

TRAINING AND SIMULATION TOOLS IN SUSTAINABLE PORT DEVELOPMENT

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Ongoing trends such as global trade growth and the need to modernise port facilities are driving urgent investments in ports; not keeping pace with these changes will mean a loss of trade and competitive market position. Nowadays, the main motivation for research in such port developments is often to find opportunities which facilitate co-creation of sustainable or ‘green’ initiatives. However, some activities related to port development negatively impact our port-cities and delta ecosystems. Port projects are confronted by a growing scarcity of prime locations, increasing environmental constraints, limited space for expansion, along with the uncertain impacts of climate change and fundamental changes in ICT systems. In port development, we recognise that conflict quite frequently occurs between various stakeholders; between port users and the port authority. In order to ensure the feasibility and

success of port development plans, it is essential to create awareness of how multiple and cumulative uses can affect and enhance port-city infrastructure systems and ecosystems.

WORLDWIDE SUSTAINABLE PORT DEVELOPMENT TRENDS

International maritime organisations, NGOs, and international banks increasingly work on multinational sustainability initiatives, some of which focus on sustainable port development (Figure 1). Recent initiatives from PIANC (World Association for Waterborne Transport Infrastructure) and IAPH (International Association of Ports and Harbours) suggest moving away from the traditional approaches and adopting new innovations to create added value for ‘Green Port’ development. Those organisations use different definitions for sustainable port initiatives. PIANC has emphasised the

need to develop a Working with Nature philosophy while designing and operating waterborne infrastructure including stakeholder participation. A starting point is a long-term vision of the area in which the new port (extension) is planned and forms a privileged and crucial position within the logistics chain. It anticipates the needs of future generations, highlighting the benefits and prosperity of the region that the port serves, based on green port policy interventions (e.g. legislations, port action plan, high quality product standards) related to healthy urbanisation (e.g. air emission reduction, carbon reduction, renewable energy, sustainable port-city area).

General awareness of Green Growth is rising, but the existing knowledge gap requires further incorporation of this concept within infrastructure development schemes. Applied knowledge is needed to adapt to the effects of climate change

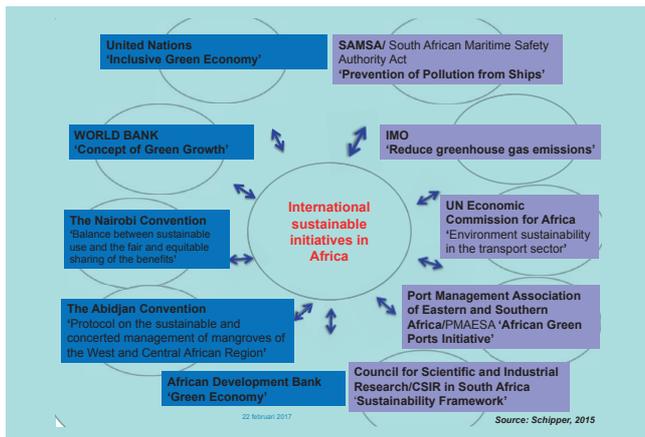


Fig 1 International conventions and investors such as the African Development Bank (Blue) started with sustainability initiatives, which have inspired African maritime organisations (Purple) to implement the green growth concept; Fig 2. Artist impression of a ‘no-impact’ offshore port development as a way of achieving sustainable economic growth. During design and construction of the no-impact port, the choice for the port locations, governmental issues and ecosystem processes are taken into account as well as communication in co-creation with all stakeholders. (Deltares, 2015)

and to maintain the quality of coastal environments while allowing port-city activities to not only continue, but also grow. As port investments are increasingly financed by the private sector, most countries rush to expand, upgrade, or develop ports to cope with the increasing demand of goods and in order to receive mega vessels. The global transport market is expected to increasingly rely on integrated port operations where expansion will be needed along with new innovative elements becoming incorporated into the design. The resulting sustainable development of port services will allow for an increase in the capacity and quality thereof.

DEVELOPING A NO-IMPACT PORT OF THE FUTURE

A growing consensus recognises the need to shift economies and social structures towards more sustainable models. The fairly new concept of ‘Green Growth’ enables policy makers and companies to identify successful strategies they can adopt, and pitfalls they can avoid, in drafting and implementing green growth policies. The aim of the Deltares project ‘Port of the Future’, commissioned by the World Wide Fund for Nature (WWF), was to develop innovative solutions for sustainable port development which are in harmony with the ecosystem and are robust or adaptable under changes in natural conditions (including the effects of climate change) (Fig 2).

The Port of the Future concept formulated as part of this assignment can be used to achieve a long term sustainable port. Furthermore, the no-impact port development programme can serve as an integral and interactive

initiative where adaptation on this topic is developed to balance economic growth and human welfare while maintaining healthy ecosystems. Through an integrated and ecosystem-based approach, port development can be realised in an all-inclusive way, providing an economic, environmental, and socially viable port. The challenge is to determine whether a no-impact port is achievable in combination with economic growth, and under which boundary conditions. In fact, a paradigm shift is required in the approach commonly taken to port development programmes when looking to adapt to climate change, sea-level rise, and urbanisation, whereby the emphasis will lay on the functioning of a healthy ecosystem and subsequent reconciliation of divergent sustainable values in the future. Such an approach will only be successful when it will be adopted for the complete, worldwide transport chain. Ports that do not explicitly aim for advanced sustainability and at reducing their impact on the environment could act as a hindrance to environmental quality, benefits to human health support, and sustainable global trade. They will continue to do so unless port capacity and efficiency can be shown to have increased benefits from sustainable port development rather than traditional approaches. A serious game can contribute in changing these outdated viewpoints.

