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Public perception of engineering-based coastal flooding and erosion risk mitigation options: Lessons from three European coastal settings

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ABSTRACT

Recent damages and losses associated with coastal floods have generated many analyses dealing with overexposure to flood risk, its consequences, associated technological choices and governance principles, and what seems to be a poor understanding of the causes and consequences of floods and working of coastal defences at the local level. While many analyses demonstrate that risks are both physically and socially constructed, in this paper we go further by analysing risk mitigation options (engineering works) as being dual (physically and socially constructed) as well. When envisioning mitigation options through stakeholders' perception, one can observe a mix of intertwined statements associated with the relevance the specific risk that is dealt with, dealing with the sometimes incomplete knowledge associated with the mitigation option and its performance at reducing risk, and, dealing with the value conflicts that may be present when envisioning a particular flood risk mitigation strategy. Our research question is "what are the drivers of stakeholder perceptions when envisioning engineering-based mitigation options." Through qualitative empirical fieldwork conducted in three European coastal settings (Cesenatico, Santander and the Gironde Estuary) we demonstrate here that engineered mitigation solutions are socially construed by referring to individual and collective heuristics associated with these options. These heuristics may lead to poor social acceptability of envisioned mitigation options, poor acceptability not directly linked to the performance in terms of risk reduction.

1. Introduction

In this paper we identify the drivers of the stakeholders attitude toward a specific category of coastal risk mitigation: engineering-based risk mitigation options. Most risk perception analyses deal with the way individuals or groups relate to uncertain events and their associated outcomes. In this paper we enter the "risk perception" analysis through a different entry point: the risk mitigation options.

Recent damages and losses associated with coastal floods have generated many analyses dealing with overexposure to flood risk, its consequences, associated poor governance principles (Eisenman et al., 2007), and what seems to be a poor understanding of the causes and consequences of floods (Burby, 2006; Schneider, 2005). This "poor understanding" points toward a need to reinforce the science-policy interface. Yet this has been mostly approached by attempts at informing the public and policymakers in order to fill a perceived "knowledge gap". This "knowledge gap hypothesis" is very much contested. There is ample evidence that knowledge is not the sole determinant of risk (mis-)perception (e.g., Kahan et al., 2012).

More recently, integrative approaches to the analysis of risk perception have been proposed (Renn, 2008) stressing the fact that risk perceptions are determined by collective and personal manifestation of cultural backgrounds, socio-political institutions, cognitive affective factors and heuristics of information processing. This diversity of these potential sources of (mis-)perceptions indicates how ludicrous it may be to try to address one of these in order to modify attitudes.

When envisioning risk mitigation strategies and options the issue of perception is complexified by the mitigation option choice itself. Risk mitigation options raise perception issues as well. Furthermore, the concrete nature of a mitigation option implementation, its direct visibility to those affected, its existence, even if the risk does not concretize itself, may lead to a differential framing of the option chosen and of the risk under consideration. Finally, mitigation option may raise acceptability issues as some options may profoundly change the landscape, potential land use, real estate values and the likes.

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While many analyses demonstrate that risks are both physically and socially constructed, in this paper we go further by analysing risk mitigation options (engineering works) as being dual (physically and socially constructed) as well.

This paper answer to some of the question identified above by exploring empirically the following research question: "What are the drivers of stakeholder perceptions when envisioning engineering-based mitigation options?."

In Section 2 (this Introduction being Section 1) we present a synthesis of the theoretical frameworks that we are using, we define the type of mitigation option under scrutiny and present the associated working hypothesis. Section three briefly presents the method that has been used for the empirical part of our work. Section 4 presents and discusses the results that were obtained. Section 5 concludes this paper.

2. Central concepts and working hypothesis

2.1. Risk and perception, toward an integrative framework and its application to coastal risks

Risk is a mental model (Renn, 2008, p.2). Part of this model is linked with reality as it may manifest itself (some will call it the hazard, others will associate a probability density function with the description of an event) and part is linked with the way individual and society frame this manifestation (some may call this the consequence). By "framing" we mean here: how individuals talk about, and then assess the risk, taking into account contextual elements that seems neither directly linked with the probabilistic nature of risk nor with its consequences. This framing leads to situation where risk assessment by experts and risk assessment by laypersons lead to dissonant conclusions that may lead to sub-optimal behaviours, ill designed and/or not well accepted risk management options.

Therefore, what is understood as "risk", "risk management", "risk assessment" and the likes may cover diverse realities. While this is not a difficulty in itself, it raises several challenges when identifying a risk worth managing, when choosing the management option and when setting the risk governance mechanism. The analysis of this diversity has been the focus of the active and diverse literature on risk perceptions. Key elements of this literature are presented here as well as its potential interest to the analysis of engineering-based coastal risk mitigation options. Several theories constitute the main stream in risk perception since the 80s. We chose to focus on the followings: the psychometric approach to risk, the cultural theory of risk, the social amplification of risk, the governmentality approach to risk and the synthesis recently produced by Renn (2008).

