



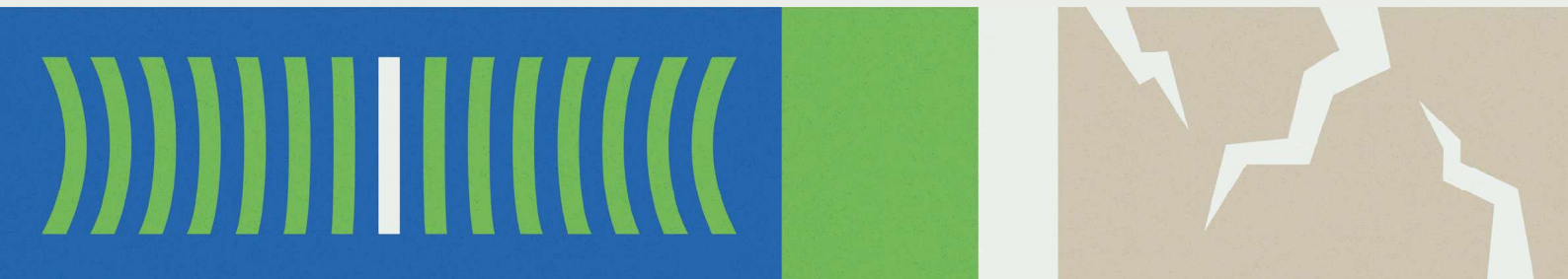
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Multi-Risk sciEnce for resilientT commUnities under a changiNg climate

Water, Ground Instabilities, Earthquakes & Volcanoes, Urban and metropolitan settlements, Environmental Degradation, Critical Infrastructures, Communities' resilience to risks, Science underpinning climate services.

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Critical Infrastructure Multi-Risk Deployment: An innovative framework to support NaTech preparedness in industrial facilities

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TS2-WP5 -T5.2-sub Task 5.2.2-Action B.5.2.2.

Abstract

This research addresses the vulnerability of industrial infrastructures to NaTech (Natural Hazard Triggering Technological Accidents) events, highlighting the need for improved preparedness. It introduces an adapted Quality Function Deployment tool (Castro Rodriguez et al. 2022) to enhance multi-risk assessments of NaTech vulnerabilities in industrial infrastructures (Castro Rodriguez et al. 2025a). The resulting Industrial Critical Infrastructure Multi-Risk Deployment framework was tested in an energetic critical infrastructure as a case study, considering multiple hazards and their cascading interactions and assessing their impact on industrial items. Moreover, a location priority factor (LPF) was introduced to contextualize the territorial vulnerabilities. A multi-vulnerable correlation matrix was included to identify internal interactions between industrial items. A rating system was also integrated, including criteria based on quantitative historical data and qualitative assessment when deterministic data is unavailable (Castro Rodriguez et al. 2024). As for final output, the punctual infrastructure multi-risk value provides a multi-risk early warning indicator on NaTech potential, aligned with the function-location approach to characterize vulnerabilities in industrial multi-hazard contexts (Castro Rodriguez et al. 2025b). According to a scale of importance, the meaning of this punctual value has implications at a primary decision-making level. In addition, the intermediate output of this framework supports decision-makers by raising vulnerability awareness and providing data-driven insights for enhancing industrial and territorial preparedness facing natural challenges.

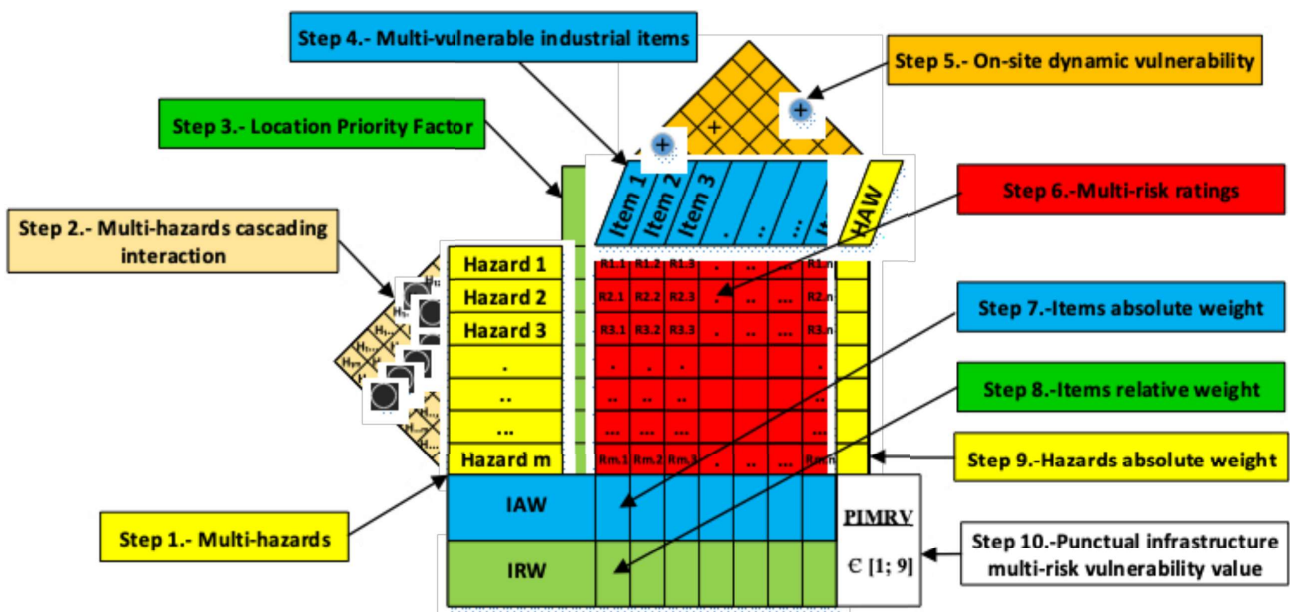


Figure 1 – Framework Industrial Critical Infrastructure Multi-Risk Deployment (ICI-MRD) numbering the steps for its implementation.

Keywords: *Critical infrastructures, Quality Function Deployment (QFD), multi-risk, NaTech, preparedness, vulnerability.*

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