

The FLOODLABEL as a social innovation in flood risk management to increase homeowners' resilience

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Abstract

In flood risk management awareness has been growing that the responsibility for coping with a flood cannot be assumed by the government alone. Homeowners need to be actively involved in flood risk management by taking responsibility; for this, they need empowerment and support to take adequate precautions. If homeowners implement precautionary measures, they can mitigate damage caused by floods and thus increase their resilience. This requires an appropriate risk communication strategy with the population. The FLOODLABEL in Germany informs and prompts homeowners to take precautionary measures. The Flood Competence Center developed the FLOODLABEL. This study employs the analytical framework of social innovation as the FLOODLABEL has some characteristics of social innovation. This study first explores the FLOODLABEL, which constitutes social innovation in flood risk management, and therefore characterizes the five development phases and their successes and challenges as social innovation. Second, it tries to understand and reflect upon the current stage of the FLOODLABEL as a social innovation in Germany and seeks to learn from this tool about the potential drivers associated with the process of implementation. Third, there is potential to gather a better understanding of other social innovations in flood risk management.

KEYWORDS

flood prevention, flood risk management, resilience, self-precaution, social innovation

1 | INTRODUCTION

In flood risk management, awareness has been rising that the state cannot take on the responsibility of coping with flood risk alone (Walker et al., 2014). For comprehensive flood risk management, homeowners are expected to be more proactive in taking precautionary measures and take responsibility as stakeholders in flood risk management (Snel et al., 2020; Walker et al., 2014). Major

damage primarily affects buildings on private property (Osberghaus, 2015). A wide range of measures can be taken to mitigate flood damage for individual buildings; however, most of these measures have to be implemented by homeowners themselves (Bubeck et al., 2012). If homeowners implement precautionary measures, they can mitigate damage from flooding and thereby improve their resilience (Begg et al., 2017; Bubeck et al., 2012; Kreibich et al., 2011). Homeowners personally

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implementing precautionary measures contributes to increasing cities' flood resilience (Brombach et al., 2013). A significant effect can be achieved if homeowners implement precautionary measures to reduce flood damage in a coherent area at the city or district level (Aerts & Botzen, 2014; Patt & Jüpner, 2013). Homeowners currently still do not take sufficient measures to reduce flood damage. The reasons for this are a lack of knowledge about possible measures and a lack of tailored information on flood risk (Hartmann & Scheibel, 2016).

This paper explores FLOODLABEL, a tool that was developed by the Flood Competence Center in Germany, that can prompt and empower homeowners to take precautions (Scheibel & Johann, 2015). The tool offers tailored advice to homeowners on how to adapt their properties to flood risks. It aims to provide homeowners with information and solutions through a specially trained expert who labels the property at risk in an on-site inspection. Users will receive a detailed analysis of their property's exposure differentiated by different types of flooding: fluvial flooding, pluvial flooding, groundwater flooding, and sewer backwater, along with tailored advice on measures they could take to protect themselves (Hartmann & Scheibel, 2016). The tool supports risk communication and knowledge, increases risk awareness among homeowners, and empowers them to take bottom-up action (Attems et al., 2020). The existence of the FLOODLABEL tool can be compared to the EU Energy Label (Attems et al., 2020) and has been utilized increasingly. Similar communication systems and tools exist in nearby European countries (Netherlands: BlueLabel, Overstroomik.nl; Belgium: Watertoets; UK: Flood-toolkit, Know Your Flood Risk), some of which have emerged from the FLOODLABEL or have developed concomitantly (Attems et al., 2020; Davids, 2021; Witte et al., 2021).

This paper discusses whether the FLOODLABEL can prompt homeowners to take action and thus foster the necessary social transformation in flood risk management toward flood risk governance. Therefore, this study employs the analytical framework of social innovations, as the FLOODLABEL has some characteristics of a social innovation, and social innovations are deemed able to foster social transformations (BEPA, 2010). So, this study explores whether the FLOODLABEL constitutes a social innovation in flood risk management. It tries to understand and reflect upon the current stage of the FLOODLABEL and seeks to learn from this tool about successes and challenges associated with the process of implementation. This can potentially help to gather a better understanding of other social innovations in flood risk management.

