Coastal Engineering xxx (2017) 1–11

Contents lists available at ScienceDirect

Coastal Engineering

journal homepage: www.elsevier.com/locate/coastaleng

Experiences and results from interdisciplinary collaboration: Utilizing qualitative information to formulate disaster risk reduction measures for coastal regions

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ARTICLE INFO

Keywords:
Interdisciplinarity
Transdisciplinarity
Social science and humanities
Natural science and engineering
Disaster risk reduction
Risk management
Risk perception
Culture
Values
EU floods directive
Porto Garibaldi
Ria Formosa
Coastal zones

ABSTRACT

This paper illustrates both the potential and challenges of interdisciplinary collaboration amongst researchers from the social sciences/humanities and the natural sciences/engineering in formulating disaster risk reduction measures for coastal regions. The authors aim to share their experiences of working across different scientific and engineering disciplines in the EU project RISC-KIT to co-produce disaster risk reduction measures suitable for specific regional and local contexts, in this case two coastal study areas in Europe (Porto Garibaldi, Italy and Rio Formosa, Portugal).

An overview of the historic-cultural origins of scientific disciplines is first presented, explaining the historical fragmentation of scientific knowledge into natural and social sciences and its associated challenges for prior disaster risk studies – and how the current state of an interdisciplinary approach has emerged. This is followed by an analysis of interdisciplinary collaboration, drawing on the experience and data collected (both quantitative and qualitative) from the two case study areas. The article concludes with suggestions to further overcome the segregation of disciplines within disaster risk studies and projects.

The authors found that qualitative data help to understand knowledge, values and behaviours of institutional and non-institutional stakeholders in formulating appropriate risk reduction measures to increase resilience in a local context – and that such data work "hand in hand" with quantitative information. Furthermore, the collection of qualitative data by researchers of the natural science and engineering disciplines has the potential to build bridges between disciplines and to stimulate further investigations, as in this case, to explain contradictions in human behaviour when managing risk.

1. Introduction

1.1. History of disciplinary work in science

Even today, the works of the universal genius, Leonardo da Vinci, provide an esteemed example of holistic scientific studies that embrace both natural and societal processes (Bermosa, 2017). In this regard, he was succeeded by other scientists such as Philipp Melanchthon, Gottfried Wilhelm Leibniz, Isaac Newton, Johann Wolfgang von Goethe or Alexander von Humboldt, all of whom followed with attempts to fully integrate the phenomena of the world around them in their subsequent studies.

With the dramatic increase of scientific knowledge by the 19th century, more complex fields of study arose. This resulted in a process of disintegration of knowledge and the establishment of scientific disciplines. Broadly speaking, two strands of expertise arose: one focusing on the phenomena of the bio-physical world, mostly understood through collection and analysis of quantifiable data (generally categorized as natural science), and another strand dealing with the non-physical environment, mostly utilizing qualitative data for the analysis of social human issues (generally categorized as social science and humanities). Pioneering discoveries in the fields of physics, medicine, biology and

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https://doi.org/10.1016/j.coastaleng.2017.09.010
Received 31 January 2017; Received in revised form 14 September 2017; Accepted 15 September 2017
Available online xxxx
0378-3839/

chemistry since the late 19th contributed to this increase of 'scientification' often identified with the quantification of bio-physical worlds and living environments.

1.2. The challenge of interdisciplinary work in disaster risk reduction

By 1975, the capability of countries such as the United States to resist natural disasters had already been assessed. It was found that "research on disasters was dominated by physical scientists and engineers and that little attempt had been made to tap into social sciences to better understand the economic, social, and political dimensions of extreme natural events" (Mileti and Noji, 1999). Since then, criticism with regards to the narrow approaches taken to disaster risk studies and the exclusion of the human relationship with the natural environment in this process has continued to grow. For instance, David Alexander, an expert in the field of interdisciplinary disaster risk reduction (DRR) studies "who deals with about 800 unpublished manuscripts a year in the field" (Alexander, 2017) observes that "disciplinary barriers have impeded progress towards a better understanding of emergencies and how to manage them" (Alexander, 2000). According to Alexander, the root causes of such a fragmentary nature of disciplines in disaster studies stems from the "fear of loss of identity and questions of power, since a strong sense of identity is the first necessity when marketing a research proposal. Moreover, interdisciplinary research is generally fuzzier in terms of its aims, progress and outcome than conventional discipline-based investigation (Alexander, 2000). Nevertheless, disciplines such as climatology, economics, geography, geology, law, planning, sociology, history, anthropology, literature and others are all today found to be more often than not in the studies and management of disaster risk reduction and form a multidisciplinary strand of professionals, the so-called "hazard community" (Mileti and Noji, 1999).

