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Flood risk assessment – Practices in flood prone Swedish municipalities

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ABSTRACT

Risk assessments are important to ensure efficient and effective flood risk management. Methods and strategies for flood risk assessment are described in the literature, but less is known about how assessments are actually performed. We have studied local flood risk assessments in Sweden by interviewing flood risk managers in municipalities and analyzing documentation of flood risk assessment efforts.

There is a large variation between municipalities in how flood risk assessment has been done. The efforts made in association with the EU Floods Directive together with a Government Commission about a flood in Lake Mälaren are the most advanced assessments. Only a few of the municipalities have done comparable assessments. Generally, however, there is a lack of experience and theoretical knowledge about concepts and methods of flood risk assessment in the municipalities.

In the assessments studied, the flood itself had been rather well defined in hazard maps. The consequences of a flood had been studied in the larger projects but only by half of the municipalities. It is mainly direct, tangible consequences that have been included. It is mainly the exposure of assets that has been investigated while little attention has been paid to vulnerability.

To improve flood risk assessment in Sweden there is a need for knowledge and resources in the municipalities. Prioritization and motivation are needed to actually perform the assessments. National guidelines for may be helpful to guide municipalities in this work and to have more uniform risk assessment.

1. Introduction

Flood is a natural hazard expected to become more frequent with a changing climate. Society's vulnerability to flood is also increasing due to increasing exploitation of floodplains and the increasing complexity of technical infrastructure.

Historically floods have been seen primarily as external events that hit the society and the focus has been on protection by fighting or controlling the flood, primarily with technical solutions. This view has been changing with an increasing understanding that a flood disaster is the result of interactions between the natural event and the society that is affected. It is also clear that traditional flood protection solutions may both fail and cause other severe damage. Flood defence or flood control is therefore gradually turning into flood risk management where not only the flood phenomenon is considered but also its impact on society and society's vulnerability (e.g. [1–3]). A risk management approach also means that measures should be taken and prioritized in relation to the nature and magnitude of the risk. Assessing the flood risk is therefore crucial. The EU Floods Directive, adopted in 2007, is an important step in this direction [3,4].

Methods and strategies for assessment of flood risk are described in the scientific literature (e.g. reviews [5,6]), text books (e.g. [7,8]) and policy reports (e.g. [9–11]). Methods and tools are continuously developed by researchers as well as within governmental agencies and the private sector. New methods and tools are also the major outcomes of several large EU research efforts like FLOODsite [12] and MOVE [13].

Less, however, is written about how flood risk assessment is actually performed by flood risk managers in practice. Nones [14] reports the results of a brief assessment of the implementation of the Floods Directive in terms of information included in hazard and risk maps. The study covers eight selected member states and is based on a questionnaire. Studies of the implementation of the Floods Directive have also been performed by Müller who has compared the technical conditions for preparing the required assessments, maps and plans in a number of member states [15].

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de Moel et al. [4] gives an overview of national level flood maps in 23 European countries. It concerns national level flood maps and describes the flood maps as well as their use in a general way. Klijn et al. [3] have compared the national flood risk management approaches in several EU member states but they touch only briefly on the risk assessment component of risk management. In a related field Andersson-Sköld et al. [16] have used interviews with risk managers to investigate how Swedish municipalities have done risk assessments for landslides. There are also studies on the implementation of flood risk management [17] and climate adaptation strategies and measures, including flood management (e.g. [18–21]) in local level planning and management. Flood risk assessments are only a minor part of these studies if included at all. Further, Kjellgren [22] has examined the use of flood hazard maps for risk communication purposes and Höppner et al. [23] found that there is a gap between theory and practice when it comes to risk communication and social capacities for flood management.

We have, however, not found any investigation of how flood risk assessment has been performed in practice by those that are responsible for the practical flood management at the local or regional level and that can reveal the extent to which methods and approaches described in the literature have actually been put to use by practitioners.