The study is based on a qualitative research design. Ten expert interviews were conducted with participants of the FLOODLABEL project group. Qualitative research is necessary to understand specific aspects and details of the development of the FLOODLABEL. This study explores the development phases, for which a detailed understanding of the internal structures of the Flood Competence Center and the functioning of the FLOODLABEL tool (Section 2) were needed. This is followed by an explanation of the meaning of social innovation in this context and the development process of a social innovation initiative (Section 3) in order to understand the analytical framework of this study.

2 | FLOODLABEL

The FLOODLABEL was developed by the Flood Competence Center (HKC) in Germany. This is a nonprofit network association that aims to foster knowledge and action in flood risk management. It, therefore, brings together stakeholders and interest groups related to floods from academia, society, business, and others. The FLOODLABEL aims to prompt homeowners to take the initiative to adapt their homes and real estate to flood hazards. It provides a detailed risk assessment of the property in question with the help of an on-site inspection by an especially trained expert. In addition to assessing the existing flood risk, the experts will provide recommendations for self-precautionary measures tailored to the property (Hartmann & Scheibel, 2016). For the experts, the HKC developed a dedicated two-day training program in cooperation with the Association of German Water Engineers (DWA). Upon successful completion of the training, the participants will be able to work independently as FLOODLABEL experts. The role of the HKC is to provide the experts with all the necessary documents to prepare a FLOODLABEL, to provide the homeowner with the contact details of the experts via the website, and to ensure quality and issue the certificate.

Although the insurance sector supported the FLOODLABEL (Scheibel & Johann, 2015), the tool has no commercial interest for HKC. To obtain a FLOODLABEL, homeowners must actively request an expert. The label is not attached to the title of the property. It can be presented for sale or insurance purposes (Hartmann & Scheibel, 2016), but this is voluntary and not required by law. Homeowners receive a FLOODLABEL certificate with a detailed accompanying form. This document that measures have been recommended and are being taken. It also shows the reduction in flood risk resulting from the implemented measures, to document their impact,

practice. Furthermore, overlaps and interactions can occur among the phases. Initially, the need for innovation is demonstrated by identifying the problem, for which ideas for solutions are generated in the next stage, drawing on knowledge and experience. In the pilot phase, the ideas are tested in the field, where they become everyday practice in the next step. In the following stage, there are a number of strategies for the growth and diffusion of an innovation so that sustainable systemic change is achieved in the long term.

4 | METHODS

Data was collected through 10 qualitative interviews with stakeholders involved in the FLOODLABEL project group. Answering the research question requires access to specific knowledge and details about the history of the FLOODLABEL. This information can only be obtained through a qualitative research method. The stakeholders interviewed have all been closely involved in the development of the FLOODLABEL. They included representatives from the following areas: the insurance sector, engineering offices, universities, municipalities, water associations, and citizens' initiatives. Leaders interviewed included HKC's former board chair who was active at the time of FLOODLABEL's development, and the association's current executive director. Of the 10 interviews conducted, two were conducted face-to-face while the remaining eight used videoconferencing. The interviews were conducted in German and subsequently translated into English. The chosen method provides deep insights into the development of the FLOODLABEL that is relevant to this research.

The interviews were conducted as guided interviews that aimed to translate the research interest into concrete questions while following a structured approach. In addition, the consistent use of the guide ensured that all interviews would be comparable. In terms of content, the guide divides the interview into three topics. The first part explores the stakeholders' personal motivation to participate in the development. In the second part, the different phases of development were characterized, focusing on the successes and challenges of each phase. The current state of development of the FLOODLABEL was explored. The third part of the interviews focused on the future development of the FLOODLABEL, its potential, and the drivers that can strengthen the FLOODLABEL. The aforementioned three topics, into which the interview guide is divided, are relevant to answering the research question.

