PROTECT – A RISK AND PREVENTION AWARENESS TOOL FOR NATURAL CATASTROPHE RISKS AND PREVENTION MEASURES

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European Insurance and Occupational Pensions Authority

Luxembourg: Publications Office of the European Union, 2025

PDF ISBN 978-92-9473-507-2 doi:10.2854/0380923 EI-01-25-001-EN-N

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1. EXECUTIVE SUMMARY

EIOPA believes that raising the awareness about natural and climate-related hazards and their risks among citizens is crucial. It helps fostering a proactive approach towards risk prevention, which is key to keep availability and affordability of property insurance with coverage against natural catastrophes in Europe. In addition, by understanding the potential impacts of climate change on their properties, citizens and businesses are more likely to adopt measures that reduce their vulnerability to extreme weather events and other climate-related hazards. This not only reduces potential damages and financial losses but also contributes to the long-term resilience of Europe. Furthermore, educated citizens can make informed decisions about their insurance needs, leading to more appropriate insurance coverage. In this regard, raising awareness about exposure to natural hazards and potential prevention measures will help to reduce the insurance protection gap for natural catastrophes in the EU.

To support this work, an analysis of 77 private and public tools aimed at raising awareness about natural hazard risks was made in collaboration with Verian ([1]). This analysis revealed that these tools typically differ materially regarding the scope of the natural hazards assessed, the level of geographic granularity implemented, the methodologies used to provide risk estimates as well as their user friendliness. In addition, most tools fall short of providing recommendations in terms of risk prevention against natural hazards, which is deemed relevant to strengthen the homeowners' resilience and also do not consider aspects related to insurance literacy. Furthermore, most of these tools lack a true interactive component that makes the user engage with the information provided and take action.

In this context, EIOPA is proposing an awareness tool that can be used by all Europeans to better understand the potential impacts of climate change on their properties. EIOPA outlines the key features that should be made available in the tool, including:

- raise **awareness on exposure to natural catastrophe (NatCat) risks**: show property owners the risk score of their property regarding natural hazards;
- raise **awareness about risk prevention:** describe the most common prevention measures per type of peril (before/during/after the event);
- raise **awareness about risk-based benefits of prevention measures**: provide information that such measures can have an impact in the risk-based insurance premium;
- contribute to **financial literacy** by increasing consumers' awareness about the benefits of adequate insurance coverage (providing information on the importance of being aware of exclusions, on national insurance schemes in place for natural catastrophes, etc.);
- incentivise the user engage with the information provided (i.e. by featuring interactive elements) and the tool should be simple and easy to use (online or via a mobile phone app).

The paper explores the design of the above mentioned layers, including the data and methodologies that can be employed. A key consideration is the balance between two competing factors: accuracy/complexity and user-friendliness. On one hand, achieving high accuracy and complexity requires a deep level of technical expertise, resulting in precise and comprehensive results. However, this approach can be overwhelming for non-experts and demands significant expertise to create and maintain. On the other hand, prioritising user-friendliness involves designing an intuitive and accessible tool that is easy to use and understand, even for those without extensive technical knowledge. To achieve this, it may be necessary to use clear language and minimise complexity to facilitate navigation and engagement for a broader audience.

In addition, EIOPA also mentions limitations of existing tools in terms of reaching a broad audience, and considers in which process the risk and prevention measures information could be presented. Indeed this is an important aspect which should be considered in parallel to the development of any tool. Using the tool during the purchas-

([1]) Behavioural research on the development and testing of a blueprint for a risk and prevention awareness tool to raise customers' awareness on their level of risk vis-à-vis natural catastrophes and available risk mitigation measures (EIOPA/2024/07).

ing process of a house ([2]) and during the purchasing of a house insurance policy, perhaps in the Insurance Product Information Document (IPID), seems to be the best way going forward. To ensure the maximum compliance, considerations should be made whether additional "duty to inform" the consumer about the tool should be imposed or recommended at those mentioned stages. The biggest challenge with the above mentioned approach is targeting individuals who are actively looking for a home or an insurance, which would restrict its broader utility. For this reason, additional methods to increase awareness, also for those consumers which are not actively searching for a house or a house insurance, should be implemented.

Finally, considerations on how potential users might take actions and how to measure the impact of a tool are also important considerations. Measuring the impact of the tool is an important aspect of ensuring its effectiveness and the most appropriate way to track the impact should be in line with the overarching objective of the project.

In addition, EIOPA is aware of the limitations of the proposed awareness tool, acknowledging that there may be extreme cases where properties are deemed uninsurable due to exceptionally high risk levels, or unforeseen events that cannot be anticipated or mitigated. Additionally, the tool may not be able to account for all potential risks, as the complexity and unpredictability of natural and climate-related hazards can sometimes lead to unexpected consequences.

It is essential to acknowledge that the proposed awareness tool will not be a *panacea* for the complex challenges posed by natural and climate-related hazards. While it has the potential to significantly improve the awareness and understanding of these risks among citizens, it is crucial to recognise that its impact will be limited by various factors, including the willingness of individuals to take action and the effectiveness of risk prevention measures. Therefore, it is vital that stakeholders, including governments, (re)insurers, and individuals, continue to work together to mitigate and adapt to these risks, using a combination of strategies that include risk assessment, prevention, and transfer. By doing so, the tool can be a valuable component of a broader effort to build resilience and reduce the vulnerability of European communities to natural and climate-related hazards. Nevertheless, despite these limitations, the tool has the potential to significantly improve the situation for many European citizens, providing them with valuable information and insights to make informed decisions about their properties and insurance coverage. By raising awareness about natural hazard risks and promoting risk prevention measures, the tool can help reduce the vulnerability of communities to these events, even if it cannot eliminate all risks entirely. Furthermore, by encouraging a culture of risk awareness and resilience, the tool can contribute to a more proactive and adaptive approach to managing natural and climate-related hazards, ultimately leading to better outcomes for individuals, communities, and the insurance industry as a whole.

([2]) Wherever the word "house" is used in this report, the reader can read this in a broad context covering all buildings and constructions. Where the term "house insurance" is mentioned, it should be read as all insurance policies relevant for the house/building/infrastructure.

2. INTRODUCTION

CLIMATE CHANGE AND NATURAL HAZARDS

Picture of the Valencia floods, October 2024

Rising temperature levels due to climate change lead to more intense and frequent natural hazards such as floods or storms in Europe, making citizens and particularly owners of private and commercial properties (and future property owners) increasingly exposed to natural hazard damages. Citizens will likely face higher premium levels over time due to climate change, or will otherwise have to bear increasing costs related to potential damages on their own. In 2023 the German Insurance Association (GDV) has published a press release stating that property insurance premiums might double in the next ten years due to climate related increase in claims costs ([3]). Additionally, property insurance coverage may even become unavailable in certain regions due to high exposure to natural hazards and subsequent exclusions by insurers, pushing the need for intervention measures such as raising risk awareness and developing innovative insurance solutions as to foster the adaptation of the society to climate change.

THE IMPORTANCE OF RAISING RISK AWARENESS

EIOPA's work has demonstrated that raising the awareness among citizens about natural hazards and climate risk is crucial, as it can increase insurance uptake and help closing the NatCat protection gap. Moreover, or helps foster a proactive approach towards risk prevention, which is key to keep property insurance with coverage against natural catastrophes affordable and available in Europe. The EU Commission Eurobarometer survey looked into the levels of disaster risk awareness and preparedness of the EU population. It shows that almost two-thirds of citizens (65%) believe they need more information to prepare for disasters and emergencies ([4]).

In this context, raising awareness is not only about increasing the public perception about the probability of occurrence of a natural hazard, but also about increasing the knowledge about what can consumers do to after having accessed to those information, such as taking out insurance or implementing prevention measures. In fact, EIOPA's Staff paper on measures to address demand-side aspects of the NatCat protection gap ([5]) identifies that the third most reported reason by uninsured participants for not being covered was the lack of awareness of the existence of NatCat coverage. In addition, EIOPA's 2023 Eurobarometer survey found that almost one in five consumers are uncertain about the exact insurance coverage that may apply to their house in case of natural catastrophes ([6]).

CURRENT STATE OF RISK AWARENESS TOOLS IN EUROPE

In Europe, there are already several private and public tools on raising awareness, sometimes even multiple

([3]) Klimaschäden könnten zu Verdoppelung der Prämien in der Wohngebäudeversicherung führen (Climate damage could lead to a doubling of home insurance premiums)

([4]) New EU Eurobarometer on disaster awareness and preparedness of EU citizens | UCP Knowledge Network

([5]) EIOPA research sheds light on why households and businesses are reluctant to take out NatCat insurance - EIOPA

([6]) Flash Eurobarometer 2023 - Consumer trends in insurance and pension services

tools within a specific country, showing citizens an estimation of their exposure and/or vulnerability to natural hazards. However, these tools typically differ materially regarding the scope of the natural hazards assessed, the level of geographic granularity implemented, the methodologies used to provide risk estimates as well as their user friendliness. In addition, most tools do not provide recommendations in terms of risk prevention against natural hazards, which is however key to strengthening the property owners' resilience against an increasing frequency and intensity of natural catastrophes.

THE NEED FOR A COMPREHENSIVE RISK PREVENTION AND AWARENESS TOOL: PROTECT

The variety of tools in conjunction with the lack of information on risk prevention measures makes it challenging for private and commercial property owners in Europe to take informed decisions on the appropriate level of protection against natural hazards in terms of insurance coverage and risk prevention.

EIOPA considers that raising citizens' awareness on their risk exposures against natural hazards and providing proposals for suitable prevention measures could be decisive in closing the insurance protection gap for natural catastrophes in the EU and in fostering society's adaptation to climate change. It therefore introduces PROTECT, a risk prevention and awareness tool which is further outlined and discussed in this paper.

EIOPA proposes that the tool contains risk information on potential hazards covering all EU Member states, to help citizens better grasp their level of risk exposure and to describe preventive measures which could support them in reducing potential future losses and to increase their resilience. The objective would also be to allow all EU citizens to have similar access to such information (which is not achieved given current fragmentation of existing information through a myriad of tools).

THE ROLE OF BEHAVIOURAL SCIENCE IN RISK PREVENTION AND AWARENESS

The development of this paper has also been informed through the understanding of behavioural science and consumer behaviour, through so-called behavioural nudges ([7]), suggestions or cues people's behaviour can be influenced, in a predictable way, without limiting their freedom of choice ([8]). They are important because they can help people make better decisions, such as taking steps to mitigate natural catastrophe risks, by tapping into social norms, triggering self-responsibility, and making risks feel personal. By using behavioural nudges, it is possible to encourage people to take action to protect themselves and their properties from different natural hazards relevant for their location.

Effective behavioural nudges can be designed using various techniques, including broad bracketing of time, framing risks and costs, and tailored or personalised messaging, to name a few. For example, a behavioural nudge might involve highlighting the risks and costs of not taking action, such as the potential financial losses or damage to property, in a way that is clear and easy to understand. Additionally, behavioural nudges can be used to make risks feel more immediate and personal, for example by providing information about the specific risks faced by an individual or community, rather than just presenting general information about natural hazards and their risks. By incorporating behavioural nudges into risk communication strategies, it is possible to increase the likelihood that people will take proactive steps to reduce their vulnerability, and to promote a culture of resilience and preparedness.

In this paper, a variety of behavioural nudges are explored to assess the relevance as well as the effectives of certain features in risk prevention and awareness tools, namely:

- Addressing biases: framing risks and costs to know how they can be overcome;
- Nudging: triggering self-responsibility or making risks feel personal;
- Information provision: providing realistic, trustworthy and actionable information
- Tool structure: use of visuals and accessibility of a tool.

LAYERS OF INFORMATION IN THE PROPOSED TOOL

The risk prevention and awareness tool PROTECT envisages that it will capture specific layers of information as depicted below:

(I). the property owner's level of risk exposure to various natural hazards based on their area of residence;

(II). available risk prevention measures which describe the most common hazard-related prevention measures per type of peril (before/during/after the event);

(III). measures related to insurance coverage, providing information on the importance of being aware of exclusions, on potential national insurance schemes in place for natural catastrophes, etc.

(IV). and finally to raise awareness about risk-based benefits of prevention measures: provide information that such measures can be reflected in the risk-based premium.

These layers of information provided should be presented in a user friendly way and will be based on transparent methodologies and data to build trust and credibility.

To conclude, by understanding the potential impacts of climate change on their properties, policyholders are more likely to adopt measures that reduce their vulnerability to extreme weather events and other climate-related hazards. This not only reduces potential damages and financial losses but also contributes to the long-term resilience of the society against climate change. Furthermore, educated citizens can make informed decisions about their insurance needs, leading to more appropriate insurance coverage. In this regard, raising the awareness of citizens about their exposure to natural hazards and potential prevention measures will effectively help to reduce the insurance protection gap for natural catastrophes in the EU.

([7]) Thaler, R. H. (1985). Mental accounting and consumer choice. Marketing Science, 4(3), 199-214. doi: 10.1287/mksc.4.3.199

([8]) Thaler, R. H., & Sunstein, C. R. (2008). Nudge: Improving decisions about health, wealth, and happiness. Penguin Book

Reading guide

- Section 3 of this paper ("Overview of existing tools") analyses existing tools.
- Section 4 "Proposal for a risk and prevention awareness tool" sets out how such a risk and prevention tool could look like.
- Section 5 analyses the "Risk score".
- Section 6 ("Prevention measures") presents the prevention recommendations the tool could provide.
- Section 7 ("Impact of prevention measures view") discusses how to raise awareness on the impact of possible prevention measures on insurance premiums.
- Section 8 presents ways for "Raising awareness in the purchasing process, taking actions and measuring the impact".
- Finally, section 9 presents potential next steps.
- This paper was written in close collaboration with the EU National Competent Authorities (NCAs) and EIOPA's Technical Expert Network on Catastrophe Risks ([9]). In addition, this study has been complemented with a behavioural analysis ([10]). Further details regarding the study can be found in "Annex I – Behavioural analysis supporting this paper".
- EIOPA has considered the feedbacks received during the public consultation in this final version of the paper.

([9]) See Annex II - Organisations which are members of the technical expert network on catastrophe risks.

([10]) Analysis was performed by Verian - Germany

Request for Service EIOPA/2024/07 under Framework Contract CHAFEA/2019/CP/01 Provision of Behavioural Studies – Third Wave to provide services for Behavioural Research.

3. OVERVIEW OF EXISTING TOOLS

A number of tools have been developed to raise awareness on the impact of natural hazards, which have different national scopes, target audience, perils covered, messages... EIOPA analysed existing tools as a starting point to take stock of what already is out there and to inform the development of a proposal that can address the shortcomings identified. From the analysis of the existing tools in this chapter, PROTECT, a risk prevention and awareness tool to raise awareness on risks and prevention measures, will be discussed in the next chapters.

EXISTING RISK COMMUNICATION TOOLS AND IMPORTANT DESIGN VARIABLES

The policy context around the insurance protection gap related to natural catastrophes ([11]), ([12]) has given governmental bodies many avenues to address these issues, including raising awareness through risk communication tools. As mentioned, risk awareness is a pre-condition for individuals to take action to mitigate against potential damage caused by natural hazards, with low perception of risk being the main reason for inaction ([13]). It is therefore important to find ways to raise overall levels of individual risk awareness and thereby increase action taken to reduce the impact of natural hazards.

Studies have previously found that risk communication tools and strategies can increase individuals' risk awareness levels and their propensity to take action to mitigate NatCat damages ([14]). However, there is disagreement as to which features and attributes of these risk communication measures will prove the most successful. A study by Maidl and Buchecker indicated that risk prevention and awareness tools were more effective if respondents trusted the public authorities issuing these materials and if they liked the risk awareness product that they were presented with ([15]). Meanwhile, Haer et al. found that people-centred risk awareness campaigns yielded more positive results, with tailored information making individuals more likely to take protective action ([16]). Other studies have found that the promotion of risk prevention and awareness tools may be key to improve outcomes, with research from Kjellgren suggesting that public authorities producing these tools lack resources and are reluctant to worry residents, meaning that information is not spread effectively ([17]).

The broad range in scientific opinion as to what makes a good risk prevention and awareness tool is mirrored in the market, where a large number of varied tools exist. To gain an understanding of the different risk prevention and awareness tools on the market, this study includes the mapping of such tools (see Annex III: Description of mapped attributes of existing tools). This exercise has revealed a multitude of attributes included in these tools and a wide range in the scope covered. From this diverse range of tools, an initial typology of attributes can be identified, with six key impact criteria, where the tools differ (Figure 1).

([11]) EIOPA, ECB (2023). EIOPA and ECB call for increased uptake of climate catastrophe insurance - EIOPA

([12]) EIOPA, ECB (2024). EIOPA and ECB joint paper: Towards a European system for natural catastrophe risk management - EIOPA

([13]) EIOPA (2024). Measures to Address Demand Side Aspects of the NatCat Protection Gap – Staff Paper.

([14]) E.g. Joint Research Centre (2020). Science for Disaster Risk Management 2020: acting today, protecting tomorrow. European Commission (2021). Overview of natural and man-made disaster risks the European Union may face. World Health Organization (2021). Effective risk communication for environment and health: A strategic report on recent trends, theories and concepts.

([15]) Maidl and Buchecker (2015). Raising risk preparedness by flood risk communication.

([16]) Haer et al. (2016). The effectiveness of flood risk communication strategies and the influence of social networks – Insights from an agent-based model.

([17]) Kjellgren (2013). Exploring local risk managers' use of flood hazard maps for risk communication purposes in Baden Württemberg.