In Sweden it is primarily the responsibility of the municipalities to prevent and manage accidents, crises and extreme events that cannot be handled by individual inhabitants [23,24]. Regarding floods, individuals should protect their own property but the municipalities have the responsibility for the overall flood risk management. The EU Floods Directive has been implemented in Swedish legislation through the Floods Ordinance [26], and the Swedish Civil Contingency Agency (MSB) is the coordinating national authority. 18 municipalities have been identified as having potentially significant flood risk and are hence included in the work regulated by the directive. There are no other regulations or national guidelines for flood risk assessment.

This study aims to generate new knowledge about practical flood risk assessment on a local level by examining how flood risk is actually assessed, and the extent to which the methods for flood risk management, described in literature, are applied by flood risk managers. We will do this by characterizing the risk assessments performed in relation to flood risk management theory and recent literature, to determine whether risk management approaches promoted in the literature have found their way into practice. This knowledge is essential for learning from the experience so far in the development and implementation of effective strategies and methods for a risk management approach in local flood risk management. It is also useful for assessing the impact of the EU Floods Directive on local practices.

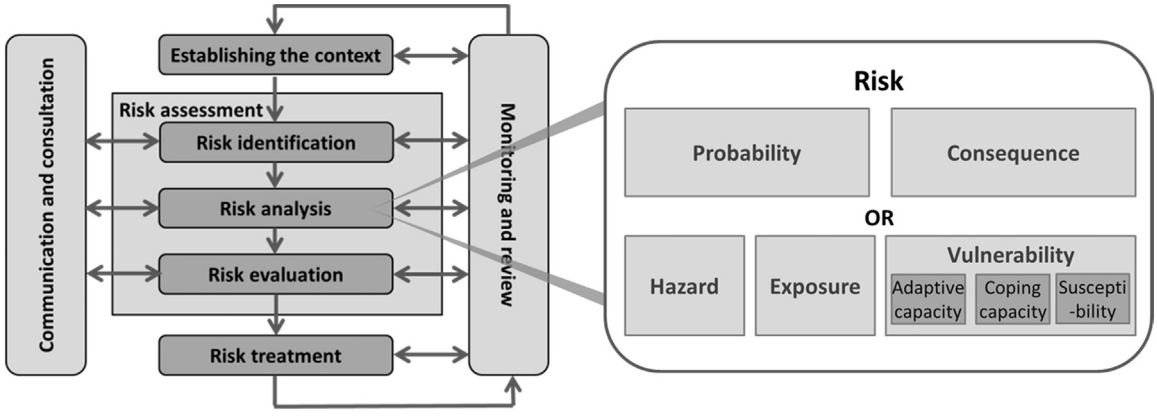
For this purpose an interview study with key persons responsible for flood risk management at the municipal level in Sweden has been performed. The study has focused on a central part of flood risk management, namely the flood risk assessment. The study was done at an early stage of the work with risk maps prescribed by the EU Floods Directive and includes both geographical areas covered by the Directive and those that are not.

2. Method

We have investigated how risk assessment has been performed in Sweden based primarily on interviews, as described below. This was complemented with an analysis of documentation from large flood risk assessment efforts. The data were analysed and compared with theory of risk management and flood risk assessment to investigate to what extent risk assessment described in theory has been implemented in practice. We begin by describing the terminology and theoretical background that we use for the analysis as well as risk assessment methods that the study builds on as well as some general flood risk assessment efforts in Sweden.

2.1. Definitions and conceptual framework

The terminology for risk and risk management differs between disciplines and sectors. More or less the same concepts are used but with varying meaning. Attempts at standardisation have been



Risk identification aims to "generate a comprehensive list of risks based on those events that might create, enhance, prevent, degrade, accelerate or delay the achievement of objectives"

Risk analysis "involves consideration of the causes and sources of risk, their positive and negative consequences, and the likelihood that those consequences can occur"

Risk evaluation is "the process of comparing the results of risk analysis with risk criteria to determine whether the risk and/or its magnitude is acceptable or tolerable"

Risk assessment includes the steps of risk identification, risk analysis and risk evaluation

Risk treatment is the process to modify risk. It includes selecting and implementing measures to reduce risk and control and modify measures that have been taken

Fig. 1. Risk management process and two definitions of risk based on the international standard ISO 31,000:2009 and definitions from KULTURisk [27,32].