The material was evaluated using qualitative content analysis. Categories were created for systematic analysis.

These form a kind of grid to assist in examining the material and reducing the data to its relevant information. The transcribed interview passages were coded based on the main themes developed from the research question for the guide: motivation, developmental phases, induced change, potential, and drivers. For the analysis of the interview, these themes were defined. Ordinal and nominal subcategories were added to the main categories. The material was coded, and the relevant passages were assigned to the appropriate categories and paraphrased. Due to the amount of data, generalization and reduction of repeated statements with similar content were applied in order to better organize the material. A qualitative content analysis was made from the collected text data by building inductive categories and summarizing them using simple descriptive statistics (frequency). The interpretation of the data was cross-checked by the authors. Additionally, a focus group discussion with the FLOODLABEL project group helped to validate the findings.

5 | RESULTS

5.1 | The motivation for the development of the FLOODLABEL

Stakeholders contributed to the development of FLOODLABEL for different intrinsic motivations, but two main motivations can be identified. The first main motivation for four of the respondents was to support flood-affected people. Respondent A said: "*It was the motivation from the HKC association itself to do something specifically for flood-affected people.*" Affected citizens should be given the opportunity to receive free information about their vulnerability. The aim was to make people aware of the flood risk, to prevent them from forgetting about it, and to motivate them to take action. The second main motivation for the other four respondents was to develop a tool for the insurance sector to use as a basis for underwriting natural hazard insurance. There was a need for action on the part of the insurance sector because existing regulations did not allow for every building to be insured. For Respondent B, "*a gap was identified in the risk assessment for certain locations in relation to the possibility of insurance coverage.*" Houses that had been built with flood adaptations but were located in a flood-prone area could not be reasonably insured. This inspired a strong interest in developing a flood risk assessment tool that could also be used by the insurance sector. The motivation for supporting the HKC in its development was to make this tool available as a service to the insurance industry.

In addition to the two main motivations, four other motivations can be identified. The motivation for the

three respondents was their personal expertise, competence, and willingness to develop a label for objective advice: they sought to develop “a neutral label that does not directly identify where it comes from” (Respondent C). It was recognized that this would require a technical, validated, and competitively neutral approach. Three of the respondents also had a self-interested motivation related to their personal work. One respondent was hoping to be able to generate scientific projects from the development in the future and thus see potential for their own work while two other respondents saw the need for a communication tool to aid them in their personal work. A tool can support communication with affected citizens by explaining their risk situation in concrete terms and communicating the possibility of taking precautions themselves.

Respondent D identified the implementation of self-precaution as a missing aspect of flood risk management: “In the flood risk management cycle, it says information and precaution, but that people living in flood-prone areas actually do something about it is not really there.” This aspect motivated them to work on the development of a tool to support self-precaution. The diversity of stakeholders’ motivations also reflects the interdisciplinary nature of the project group and the diverse interests represented in the initiative.

The participants have influenced the creation of the FLOODLABEL through their different motivations and involvement in the different phases of development. However, not all stakeholders were involved in all stages of the development—some left early, and others only accompanied and supported individual stages. Despite the different motivations and time commitments to the development process, those involved shared a common goal of making self-precaution on the part of homeowners a more prevalent part of flood risk management by raising awareness of hazards and empowering people to take action. The history of the FLOODLABEL tool can be described in five phases, from its creation to its impact and implementation in practice.

5.2 | The development phases of the FLOODLABEL

5.2.1 | Phase 1: Diagnose the cause of a problem

According to the respondents, four different issues gave rise to the ideas for the FLOODLABEL. First, came the experience of the Cologne floods in the 1990s and the need to support people affected by flooding. Second,

the insurance sector experienced significant pressure to act. Third, a solution for assessing natural hazards to buildings was missing. The fourth systemic aspect is the identification of self-precaution as a missing key factor in the flood risk management cycle.

