royal IHC, STC BV, STC Group, STC Nestra, Van Oord DMC BV, Deltares, Port of Amsterdam International, was formed.

The consortium submitted a research proposal titled “Integrated and Sustainable Port Development in Ghana within an African Context” (NWO-WOTRO 2015). A grant was provided for the organisation of a workshop to involve all consortium members and (other) stakeholders in the development of the final application. Finally, the project was awarded in November 2015.

Objective of the project

The choice of Africa as a location for the pilot project is motivated by the fact that Africa is on the rise and new port developments are essential to unlock production and trade opportunities and enable future growth. Further, many of the consortium members are currently involved in port developments in west-Africa, which gives access to local information and data.

The aim of the research project is to develop a generic participatory framework and a set of tools for sustainable port development in Africa in which the environmental, economic and public benefits are balanced and in which economic value is created through a stakeholder inclusive design process. This project envisions an ‘Africa-specific’ design-framework and proposes an integrated approach to port design that is stakeholder inclusive and encompasses: engineering (design and construction), ecological, socio-economic, and governance aspects. A bottom-up approach involving a wide range of stakeholders is employed, whereby research in these disciplines is directed at a pilot project in Africa.

The selected pilot project case, i.e., the expansion of port of Tema in Ghana, is the basis on which the project studies opportunities for sustainable port development in the Pan-African context and demonstrates the added value of a sustainable design process that aims at optimizing the economic value of the entire project and surroundings. The project will result in a port design that complies with the requirements (functional, sustainable etc.). In addition, a database of knowledge for the future will be created. This database will provide a guideline for port development companies while formulating criteria for design and layout development, material selection, construction methods, operations and maintenance.

The overall goal of this project is to advance fundamental knowledge and implementation processes on the best practices for the development of sustainable ports in an African context. This objective is obtained by creating an international 'Green ports Africa network', a community facilitating researchers and private sector practitioners in knowledge sharing and dissemination. The proposed port development practices are intended to be subsequently replicated in Ghana and beyond. Adoption of the ‘Best practice guidelines for implementing integrated and sustainable port development in Africa’ is intended to take place through the involvement of national and pan-African decision makers in the project. This enhances the best practices of the envisioned stakeholder inclusive approach to be institutionalized through widespread dissemination of results and a shift from traditional port design to contemporary Green Port design.

6 Conclusion

NWO-WOTRO funded research project “Integrated and Sustainable Port Development in Ghana within an African Context” aims to stimulate the development of sustainable ports that maximize their environmental, economic and public benefits through integration of engineering, ecological, economic and government aspects in the design process through conducting a pilot study. The envisaged impact of the project is the institutionalization of the stakeholder inclusive approach at higher

organizational, sectoral and cross sectoral levels.

This represents a significant step forward in enhancing knowledge synergy not only for sustainable port development but also for sustainable large scale infrastructure development in general.

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[iii] AAPA: American Association of Port Authorities

EPA: US Environmental protection Agency
ESPO: European Sea Port Organization
IAPH: International Association of Ports and Harbours,
UNEP: United Nations Environment Programme
UNCSD: United Nations Conference on Sustainable Development
PIANC: Member World Association for Waterborne Transport Infrastructure
USCAE: US Army Corps of Engineers (Corps)

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