Besides these observations from the scientific disciplines themselves, the EU's framework program recognizes the need and challenge of interdisciplinary collaborations in general (European Union Research Advisory Board, 2004). The objective of improving opportunities for interdisciplinary endeavors has remained on the agenda of all seven EU framework programs and is now being transferred to the EU's subsequent research program Horizon 2020 (Allmendinger, 2015). A large body of literature is available that is tackling the challenges, benefits and risks of interdisciplinary research in general (Bridle et al., 2013) as well as demonstrating successful interdisciplinary research endeavors; e.g. with respect to coastal dynamics and human interventions (Marin et al., 2009; Prati et al., 2015; Pescaroli and Magni, 2015). This paper intends to add to this empirical evidence of 'what works' in interdisciplinary collaboration in disaster risk studies and what remains a challenge – and what are ways to approach the quest of better integrating scientific disciplines in disaster risk studies and elsewhere.

1.3. Disaster risk reduction measures and society

Europe's coastlines are a product of human cultivation leading to its ultimate settlement and resulted in engineering its characteristics to suit purposes of states, economy, and human recreation. Over the last century, the trust in technical intelligence and engineering capacities has led to bold new attitudes about building and living close to the sea, often interfering with the natural sediment transport of coastal systems and exacerbating erosion at many European coastlines. In addition, rapid coastal urbanization, mass tourism, maritime transportation and agricultural production have caused serious pollution problems and high demands on maritime resources. These problems are further accelerated by climate change, causing sea levels to rise and an increase in high-impact hydro-meteorological events. Coastal vulnerability is likely to increase due to two effects: 1) the increase of sea level rise and coastal flooding hazards; and 2) the increasing exposure to these hazards due to on-going coastal development (Martinez, 2017).

In 2004, research supported by the European Commission acknowledged that over 20% of the European coastline already faced serious problems, with thousands of kilometres affected by significant erosion (Eurosion, 2004). In 2007, the EU Parliament responded by issuing the European Floods Directive (European Commission), demanding member states to prepare flood risk management plans in accordance with their national laws and guidelines until a 2016 deadline. The directive is based on the principles of the safety chain: prevention – protection-preparedness – and thus recommends a common strategy of risk management to all member states (Klijn et al., 2008; Ten Brinke et al., 2008).

Few studies so far acknowledge that sophisticated flood risk strategies do not automatically imply comprehensive, accepted and common approaches at the EU level and that this discrepancy may be the reason for the specific societal circumstances of the country or region for which the flood management plan has to be implemented or improved. Recent research undertaken by engineers (Nones, 2015) on the effectiveness of the implementation of the Floods Directive (FD) points out that the FD implementation still remains a large challenge from a technical point of view given "the very different and site-specific initial situations in each of the studied member states must be adjusted during the next implementation cycles, and eventually harmonised in compatible flood risk management plans" (Nones, 2015). Nones (2015) suggests that (1) "flood risk maps from different countries are generated according to the same methodology and with the same contents and that (2) flooding issues shall be considered by many different points of view … considering the individual responsibility and preparedness of the citizens living and working in flood risk zones". Furthermore, research on flood risk management still excludes social, cultural, political and administrative realities in cases of flood events or risk management. This is primarily due to two reasons: (1) the focus was often placed on the technical solutions that would provide the desirable "safety"; and (2) in-depth interviews and observations are required for this kind of approach, often requiring different disciplines to collaborate e.g. sociologist, politic scientists with cultural anthropologist and environmental historians. For instance, by comparing two local responses to flood risk management plans, Martinez et al. (2014) analyzed the social and cultural barriers to and enabling factors for the implementation of DRR measures in two communities in the Baltic Sea. It was found that path dependencies and root causes of historical, cultural, political and economic relations amongst flood management institutions and people living in these communities played a significant role in shaping their particular approach towards flood risk management (Martinez et al., 2014).

One of the novel approaches of the RISC-KIT project was the joint collection and analysis of quantitative and qualitative data from scientists and engineers from various disciplines. These quantitative and qualitative data formed the basis of the RISC-KIT toolkit to reduce the risk of and increase the resilience to low-frequency, high-impact hydro-meteorological events in coastal zones in Europe (Van Dongeren et al., 2017). The project was made up of ten case study sites in Europe, in which multidisciplinary research teams applied mixed data gathering methods while investigating in the "physical" and the "human" fields of the coastal environment across the social science and humanities (SSH hereafter) and natural science/engineering (NS hereafter) disciplines. In this paper, the authors analyze their experiences as a multidisciplinary research team in two case study sites in Italy and Portugal.

2. Case study areas, methodology and findings

2.1. General approach used in the case studies

In the proposal writing phase of the RISC-KIT project the stakeholder groups to be approached over the course of the project were discussed and agreed amongst project partners. Three main stakeholder groups were identified based on this process. Accordingly, interviews in the RISC-KIT project were carried out with: (1) decision makers (those with power in the case study area, e.g. coastal managers, land-use planners,