The experience and scale of the damage caused by the 1990s floods in Cologne led half of the respondents to understand the need to support personal precautions in order to increase societal resilience. According to respondent A, “Cologne had developed very advanced flood protection after the events, a combination of structural protection, retention, and prevention (...).” The HKC wanted to build on this and assist other flood-affected people by supporting the highly qualified experts.

The scale of the damage put pressure on disaster funds and the insurance sector. For four respondents, the insurance sector’s need for action was the basis for the idea of a FLOODLABEL. They aimed to create a flood rating based on the insurers’ existing rating system (ZÜRS zones).

For three respondents, a key aspect was the development of a valve solution, a neutral, objective tool for assessing buildings in terms of hazards, and the measures taken to protect property. Such an instrument is significant for every building due to the hazards of pluvial flooding and sewer backwater—on the one hand for the value of the property, and on the other hand for the owners/tenants’ behavior. In addition, damage can be significantly minimized. At the time, there was no comparable instrument to support self-precaution.

According to two respondents, the idea for a FLOODLABEL is based on a systemic aspect. Self-precaution was identified as a missing key factor in the flood risk management cycle and should be supplemented. This would require the provision of an appropriate tool to support self-precaution.

Respondents’ diagnosed the cause of the problem quite differently. This diversity reflects the need for such a tool in different sectors and for different target groups.

5.2.2 | Phase 2: Identifying ideas and initial concept development

To further elaborate on the initial idea for the FLOODLABEL, a project group was initiated in the following year. The interdisciplinary project group consisted of various stakeholders, representatives from the insurance sector, engineering offices, universities, municipalities, water associations, and citizens’ initiatives. Not all participants were involved to the same extent in all steps of the concept development.

The first steps of the development were financially supported and designed by the insurance sector. In return, the tool should be able to help the insurance industry. Respondent A said, “*The insurance industry collaborated from the beginning to incorporate issues of insurability of objects into the FLOODLABEL.*” This ensured that the FLOODLABEL could optimally support the acquisition of insurance.

An initial concept for the FLOODLABEL was developed by the project group. A first version of an online risk assessment tool (Risk Check) was developed. With relatively little basic information, the aim was to provide citizens with a free tool for an initial self-assessment. In addition to the Risk Check, the FLOODLABEL 1.0 was developed during this phase with the assistance of an engineering office. Regular coordination meetings were held between the engineering office and the project group “*to include the view from a practical viewpoint and the view from the insurance sector*” (Respondent B) and to discuss the proposed solutions. The first challenges were to find an initial structure and to define the input parameters for the assessment. Based on the results of the work, an initial explanation of the assessment concept was prepared in the form of a report with pictures and illustrations.

An important aspect in developing a training concept for the FLOODLABEL experts was to ensure that the newly established HKC did not become a competitor to other institutions. Respondent A started, “*My intention towards the HKC was always to organize support, more like the citizen-based practice.*” The HKC could draw on the structures and knowledge of an external institution for expert qualification. To this end, a first draft of a training concept for the qualification of experts was drawn up in cooperation with an institution.

Respondents' perceptions of the concept development phase varied widely. For the majority of respondents, the structures and personalities were challenging and often responsible for the length of the work phase. The process was intense and characterized by interdisciplinary collaboration. One respondent described, “*It was a discovery phase where boundaries had to be found*” (Respondent B). There were several challenging issues to discuss, such as subject matter experts, costs, target group, administration, quality assurance, and patenting of the FLOODLABEL. Three of the respondents found the working process to be fast, stringent, and focused. For Respondent G, the initial phase was “*characterized by creativity and enthusiasm.*” In the long and intensive work phase, an initial concept was developed, which received good feedback from the public.

