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# The social innovation potential of ICT-enabled citizen observatories to increase eParticipation in local flood risk management



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## ABSTRACT

We live in the age of Big Data, yet many areas of environmental management are still suffering from a lack of relevant data, information and knowledge that impedes sound decision making in the face of change and increasing challenges. A highly relevant phenomenon is therefore the so-called citizen observatories whereby the observations of ordinary citizens, and not just those of professionals and scientists, are included in earth observation and environmental management. Advanced citizen observatories can enable a two-way communication paradigm between citizens and decision makers, potentially resulting in profound changes to local environmental management processes and, as such, in social innovation processes and outcomes. This paper analyses the social innovation potential of such ICT-enabled citizen observatories to increase eParticipation in local flood risk management. The findings from empirical research in two case study locations highlight the divergent roles that authorities conceive for citizens and the role(s) that citizens in practice assign to themselves. Moreover, given the institutional structures identified in these cases and the obligation of authorities to be accountable for their decisions, citizen observatories do not automatically imply that citizens will have a higher level of participation in flood risk management, nor that communication between stakeholders improves.

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## 1. Introduction

We live in the age of Big Data, yet many areas of environmental management are still suffering from a lack of relevant data, information and knowledge that impedes sound decision making in the face of change and increasing challenges. A highly relevant phenomenon is therefore the so-called citizen observatories whereby the observations of ordinary citizens, and not just those of scientists and professionals, are included in earth observation and environmental management. The basic idea of involving the public

in data gathering has been termed ‘citizen science’ by natural scientists (e.g. Refs. [4,32], ‘volunteered geographic information’ [11] and ‘crowdsourcing geospatial data’ [12] by geographers and ‘people-centric sensing’ [5] and ‘participatory sensing’ [13] by computer scientists. Citizen observatories can have many ‘shapes and sizes’, often extending beyond ‘mere’ data collection and sensing to citizen participation in decision making. They vary, for example, in terms of their area of application (from observing the physical environment to human behaviour), involving implicit or explicit data provision, collecting objective or subjective measurements, from bottom up to top down implementation, and using uni- or bi-directional communication paradigms between citizens and data ‘processors’ [6] (see Table 1).

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**Table 1**  
Dimensions of citizen observatories.

Dimensions	Range
Sensors & transmission	Physical sensor ↔ Social sensor
Stakeholders	Authorities ↔ Citizens
Area of application	Physical environment ↔ Human behaviour
Purpose of citizen observatory	Protect environment ↔ Strengthen governance
Integration	Stand-alone ↔ Integrated
Measurement	Objective ↔ Subjective
Implementation	Bottom up ↔ Top-down
Communication paradigm	Uni-directional ↔ Interactive
Citizen participation in governance processes	Implicit data provision ↔ Technical expertise Individual education ↔ Direct authority

Source: Wehn et al. [35]; based on Ref. [6].

The citizen observatories of water being developed by the WeSenseIt project go beyond 'mere' sensing in order to harness environmental data and knowledge to effectively and efficiently manage water resources. The key aspect of the observatories of the WeSenseIt project is the direct involvement of user communities in the data collection process: it enables citizen involvement collecting data via an innovative combination of easy-to-use sensors and monitoring technologies as well as harnessing citizens' collective intelligence, i.e. the information, experience and knowledge embodied within individuals and communities (e.g. using apps and social media). In a virtual web-based and mobile place, the e-collaboration platform, data and information can be gathered, shared and contextualised to provide up-to-date situation awareness. The developed platform will be in synergy with global data sharing initiatives complementary to the actions conducted under the GMES initiative; all data and selected components will be made available within the GEOSS framework. In the face of heightened severity and frequency of flood disasters, it is increasingly critical to manage flood risks [7], striving for an appropriate balance between protection, prevention and preparedness, both now and in the future [8,37] which is why WeSenseIt – in the first instance – focuses on the contribution of citizen observatories to improving flood risk management.

Next to the technological innovations and the resulting improved density of information available for environmental management, the citizen observatories present the potential for considerable improvements in terms of social innovations. Their features can enable a two-way communication paradigm between citizens and decision makers, potentially resulting in profound changes to existing flood risk management processes. Yet due to the emerging nature of citizen observatories, little is known about their implications and how to realize their social innovation potential. In this paper, we focus on one particular social innovation aspect (namely, participation) and we address the following questions: a) what are the current dynamics of citizen participation in existing flood risk management, b) to what extent are they already ICT-enabled, and c) how are these likely to be improved by the citizen observatories of water envisaged by WeSenseIt and their interactive ICT-enabled features?

Drawing on empirical research in the United Kingdom and The Netherlands, we analyse the social innovation potential of citizen observatories for eParticipation in flood risk management. We start with a general discussion of social innovation in Section 2 to identify the likely types of social innovations related to the WeSenseIt citizen observatories. Focussing on public participation and engagement in local flood management processes in particular, we review and adjust relevant theoretical approaches to serve as a framework for our investigation. In Section 3, we present the methodology used for this research while Section 4 presents the results for two case study areas. In Section 5, we discuss the findings in relation to our research questions, followed by conclusions and recommendations for future research in Section 6.

## 2. Social innovation and eParticipation

Social innovation has been defined in many ways, stemming from different contexts and rationales [21]. Some conceptualizations stress the outcomes of social innovation, arguing that it captures 'societal progress as opposed to economic progress' [23], consisting of new ideas, activities or services that meet social goals or needs [22], is concerned with improving the quality or quantity of life [21], and that it has the nature of a public good (e.g. Refs. [23,27]). Others emphasise the social process, regarding social innovation as 'self-conscious collective action that seeks to address the unsatisfied need for sustainable development' [20; p.54]. Yet in principle, social innovation is being considered both, a process and an outcome. Building on the notion of relying on innovation to address social challenges [23], we use the term social innovation here to more specifically refer to the desirable outcomes of a technological innovation for social or societal benefits (as opposed to profit maximization). As the social studies of technology literature has long argued, desirable outcomes of technological innovations are not intrinsic and therefore do not necessarily occur automatically (e.g. Ref. [9]). Hence it is important to define what the social innovation in question consists of, to what extent it is being attained and under what conditions, and how it can be fostered. In the current case of citizen observatories of water with their focus on local flood risk management, the social innovation of these observatories may span expected societal benefits ranging from generally improving sustainability, to fostering the resilience of communities, to enhancing local governance processes (e.g. in terms of transparency and accountability) related to flood risk management. In this paper, we focus on one specific social innovation aspect of citizen observatories, namely eParticipation in local flood risk management processes.

Participation in decision making is of course not a new concept but of increasing relevance in current policy debates, particularly those related to water (e.g. Ref. [25]). Based on a literature review of *stakeholder* (rather than broader public) participation in decision making, Reed [28] argues that participation approaches have progressed through a series of phases: awareness raising in the 1960s, incorporation of local perspectives in the 1970s, recognition of local knowledge in the 1980s, participation as a

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