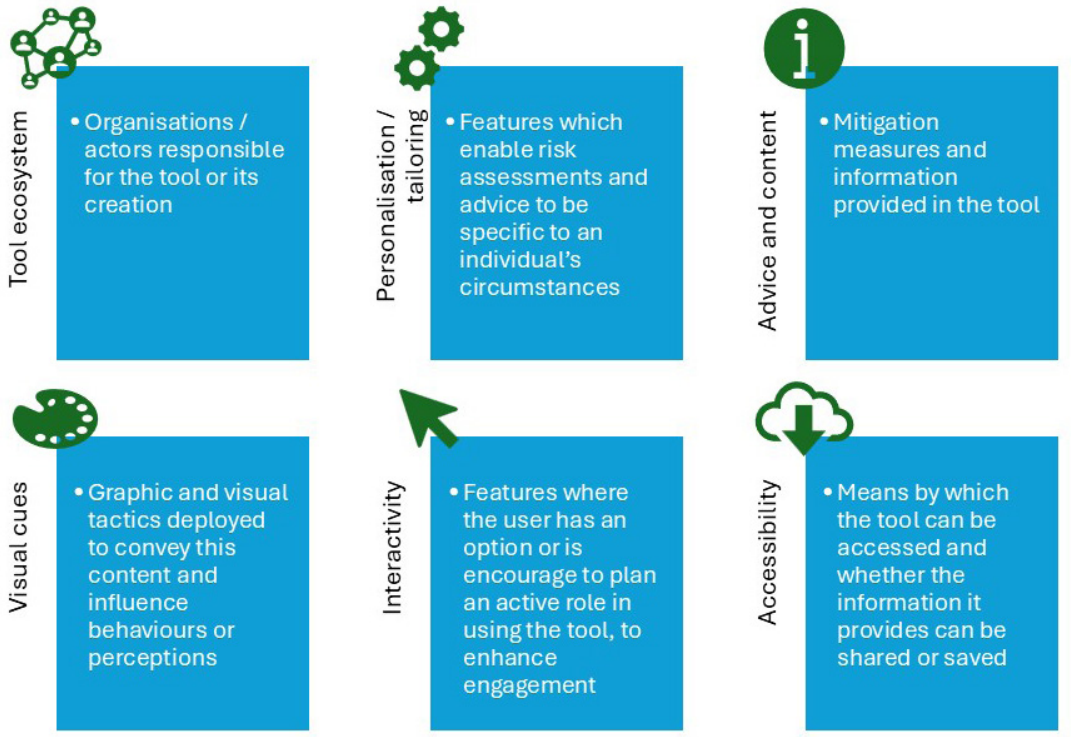


Figure 1: Six main areas of attributes describing tools to increase awareness.

Source: EIOPA redrawn from Verian 2025.

The first area where there is considerable variety is in the tool ecosystem, or with the actors and organisations associated with the tool and its creation. The owners, developers, and creators of these tools are important in determining the objectives of the product and shaping its design. The actors associated with the tool can also have an impact on how effective it is. Many of the existing tools are produced by public authorities to communicate local risk levels to their citizens. As all EU Member States have to prepare detailed flood hazard and risk maps, most of them have an interactive website/tool to present the maps ([18]). For example, the Austrian and Irish governments have produced risk awareness tools for flood-levels, with the Irish National Flood Map ([19]) and the Austrian Natural Hazard Overview and Risk Assessment ([20]) allowing users to search for their address on a map to find more information about local flood risk.

Other tools are produced by academics and think tanks. These groups often produce more technical products, like the satellite data-based land subsidence map Bodemdalingskaart 2.0 available for Belgium, Luxembourg and the Netherlands ([21]). These tools may be trickier to search but they often offer detailed geographical data, useful for researchers and for scientific purposes. Alternatively, some civil society groups may produce more accessible tools, designed to help civilians prepare for emergencies and aid their survival. The Polish website Gotowi.org represents this kind of user-friendly and accessible tool, raising citizens risk awareness levels and advising them on how to make a plan in case of a disaster ([22]).

Some tools are created by the insurance industry, with e.g. providers like Zurich Insurance and Generali producing their own tools, alongside associations of insurers like the German Insurance Association and delete the brackets from (GDV) the General Insurance Association of Japan. These tools include information about potential insurance cover available as well as other mitigation measures indi-

([18]) An overview of the flood hazard and risk maps, as well as the flood risk management plans for each country can be found via the Flood Risk Areas Viewer.

([19]) Irish Office of Public Works "Flood Maps".

([20]) Austrian Ministry for Agriculture, Forestry, Regions and Water Management "Natural Hazard Overview and Risk Assessment Austria".

([21]) Netherlands Centre for Geodesy and Geo-Informatics and SkyGeo "Bodemdalingskaart 2.0".

([22]) Gotowi.org "Get Ready".

viduals can take to protect their property from damage. The variety of actors designing, developing, and hosting tools means that diverse products are created, with different attributes to fulfil specific objectives.

The second area where tools differ, is in the level of personalisation and tailoring offered in their risk assessments. Existing tools vary in how much they personalise their risk calculations and the recommendation given. Most tools offer some degree of geographic personalisation, with this varying from country-specific risk assessments to regional recommendation, or even information on the situation at a specific address. Some tools ask for even more information to provide recommendation tailored to the end-user. The US National Flood Insurance Program offers a tool which allows users to personalise the recommendation they receive based on the foundation-type of their building, the height of their first floor and the placement of any valuable items like machinery and equipment (Figure 2) ([23]). The tool offered by Zurich Insurance goes into even greater detail by adding questions about modifications users may have made to their property and about particularly vulnerable features such as ventilation shafts and skylights ([24]). While research suggests that personalised and people-centric communication can lead to greater risk awareness levels, the range in tailoring offered by these tools suggests that there are costs as well as benefits attached to gathering this detail, both for the end-user and for the actors in the tool ecosystem.

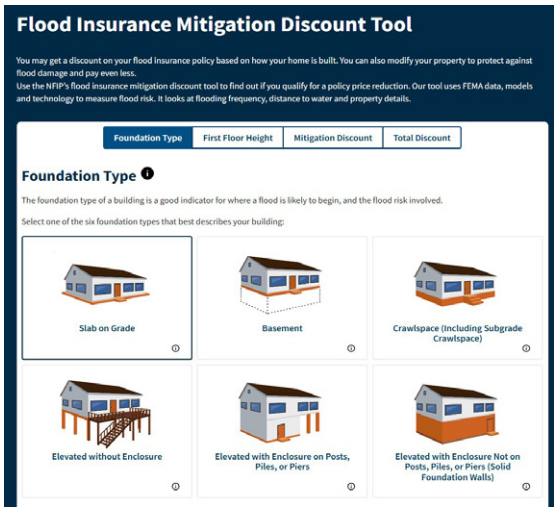


Figure 2: FEMA personalised risk awareness tool ([25]).

The third area where tools vary, is the recommendation and content included. Not only do tools differ in the number and type of peril covered, but also in whether and what type of recommendation they offer. Some choose to focus on one specific peril, with tools like flood maps lending themselves to clearly displaying localised risk for one hazard, like high water levels. Other tools include more perils, providing a broader overview of the risk levels for each hazard. Multiple perils are challenging to display on maps and are therefore usually listed or presented in a graphic form, such as in the tool provided by the Belgian Crisis Center, covering NatCat events like drought and flooding as well as other dangers such as invasive exotic species and risks from outer space ([26]).

As well as varying in the perils covered, tools offer different recommendations. Some tools offer suggestions on how to prepare ahead of a crisis, while others give guidance for what to do during a catastrophe, or information on how to stay safe after such an event. Recommendation on mitigation measures is also broad, ranging from information about insurance and premiums to practical recommendation on who to contact if you wish to modify your property to ensure greater protection. The variation in recommendation is linked to the range of actors behind these tools. Through this recommendation, tool owners and developers may reveal some of their objectives behind creating the tool, as insurance companies frequently include information about potential additional coverage, while public authorities, academics, and civil society organisations tend to give more general guidance.

The fourth area where tools differ is in the visual cues they use when displaying information. Design principles suggest that humans have instinctive responses to certain visual cues and research found that using different displays in risk awareness tools can alter the end-user's perception of danger ([27]). Maps are a popular way to depict risk zones, along with graphics and colour scales. Red is frequently used to indicate higher risk exposure levels, despite limitations for colourblind end-users. Numeric scales are also used to indicate risk, as well as images of damaged property through graphics or photo-real pictures. The range of options in displaying risk has implications for engaging users with the tool as well as with altering their risk awareness levels and incentivising mitigation action.

([23]) FEMA National Flood Insurance Program "Flood Insurance Mitigation Discount tool".

([24]) Zurich Insurance "Zurich prevention of natural hazards".

([25]) Source: FEMA National Flood Insurance Program "Flood Insurance Mitigation Discount tool".

([26]) Crisis Center Belgium "Natural Risks".

([27]) Dallo et al. (2024). Designing understandable, action-oriented, and well-perceived earthquake risk maps – The Swiss case study.

Similarly, interactive features in tools may help engage users and project messages about risk awareness levels. Some tools are highly innovative with their interactive features, such as the tool from the General Insurance Association of Japan which allows the user to engage in a virtual reality experience, viewing the inside of a high-rise flat at the moment an earthquake strikes ([28]). Similarly, a tool from Koguakin University is designed for mobile phone users and encourages them shake their phone to simulate an earthquake, before showing the damage caused ([29]). There is a broad spectrum of interactivity, with click-through quizzes and navigable maps proving to be popular features. Some tools, however, are also completely static, displaying information on fixed pages. Interactivity can force a user to engage with the tool and the information communicated, but it is unclear if these attributes ultimately alter risk awareness levels or incentivise users to take steps to reduce the potential damage caused by natural hazards.

Finally, tools differ in their accessibility, as they are available in different forms and provide different options to share or save information. Some have limited options to share or save the risk assessment or mitigation recommendation offered, but many more allow the user to print, save, or email their risk analysis and therefore revisit their results. Most tools are also available online, although some have an interface well-suited to mobile devices, and a few tools also have their own app. This is often in conjunction with a more technical programme which requires a fee-based subscription. This variation again represents an attribute where it is unclear as to how it contributes to heightened risk awareness levels and increased propensity to take preventative action.

MAPPING OF EXISTING TOOLS

In total, 77 existing tools from all over the world have been identified and mapped, using a bottom-up categorisation approach, with researchers opening and exploring existing tools and identifying key attributes within them that potentially impact end-users' experiences ([30]). This exercise collected data on a total of 48 variables (or attributes), structured in 2 levels, for each of the mapped tools. The data are structured to allow filtering and searching for examples with certain attributes. The list is created as part of the behavioural analysis supporting this activity and additional examples provided during the public consultation are added. The link to the overview and the structure of the attributes can be found in Annex III: Description of mapped attributes of existing tools.

Despite the number of tools available, there are relatively few which overlap in the market, with most offering risk assessments for specific regions, perils, as well as offering different kinds of analysis and recommendation. This variation means that each tool brings something unique to the table and potentially offers insight into the different outcomes that can be achieved through these risk communication devices. The diverse market of existing tools therefore represents an important resource in identifying best-practices in raising risk awareness and prevention, and to help shape the design of any future tools.

The tools mapped span many nations or regions (with a focus on Europe but also from areas elsewhere), and each tool covers at least one of the ten perils in scope (flood, storms, earthquakes, droughts, forest fires, heat waves, cold waves, frost, hail, tsunami), except for one tool which gives generic information to reduce the impact from natural hazards. The analysis of the mapping results suggests certain trends and common features in available tools. Some key trends and findings are included below:

- Actors from the public sector are most often behind creation of the tools, although tools were also identified from research institutes and private sector companies;
- The majority of tools involve interactive features, using click-through quizzes or interactive maps;
- When mitigation recommendation was included, it frequently directed users to insurance cover or to modify their property;
- There is considerable variation in how risk scores and levels are presented;
- Mitigation recommendation tends to take the form of text or hyperlinks to (external) sources.

Looking at the tool ecosystem (Figure 3), the mapping reveals that these kinds of risk awareness products are predominantly created by public sector actors. Research organisations and non-profits as well as the private sector make up a smaller proportion of creators and developers of these tools.

([28]) General Insurance Association of Japan (2024). "Japanese Earthquake VR".

([29]) Koguakin University (2024). "Earthquake Insurance Japan".

([30]) The overview does not claim to be complete or exhaustive. While global tools and tools focussing on countries outside Europe are included in the tool, the majority are from EU Member States.

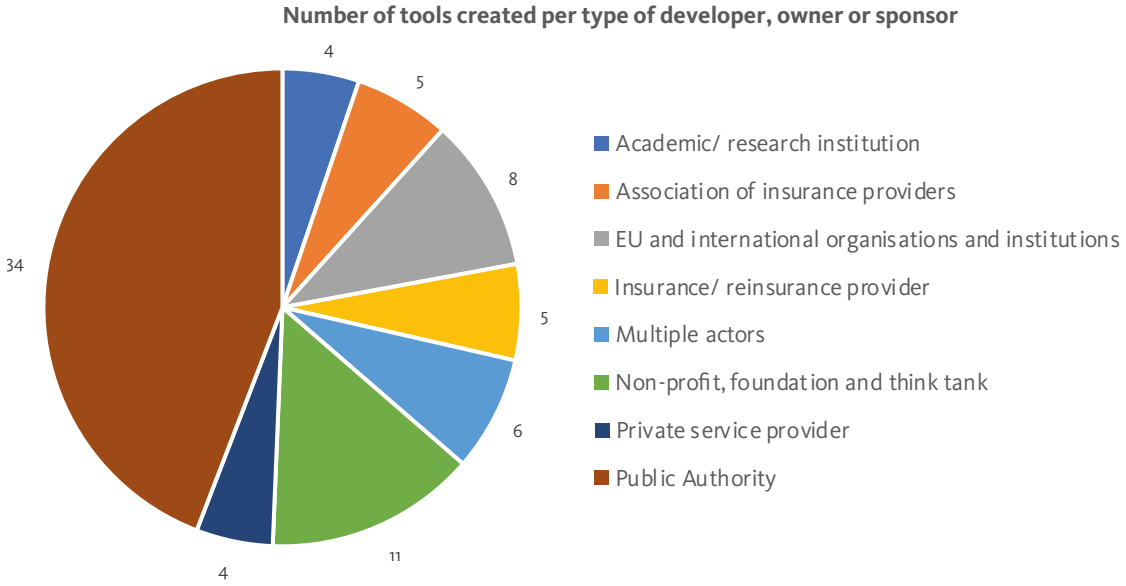


Figure 3: Number of tools created per type of developer, owner or sponsor.

The tools include different levels of personalisation to the individual user. They cover specific geographies, with 59 of the tools focussing on one specific region, 50 of them on a single country and the other nine on a specific sub-region within a country. Eleven tools have a global scope, with these built by a mix of international organisations and large actors from the insurance industry who have created paid-for tools to identify risk. Three tools cover all Member States and the remaining four tools have a scope of multiple countries (without covering the whole EU, neither having a global scope).

Other personalisation features vary considerably. Tools use different degrees of personalisation to calculate a risk score, including the location, modifications already made to a property, river proximity and the height of any foundations or the level of a flat in an apartment block. Most common, was the inclusion of location to calculate a personalised risk score, although the precision of this varied widely. Some tools only use a region or state, while other ones allow a precise address.

There is also considerable variety within the market as to what content and recommendation is included in a tool. The type and number of perils covered varies as well. Many tools focussed on one specific peril, with 33 out of the 77 mapped tools having a singular focus. Among tools covering a range of perils only 3 tools cover 7 perils or more.

Number of perils	Number of tools
0	1
1	33
2	7
3	12
4	8
5	8
6	5
7	2
9	1

Table 1: Number of tools and number of perils.

The tools also focussed on different perils, including both those covered within the scope of this assignment and other perils not included, such as radon, ground swelling and cyberattacks. A particularly large number of the tools reported on flood perils (Figure 4), with 46 tools calculating risk for this peril. This could be due to flood data being more easily available, with risks to a particular property being closely related to its location, or it could be due to interest in flood risk levels, on account of numerous recent and severe flood cases. Flooding is the only peril having specific EU legislation about the regularly reoccurring mapping of flood hazard and risk as well as the flood risk management plans as well as rules about making the results known to the general public ([31]).

([31]) Directive 2007/60/EC, *OJ L 288, 6.11.2007, p. 27–34.*

There is also considerable variation in whether tools offer recommendation on how to mitigate the impact and damage caused by natural disasters. 42 tools do not include any recommendation on these kinds of mitigation measures. Where recommendation is offered, resilience measures, in particular property modifications, are most frequently included as recommended mitigation measures. Aside from property modifications, insurance cover was frequently recommended, along with emergency guidance to keep people safe during the catastrophe (Figure 5). Some tools also recommended moving house to a less risky area, however this drastic mitigation measure was a rare recommendation.