PORT OF THE FUTURE TRAINING

To support the elaboration of a tailor made ‘Port of the Future’ master plan for a port and to secure involvement of stakeholders, a high-end tool was developed by Deltares, named the Port of the Future Serious

Game (PoFSG) (Fig 3). The aim of this game is to create support in sustainable port development with different groups of stakeholders. This includes socio-economic developments, natural requirements, and impacts of (sustainable) designs. As part of the development of the game, several skilled professionals from diverse scientific backgrounds, both internal and external to Deltares, approved the integrated knowledge rules which predict the effects of various measures within the game. The participants, those playing the game, are encouraged to work together and to collaborate on the development of a sustainable port of the future. In addition, the game raises awareness of the impact that various interventions have and the many available options for sustainable ports. In the PoFSG, all participants focus on port-specific policy making in a realistic but fictional environment. The objective is to balance the impact of port development by making combinations of environmental, social, and economic choices. Debate is initiated between participants with interdisciplinary knowledge through constructed societal and climate change scenarios with which the participants must contend. By requiring consensus and collaboration between the participants, they come to realise that successful new policy making in ports requires integrated stakeholder participation.

SIMULATION IN LATIN CONTEXT

The game has so far been applied to many locations throughout the world. For example, the training and simulation application is used in Latin America due to the rapid growth in the size of container vessels there. The Panama Canal expansion has driven port developments in Peru,



Fig 3. High-end tool ‘Serious Game’ is used for the design of a sustainable port, named the ‘Port of the Future’ Serious Game or the Spanish version ‘Puerto del Futuro’, developed by Deltares.

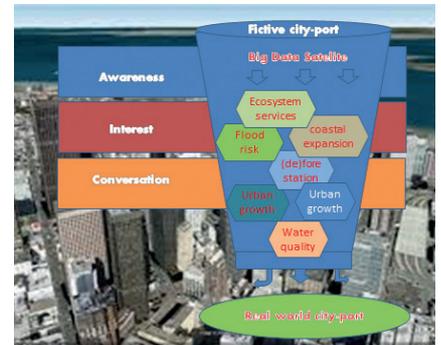


Fig 4 (left): Fig 4. A workshop on sustainable port and urban development use elements of the ‘Port of the Future’ Serious Game in Cartagena, Colombia; Fig 5 (right): Fig 5. High-end Serious Game tools will be used in future in port operations to improve efficiency e.g. as running forecasts, importing satellite data, or updating the operation or monitoring big data;

Panama, Costa Rica, Chili, Colombia and Mexico. Their stakeholders were trained in resilient port development (Fig 4). To show them how to address local challenges and opportunities, they were trained with the Latin version ‘Puerto del Futuro’ or ‘Port of the Future’. It provides showcase solutions for resilient and sustainable port developments that can be tailored for port authorities and stakeholders in the region. Some examples of more sustainable solutions are given, including clean shipping, safety, sustainable dredging, aquaculture, and sand nourishments.

As part of the training the consequences of the implementation of more than 30 different optional sustainable port-city measures is made, while the multi-disciplinary nature of these measures is expressed by a set of scientifically validated performance indicators. The game is useful for port authorities, policy makers, and planners in order to provide training in sustainable development in port-city areas.

PLANNED EXTENSIONS OF THE POF SIMULATION TOOL

Further development of the simulation tool will be focused on the use of big data. The simulations will incorporate more real-time sustainable complex scenarios of logistics, port design, all under the adaptation of

climate change, in combination with the impact that interventions have (Fig 5). The game will also be extended to deal with the uncertainties of the impact of future measures, to address potential cost savings through reduced maintenance costs in the short (1-5 years) and long term (20-30 years). The advanced tools

ABOUT THE AUTHOR

Dr. Cor Schipper is a PhD expert at Deltares who has been involved for more than 25 years in field and experimental studies related to sustainable port development, environmental geochemistry, marine biology, marine policy and sediment risk assessment. The concept of 'Port of the Future' enables him to develop and apply sustainable port development methods in which economic progress fosters environmentally sustainable and climate-proof port development.

ABOUT THE ORGANISATION

Deltares is one of the parties leading the development and application of innovative research as applied to harbor projects on a global scale. With the increasing

will have options for real-time updating as well as forecasting port simulations. This will allow for different types of tasks to be performed in port areas, such as executing forecast simulations, importing satellite data for state updating, or utilizing monitoring and big data in order to reach a higher efficiency in port operation.

demand on space in delta areas and various external pressures such as climate change, accelerated sea level rise, and subsidence exacerbating the situation, new multi-functional approaches in water management as well as the design and operational use of ports and waterway infrastructure are required. Experience obtained over many decades of operation, using state-of-the-art numerical tools, and scale-model testing that is at the cutting edge of technology has placed Deltares in a strong position within this field.

ENQUIRIES

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