5.2.3 | Phase 3: Pilot study

After 2 years, the first FLOODLABEL concept was completed, and several pre-tests were conducted to evaluate the concept in practice. According to four respondents, pre-tests were carried out with a few sample houses. Two respondents reported a pilot project involving three properties which were inspected, assessed, and cataloged using visual material. Based on these pilots, typical weaknesses of the houses were identified. During this phase, targeted stakeholders were sought to test the concept. “*In the first cases, free of charge, to gain experience themselves,*” according to Respondent A. The engineering office involved carried out the first practical tests of the concept. All pilot projects were carried out by participants in the development phase of the FLOODLABEL, as no qualified experts were available at that time. Stakeholders from the citizens' initiatives were involved in testing the first online version of the Risk Check. However, according to the respondents, this pilot phase was not carried out in a structured and coordinated way.

Based on the pilot projects, respondents identified a need for change and further development: Groundwater flooding was identified as a missing hazard and the extension of the building assessment concept to include property protection measures. Training of experts was also considered important for further implementation. Furthermore, target-group-specific communication. The outcomes from the pilot phase have highlighted the need for further development of the FLOODLABEL.

5.2.4 | Phase 4: Further development and implementation in practice

As a result of the increased attention and the desire to speed up development, a project plan was developed under pressure from the HKC board, using professional project management. The reason for this was the limited time individuals could dedicate to their involvement in the development. The development was a kind of continuous process that took a lot of time. The desire to speed up development is highlighted by respondent A: “*Other states in the Federal Republic of Germany, including some state authorities, are also working on this issue. It was important to be able to go out early*” to present a tool for the whole of Germany. The use of project management was viewed critically by stakeholders. “*This control was a big hurdle,*” said respondent G, because of the voluntary nature of the working group and the incremental development process. The voluntary working group could not work according to a pre-defined schedule, and therefore the professional project management was discontinued.

Further development was then carried out independently by the HKC project group, supported by the engineering office. For almost all respondents, the implementation of the training to qualify FLOODLABEL experts was a decisive milestone in the development history. At this stage, 4 years after the initial pilot studies, the FLOODLABEL 2.0 was ready for implementation, but further work was needed to communicate with users and disseminate the concept. The first phase of implementation was financially supported by the insurance sector. Subsequently, the communication work was carried out with the support of a professional communication agency. Among other things, a FLOODLABEL website was created as a communication tool.

The FLOODLABEL became part of an international research project focused on testing digital and automated feasibility. Through this project, the FLOODLABEL received international attention for the first time, which was a crucial step for four respondents. For respondent A, it was *“gratifying that it was relatively easy to take this to other countries with a high level of acceptance.”* For the German FLOODLABEL, the results of the project had an affirming effect. The internationalization of the FLOODLABEL was an important step for the acceptance of the concept and a confirmation of the communication tool.

The phase was marked by challenges, but also by moments of success. According to the respondents, four successes could be identified. The concept itself and its implementation, *“that the tool was launched as a novelty,”* according to respondent B. The availability of a recognized tool that also provides a solution for the insurance sector. The cooperation with the citizens' initiatives established a link with the people affected by the floods. The ongoing intrinsic motivation of the working group has been crucial to the success so far. However, according to the respondents, the implementation phase also revealed challenges. The application of the tool has shown that public awareness needs to be supported for dissemination in practice. Some parallel developments were also taking place in Germany at the time. Respondent B explains, *“The HKC has a strong regional character; so, to go nationwide from there is a challenge.”* It was not universally accepted that the idea for a national instrument came from the HKC. The concept and market implementation can be described as a great success, but challenges in dissemination were identified.

5.2.5 | Phase 5: Growth and dissemination

Opinions on where the FLOODLABEL stands today and how far it has spread diverge widely. However, according

to the majority of respondents, this is the longest phase in which the least progress has been made. As respondent E said: *“You cannot be satisfied with the development.”* Awareness levels and demand for the FLOODLABEL are still too low. Respondent D said: *“There is a lack of references for the social impact of the tool because the FLOODLABEL is still innovative.”* Respondent G worries *“that it will eventually run out of steam or get stuck.”* The opposite opinion is that most people already know the label. People are becoming more aware of floods and the need to take personal precautions. Some important changes could strengthen the FLOODLABEL in the future: communication, political governance, digitalization, and integration into the flood risk management plan. Widespread use of the FLOODLABEL has not yet been achieved, but important progress has been made in raising awareness regarding the need for precautions.