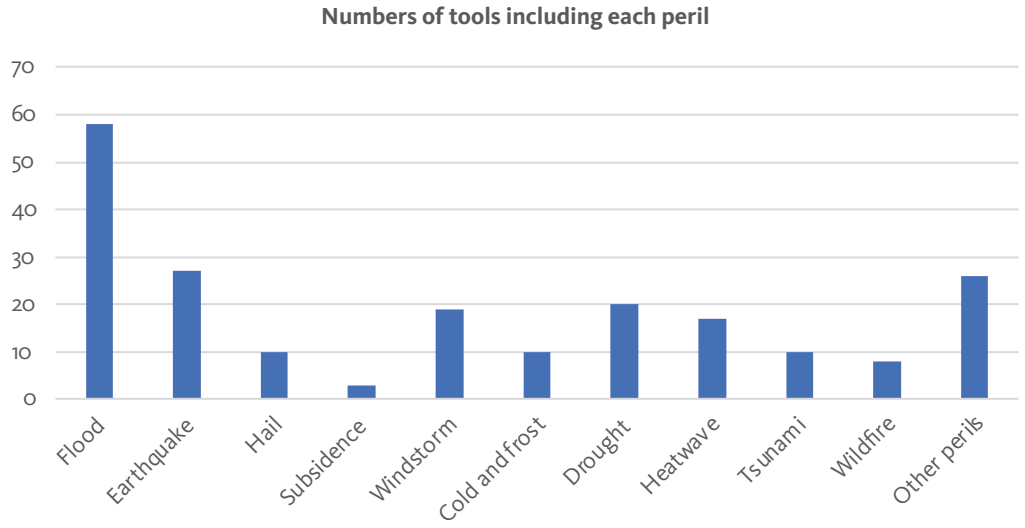


Figure 4: Numbers of tools including each peril ([32]).

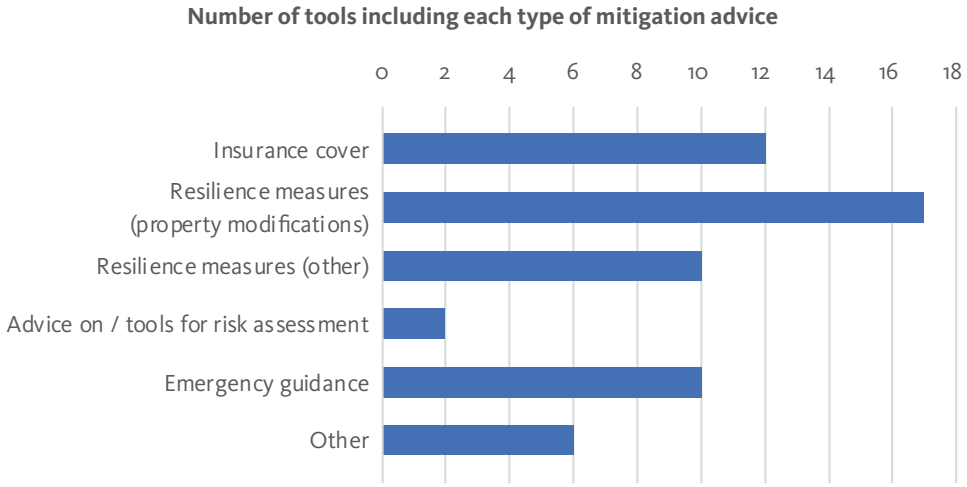


Figure 5: Number of tools including each type of mitigation advice ([33]).

([32]) Note: the sum is larger than 77 as several tools focus on more than one peril.

([33]) Note: the total is different from 77 as several tools do not give advice while others give different types of advice.

The presentational aspects are also important, with visual cues able to prompt different behaviours. After answering questions, inputting their address, or choosing a location on a map, users were often presented with a calculation of their risk level. The format of this presentation is likely to affect users' reactions to change and their perception of their risk level. However, the mapping revealed that there is a degree of consistency in how risk is displayed. A colour scale to denote risk level is most frequently present in the tools, with 45 tools using this approach, although the exact colours chosen to indicate higher and lower risk levels changed depending on the tool. Numeric scales and risk or hazard symbols were also popular. There was more consistency in how mitigation measures were presented. Visual cues were less frequently deployed, with mitigation measures frequently presented through text (22 from the 42 tools suggesting measures, Figure 6). Where images were used, illustrations and graphics were deployed rather than photos, suggesting that tool creators do not try to trigger the same emotions and behavioural reactions when informing the user about potential mitigation measures. Instead, material is frequently presented in a factual and text-based format, with links to further information or suppliers of modification material also proving popular in existing tools.

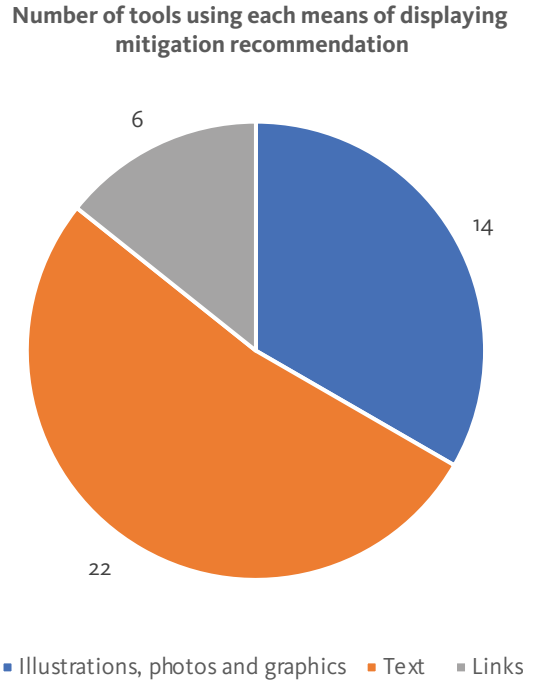


Figure 6: Number of tools using each means of displaying mitigation recommendation.

Over 70 percent of the mapped tools use an interactive interface (Figure 7). This included click-through quizzes and moveable maps where the user could add their own personal details. Static tools were visibly less popular, with webpages and PDFs offering information rather than the option to personalise responses for the user.

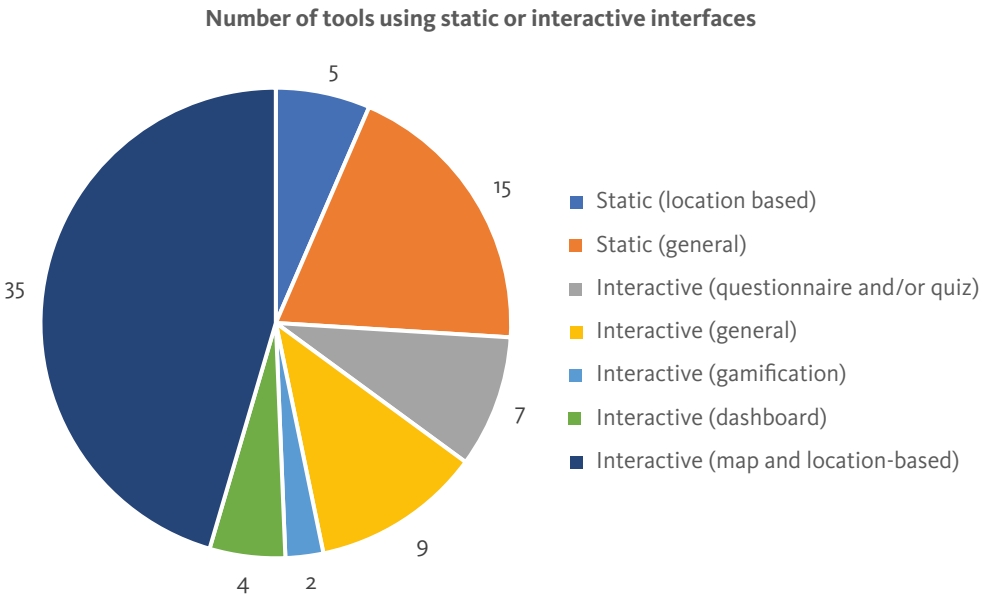


Figure 7: Number of tools using static or interactive interfaces.

Finally, the accessibility of the tools varied considerably. Most tools appeared as webpages, with just eleven available in more complex and paid formats like computer programmes. Five were also available via an App or used webpages that were clearly designed and oriented for mobile users. 38 tools did not offer any option to download, save, or print risk calculations or advice. However, as some tools provided information rather than a highly personalised risk calculation, this result is unsurprising. Most tools offered some means to save the analysis, e.g. in a PDF format, downloading the analysis, the entire dataset, or maps with risk zones highlighted.

KEY FINDINGS

The tool mapping reveals certain trends in the market and common points across the tools. A good understanding of the features present in other tools is important in designing new ones. This is because intuitiveness of the tools is of paramount importance for its potential impact and mirroring solutions well established in other tools solution can improve intuitiveness.

The mapping exercise highlighted common trends amongst NatCat risk awareness tools and norms surrounding their design. Firstly, the idea that tools should be tailored to individual situations and that they should be relatable to the user was reflected in the mapping. Findings suggested that relatable and localised risk awareness content could prove more persuasive for the end user, encouraging behavioural change. In line with this, the findings point to most tools opting for a limited geographic scope and relatively few perils. This means that the content included in the tool is likely to be more relevant to specific users, highlighting the perils they have searched for or which are more likely to impact their region and showing their local area. Location was the most popular means for tools to tailor their risk assessment, with several of the mapped tools asking users for or allowing them to provide some degree of information on their property's location.

Similarly, the use of intuitive and widespread colour scales, with users expecting colours to indicate whether something was good or bad is of importance. These expectations around colour usage were reflected in the widespread use of colour scales across the tools. However, it must be noted that while colour scales were common features, they often appeared alongside a variety of other attributes. This can imply an attempt to cater for diversity of presentation formats, echoing findings from the literature review which suggested this diverse presentation styles could be needed to spur a heterogenous population of users into action.

The mapping also revealed that it was rare for tools to include information on how property modifications could lead to lower insurance premiums. This aspect appears very difficult in tools not managed by the representatives of the insurance sector but even in the case of tools designed by insurers, there are likely important challenges in providing such information.

Most of the analysed tools have a specific target audience in mind and more clarity with the target appears to be associated with design features with higher chances of attracting and engaging users. This would appear consistent with the lessons stemming from the literature on tailoring messages and relatability. Related to this, more detailed localisation, and personalisation can help tailoring the messages.

Several of the analysed tools used attractive and compelling visual means with a potential for engaging users. The tools that were developed more recently typically had an opportunity to incorporate formats and styles that may be better suited for users accustomed to the formats available in on-line communication (on websites and in apps), possibly also tailored to formats and styles popular in specific countries. An example includes game-like features in an interactive Japanese tool from Earthquake Insurance Japan.

When behavioural nudges referring to local community experience are included in the tools, these appear to be potentially powerful. Examples include presentation of statistics on local losses in the German GDV Flood Check tool or Belgian Assuralia Monitor on climate losses, or testimonials from representatives of local communities affected by bushfires included in the Australian Resilience Ratings tool.

Inclusion of mitigation advice and provision of practicable solutions and actions is generally not very common in the whole population of existing tools. Still, the examples from some of the case studies show the potential of such information if it is well designed and adapted to the needs and capacities of target users. Examples of tools providing mitigation advice include Home Disaster Guides, Generali's tool, Earthquake Insurance Japan tool and the Australian Resilience Ratings.

The current reach of the analysed tools for which meaningful data was available appears to be limited with a relatively low number of users. There have been no evidence of any of the tools gaining a wide popularity. This may

suggest that reflection on the groups that could be targeted by advertising and timing of such actions (e.g. at specific points in the home purchase or rental processes).

Finally, there appears to be limited practical experience with testing the effectiveness of specific tools, possibly beyond their design stage (e.g. some 1200 households were involved in the trials and co-designing the Bushfire Resilience Home Assessment app in Australia in 2024). In most cases the tool owners are not tracking who their users are and do not know to what extent they take any action as a result of interactions.

However, the US government's agency for emergency management has provided some insights on how they conduct testing with citizens once the tool is ready and before it goes live ([34]). FEMA has a moderator guide through which the interviewer walks the user through the tool during a videoconference call. FEMA observes the users going through the tool, also using heatmapping, noting where users tend to click, hover their mouse over, etc. For specific tools/elements, FEMA also does A/B testing, where the user gets to see two versions and choose which version they prefer, later taking aggregate preferences (gathering preferred elements of both versions) to build the final version of the tool. While users are navigating through the tool, the moderator asks them to think out loud and to justify all their actions (e.g. "I am clicking here because I am trying to understand X."). Users are also asked to read everything they see out loud so that FEMA can understand areas where there is too much text, where it is difficult to understand or where it takes the user too long to go through the information. After the testing call, FEMA sends a follow-up survey to the interviewees to explore whether they have learnt about the topic after using the tool and what its impact would be on their actions. After testing the tool with users, FEMA starts a month-long period during which the tool is live and industry experts review it and report back any issues (e.g. incorrect calculations, unclear words, etc.).

All the above mentioned points will be considered for a proposal for a risk and prevention awareness tool (see chapter below). Also reflecting on aspects where existing tools fall short, such as a broad coverage at EU level, highlight risk reduction measures, or the link to the insurance sector.

([34]) Personal communication in the context of the behavioural analysis study

4. PROPOSAL FOR A RISK AND PREVENTION AWARENESS TOOL

SCOPE OF THE RISK AND PREVENTION AWARENESS TOOL

The tool will focus on the NatCat exposure of buildings across the EU and relevant prevention measures. Therefore, the tool will reference to property insurance. The scope of natural hazards will comprise:

- Earthquake
- River flood
- Windstorm
- Wildfire
- Potentially coastal flood

Additional perils such as hail or subsidence which are also considered under Solvency II for example could also be considered by the tool. However, there could be an issue to find sufficient data to derive potential scores. Finally depending on the regions, additional perils such as freeze, avalanche... could be relevant. Here the focus is on main perils which occur in Europe and produce significant damages. The same approach was also observed in the 77 tools analysed for the purpose of this study.

OUTCOME OF THE TOOL

The online tool could produce a summary/check list view which contains main messages such as:

1. **Understand your risk**: view your risk score for the specific location of the property against natural hazards such as earthquakes, floods, windstorms and wildfire

2. **Reduce your risk**: Recommendation of potential prevention measures -> Which different prevention measures could reduce your risk?

3. **Check your insurance contract**: Recommendation for the user to check certain key aspects related to insurance coverage. Does my contract cover the risks? What are the limits and deductibles? Learn more on exclusions...

4. **Discuss with your insurance distributor:** Recommendation to get in touch with your insurance provider to discuss contract conditions and if/how prevention measures could be reflected.

The digital tool design should aim to provide an online choice environment that contains tailored and relevant information aimed at supporting users' decision making in the process of NatCat uptake so their final choice would suit their individual situation and preferences.

DEFINE THE LOCATION TO PERFORM THE ANALYSIS

The first step to run the analysis is to define the location where the analysis should be performed. This could, for example, be useful to better understand the risks of a property as well as related prevention measures.

DISCUSSION ON POSSIBLE METHODOLOGIES

In order to engage users, the tool could ask users to:

OPTION 1: ENTER THE ADDRESS OF THE LOCATION WHERE THE USER WANTS TO ANALYSE THE RISK. THIS ADDRESS WOULD THEN NEED TO BE GEOCODED ([35]).

Pro	Con
› A nice way to engage with user; › Presenting tailored information; › Most precise risk assessment possible (depending on data availability).	› The need to consider any legal consequences (GDPR) if address is entered (need to clarify how the information is stored) ([36]); › Potential Users could be reluctant to enter personal address due to concerns with respect to data security. This behaviour could limit the reachable group of people ([37]) and might not always be needed as long as the user has the option to search for a street or area on a map as well. A trust-based approach can be established with the user to limit barriers to use. › Potential disadvantages due to the uncertainties of geocoding and its accuracy (street, address, building...).

Figure 8: Example on how the user could enter the location of interest ([38])

([35]) Geocoding is the process of translating a physical address into a geographical location typically involving latitude and longitude.

([36]) A solution could be to delete the data after the analysis is performed.

([37]) A solution could be to inform the users that the data will not be stored after the analysis is performed.

([38]) Source: Ensemble Face aux risques : le diagnostic d'exposition de votre domicile aux risques (generali.fr).

OPTION 2: ENTER THE STREET NAME AND POSTAL CODE OF THE LOCATION WHERE THE USER WANT TO ANALYSE THE RISK. THIS WOULD THEN NEED TO BE GEOCODED.

Pro	Con
› No street number is provided, i.e. less data privacy concerns.	› Less personal/engaging than option 1; › Risk exposure less precise as it can vary within a street; › People might provide less engagement as less precise; › Entering less detailed information could compromise the tool's scope, making it either ineffective or imprecise.

OPTION 3: ENTER LESS GRANULAR INFORMATION SUCH AS A POSTAL CODE. THIS WOULD ALSO NEED TO BE GEOCODED FOR THE REST OF THE ANALYSIS.

Pro	Con
› No personal address is provided, i.e. less data privacy concerns.	› Less personal/engaging than option1; › Risk exposure less precise as it can vary within postal code areas, leading to imprecise analysis; › In some countries a postal code may correspond to a single house (e.g. Ireland), it could expose more information than the user is comfortable sharing. In other countries, it might cover larger area with significant variation in risk (e.g. flood risk when there are significant topographic differences); › Entering less detailed information could compromise the tool's scope, making it either ineffective or imprecise.

OPTION 4: THE TOOL WOULD NOT ASK THE USER TO ENTER ANY ADDRESS, BUT THE USER COULD SCROLL ON A MAP TO SEE ITS RISK VIEW.

Pro	Con
› No geocoding is needed, no personal address is provided (data privacy); › Further engagement with the user; › Such an approach would open up the tool for a broader interested parties (for example when a person does not yet own property in a certain area but is willing to buy in the future).	› More time investment is needed from the user; › Might not user-friendly (many don't know how to navigate a map well); › If the risk awareness tool is a European map, it will be difficult for consumers to find their exact location on such a map via zooming/scrolling without search function.