Psychometrics deals with the quantification and prediction of risk and is probably the leading contender in the field (Sjöberg, 2000); according to Slovic (1992), the perceived risk is somehow quantifiable and predictable and one of the main questions is: "how much risk people say are they willing to accept?". The three main factors are: 1) the degree to which a risk is understood, 2) the degree to which it evokes a feeling of dread and, 3) the number of people exposed to the risk. An approach for studying perceived risk is to develop taxonomies for hazards that can be used to predict attitudes toward their risks. A taxonomic scheme might explain, for example, people's extreme aversion to some hazards, their indifference to others, and the discrepancies between these reactions and experts' opinions. The most common approach to this goal has employed the psychometric paradigm (Fischhoff et al., 1978; Slovic et al., 1984), which uses scaling and multivariate analysis techniques to produce quantitative representations of risk attitudes and perceptions. Within the psychometric paradigm, people make quantitative judgments about the current and desired riskiness of diverse hazards and the desired level of regulation of each (Slovic, 1992). These judgments are then related to judgments about other properties, such as (i) the hazard's status on characteristics that have been hypothesized to account for risk perceptions and attitudes (for example, voluntariness, dread, knowledge, controllability), (ii) the benefits that each hazard provides to society, (iii) the number of deaths caused by the hazard in an average year, (iv) the number of deaths caused by the hazard in a disastrous year, and (v) the seriousness of each death from a particular hazard relative to a death due to other causes (Slovic, 1992). While the psychometric approach has been widely used to quantify relative perception of risk, it seems of little use when envisioning options for risk mitigation. Acknowledging the need for action, does not necessarily define the attitudes toward modes of action.

In the seminal "Risk and Culture" (Douglas and Wildavsky, 1982), one can read: "can we know the risks we face, now or in the future? No, we cannot; but yes, we must act as if we do. Some dangers are unknown; others are known, but not by us because no one person can know everything. Most people cannot be aware of most dangers at most times. How, then, do people decide which risks to take and which to ignore? On what basis are certain dangers guarded against and others relegated to secondary status?" "Risk and Culture" attributed political conflict over environmental and technological risks to a struggle between adherents of competing ways of life associated with the two dimensions "group" and "grid". A "high group" way of life exhibits a high degree of collective control, whereas a "low group" one exhibits a much lower one and a resulting emphasis on individual self-sufficiency. A "high grid" way of life is characterized by conspicuous and durable forms of stratification in roles and authority, whereas a "low grid" one reflects a more egalitarian status. Therefore, egalitarian ("low grid") and collectivist ("high group") cultures gravitate toward fear of environmental disaster as a justification for restricting commercial behaviour productive of inequality; and individualistic ("low group") and hierarchical ("high grid") cultures resist claims of environmental risk in order to shield private orderings from interference, and to defend established commercial and governmental elites from subversive rebuke. This cultural theory is of interest when envisioning coastal risks because it indicates that risk, and risk mitigation options, and perceptions may very well be defined by factors that are not necessarily directly connected to knowledge. Risk assessment and mitigation may encounter difficulties associated with norms and tradition. The setting up of engineering-based mitigation options may lead to attitudes toward these options that are influenced by cultural factors as defined above rather than by the performance in terms of risk mitigation of the option that is envisioned.

The concept of "social amplification of risk" suggests that the actions of the media, government, and nongovernmental organizations, as well as disputes among scientists, can significantly increase or decrease public risk concerns (Kasperson et al., 1988). The social amplification of risk theory is of interest when analysing coastal risks because of the importance of climate change. Climate change is a field where controversies have been making the headline news. Furthermore conducting field level research on risk is an information gathering, mobilizing and knowledge creation activity, which in itself may contribute to social amplification dynamics.

"Governmentality" theory deals with new style of governance in modernity where the risk is mainly understood as entirely socially it makes no sense to ask for more or less risk or how real risks are (Foucault, 2004). Governmentality emphasises the diversity of forms that risk takes as a governmental technique, and stresses their very different implications for those who are governed. It focuses on governmental plans and programmes. Within this framework it is argued that the relevant hazards may be unilaterally and centrally defined by those holding the power. As such hazards and therefore risk can be instrumentalized by governments pursuing objectives (hidden agendas) not pertaining to risk per se. Within coastal context, climate change may thus be framed as an opportunity for governments to regain control of coastal areas.

Combining these various theoretical and empirical approaches, Renn and Rohrman (2000) and Renn (2008) have been proposing an integrative model of risk perception (Fig. 1).

This model acknowledges the fact that risk perceptions are influenced both by collective influences and the personal manifestation of these influences. Furthermore this model acknowledges the fact that