According to the majority of respondents, the growth phase has been marked by four successes. First, the number of experts has steadily increased through regular training courses and the steady increase in the number of HKC members. Second, many external supports and collaborations through institutions have been established over the years. This reflects the great interest in the FLOODLABEL. Third, more and more multipliers for the FLOODLABEL are emerging, the most important being the insurance sector, citizens' initiatives, and the scientific community through project initiatives and publications. Fourth, FLOODLABEL is becoming known internationally through its involvement as a project partner in various research projects. Respondent A emphasized, *“If you look beyond the national border, the experts, the colleagues in other countries definitely take up such experiences.”* The projects provide important insights and experiences for further development in Germany. The successes of the phase lie in expert training, external cooperation, multipliers, and internationalization.

Respondents identify one main challenge in the growth phase. The lack of political will. For respondent A, *“the responsibility for floods in Germany lies mainly with the federal states, but also to some extent with the municipalities so that they really actively draw attention to the issue and include it in their prevention strategy.”* In most cases, the integration of self-precaution into the flood prevention concepts of the municipalities and the financial support for its implementation has not yet been achieved.

5.3 | Potential and drivers of the FLOODLABEL

To further strengthen the FLOODLABEL in the future, respondents identified four main potentials and drivers:

communication, political governance, digitalization, and integration into the flood risk management plan.

Appropriate communication can increase the population's awareness of the flood risk and the need to take personal and behavioral precautions. This can be achieved by communicating the added value, by users reporting positive examples after an event, and by continuously providing information through municipal support (e.g., annual tax notices). External institutions such as architects, tradesmen, chimney sweeps, and utility companies can be involved in dissemination. More support is also needed for investment in education and awareness campaigns among children and young people.

Political support for self-protection measures in the form of financial incentives is important in order to increase awareness and acceptance. According to respondent A: *“Experience in other areas shows that this makes a huge difference, where support is effective, people become aware of it.”* For funding programs, the FLOODLABEL is the right tool, as it would otherwise be costly to check applications. Respondent E said, *“For countries, it is cheaper in the end than paying reconstruction aid, helping citizens from the outset, investing in prevention.”* For some respondents, the integration of the FLOODLABEL into land-use planning is also a potential for the future.

Digitizing the FLOODLABEL and developing an app for the whole process has several potential benefits according to the respondents. A simplified workflow will be created, and an interactive initial risk assessment may generate a different level of concern among users. It would also provide access to a younger audience.

The FLOODLABEL must have a permanent place in the flood risk management plan and be included in the planning. It is already implied in the self-precaution component where it must be integrated as a tool. In this way, the FLOODLABEL can be integrated into an overall approach.

The identified potentials can strengthen the FLOODLABEL in the future, but external institutional and policy support is needed for implementation.

6 | DISCUSSION

6.1 | FLOODLABEL induced changes in flood risk management

The FLOODLABEL has the potential to bring about a transformation in flood risk management. Self-precaution is becoming increasingly important in flood risk management and is becoming more systemically recognized. This confirms the assumption of Franz et al. (2012) that social innovation induces a change in social practice. The tool

supports precaution and has brought about a change in communication. These changes are visible in decision-making, behavior, action, and knowledge (Franz et al., 2012; Haxeltine et al., 2016). As a communication tool, the FLOODLABEL promotes dialogue, which is essential for action. It leads to increased awareness among those affected. The FLOODLABEL is a solution tool for the public, the insurance sector, and policy-makers. The assumption that transformative social innovations have the potential to change agendas, institutions, and procedures (Avelino et al., 2019; Parés et al., 2017) applies to the FLOODLABEL. It works across different institutions and provides the solution for a holistic approach. Linking risk precaution, self-precaution, and information precaution through a precautionary tool can bring about sustainable change in flood risk management.