OPTION 5: A COMBINATION OF OPTION 1 AND OPTION 4 WITH THE POSSIBILITY TO GEOLOCATION VIA MOBILE DEVICES AND/OR SELECT LOCATION VIA "DROP PIN" FUNCTION ON AN INTERACTIVE MAP.

Pro	Con
› Allows mapping the risks with the ability to search areas with varying degrees of accuracy, including specific addresses in situations where an address does not yet exist for a specific location; › The tool could use GPS data from the user's mobile device to automatically detect their current location; › Users can place a marker ("pin") on the map to indicate the precise location; › Balance between the resolution of the data, and the accuracy of the location score.	› More time investment is needed from the user and is not user-friendly (many don't know how to navigate a map well); › It is important to ensure that specific addresses are not unnecessarily collected to minimise regulatory risk; › More complicated to search for information when you are not at the location of the property (e.g. when searching for a future property); › If the user chooses to disable the access to GPS data on his mobile, the usability of this tool may be significantly reduced.

OPTION 6: CREATE AN APP WHICH PRODUCES A QR CODE WITH CADASTRAL DATA

Pro	Con
› System present in some Countries; › No GDPR impacts.	› Need of a "world-wide" homogeneous system.

Summary and conclusion

Option 1 is the most appropriate to provide a precise and personalised view of risk exposure. Entering less detailed information could compromise the tool's scope, making it either ineffective or imprecise. However, it is important for the user to have access to the surroundings of the address, in particular to make a comparison in the context of the construction of a new building or the purchase of a property, so that this user can choose a less exposed area. Arguments against entering location data are unconvincing, as using geoportals also requires property data input, which is not a significant issue, especially when the benefits of using the tool are appropriately highlighted. Sharing personal information about exposure carries the risk of de-mutualisation.

Option 2 and Option 3 may not provide valuable information, entering only a postal code may be too general in many cases. Postal codes can cover diverse locations with varying risk levels, leading to imprecise analysis (e.g. on slopes or riverbanks, the risk may depend on individual streets or house numbers, and for windstorms, insurers sometimes determine coverage on a street-by-street basis). In some countries a postal code may correspond to a single house (e.g. Ireland), where it could expose more information than the user is comfortable sharing. In other countries, for example in Poland, Options 2 and 3 may lead to inaccuracies, misleading users, for risks such as flooding, as seen in places where the entire area shares one postal code, yet there can be significant differences in risk.

Option 4 is more precise and minimises the risk of data theft, but it can have issues with user-friendliness. Allowing users to pin their own home on the map would also allow users whose address is not geocoded (for example for new houses – no address available) to use the tool.

An additional consideration proposed is to combine option 1 with option 4 (see option 5) with the possibility to Geolocation via Mobile Devices and/or select location via "Drop Pin" Function on an Interactive Map. Geolocation via Mobile Devices – The tool could use GPS data from the user's mobile device to automatically detect their current location. This would enable users to quickly assess risk exposure for their present position. This view considers that it is the best solution allowing for the mapping of risks with the ability to search areas with varying degrees

of accuracy, including specific addresses. It is important to ensure that specific addresses are not unnecessarily collected to minimise regulatory risk.

Also, option 6 was proposed to create an app which produces a QR code with cadastral data, taking into consideration that the system present in some Countries and there are no GDPR impacts but it would be necessary a "world-wide" homogeneous system.

Some stakeholders raised a question of who should be given access to the risk score (in addition to security concerns and GDPR compliance issues). One stakeholder mentioned that only property owner should have full access to inspection results, while third parties should only receive more general and limited information about the property's condition. If a stakeholder requires more detailed information, it can be provided voluntarily by the property owner. Another stakeholder mentioned that the detail of the assessment should only be available to the property owner, banks/insurance companies that the property owner interacts with, or other actors such as authorities that can justify their need.

The tool should be adapted to the users' purpose. The tool should provide users with an initial risk assessment, without delving into extremely tailored evaluations. Consequently, any attempt to include detailed metrics or quantify premium savings resulting from preventive measures should be avoided, as such analyses require highly specific and detailed information. The objective is to promote effective risk management practices and encourage ordinary users, to gain a better understanding of the risks their properties may be exposed to, and for institutional or professional users, to have access to sufficiently detailed information to identify reasons to take actions or adjust decisions. Users seeking more specific insights should be encouraged to consult their insurance providers and/or obtain appropriate professional advice and guidance from e.g. intermediaries.

Data accuracy and reliability is key. With regard to the choice of data underlying risk estimates, natural catastrophe risk analyses should not rely only on a single provider. A comprehensive risk assessment should be based on data from a broad range of sources, as risk analyses — particularly those with a high level of granularity — are highly dependent on the quality of the information provided by data providers and from the latest update of the model releases. It should be stressed that geocoding is not sufficient to assess NatCat risk.

Trust plays a significant role in the effectiveness of a tool for calculating NatCat risks, as 70% of interviewees in the behavioural analysis study in Germany expressed scepticism about insurance companies, and they would prefer a public authority to create such a tool. This suggests that they trust government institutions more than private companies. The source of the tool was also important to them, with 50% of interviewees preferring an in-person consultation with an expert on NatCat. Furthermore, the reliability and accuracy of the advice provided by the tool are essential, as many interviewees were interested in mitigation advice, but only if it is reliable and accurate. Overall, trust in the source and credibility of the tool is vital for its success and user engagement.

In Greece, according to the same behavioural analysis study, participants tend to trust sources that are perceived as independent and unbiased, such as the state or accredited independent sources. They view these sources as reliable and having clear intentions, whereas insurance companies are met with scepticism due to potential ulterior motives. Civil engineers are also trusted as they are seen as experts in their field with individualised advice, and their motives are not questioned. The credibility of the source is a key factor in the effectiveness of risk messages, risk tools, and prevention messages, with the scientific community and the state being more justified and trustworthy.

5. RISK SCORE

A risk score reflects the level of risk in the presence of some risk factors (e.g. risk of earthquakes, floods etc.). Risk scores are mainly designed to be:

- Simple to calculate: In simple cases, manual computing can be used to calculate a basic score (although some scores use rely on more sophisticated or less transparent calculations that require a computer program).
- Easily interpreted: The result of the calculation is a single number, with a higher score usually means higher risk.

DISCUSSION ON THE TIME HORIZON OF THE RISK ASSESSMENT

When citizens make decisions, historical losses may often be used as a reference point or a benchmark to highlight the prominence and likelihood of certain risks occurring in particular areas of interest. However, risks are changing, using the past might not explain coming events. It might therefore be needed to consider other time horizons.

The tool could provide:

OPTION 1: A SCORE FOR THE CURRENT RISK EXPOSURE. THIS WOULD PROVIDE A VIEW OF TODAY'S RISK.

Pro	Con
Provides a view of the current risk level which is relevant for the user to take immediate action. This option provides reliable and up to date data, making it straightforward and easy to assess for consumers.	Need to perform modelling and get access to data which can be challenging for some perils/regions.

OPTION 2: A SCORE FOR THE FUTURE RISK VIEW. IN LIGHT OF CLIMATE CHANGE, FREQUENCIES AND INTENSITIES OF NATURAL CATASTROPHES ARE CHANGING. IT MIGHT THEREFORE BE NEEDED TO CONSIDER A FORWARD-LOOKING VIEW.

Pro	Con
Since the past is not an ideal predictor of the future as regards climate change, it is important for the user to also better understand how the risk might change.	Adds uncertainties in the estimation due to necessary technical assumptions about the future trajectory of climate change; Future risks facing a property might vary based on climate or nature changes or remediation activities that communities take. It would be risky for the tool to convey the sense that the future is determined; It is important to remember that insurance contracts are typically short-term, most often annual, so information that looks into the future will have informational value (potentially raising awareness) but rather without a real impact on the actions taken by individuals; Moreover, it is heavily dependent on the chosen model, making it more susceptible to errors.

OPTION 3: A VIEW OF HISTORICAL LOSSES (ECONOMIC AND INSURED LOSSES). HISTORICAL DATA PROVIDE A VIEW OF EVENTS WHICH OCCURRED IN THE PAST.

Pro	Con
› It is easy for the user to refer to historical losses as this is something that was mentioned in the media for example; › Seems reasonable to assume that data for this option should be available.	› Historical losses are available only for events which took place but a risk could still exist which would not have materialised in the historical losses (unprecedented events); › Historical losses can give an incomplete vision of the real risk today (inflation, changes in the density of built-up areas); › Historical losses will likely be composed of insured losses. This will leave aside, that for a certain event there will probably also be uninsured losses which were covered by state aid or by the property owner alone; › It seems that if users are to use the tool to make investment decisions on future protection, then it doesn't seem helpful to include historic and perhaps current; › Historical losses could provide a false sense of security (or risk) to users; › This option pose data privacy question as this could entail disclosing information on losses.

Figure 9: Example based on a historical loss perspective ([39])

([39]) Source: Hochwasser-Check fürs Haus: Jetzt Risiko online ermitteln (dieversicherer.de).

OPTION 4: A COMBINATION OF DIFFERENT PERSPECTIVES (PAST, PRESENT, FUTURE).

Pro	Con
› Providing comprehensive information; › The possibilities could be added in different phases of tool introduction (first current view, then future trend and then past events data).	› High technical complexity (risk assessment); › Could lead to confusion for the user, e.g., if level of risk differs materially (or event not at all) across the different time horizons assessed.

OPTION 5: A COMBINATION OF PRESENT AND FUTURE (NOT PAST).

Pro	Con
› Providing comprehensive information; › The current level of risk plus an indication on the trend for future years (upwards, stable, downwards) would be also a reliable way to use actual data.	› High technical complexity (risk assessment); › Could lead to confusion for the user, e.g., if level of risk differs materially (or event not at all) across the different time horizons assessed.

Summary and conclusion

Option 4 is the most accurate but brings a lot of complexity. It is the option that most of the stakeholders prefer. The most pragmatic option is option 1.

An additional consideration proposed is to consider present and future (see option 5). This view considers that it is a good way to use current data and make future predictions.

Option 2 presents the problem of uncertainty in the estimation, which is highly dependent on the model chosen.

Option 3 has the most disadvantages. Historical data is only available for past events, which does not necessarily capture future risks and may give users a false sense of security (or risk).

DISCUSSION ON POSSIBLE METHODOLOGIES TO DERIVE THE SCORES

A score for natural catastrophes is a numerical value that represents the likelihood and potential impact of a natural disaster, such as an earthquake, hurricane, or flood, on a specific location or asset. The score is often expressed as a numerical value, such as a percentile or a categorical rating (e.g., low, moderate, high). Note that scores can vary depending on the specific methodology and data used, and may be influenced by various factors, such as climate change, urbanisation, and infrastructure development.

OPTION 1: A SCORE BASED ON HAZARD INFORMATION ONLY WHERE THE INTENSITY IS NOT CONSIDERED BUT ONLY THE FREQUENCY.

Pro	Con
› Open-source hazard data are available for different perils/countries; › Easy to understand (as shown in Figure 10 and Figure 11); › Allows comparison with other perils; › Seems to be a frequent way to assign a hazard score.	› Does not account for different intensity which also would impact the potential impact; › Provides only a partial view of risk (e.g. an area frequently floodable is not necessary at high risk for flood if the water depth is shallow); › Does not account for specific vulnerabilities of buildings which ultimately will influence the damage on a house; › Frequency can only be useful for more binary perils like flood or wildfire but makes less sense for something like earthquakes where the intensity of hazard is very important.

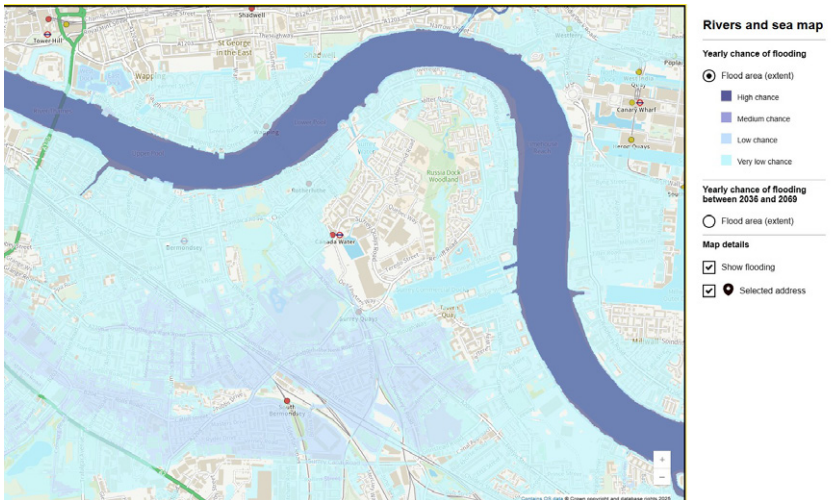


Figure 10: Example of a view on flood risk which uses the frequency to define the score (40).

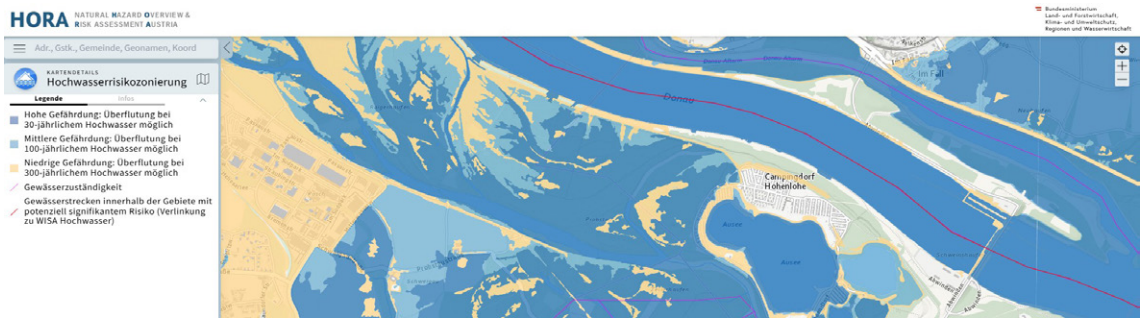


Figure 11: Second example of a view on flood risk which uses the frequency of events to define the score (41).

(40) Source: Where do you want to check? - Check your long term flood risk - GOV.UK (check-long-term-flood-risk.service.gov.uk).

(41) Source: HORA - Natural Hazard Overview & Risk Assessment Austria.

OPTION 2: A SCORE BASED ON HAZARD INFORMATION WHERE THE HAZARD INTENSITY AND FREQUENCY ARE CONSIDERED.

Pro	Con
› Widely used in many tools, especially for floods; › The frequency and intensity of events are key to understanding risk, while additional information about buildings is merely an enhancement; › If the intention of the product is not for any uploading of data by the user, then Option 2 may be the better option.	› Need to choose one specific return period or aggregate them together; › Not straight-forward to assign a score based on intensity; › Challenging to compare with other perils as need to assign score based on intensity; › A subjective view of risk (the level of damage a property experiences depends on characteristics such as line of business, occupancy, number of floors, construction class, etc.).

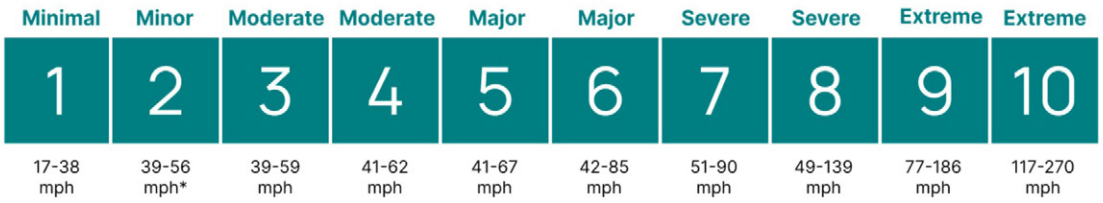


Figure 12: Example of a score for windstorm based on the hazard ([42]).

OPTION 3: A RISK SCORE. FOR NATCAT THE RISK IS DEFINED AS A COMBINATION OF HAZARD, EXPOSURE AND VULNERABILITY ([43]).

Pro	Con
› The offers the full view of risks and accounts for the way houses are built; › Provides information on how to protect and adapt the individual property and assess whether the risk is a problem at all.	› Very difficult to get data for each house on construction type, year built… which would influence the vulnerability; › The data from the Risk Data Hub ([44]) for example do not yet include a view on the building type; › Complex to implement and costly to maintain.

([42]) Source: Wind Factor™ Hurricane Wind Model Methodology | Risk Factor. Based on the wind speeds under a range of likely occurrence intervals or "return periods" for this year and 30 years into the future.

([43]) hazard: what are is the intensity and frequency of the NatCat events? exposure: which objects will be impacted by the NatCat events? vulnerability: if the object are impacted by the NatCat event what will be the damage?

([44]) Risk Data Hub is a pioneering platform form the DG JRC Disaster Risk Management Knowledge Centre (DRMKC Risk Data Hub).

