MUTILEVEL METHODOLOGY TO ADDRESS CLIMATE CHANGE RISK IN PORTS

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INTRODUCTION

Ports play an important role in worldwide economy, being crucial nodes on the global trading network. Besides, they are singular infrastructures with a long useful life that made them highly sensitive to changes in climate conditions (IPCC, 2014). Their location in coast, rivers or lakes provides high exposure to a wide variety of hazards including sea level rise, changes in extreme sea levels (waves, storm surge) or flooding. Moreover, port operations are susceptible to weather conditions that can lead to disruptions in the commercial activity and, thus, monetary losses. In this context, the development of risk assessment due to climate change and extreme events and adaption guidelines has become a priority for ports and, indeed the economies of countries. However, despite this concern on the part of the sector, to date there are few methodologies, tools or work done in this line.

OBJECTIVES

The aim of this study is to develop a multi-level methodology for conducting climate and disaster risk assessment in ports in order to identify hot spots and prioritize adaptation strategies.

METHODOLOGY

We propose a three-level methodology to define different scopes of assessment using a sequential path from a preliminary screening to a detailed risk evaluation. This approach presents the advantage of optimizing to detect risk hotspots and hence prioritize adaptive action, sources and capacities to develop the most relevant assessment for the necessities of the port.

In a first level, a pre-diagnosis based on the risk perceived by the port stakeholders from a guidance questionnaire is proposed (Becker et al. 2011). A qualitative risk level will lead (medium/high risk) or not (low risk) to the next levels of the methodology.

The following levels are based on the general risk framework adopted by the IPCC (2014) in which the risk is obtained by the product of hazard, exposure and vulnerability: $R=H \cdot E \cdot V$. Depending on the scope of the study, more accurate information will feed the components of the risk.

An advanced screening level is proposed to determine the risk category of a given port based on project and climate specific information. The profile risk (high, medium, low) is obtained taking into account the impacts of climate change over the operations and assets of the value chain of the port using financial indicators based on monetary losses and increase of investment. The relatively easy way of the approach and its scope allows the application to a wide range of ports leading to global or regional analysis of climate change risk in port investments or holdings.

High risk result from this advanced screening may require a high a detailed risk assessment of the port.

The detailed risk level is based on high spatial resolution hazard, exposure and vulnerability information

The first step will be the definition of the relevant assessment parameters such as: location and geographic limits, planning horizon, relevant climatic and non-climatic drivers of risk; relevant stakeholders and potential local collaborators, available information sources for hazards, exposure and vulnerability, etc. Many of these items will be crucial to decide on scales and tools to be used. Hazard is specifically characterized through hydro-meteorological and marine dynamics (sea level rise, changes in waves, storm surge, wind regime or precipitation). Regional data at high spatial resolution is essential. This requires ensuring the availability of reliable datasets that provided good spatial and time coverage. Exposure and vulnerability assessment requires detailed information on the assets and operations of the port. This includes the physical characterization of infrastructures (breakwater, berths, channels, etc) and equipment, but also damage and operating functions that accounts for the sensitivity of assets and operations to weather conditions. The assessment of risk in operational, financial, or socioenvironmental categorization allows to detect risk hotspots and hence prioritize adaptive action. Different alternatives will arise from the combination of established thresholds of variation in risk levels and/or acceptable consequences along with the implementation of adaptation options and risk reduction in order to maintain risk below such thresholds.

A highlight on the uncertainty of the process is required when dealing with climate change outputs. The methodology proposed has an associated uncertainty within each level that relies on the scale of the study, climate information coming from General Circulation Models (GCMs), the approach for projecting the information, the assumptions adopted or the scenarios of climate change used.

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REFERENCES

Becker A., S. Inoue at al. (2012). Climate Change impacts on International Seaports: Knowledge, perceptions and planning efforts among port administrators. Climatic Change, 110, 5-29.

IPCC 2014. 5th Assessment Report, Working Group II. Impacts, Adaptation and Vulnerability.