6.2 | Sustainable systemic change through a social innovation

The FLOODLABEL has not yet achieved sufficient growth and diffusion to bring about systemic change in Germany. The leap into the sixth phase of a social innovation, as theorized by Murray et al. (2010), has not yet materialized. There may be various reasons for this, but the research works point to the lack of external support for the FLOODLABEL. Only through external support can the potential of social innovation described by Moulaert et al. (2013) be realized. Through participatory processes, an improvement in the social system is created, and changes in political arrangements and/or governance processes are achieved. Policy direction and promotion of the FLOODLABEL are needed to support self-precaution. The FLOODLABEL needs a permanent place in the flood risk management plan. The tool needs to be integrated with other flood risk management tools in an overall approach. Communication designed to raise awareness needs to be supported externally to increase public acceptance. As a social innovation, the FLOODLABEL has the potential to reach the next level. It can contribute to the adaptation and further development of the governance system and regional planning (Baker & Mehmood, 2015; Davoudi, 2012). However, without further development and external support, FLOODLABEL will not bring about sustainable systemic change.

6.3 | The concept of social innovation

An examination of the FLOODLABEL as a social innovation in flood risk management helps to understand where

it stands today and what it will take to bring about sustainable change. According to Murray et al. (2010), the process of social innovation can be a useful approach to responding to social challenges, developing solutions, and making more efficient use of scarce resources. An exploration of its genesis shows that this is true of the FLOODLABEL and that it provides a missing tool to support self-precaution in flood risk management. Murray et al. (2010) suggest that the phases need not be sequential in time and that there may be overlap and interaction between phases. The FLOODLABEL has gone through five of the six phases, and some overlap between phases has been observed. The development of the FLOODLABEL has gone through all phases since the initial concept development. The concept of social innovation can be applied very well to the FLOODLABEL and helps to understand which drivers can further strengthen the FLOODLABEL in the future.

7 | CONCLUSION

The FLOODLABEL has sufficient characteristics of a social innovation. However, the development and current status of the tool show that it needs to be integrated into flood risk management to raise awareness among homeowners and to empower and support them to take precautionary measures. This can reduce flood damage and improve homeowners' resilience (Begg et al., 2017; Bubeck et al., 2012; Kreibich et al., 2011). A tool provides an opportunity to actively engage homeowners as stakeholders in flood risk management (Snel et al., 2020; Walker et al., 2014). This research shows that providing an instrument alone is not enough to prompt more people to take self-protection measures. It further demonstrates that social innovation can provide a solution to a social problem according to Murray et al. (2010).

The study provides lessons for other social innovations, communication systems, and tools in flood risk management. Lessons for project groups developing a social innovation and indications of drivers that can strengthen similar tools in flood risk management can be gleaned from its story.

The development process of a tool does not have to be linear. Participants can change without inhibiting the process. The intrinsic motivation to continue and implement the idea can sustain a social innovation, independent of the individual innovators. The incremental organization during the development process shows that strict project planning is not necessary in the development of a social innovation.

Several drivers were identified from which other flood risk management tools can learn. Appropriate

communication is a crucial aspect of raising household awareness of flood risk so that the tools provided are adopted and used. Political support and the use of flood preparedness tools can strengthen the tools and improve their acceptance among the population. Further development and adaptation of existing tools to increasing digitalization are important aspects also. These lessons can strengthen the development and implementation process of other social innovations and communication systems and tools in flood risk management in the future.

The qualitative research design was necessary to explore specific aspects and details of the development history. The selection of interviewees only from the project group may have resulted in a somewhat one-sided view of the issue. Future research on the FLOODLABEL should include external perspectives as well as those of users and collaborating institutions. The FLOODLABEL has the potential to support self-precaution and thus increase flood resilience. It is therefore a prime example of social innovation in flood risk management.

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The authors have declared no conflicts of interest for this article.

DATA AVAILABILITY STATEMENT

Data are on file with author and accessible on request.

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