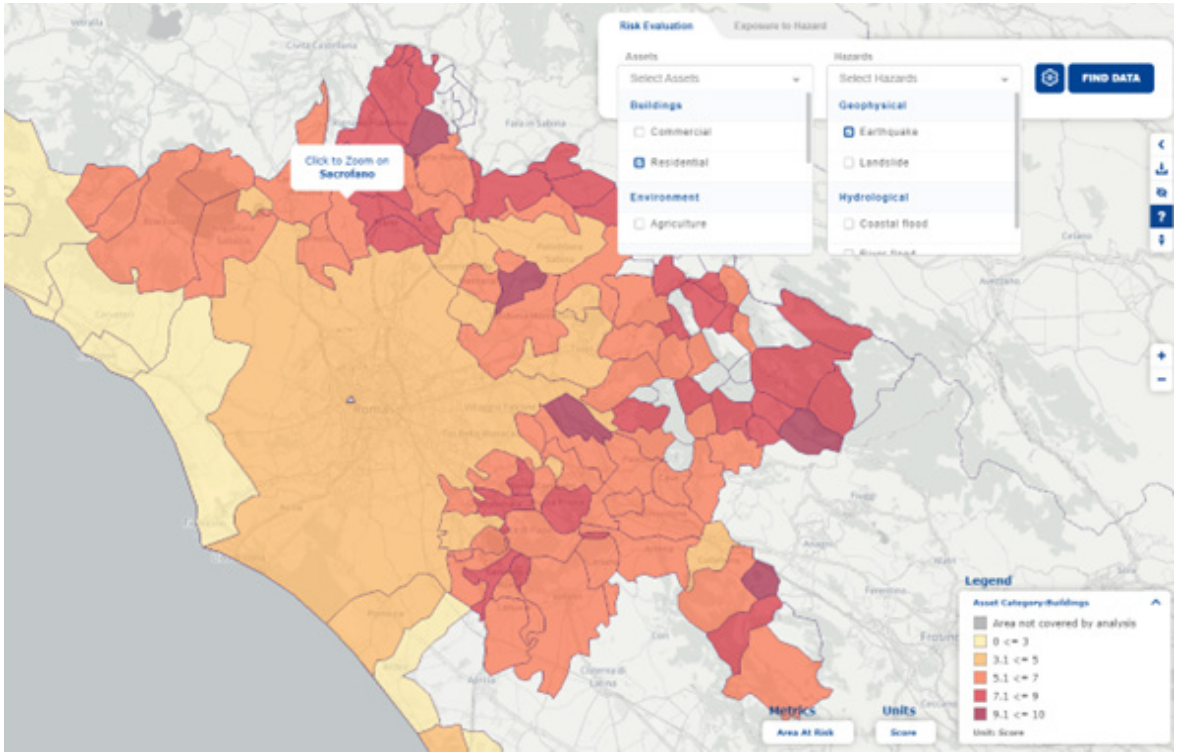


Figure 13: Example from risk scores from the risk data hub (45).

OPTION 4: INTERMEDIATE BETWEEN HAZARD ONLY AND FULL RISK ASSESSMENT

Another intermediate option between hazard only and full risk score (including exposure/vulnerability) could be to have some selectable options. This could be an opportunity for the user to do some *what-if analysis* and help with decision making as well as increase awareness of adaptation options.

Pro	Con
› Opportunity for user interaction and analysis, support to decision making as well as presenting good overview of adaptation options; › The user doesn't need to know information about their property, but they can test out some options (e.g. how risk is affected if user replaced roof or raised doorstep height, or difference between a slate roof vs a concrete roof).	› Brings more complexity; › Challenging to quantify impact of adaptation.

(45) Source: DRMKC Risk Data Hub (europa.eu).

Summary and conclusion

Option 3 is the most accurate but brings significant challenges as well as a lot of complexity and practical challenges which might not be what the tool wants to achieve. Stakeholders raised serious doubts about the feasibility to build such a risk score.

Option 1 and Option 2 should be easier and more pragmatic from the implementation perspective. Stakeholders also mentioned that it would be important to include the intensity and frequency components in the score. Option 2 therefore seems to be the most suitable and comprehensive without being complex to implement. This option also offers possible adaptation (such as flood defences) depending on the specific hazard being considered.

An additional consideration proposed is also to bring an additional perspective to capture the potential impact of adaptation measures (see option 4). This view could be brought in addition to the score to show the effect of adaptation measures. This view could also be introduced in the prevention measure part of the tool.

DISCUSSION ON POSSIBLE WAYS TO DISCLOSE THE SCORE

Different levels of risk exposures could be structured and sorted in different ways. The risks can indicate comparable scores between different types of NatCat perils. The score could be a numerical and/or alphabetical ranging from *0* to *X*, or from *A* to *X* alternatively, with higher scores indicating a higher risk of natural disasters. The score could also be colour-coded or graded for ease of use and understanding. How the risks scores are presented to the property owners, will directly affect the type of choice the user makes.

Below, a number of existing examples of tools which disclose risk scores and could be relevant for EIOPA's tool has been presented.

OPTION 1: A FIRST OPTION SHOWS A SCORE WITHIN A CERTAIN RANGE (E.G., FROM 0 TO 10) IN CONJUNCTION WITH A COLOUR CODING.

Pro	Con
› Figure and colour (e.g., traffic lights) are easy to grasp; › Continuous scaling allows granular distinction of risk levels; › It allows the user to prioritise information.	› Number and colour could be confusing, also mapping between number and colour needs to be developed (discretionary task); › Simplified information might be misleading; › A 0-10 scale may be too detailed and difficult for consumers to interpret.

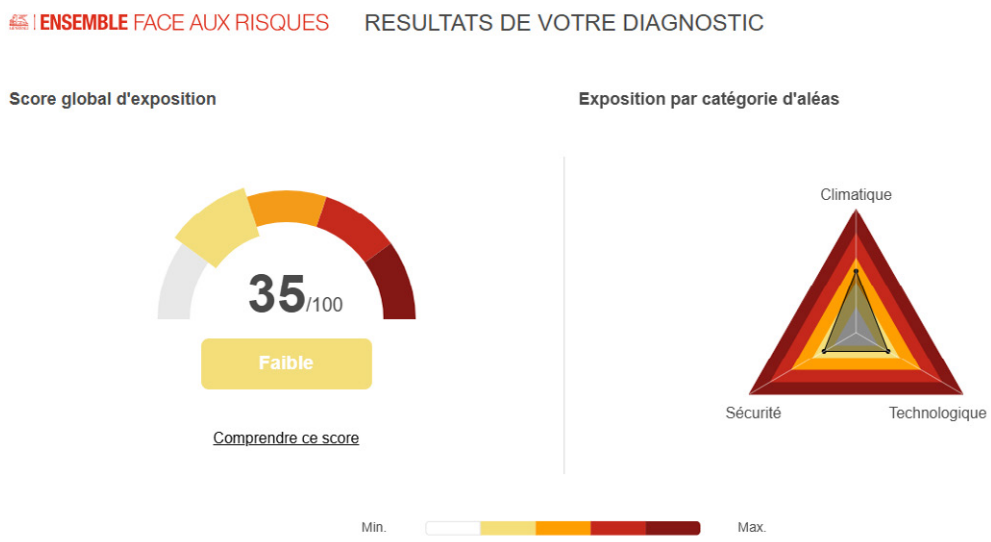


Figure 14: Option 1 of risk scores ([46]).

OPTION 2: SECOND EXAMPLE: VISUALISATION RISK LEVELS ON A MAP.

Pro	Con
› Helps user to understand the spatial dimension of the risk exposure, and it could enhance transparency and facilitate decision-making; › Would be a good way to visualise exposure in case the tool does not ask for a specific address; › It is an intuitive way to allow for showing the hazard in a specific location and comparing it with other areas, which provides valuable information to potential users. The map enables visualisation of the risk distribution geographically, making it clear and intuitive.	› Less granular depiction of the risk exposure possible, potentially providing false impression of the true risk; › Can be too abstract for the user; › Risk levels on a map can be useful for visualising geographic risk, but it can be easily misinterpreted by consumers. Finding an exact location on a European-wide map by zooming or scrolling can be difficult without a search function. Additionally, the classification by colours might be difficult to understand and it would need clear guidance on interpreting the map.

([46]) Source: Ensemble Face aux risques : le diagnostic d'exposition de votre domicile aux risques (generali.fr).

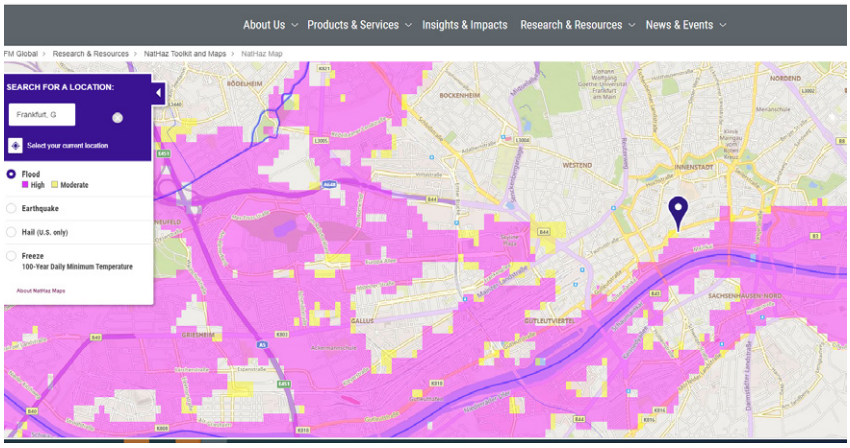


Figure 15: Option 2 of risk scores ([47]).

OPTION 3: ANOTHER EXAMPLE SHOWS A VISUALISATION OF THE RISK LEVEL ALONG A BAR WITH HIGH-LEVEL SCALING (LOW VS. HIGH RISK)

Pro	Con
› Visualisation easy to grasp; › Continuous scaling of risk levels possible (allows for higher granularity).	› Could provide false impression about the materiality of the risk exposure (distance to the extreme levels "high" / "low" difficult to interpret).

Figure 16: Option 3 of risk scores ([48]).

([47]) Source: NatHaz Toolkit: Manage Threat of Natural Hazards – FM Global.

([48]) Source: Hochwasser-Check: Wie groß ist das Risiko an Ihrem Wohnort? (dieversicherer.de).

OPTION 4: A FOURTH EXAMPLE SHOWS RISK CATEGORIES ALIKE THE ENERGY EFFICIENCY SYSTEM

Pro	Con
› Certain level of users have already experiences with such a system (beneficial for credibility, trust), making it easier to understand; › Good balance between detail and clarity.	› Granularity of the scoring limited; › Simplified information might be misleading.

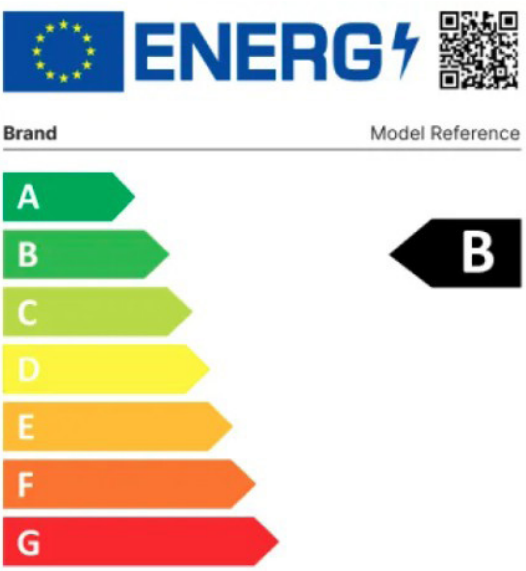


Figure 17: Option 4 of risk scores by analogy to the European energy label classification. (49)

Summary and conclusion

In general, many stakeholders mentioned that a combination of the above mentioned would be ideal. However, the preferred combination of the options was not univocal, as some suggested 1 and 3 together while other 2 and 4.

In addition, stakeholders suggested the following:

› In relation to the target market:

- The right option to endorse depends on the target audience. For a retail audience, policy-makers should probably opt for Option 1 and/or Option 4 because these would provide simplified information in the most accessible way to consumers. For a professional audience, it would make most sense to adopt option 2 or option 3, perhaps with a preference for option 3.

› In relation to risk categorisation:

It would helpful to generalise to other hazards an approach similar to Richter scale used for earthquake because of its wide acceptance and understanding by population. For instance, There should also be an explanation of what the score means (e.g. Risk category 1: *"not affected"* by flooding, Risk category 2: floods occur less than 1 x in 100 years, Risk category 3: floods 1 x in 10 to 100 years, Risk category 4: floods at least 1 x in 10 years).

- Inform the user whether the property under scrutiny faces a certain level of hazard (high, standard, low - possibly via coloured mapping), together with its upcoming trend (up, stable, down) and the level of vulnerability of the object (standard, above or below average).
- A distinction should be made - insurable risks should be presented according to the risk classification used by the insurance industry, allowing consumers to have the right parameters for calculating premiums when searching for suitable insurance. For risks that are not yet insurable, the score should be based on existing classifications and their representation to ensure consistency and clarity.

› In relation to disclosures:

- Options 1 or 4 could possibly be achieved by using a traffic light system for basic information. Learnings can be leveraged by insights from the "Nutriscore" or energy label experience, avoid ambiguous designs and favour simple, easy-to-understand colour-coded designs. The tool should be based on behavioural science and avoid being alarmist: it must rely on empowerment and positive messages, and contribute to creating a risk culture.

(49) Ecodesign and Energy Label - European Commission

- It is proposed that the core of the information disclosed consists in an overall assessment of the risk exposure of the area/district in which a property is located. More detailed information (where available) could be disclosed at the users' request.

› There is a reputational risk: consumers might make major life decisions like buying a house on the basis of information presented by a public body that seems reliable at the time but in fact unintentionally misstated the risk profile of the property. If the consumer were then to suffer material loss as a result of relying on the tool, the credibility of the tool and its sponsoring authority would be severely damaged. There could also be legal risks arising from such situation.

The behavioural analysis conducted to assess the impact of different risk score visualisation options, identified the central role of risk perception on respondent's willingness to take up insurance or mitigation measures, after they have been exposed to the tool.

As could be expected, respondents who perceived the risk level to be high were significantly more likely to show interest in insurance and in making property modifications than those who felt that the risk level was low, regardless of the risk visualisation that they saw.

Another important finding is that the impact of specific elements of the tools appears to differ depending on the level of risk communicated. For example, the option showing the risk on a map (which is Option 2 above) led respondents to estimate a higher level of risk compared to the respondents who were exposed to other options, when the property was shown to be in a low or medium risk zone. This could be driven by the visual features of a map presentation, where a low or medium risk location of a property used in the experiment was still relatively close to areas marked as high risk. Meanwhile the simple text message conveying the risk score was leading to higher assessments of perceived risk than presentations of other options when communicating a high risk scenario.

The behavioural analysis also indicated that the design may need to differentiate presentations to users who seek information on properties with different NatCat risk levels. There is evidence that specific options solutions work differently depending on the level of risk they are communicating. It is hence possible that certain presentations can work well (i.e. correctly align perceptions of users) e.g. when the risk is low, but less so in high-risk situations.

6. PREVENTION MEASURES

In addition to the view on the risk scores (discussed in the previous section), the tool would also offer a view on possible prevention measures that can be taken to reduce the risks.

GENERAL INFORMATION

OPTION 1: THE TOOL COULD PROVIDE A NUMBER OF GENERAL RECOMMENDATIONS (SEE EXAMPLE IN TABLE 1).

Pro	Con
› Straight forward to apply.	› Need to not overwhelm the user.

	Create a plan for your family and home
›	Compile a list of emergency contacts, including fire, police, family, neighbours, friends, tree services, utility companies, and your insurance agent.
›	Create a communications plan for your family before and after an event.
›	Identify ahead of time the best place to shelter in your home so you can act quickly when needed.
›	Decide on locations where you will meet in case a disaster strikes
›	Prepare an emergency supply kit that includes important documents. Be ready to live without power and running water for a period of time.
›	Practice the plan with your family.
›	Learn first aid.
	Stay informed / sign-up for alerts
›	You can also sign up for Met Office Weather Warnings. https://www.befloodready.uk/before-a-flood/flood-warnings
›	Find a reliable source for severe weather information. Follow your local National Weather Service (NWS) office on social media and the NWS Storm Prediction Center (SPC) on Facebook or X. Tune in to local news often when severe weather is forecast.
›	Enable wireless emergency alerts on your cell phone. Check your wireless service provider's website to find out how to do this for your specific phone type.
›	Purchase a weather alert radio that broadcasts emergency alerts from your local National Weather Service office, preferably one with a hand crank.

Table 1: Example of general recommendations ([50]).

([50]) Source: Thunderstorm Ready Home – Insurance Institute for Business & Home Safety (ibhs.org).

OPTION 2: TAILORED APPROACH

A tailored approach should be based on the adoption of a tool which should be characterised by specific features. In particular, it should be peril specific, location specific and distinguish behavioural and construction measures, sector specific, complemented with a list of practical measures as guidelines.

Pro	Con
› Appropriate for presenting preventive measures; › Adequate to the specifics of hazards, locations and lines of business.	› High costs; › Difficulty in creating tailored emergency plans due to the responsibility of municipalities, emergency services and authorities, along with the role covered by the government that should provide the necessary guidelines and legislation.

Summary and conclusion

In general, respondents favoured the option 1 and the same time emphasised the importance of a tailored and risk-based approach; the role of local authorities and the consistency of possible EU-level observations with what is already in place at the local level; the effectiveness of adaptation measures is closely related to the costs for consumers.

In particular, the proposed options seem appropriate for presenting preventive measures. However, some stakeholders point out that preventive measures should be tailored according to the risk exposure of the user.

In addition, some other respondents underline the presence of barriers to the adoption of preventive measures by consumers, which are often related to both the cost of taking such measures. The high costs of taking preventive measures will materially reduce the ability of EU consumers to take such actions, even if taking such actions benefits consumers in the long run.

Others suggest that it should be taken into account that the high costs of preventive measures will significantly reduce the ability of EU consumers to take such actions, even if these are beneficial to them in the long term.

INSURANCE RELATED INFORMATION

An adequate insurance coverage is key to protect citizens against potential losses arising from natural catastrophes. Different type of information could be disclosed to the user of the tool.

