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Universidad del País Vasco

Euskal Herriko Unibertsitatea

PhD Thesis

CLIMATE CHANGE RISK MANAGEMENT FOR THE SUSTAINABLE DEVELOPMENT OF THE HISTORIC CITY: FROM THE MATERIAL TO THE TERRITORY

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tecnalia Inspiring Business

POLITECNICO MILANO 1863

A Lorenzo,

per avermi insegnato ad amare, credere e lottare.

ABSTRACT

Cities are complex and interdependent systems, vulnerable to threats from natural hazards. Over recent years, sea-level rise, the increasing frequency of storms, and numerous other extreme precipitation events have all occurred, impacting on a large number of historic structures and increasing concern over risks due to weather patterns and global climate change.

Conservation of urban areas of historic value involves the management of change that, when properly addressed, is an opportunity to improve the quality of urban areas, ensuring the protection of social values as well as the authenticity and integrity of the physical material. Disaster risk reduction and adaptation to climate change should be seen as components of conservation, as they all share the objective of addressing the challenges of sustainable urban development.

The scope of this thesis is to analyse the impacts of flooding events caused by extreme precipitation and sea-level rise in urban areas with historic value, in order to prioritize interventions in the most sensitive areas.

A methodological approach for vulnerability and risk assessment has been developed, supported by an information strategy and a multi-scale urban model. The MIVES (Integrated Value Model for Sustainability Assessment) methodology was applied, in order to provide decision-making with objective and justified prioritization. The methodology delivers a balanced solution in terms of accurate results and data requirements, by using a categorization method for urban modelling. Information is organized and structured in hierarchical levels, permitting the comparison of building vulnerabilities and risks through the use of a unique index, thus facilitating the decision-making that is needed for the prioritization of efficient interventions.

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"If a man will begin with certainties,
he shall end in doubts;
but if he will be content to begin with
doubts, he shall end in certainties."

Francis Bacon

1

RATIONALE

1.1 BACKGROUND

1.2 SCOPE OF THE RESEARCH

1.3 RESEARCH METHODOLOGY

1.4 SIGNIFICANCE AND MAIN CONTRIBUTIONS

1.5 STRUCTURE OF THE DOCUMENT

Cities are complex and interdependent systems, vulnerable to threats from natural hazards. Over recent years, increasingly numerous and extreme precipitation events and subsequent flood events have occurred, impacting on a large number of historic structures. Furthermore, sea-level rise and the increasing frequency of storms, have posed new challenges to historic assets located in coastal areas, increasing concern over risks due to weather patterns and global climate change.

Disaster risk reduction and climate change adaptation should therefore be seen as components of conservation management, requiring a deep understanding of the vulnerability of historic buildings to flooding and associated extreme rainfall events and sea-level rise.

Historic cities, through adaptive processes, have always shown resilience, combining mixed uses on a human scale, density and vibrancy. They carry an identity forged over generations, encourage participation, communication and intimate relationships between public and private spaces. They are models from which the designers of new urban planning strategies may learn. While respecting their cultural values, specific methods for evidence-based decision-making have to be adapted and developed, in order to manage the evolution of historic cities and to guide them towards new comfort and climate-related parameters.

This situation calls for an efficient and holistic decision-making approach for sustainable urban planning, based on information management, that integrates disaster risk reduction, climate change adaptation and cultural heritage conservation.