Indicator-based approach to evaluate the resilience of port infrastructures: application to the port of Genoa in the event of extreme weather conditions

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The capacity of a community to react and resist to an emergency is strictly related to the proper functioning of its own infrastructure systems. Nodal infrastructure systems, like ports, provide essential services for modern societies. Seaports are critical engineering systems that provide continuous economic activities. Because of their natural location, these systems are exposed to various natural and manmade hazards that can significantly disrupt their services. While limiting the hazards is not possible, improving the resilience of the infrastructure is one of the manageable strategies that can be adopted. To do that, the current resilience state of the system must be identified.

This paper proposes a new analytical framework for the assessment of ports' resilience. The proposed framework is based on the PEOPLES framework. It comprises four dimensions: Physical infrastructures; Organisational and Governmental Services; Resources and Economy Development; and Territory and Environment, summarized under the acronym "PORT". Each of the dimensions is further split into several components and sub-components to capture the detailed characteristics of the analysed infrastructure. The analysis starts by collecting all indicators related to seaports found in the literature as well as coming up with new indicators. The indicators are then classified under the four dimensions of PORT. Each indicator is given a weight factor to describe its contribution towards the resilience. Then, each indicator is allocated with a measure allowing the quantitative description of the indicator. A resilience curve for the port system is obtained as an output. The resulting resilience assessment allows identifying the current resilience state of the port and the aspects on which most efforts should be placed.

The proposed methodology is applied to the port of Genoa for the case of extreme weather conditions. Future research is aimed at completing the quantitative description of the indicators, with the final aim of developing a user-friendly software tool to make the methodology more practical to use.