Some NCAs have already started investigating the quality of information disclosed by natural catastrophes insurance policies. For example, the Italian supervisor IVASS recently published the results of a survey conducted to assess the clarity of the policies covering natural catastrophes in Italy ([51]). The results highlighted important shortcomings in the offering of such policies. Namely, policy conditions are not always clear and easy to understand, there are specific exclusions for each cover; in addition to those common in the basic cover, the definition of the different natural catastrophe is not consistent between the different policies. Moreover, in order to gather information on the characteristics of buildings, the policyholder is often required to fill in complex questionnaires, with technical information of which he/she may be unaware, such as the stability of the building or the compliance of roofs and canopies with current regulations.

The above findings are in line with a recent study published by EIOPA, which found that some of the IPIDs analysed used unclear, vague and inconsistent language or relied too heavily on separate policy documents, making it difficult for consumers to understand the full scope of coverage and the exclusions that apply ([52]). Definitions of NatCat events across insurers also varied greatly or were only partially explained. Some IPIDs, for instance, indicated general coverage for "flood", but excluded all precipitation-related floods without explicitly pointing this out. Coverage limitations – whether geographical, frequency-related or connected to the type of hazard or the magnitude of the damage – were not always disclosed clearly either. For example, some policies only offered payouts for hail damage once every five years without specifying this condition in the IPIDs.

Such supervisory activities suggest that ad-hoc tools for helping consumers are needed.

([51]) IVASS (2024). Survey on policies covering natural catastrophes.

([52]) Clearer and more consumer-friendly information is needed to prevent the 'illusion of being insured' for natural catastrophe coverage, EIOPA study finds - EIOPA.

DISCUSSION ON POSSIBLE ELEMENTS TO COVER IN THE TOOL

OPTION 1: PROVIDE INFORMATION ABOUT COUNTRY SPECIFIC ASPECTS OF NATCAT INSURANCE.

Pro	Con
› Each country has specificities so it's important to mention them; › Information regarding governmental cover should be included in the tool. For example if there are pools available which are relevant for knowing the coverage available in the country, if insurance of some NatCat risks are voluntary or mandatory. The tool should also include a link to national tools already available; › The tool should focus on rising awareness of NatCat risks, rather than providing informing of NatCat insurance as insurance conditions change over time.	› It can become a lot of information, it needs to be well presented; › If the information is not country specific, regarding NatCat risks in household insurances, it will not be relevant as the coverage of NatCat risks differ between different member states.

OPTION 2: PROVIDE BASIC INFORMATION REGARDING INSURANCE SUCH AS "KNOW WHAT YOUR INSURANCE COVERS", CREATE A HOME INVENTORY…

Pro	Con
› Very straight forward to put in place; › The tool should only include basic insurance related information as too much information will be overwhelming; › To be relevant, the tool should include basic country specific insurance related information regarding NatCat risks in household insurances.	› Provides very basic information which might not be sufficient for the user to take adequate decision.

Before	During	After
Know your NatCat insurance Know what your insurance covers and what it doesn't Do an annual check-up with your agent to make sure you have the right coverage		Contact your insurer
Take a household inventory Create a home inventory video Use your cell phone to video belongings in each room of your house. Be sure to open cabinets and closets! Store your home inventory in the cloud.		Take picture of the damages and document them
Know your insurer Keep your insurance agent's contact information in your phone and accessible offsite.		

Table 2: Example of insurance related measures ([53]).

([53]) Sources: Thunderstorm Ready Home – Insurance Institute for Business & Home Safety (ibhs.org) and Hochwasser-Check fürs Haus: Jetzt Risiko online ermitteln (dieversicherer.de).

OPTION 3 : INSURANCE LITERACY: EXPLAIN DEDUCTIBLES, EXCLUSIONS, LIMITS.

Pro	Con
› Very important aspect to consider in insurance coverage.	› Could be overloading.

Summary and conclusion

Many stakeholders preferred option 1 or a combination of option 1 and 2.

Overall, several stakeholders suggested that the tool should refer the policyholder to contact the insurance undertaking to get more specific and personalised information regarding the insurance and what is covered and excluded. With the same view, some stakeholders commented that the tool should not include personalised information, as such information would be far too complex and far too costly to provide.

Other comments from stakeholders were that the insurance conditions change over time why there is a risk of providing misleading information in the tool if the information is not updated. Another aspect mentioned was that the insurance cover also depends on the specific conditions of the property being insured, why generic insurance related information could be problematic.

Several stakeholders mentioned the importance of using an easy language when providing insurance related information in the tool, in order to make the information understandable for consumers.

In this context, one options could also be to include information to consumers regarding what to look for in policies - i.e., explaining that most often household insurance does not cover all possible perils, so they need to look in details to exlcusions and limitations.

The importance of using consistent terminology in the final paper when referring to insurance agents/ brokers/ insurance intermediaries were also raised.

DISCUSSION ON POSSIBLE WAYS TO DISCLOSE THE INFORMATION

OPTION 1: TOGETHER WITH A LIST OF PREVENTION MEASURES, A LIST OF MEASURES TO TAKE REGARDING INSURANCE RELATED ACTIONS COULD ALSO BE PROVIDED.

Pro	Con
› Insurance-related information should be presented in a concise manner, for instance with a checklist, so that consumers can easily understand the main steps to be taken; › A comparison should be made between the home-owner's contract and what it should include to be well covered.	› Limiting the tool to key insurance actions, could lead to a lack of information for the consumer; › Risk of forgetting to disclose important elements of insurance coverages.

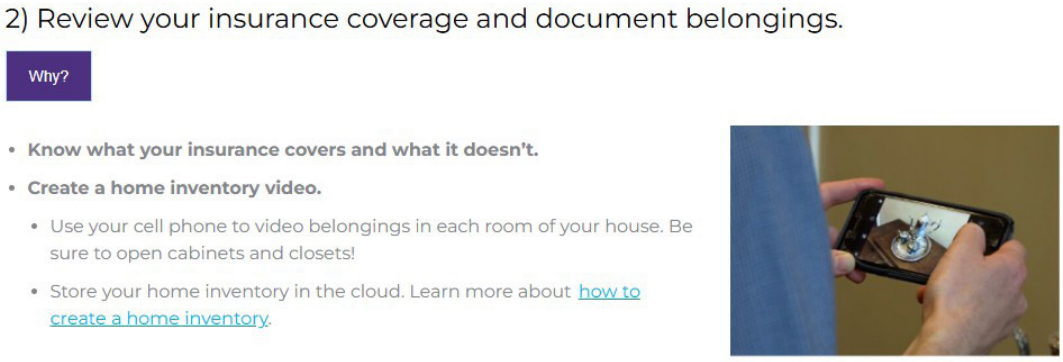


Figure 18: Option 1 to show insurance related actions ([54]).

Summary and conclusion

Respondents expressed their wish that the tool should disclose insurance-related measures to be taken, to distinguish clearly between preventive measures, in order to avoid creating confusion for the consumer. More specifically, this tool must distinguish between the disclosure of information required to underwrite an insurance policy and those required in the context of a claim.

The public consultation highlighted the need for the tool to disclose information in a simple way that could optimises the use of artificial intelligence. For instance, the consumer could be assisted by a virtual assistant or chat bot and access the information in a few clicks through a QR code.

The behavioural analysis conducted in parallel testing different ways to disclose information also showed that actually the perceived risk level is the primary driver of willingness to take up NatCat insurance as well as the way the information has been disclosed. However, the analysis also shows that the way to disclose insurance related information has to be simple.

Finally, it should be noted that the consultation raised concerns about the management of the data collected, particularly with regard to the data that may remain stored in the tool or even published *via* the tool, such as inside buildings affected by a disaster. In addition, methods of consulting databases were also mentioned, with the idea of an open-source database, provided by the data collected by the supervisors. It is important to note that any use of data in the tool, such as an inventory video, would be carried out in accordance with General Data Protection Regulation (GDPR).

([54]) Source: Thunderstorm Ready Home – Insurance Institute for Business & Home Safety (ibhs.org).

PREVENTION MEASURES ON BUILDINGS

A number of measures can be taken on properties to minimise the risks and potential damages arising from NatCat events (see also Table 3).

Peril	Before
Windstorm	**Inspect and repair your roof** • Have your roof inspected by a trusted and licensed roofing company who will look for the following: • Roof cover condition – Asphalt shingles: look for curling, loose (unsealed), missing and/or torn shingles. – Clay, concrete, and slate tiles: look for cracked, missing, and/or unattached tiles. – Metal panels: look for dents/divots, loose screws, deteriorated rubber washers, discoloured or worn off paint (which acts as an anti-rust layer), and/or signs of rusting. • Vents, skylights & chimneys – Vents: look for loose seals. – Skylights: look for leaking, loose, or wavy flashing, cracks, and/or damage to the window around the skylights. – Chimneys: look for leaking around the flashing and/or missing mortar. – Roof valleys/seams: look for leaking from roof valleys or seams that are under your roof cover material.
Windstorm	**Trim trees and tidy your yard** • Keep all tree limbs trimmed and away from your house. Hire an arborist to remove branches that overhang the house and remove any dead, dying, or diseased trees. Anchor any outdoor play equipment to the ground. Keep ladders and other large items that are not used daily into a shed or garage.
Windstorm	**Service & organise your garage** • Service your garage door annually. • If a new door is recommended when you have it serviced, check out the home upgrades page to know what to look for in purchasing a new wind-rated garage door. • Organize your garage so you can easily park your vehicle under cover when severe weather, especially hail, is in the forecast.
Windstorm	**Seal gaps and cracks on your home's exterior** • Caulk and seal any cracks or gaps on your home's exterior using a tube of silicone caulk. • Add weather stripping as needed to seal around doors and windows, making sure you cannot see any daylight from inside your home.
Windstorm	**Check & clear your gutters and downspouts** • Inspect gutters and downspouts to ensure they're secured to the house by gutter straps. • Clean all gutters, downspouts, and drains so they are free of tree debris and vegetation that may restrict proper flow. • Check downspouts to ensure they divert water at least 3 to 4 feet away from the foundation.

Table 3: Example of prevention recommendations ([55])

([55]) Thunderstorm Ready Home – Insurance Institute for Business & Home Safety (ibhs.org)

DISCUSSION ON POSSIBLE DATA

Although several tools that are listed include prevention measures, most of the information sources focus on the different elements of the risk only (and require expert knowledge to assess which measures can be taken to lower this risk).

Ideally, data on potential prevention measures would be open-source to raise the credibility of the tool. However, a comprehensive open-source database in this regard appears to be very difficult to obtain. Getting private data, e.g., through a data collection with the insurance sector in the EU, could provide suitable data but may be challenging as well. EIOPA's pilot exercise on impact underwriting in 2022 showed that the EU insurance sector was at early stages in this regard ([56]).

In addition, there are no certification standards for the effectiveness of the measures to reduce damages suggested in different apps and webpages that already exist. Potential sources of data for a prevention measure database could be based on:

Data	Pro	Con
European Climate Adaptation Platform Climate-ADAPT / EEA ([57])	› Open-source and inflow of new information based on user experiences/needs; › For all acute and chronic hazards; › Adaptation options and key types of adaptation measures.	› No risk-based / insurance-based database; › No quantification of effects of measures; › Including measures not under the control of individual citizens.
EIOPA data collection with insurers in the EU	› Measures that work in practice; › Insurers and national association could have an interest in participating in the project. So they might be incetivised to provide data.	› Effort for undertakings; › Limited data available (sector at early stage); › Risk-based effects difficult to assess / generalise.
EIOPA data collection with loss modellers, e.g., through EIOPA's NatCat expert network	› Measures that work in practice; › Risk-based effects can be estimated.	› Effort for loss modellers.
EU Floods Directive Flood Hazard and Risk Maps (and Flood Risk Management Plans) ([58])	› Open source; › Repeated/updated every 6 years; › OGC WMS and WFS for integration in other systems (for most countries).	› Covers only flooding (all sources and mechanisms); › National information to be aggregated at EU level; › No insurance-based database (focus on public authority actions).
Literature/existing web-based sources	› Open-source.	› Limited data / high-level information or more US based; › Not insurance-related.

Table 4: examples of existing data sources with their pro and con.

([56]) EIOPA (2023). Impact underwriting: EIOPA reports on insurers' use of climate-related adaptation measures in non-life underwriting practices - EIOPA

([57]) Discover the key services, thematic features and tools of Climate-ADAPT

([58]) The information reported by EU Member States to the European Commission / EEA in the context of the EU Floods Directive, in particular the flood hazard and risk maps.

In addition, a categorisation of measures, e.g., with regard to costs and effectiveness, could be useful to further guide property owners ([59]). See "surging seas" example: small-scale measures matter as they can reduce certain risks ("better than nothing"). However, data to categorise measures will be difficult to get, and should be high-level for indicative purposes.

Measures	Pro	Con
Cost ([60])	› Financial dimension important for decision making process in the context of personal budgets.	› Cost estimates difficult to get; › Might nudge users to take up rather less expensive, and less effective, measures.
Effectiveness ([61])	› Important for decision making process in the context of personal risk aversion; › Classification with a strong convincing power.	› Risk estimates difficult to get.
Return on investments	› Putting costs in perspective; › Indicating limits beyond which extent measures are no longer efficient or effective.	› All difficulties on cost also relevant for return on investments; › Future scenarios as well as statistical variation to be taken into account.

Table 5: Examples of categorisation of measures with pro and con.

Summary and conclusion

Many additional tools and information sources were suggested during the consultation. However, most of them focus on a hazard and only some of them also include the role of measures that can be taken by individual citizens.

Before presenting the different measures, it should be noted that the focus is on those measures to be taken within the power of individual citizens ([62]). In addition, the focus will be on preventive measures (because of their efficiency) and on measures related to building back better, although it should be noted that splitting measures according to the different stages of the risk management cycle won't always be possible. As several measures are relevant for specific perils, a list per peril is helpful to:

- Suggesting only measures relevant for the location;
- Raising awareness beyond the perils best known (e.g. when looking for measures in the aftermath of a specific event) and promoting measures with co-benefits for different perils.

It should do this while avoiding conflicting recommendations across perils and specifying the type of the measure.

As detailed estimates for the metrics suggested to categorise the measures might be difficult to get - while their communication might be incomplete - a simple classifi-

([59]) To promote "quick wins", measures with a relatively low cost, high efficiency or cost-effectiveness and where the time frame before the benefits become clear is not very long.

([60]) When presenting different measures, the costs of measures, in particular for preventive measures should be promoted as an investment rather than a cost.

([61]) The effectiveness is also dependent on the order the measures are taken in (and therefore dependent on the other measures taken). Certain individual measures might not be effective on their own, unless taken in combination with other measures.

([62]) As multiple sources already exist for expert audiences, including spatial planners and disaster risk coordinators, new lists of measures should preferably serve a complementary audience.

cation for cost and/or effectiveness might be considered (e.g. traffic light system, or similar to known certification systems ([63]), e.g. from A to F). Some suggestions go in the direction of integrating the adaptation measures with a system like energy performance certificates.

It was also mentioned that measures that are indifferent or even harmful may be presented as well, to avoid these are seen as 'not covered' in the examples.

DISCUSSION ON POSSIBLE WAYS TO DISCLOSE THE INFORMATION

It is important to carefully consider which instruments, information, choice sets and online choice environment can be used to ensure that policyholders can form an opinion, better understand and grasp the risk awareness for undertake any prevention and/or mitigation measures, and make a good comparison for NatCat uptake, all leading to an outcome which is useful to their personal situations ([64]). User friendliness is key to help users of the tool to better understand their risks and how they can mitigate them. The information provided should not be too technical as this might be counterproductive i.e. users get shocked and might not take up risk prevention measures. It is also important to use behavioural insights to make the online choice environment more effective for policyholders ([65]).

The options below are not necessarily mutually exclusive. Any final tool can include elements from the different options, e.g. including a more visual representation and a list to serve as many potential users in a way they are considering action. A balance should be sought between development and maintenance costs and reaching the broadest possible audience.

A suggestion to present at first only the most relevant (e.g. the most effective) measures, to avoid the user is lost in a long list of options can be solved via the categorisations discussed in the previous section as well as through the visualisation (larger or different symbols, different colours, different fonts ...).

OPTION 1: INTERACTIVE VISUALISATION

Pro	Con
› Interactive visualisation / gamification helpful to raise awareness and understanding; › Interactive tool increases user engagement; › Visual information might be easier to absorb, the variety of places in the house where measures can be taken is immediately visible; › Users might be already familiar with such visualisation from energy related renovation and modernisation programs (such visualisations do exist in this area).	› Extensive IT work needed; › For lots of adaptation measures, risk may be that some get overlooked; › Model house, that includes all potential areas of action might become complex (e.g. addition of basement, greenhouse, surrounding garden).

([63]) Energy performance certificates may provide an interesting example to learn from. Lessons learned from Energy performance certificates show that the information ideally is tailored to the user group (owners, tenants, developers, ...) and in all cases should be as accurate and reliable possible (see also in Chapter 5 "Discussion on possible ways to disclosure the score").

([64]) Therefore, for any tool and independent of the visualisation chosen, it will be important to not only summarise what can be done but also why adaptation measures are important. They will, for example, not have an impact on deductibles of individual house-owners so the motivation to act cannot needs to highlight multiple advantages.

([65]) This work can build further on previous initiatives, to learn from and to further develop their recommendations in an online environment. An example is the UK Bonfield Action Plan. In addition, the amount of information available might impact the visualisation choices. Therefore, suggestions were made to postpone the visualisation choice until prototyping makes clear how much information can be presented.

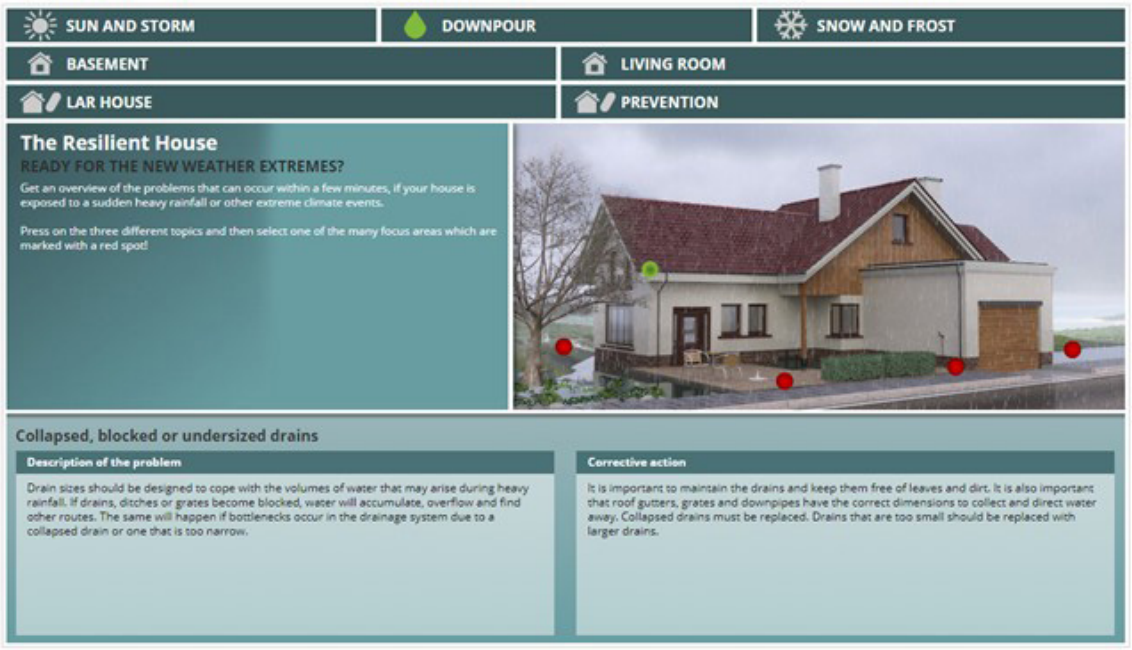


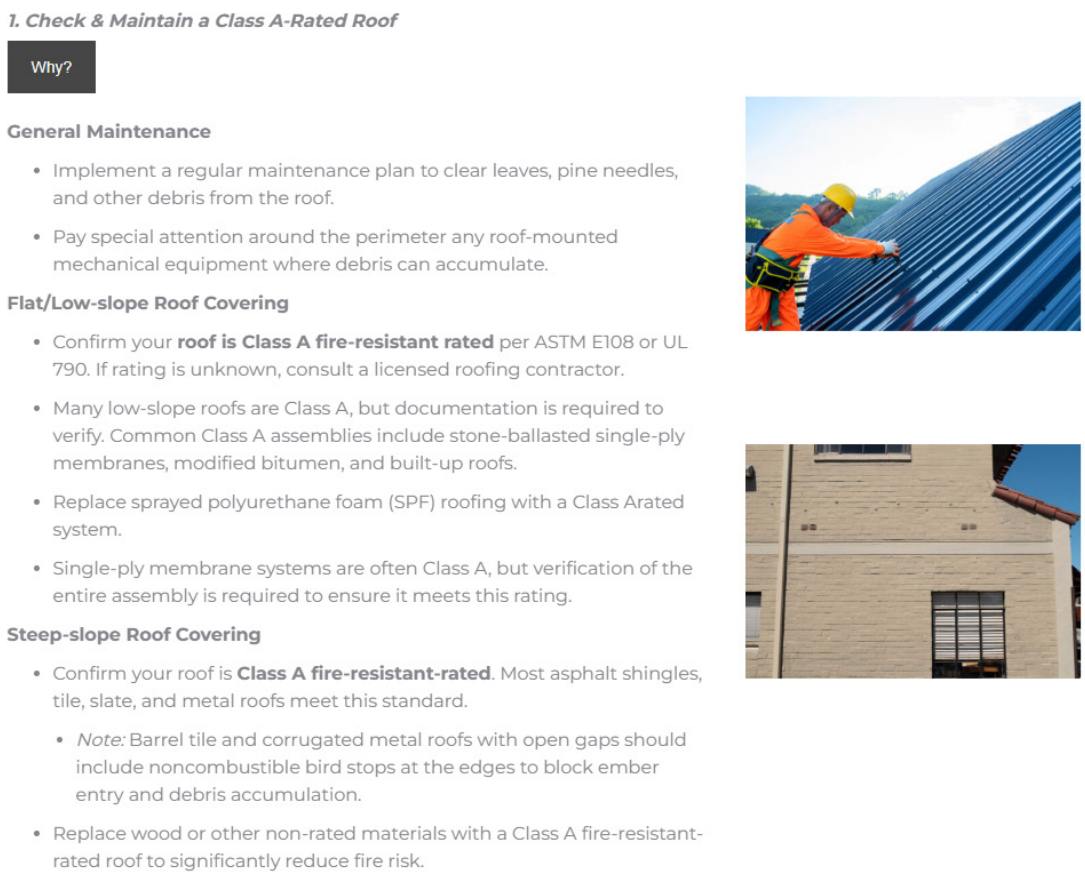
Figure 19: The resilient house ([66]).

OPTION 2: LIST ([67])

Pro	Con
› Easy to go through; › The focus remains on the content; › Possibility for "nesting", to bring structure to the list and into the measures (e.g. based on location in the house, or the categories discussed in the previous section).	› Not very attractive i.e. could be cumbersome; › When technical terminology is used, it can become difficult to understand where the measure takes place and how it impacts a certain peril.

([66]) Source: The resilient house - Ministry of Environment of Denmark and Environmental Protection Agency.

([67]) A variation suggested for such a list is a summary with only the titles of the most relevant measures per peril next to the risk score for the peril and the option to click to a page with more detailed information (including more different measures). The key messages are clearly presented, while all the detail still remains available for those who click.



1. Check & Maintain a Class A-Rated Roof

Why?

General Maintenance

- Implement a regular maintenance plan to clear leaves, pine needles, and other debris from the roof.
- Pay special attention around the perimeter any roof-mounted mechanical equipment where debris can accumulate.

Flat/Low-slope Roof Covering

- Confirm your **roof is Class A fire-resistant rated** per ASTM E108 or UL 790. If rating is unknown, consult a licensed roofing contractor.
- Many low-slope roofs are Class A, but documentation is required to verify. Common Class A assemblies include stone-ballasted single-ply membranes, modified bitumen, and built-up roofs.
- Replace sprayed polyurethane foam (SPF) roofing with a Class Arated system.
- Single-ply membrane systems are often Class A, but verification of the entire assembly is required to ensure it meets this rating.

Steep-slope Roof Covering

- Confirm your roof is **Class A fire-resistant-rated**. Most asphalt shingles, tile, slate, and metal roofs meet this standard.
  - *Note:* Barrel tile and corrugated metal roofs with open gaps should include noncombustible bird stops at the edges to block ember entry and debris accumulation.
- Replace wood or other non-rated materials with a Class A fire-resistant-rated roof to significantly reduce fire risk.

Figure 20: IBHS example on wildfires ([68]).

OPTION 2BIS: LIST WITH THE RISK SCORE AND THE TITLES OF THE MOST IMPORTANT MEASURES ONLY, FOLLOWED BY THE OPTION TO CLICK AND SEE THE LIST AS IN OPTION 2

Pro	Con
› Key messages are clear; › Other: Similar to option 2.	› Requires an action from the user to have an overview of all relevant measures; › Other: Similar to option 2.

([68]) Source: IBHS (Wildfire – Insurance Institute for Business & Home Safety)

OPTION 3: QUIZ

Pro	Con
› Gamification idea, element of interactivity; › Can be targeted to the specific knowledge and needs of the one taking the quiz/filling in the questionnaire; › Proven to be an effective educational approach; › Tailoring possible towards knowledge gaps or elements specific to the property.	› Extensive IT work needed, especially if results are tailored to the answers given; › Intermediate step to option 1 or 2 (takes long before suggestions are made), and also include their cons.

Summary and conclusion

From the public consultation, it is clear that the audience largely agrees that a balance should be found between both visual attractivity and clarity of the proposed measures. Depending on the one seen as the prevalent one, an option is chosen, or a combination of different options is suggested (while realising that this is not only combining the pros of the options but also their cons, plus the need to develop and maintain a more complex system).

When option 3 becomes a questionnaire rather than a quiz, it might be easier to detect which information is most relevant, but the gamification idea is gone as well as the idea of getting suggestions after a few clicks. That might undermine the idea of a tool where one gives their address and after a few clicks gets information on measures that increase resilience.

It should be mentioned that all respondents of the consultation can be considered as familiar with the topic to a much larger degree than the average citizen. Therefore it is important to mention that EIOPA also commissioned a behavioural analysis study to present these options to the potential users of such a tool.

A behavioural analysis in the format of a consumer survey comes to similar conclusions. Independent of the presentation of the measures, the costs (in particular of costly measures, above EUR 10.000) are the main barrier for modifications. Next to the high upfront costs, the uncertainty about the effectiveness of the measures is perceived as the main barrier. There is no clear preference from consumers in a test group for the options 1 or 2 described above and perceived risk level and available information on insurance uptake might impact the preference for the presentation of preventive measures. Although based on a limited sample, there might be a preference for a simple list with measures for those with a (perceived) high risk for one or all perils (as simple overview), while others might have a slight preference for an interactive visualisation to check options. Morer important than these preferences might be cultural preferences and the device (computer of mobile phone) and application (website versus app), requiring all conclusions to be taken with the necessary caution.

7. IMPACT OF PREVENTION MEASURES VIEW

Another important message that the tool could provide is that prevention measures can have a positive impact on the availability and affordability of insurance, by affecting risk-based insurance premiums, highlight a balanced approach that takes into account the complexities of insurance pricing and the need for clear and transparent information.

Displaying prevention measures and raising awareness about their benefits can be important for consumer experience providing clear and transparent information is available. Interactive tools and visualisations could be useful in educating and engaging the wider public, and in helping users to understand the impact of preventive measures. However, mere provision of information of implementing preventive measures can overwhelm the end-user with endless choices. This will in turn affect how consumers perceive the affordability of insurance. Assessing the effectiveness of prevention measures remains a challenge.

The challenge will remain to accurately portray the height of discounted premiums in relation to the selected prevention measures – premiums are also influenced by other factors. An alternative could be to portray a range of potential discounts to reflect the variability in insurance pricing.

The general information on the potential discounts available for implementing preventive measures, would rely on data granularity as well as accuracy, to maintain the accuracy of information given to the end-user. The more tailored the approach, the more there is the need for reliable and open-source data to support the development of effective preventive measures. Data availability and transparency are essential for the development of effective preventive measures, and that efforts should be made to collect, share, and standardise data in a way that is accessible and useful to users in the context of climate risk awareness.

DISCUSSION ON POSSIBLE METHODOLOGIES

OPTION 1: PROVIDE SOME HIGH-LEVEL MESSAGES ON HOW PREVENTION MEASURES CAN IMPACT AVAILABILITY AND AFFORDABILITY OF INSURANCE.

Pro	Con
› Help users to better understand the effects of different measures on their risks and to bring them into a position to discuss these effects with their insurer/broker; › Maintain a high-level approach to inform consumers in a friendly way, whilst keeping it practical and accessible; › Raise awareness in general on climate risk and insurance awareness.	› Is considered as too generic for average consumer; › Does not provide an exact quantification of each measure on the impact on the premium, for e.g. the maximum possible options in prevention measures; › Granular data is needed, for e.g. to individualise the examples as much as possible.

OPTION 2: PROVIDE SOME ILLUSTRATIVE EXAMPLES ON HOW PREVENTION MEASURES CAN IMPACT PREMIUMS.

OPro	Con
› Help users to better understand the effects of different measures on their risks and to bring them into a position to discuss these effects with their insurer/broker, with clear examples; › A more individualised approach will ensure that the right prevention measure is prioritised. Including comprehensive overview of the prevention measure, per type of risk; › Various approaches are possible, for e.g. dynamic models, with geolocation and historical loss data, or with a comparator; › A unique resilience index can be developed that combines data on property type, implemented measures, and geographic location to provide a risk rating before and after the implementation of measures.	› Does not provide an exact quantification of each measure on the impact on the premium; › Given the lack of data on prevention measures, a simplified version may not yield desired results; › Reliable and available data is needed, otherwise risk may arise that consumers are misinformed on potential savings.

Summary and conclusion

A tool can help raise awareness about the benefits of preventive measures, which can positively impact and promote insurance availability and affordability. Data availability, transparency, and standardisation are essential for creating effective solutions and promoting climate risk awareness. This in turn will promote clear and transparent information, interactive features and the use of user-friendly visualisations can help end-users in the process. In addition to displaying risks, users could be provided with an estimate of potential costs in the event of damage and a display showing how implementing specific measures could reduce the insurance premium or the amount of personal liability in case of damage.

Intermediaries' roles can aid in the above, by providing information and supporting the implementation of preventive measures. Additionally, the role of intermediaries, such as insurance brokers or agents, can be carefully considered and coordinated and it can help to facilitate the implementation of preventive measures by providing guidance and support to users.

Notwithstanding the role that public authorities can have in reducing the insurance protection gap ([69]) to further cooperation, many emphasised the need for concrete actions from various public as well as private stakeholders to incentivise long-term change, dialogue and recovery. This is specifically crucial to address expectations in disclosures whereby clearer communications could highlight the limitations and restrictions of coverage that apply.

DISCUSSION ON POSSIBLE WAYS TO DISCLOSURE THE INFORMATION

EIOPA is of the opinion that clear communication to end-user regarding the scope of the coverage as well as the level of protection offered by insurance policies is crucial, in order to avoid a mismatch between existing and potential consumers' expectations for NatCat events, vis-à-vis the actual coverage provided in the aftermath of a NatCat event.

([69]) EIOPA and ECB (2024). EIOPA and ECB joint paper: Towards a European system for natural catastrophe risk management.

OPTION 1: INTERACTIVE TOOL TO PLAY WITH DIFFERENT OPTIONS ([70])

Pro	Con
› Very clear steps to understand where the premium discount comes from and how high it would be; › Graphic option more appealing to the end-user.	› Needs very detailed calculation to get a correct estimation on premium discount; › Suitability for public schemes; › Difficult to calculate based on bundled property insurance.

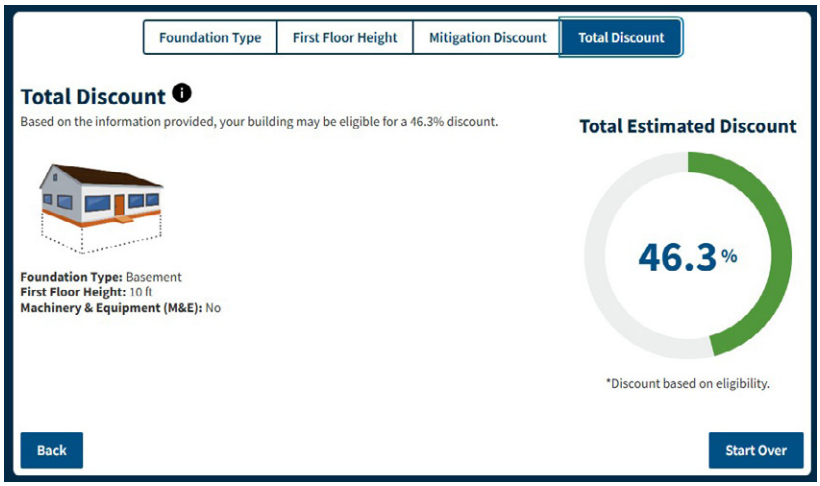


Figure 21: Example of an interactive tool from FEMA ([71]).

OPTION 2: A SIMPLIFIED ILLUSTRATIVE EXAMPLE

Pro	Con
› Provides information is a friendly way; › Easier to develop and present the information; › Maintain a high-level approach to inform consumers in a friendly way, whilst keeping it practical and accessible; › Raise awareness in general on climate risk and insurance awareness.	› Might not be providing sufficient incentive to take action; › Does not provide an exact quantification of each measure on the impact on the premium.

([70]) Note that the idea would not necessarily to show the exact amount of how much the premium is reduced but rather to visualise the decrease in an interactive way.

([71]) Flood Insurance Discounts | National Flood Insurance Program

Summary and conclusion

The importance of clear communication to consumers about the scope and level of protection offered by insurance policies, especially in the event of natural catastrophes is often one that requires understanding of consumer preferences on how consumers observe and process information – this will have to be a careful trade-off while balancing consumer needs, whilst prioritising clear communications about coverage limitations. Intermediaries, such as insurance brokers, can play a key role in providing information and supporting preventive measures. Stakeholders have pointed out that it will remain a challenge to challenge to accurately portray the impact of preventive measures on insurance premiums.

8. RAISING AWARENESS IN THE PURCHASING PROCESS, TAKING ACTIONS AND MEASURING THE IMPACT

In order to ensure that citizens are properly aware of the risks and prevention measures, it would be important to also consider how this information could be shared at relevant steps. Bringing this information to the consumer at a certain moment in a more mandatory way could lead to a greater increase in awareness. As described at the beginning of this paper, many tools exist but do not seem to be contributing materially for preventing the widening of protection gaps. For example, this information could be relevant when buying a house or an insurance product. In addition, it is also important to consider how to increase the chance that the tool will lead to desired action/behaviour and how to measure the impact of the tool.

RAISING AWARENESS IN THE PURCHASING PROCESS

OPTION 1: A LINK COULD BE ADDED IN THE IPID FOR THE POLICYHOLDER TO CHECK ITS NATCAT RISKS AND RELATED PREVENTION MEASURES

Property and casualty insurers have to provide consumers with an IPID. The IPID provides information about the most important features of an insurance product. It serves to ensure that insurance products are transparent, clear and comparable. The requirements regarding the form and content of IPIDs are set out in Commission Implementing Regulation (EU) 2017/1469 in conjunction with the Insurance Distribution Directive.

Pro	Con
› Raise possibility for a discussion between the policyholder and the insurer; › Simplicity; › Standardised summary document.	› Raise awareness only to specific stakeholders; › Could overload the document; › To not overload the IPID, a link could be added to the tool but the point was raised that not many users would actually open the link.

OPTION 2: THE INSURER SHOULD PROVIDE THE RISK SCORES AS WELL AS THE LIST OF RECOMMENDATION OBTAINED FROM THE TOOL.

A standard nat NatCat could be referred on the insurers' personal websites.

Pro	Con
› Insurer could encourage the use of the app during the policy purchase and advising on the best product based on risk scores; › Advice to policyholders is needed as they might be overloaded by the amount of documentation already provided to them.	› Potential issues of using an assessment that may differ from the insurer's internal evaluations; › Could highlight potential conflicts of interest in premium calculations.

OPTION 3: INFORM THE BUYER DURING THE SALE PROCESS OF A PROPERTY

Pro	Con
› Bears resemblance to energy consumption ratings, illustrating how existing initiatives can provide value into consumer decision-making and risk awareness; › Advantage of informing citizens before buying a property ([72]).	› Drawback of targeting individuals purchasing homes for example which would restrict its broader utility.

Summary and conclusion

The effectiveness of these efforts is closely tied to the diverse insurance distribution systems in place, as consumers across Europe are acquiring insurance through a variety of channels. Understanding these dynamics is crucial for developing more effective and accessible insurance solutions tailored to the unique needs of different markets. Additionally, the following additional strategies can be also considered:

› Educational content on social media and websites: Regularly posting educational videos, infographics, and articles explaining the importance of preventive measures and how they can reduce the risk of natural disasters. This can help build long-term awareness among consumers.

› Engagement with local communities: Organising workshops or events within communities to inform citizens about risks and preventive measures. Collaboration with local authorities and organisations can increase trust and engagement.

Overall, option 3 was the option which received the highest support followed by option 1. A combination of all options was also mentioned to be a good solution to reach the broadest amount of citizens.

TAKING ACTIONS

As mentioned before, it is also important to consider how to increase the chance that the tool will lead to desired action/behaviour.

OPTION 1: THE TOOL COULD PROPOSE EASY RECOMMENDATION SUCH AS CONTACT YOUR INSURER OR MAKE SURE YOU HAVE AN EMERGENCY KIT READY.

Pro	Con
› This focuses on providing users with straightforward, actionable advice that they can immediately implement; › By suggesting that users contact their insurer and intermediaries, or prepare an emergency kit, the tool not only raises awareness but also drives users towards concrete steps that enhance their preparedness and response capabilities.	› Would need to make sure that the actions are done.

([72]) In France, there is a requirement to inform potential buyers about the exposure of a property to climate risks during the sale. This obligation is part of the technical diagnostic file that the seller must provide to the buyer. The document specific to this information is called the " State of Risks and Pollution," which must be provided if the property is located in an area covered by a natural, technological, or mining risk prevention plan, or in a seismic zone. This document informs the buyer about the risks to which the property is exposed, such as flooding, landslides, earthquakes, etc.

OPTION 2: ADD LINK TO NATIONAL INSURANCE ASSOCIATIONS.

Pro	Con
› Can provide complementary information.	› Not all webpages from insurance associations are equal.

OPTION 3: ADD LINKS TO INSURANCE PROVIDERS.

Pro	Con
› Facilitate to find the right insurer.	› Issue of the tool becoming an advertising tool.

OPTION 4: AN INDEPENDENT COMPARISON TOOL: THE IDEA WOULD BE TO RANK THE DIFFERENT INSURANCE OFFERS BASED ON THEIR PRICE AND COVERAGE OF CLIMATE RISKS COULD ALSO BE AN OPTION.

Pro	Con
› Increase transparency;	› Commercial influence;
› Time-saving;	› Limited coverage;
› Access to multiple options.	› Information overload.

Summary and conclusion

Similarly to the previous section "Raising awareness in the purchasing process", stakeholders mentioned that it would be a combination of options which would be the favoured outcome. Additional ideas were also shared by stakeholders such as:

- Implement an interactive feature that allows property owners to input specific details about their property and location to receive, where possible, more specific recommendations. This can help users understand their specific vulnerabilities and prioritise actions.
- Provide links to local government resources, emergency management agencies, consumer associations and community organisations that offer support and guidance during natural catastrophes. This can help users access timely and relevant information. Similarly, and where appropriate, provide links to guidance on preventing and mitigating climate risks and other relevant resources created by national risk management associations.
- Include case studies or testimonials from individuals who have effectively mitigated risks through preparedness actions. Real-life examples can motivate users to take similar steps.
- Introduce gamified elements, such as badges or points for completing preparedness tasks, to encourage user engagement and make the process more enjoyable.
- Offer virtual workshops or webinars on topics related to natural catastrophe preparedness, featuring experts who can provide insights and answer user questions. Add short educational videos or infographics explaining why certain actions (e.g., emergency preparedness) are important.
- Personalised advice:
  - Allow users to input basic information (e.g., location, type of house) to receive tailored recommendations.
  - Chat support or AI assistant: Add chat support for users who have additional questions.
  - Reminders: Allow users to set reminders for specific actions
- The tool could be integrated into existing consumer information channels, such as energy performance certificates to make the information more accessible.
- Tool would need to focus on a few perils to be very clear.

MEASURE THE IMPACT OF THE TOOL

Finally, considerations also need to be taken to understand the impact of such a tool. Several options have been proposed.

OPTION 1: MONITOR THE INSURANCE PENETRATION.

With regard this option, generally, the views of stakeholders were mixed. Some stakeholders supported this option, which was described as straightforward and specifically measured.

Pro	Con
› Direct and straightforward.	› Complex to measure, given the significant differences in insurance penetration between countries. For instance, this option will not be relevant for particular national markets, where all property insurance contracts necessarily include coverage under the natural disaster compensation scheme; › There are different reasons that affect insurance penetration.

OPTION 2: MONITOR THE UPTAKE OF PREVENTION MEASURES ON PRIVATE HOUSES.

Pro	Con
› Monitoring preventive measures could bring the most benefits because it directly measures how much the tool encourages users to take concrete actions and it provides clear evidence of the tool's impact on risk reduction.	› It is complex to monitor the uptake to prevention measures, which would require verification of the proper implementation and use of preventive measures in buildings and very high implementation costs; › There are different reasons that affect this uptake; › It would require the user to indicate whether they implemented a measure or not.

OPTION 3: MONITOR THE NUMBER OF PEOPLE USING THE TOOL.

Pro	Con
› Easy and straightforward.	› Significant impact can only be proven when a large number of people use the tool over an extended period.

OPTION 4: CONDUCTING REGULAR SURVEYS WITH USERS.

Pro	Con

- Simple to implement;
- It would be useful to conduct knowledge tests before and after using the tool to measure the increase in awareness about risks and prevention.

- Regular surveys may be perceived as too intrusive for users, potentially leading to frustration;
- Results will be based feedback only from a smaller subset of users and are therefore less relevant.

Summary and conclusion

In general, stakeholders reported that a combination of the options above should be considered, as combination of multiple options could provide the most comprehensive picture of the tool's effect analysing the replies, there is a majority favouring option 3 and 1 (in this order). In addition, some raised that the most appropriate way to track the impact should be in line with the overarching objective of the project (e.g. if the primary goal of the tool should be to increase citizens' awareness and close the insurance protection gap, then Option 1 and 2 should be preferred).

In addition to the options proposed above, stakeholders also proposed other ways to measure the impact of the tool:

- Run a pilot scheme for the tool, rolling it out initially only to a select target audience of users and a select geography (e.g. where reliable data are easily available in abundance).
- Track how users interact with the tool (e.g., which parts of the tool are used the most, how much time they spend on certain pages).
- Monitor data on property damage reduction in areas where the tool is intensively used. This would allow to show how much the tool encourages users to take concrete actions and help identify the most effective measures. On the other hand, it would require detailed user data, which may be challenging to collect.
- Analyse data on insurance claims related to natural catastrophes to see if there is a correlation between tool usage and reduced claim frequency or severity.
- Track the number of users who share the tool or advice with others (e.g., via social media).
- Insurance agents could investigate with new clients (or existing clients who change their coverages) why they decided for insurance (or for changes) and if they use /know the tool.
- Measure the tool's impact on the development of local, regional or national prevention or awareness-raising policies.

9. POSSIBLE NEXT STEPS

There could be the opportunity at European level to consider the practical implementation of the proposals included in this paper into a tool, tentatively named PROTECT. However, the development/long term maintenance of such tool would require cooperation among several relevant stakeholders/EU institutions. For this, a step-by-step approach could be envisaged.

For a long-term solution, it is important that EIOPA and the European Commission explore possible avenues to further develop and maintain such a tool. In fact, while EIOPA has led the current project, other concerned agencies, institutions and stakeholders may be involved requiring discussion how to ensure a coordinated approach. It is important that further dialogues take into account mandates, budget and resources necessary to maintain such a tool and regularly update it. A coordinated approach would be essential to ensure its success and sustainability.

In the meantime, it is important to continue developing efforts aimed at improving the risk awareness of consumers, for example by developing factsheets bringing information to consumers on prevention and insurance measures. This information could subsequently, at least to some extent, be incorporated in the to tool ([73]).

([73]) A good example of this has been done by the public-private partnership "Hazard Insurance Partnership" in Australia.

10. ANNEX I – BEHAVIOURAL ANALYSIS SUPPORTING THIS PAPER

This study has been carried with the support of Verian ([74]), (referred to as "behavioral analysis" in this paper). The behavioural analysis involved the consumer testing of a (pseudo) blueprint for a risk and prevention awareness tool, and tested which factors are most likely to incite and raise customers' awareness regarding the available risk mitigation measures and the perceived level of risk vis-à-vis NatCat.

The first phase of the analysis included desk research, mapping of existing tools and interviews with tool creators to gather information on existing or proposed NatCat risk awareness tools, as well as features to test. A literature review of around 50 sources examined the effective risk communication strategies and their impact on raising awareness of natural catastrophe risks among homeowners. The review found that successful communication involves activating certain behavioural nudges while tailoring messages to specific community needs, using multiple channels, and leveraging social norms to overcome barriers. It also recommended using diverse formats, such as visual aids and interactive tools, to make complex information more accessible and understandable, and to address cognitive biases and enhance comprehension and engagement. To gain a deeper understanding of user needs, 30 interviews in two selected countries were also conducted. End-user interviews in Germany and Greece revealed preferences for relatable, realistic, and simple messaging, as well as personalised risk assessments and mitigation advice, with a strong preference for trustworthy sources such as public authorities as well as insurers. The interviews also showed that users respond somewhat differently to risk communication, with German users preferring serious and credible sources, while Greek users being motivated by messages that leveraged loss aversion and offered concrete solutions, and appreciated interactive features and clear visuals. Interviews with creators of such tools were also conducted, which highlighted the importance of visuals in tool design, including the use of established visual norms such as coloured risk scales.

As a second phase, the initial findings were incorporated into the development of the three different blueprints, displaying the risk and offering mitigation advice using varying designs. Finally, the effectiveness of these blueprints was tested through an online behavioural experiment and an accompanying survey, conducted with 1600 participants, in two EU Member States, Germany and Greece.

Phase three was implemented through a randomised control trial, whereby respondents were randomly allocated into one of the four groups: a control group and three treatment groups corresponding to the three blueprints. All respondents were introduced to the same hypothetical scenario about an imaginary person who recently bought a house and were shown a mock-up of a NatCat risk awareness tool. Those in the control group were exposed to blueprints with empty features, while each of the respective treatment group, were exposed to a corresponding blueprint with varying designs. Respondents were then asked further questions, to assess the risk level for the house, whether the fictional character should uptake NatCat insurance, and additionally whether the fictional character should take on any mitigation measures.

The impact of the tool was tested in relation to the three main outcome measures: whether it altered the users' risk perception, whether it nudged them to take up NatCat insurance and whether it nudged them to implement mitigation or prevention measures, (e.g. installing flood doors or improving building foundations).

The results of the above-mentioned testing were used throughout the paper and will be taken into consideration for the next steps of the project.

([74]) Behavioural research on the development and testing of a blueprint for a risk and prevention awareness tool to raise customers' awareness on their level of risk vis-à-vis natural catastrophes and available risk mitigation measures (EIOPA/2024/07).

11. ANNEX II - ORGANISATIONS WHICH ARE MEMBERS OF THE TECHNICAL EXPERT NETWORK ON CATASTROPHE RISKS

Please see below the list of organisations with whom the members of the Technical Expert Network on Catastrophe Risks are affiliated. The inputs provided in the discussion paper is based on each individual members' expertise and contribution.

- Allianz
- Achmea
- AON
- AVIVA
- CMCC (Euro-Mediterranean Center on Climate Change)
- Consorcio de Compensacion de Seguros
- Cotality
- Deloitte
- EEA (European Environment Agency)
- Gallagher Re
- Generali
- Guy Carpenter
- Hannover Re
- HDI
- Impact Forecasting
- JBA
- Liberty Mutual
- MSK Meyerthole Siems Kohlruss
- Munich Re
- ORTEC
- PERILS
- Moody's RMS
- Siriuspoint
- Swiss Re
- Verisk

12. ANNEX III: DESCRIPTION OF MAPPED ATTRIBUTES OF EXISTING TOOLS

An overview of 77 tools is given as examples in a separate table, published together with this report. The overview is created in collaboration with the behavioural analysis study supporting this activity and the examples provided during the public consultation.

This file does not have the ambition to be exhaustive, but rather a compilation showing the diversity of available instruments and is last checked in May 2025.

Table 6 below describes the structure of the information about the different tools as provided in the separate annex:

Title	Sub-title	Item	Example of mapped variation in attribute
Name		Title	*Flood risk Areas Viewer, Risk Estimation Dashboard*
Tool ecosystem		(Main) tool developer, owner or sponsor	*Generali, Italian Department of Civil Protection*
		Sector of developer, owner or sponsor	*Public authority, Private service provider*
Personalisation	Geography	Geographic scope	*National, EU or European*
		Specific geography	*Global, Austria, City of Amsterdam*
	Risk assessment criteria	Location	*Yes/no*
		Building and property characteristics	*Yes/no*
		Environment of the building or assets	*Yes/no*
		Adaptation Strategy, preventive measures	*Yes/no*
		Health and social network	*Yes/no*
		Other criteria	*Yes/no*

Title	Sub-title	Item	Example of mapped variation in attribute
Content and type of advice	Perils covered	Flood	*Yes/no*
		Earthquake	*Yes/no*
		Hail	*Yes/no*
		Subsidence	*Yes/no*
		Windstorm	*Yes/no*
		Cold and frost	*Yes/no*
		Droughts	*Yes/no*
		Heatwave	*Yes/no*
		Tsunami	*Yes/no*
		Wildfire	*Yes/no*
		Other perils	*Yes/no*
	NatCat mitigation recommendations	Insurance cover	*Yes/no*
		Resilience measures (property modifications)	*Yes/no*
		Resilience measures (other)	*Yes/no*
		Advice on/ tools for risk assessment	*Yes/no*
		Emergency guidance	*Yes/no*
		Other	*Yes/no*
	Type of information	Historic data	*Yes/no*
		Actual information and/or warnings	*Yes/no*
		Projections	*Yes/no*
		Risk assessment (modelled information)	*Yes/no*
		Indicators	*Yes/no*
		Prevention and guidance	*Yes/no*
Visual cues	Risk calculation visuals	Colour scale	*Yes/no*
		Numeric scale	*Yes/no*
		Scoring labels and risk symbols	*Yes/no*
	Mitigation recommendation visuals	Illustrations, photos and graphics	*Yes/no*
		Text	*Yes/no*
		Links	*Yes/no*

Title	Sub-title	Item	Example of mapped variation in attribute
Interactivity		Interactive / static page	*Interactive (dashboard), Static (location based)*
		Links to further resources	*Methodological documents, fact sheets, Methodological documents, wide range of information available on the general FEMA website*
Accessibility	Tool interface	Webpage	*Yes/no*
		App	*Yes/no*
		Software (incl. API and web services)	*Yes/no*
		Behind paywall	*Yes/no*
	Saving option	Option to save analysis	*Yes/no*
Link			https://www.desinventar.net/, https://www.floodsmart.gov/flood-risk

Table 6: structure of the information provided for each tool in the Annex.

GETTING IN TOUCH WITH THE EU

In person
All over the European Union there are hundreds of Europe Direct centres. You can find the address of the centre nearest you online (european-union.europa.eu/contact-eu/meet-us_en).

On the phone or in writing
Europe Direct is a service that answers your questions about the European Union. You can contact this service:

— by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

— at the following standard number: +32 22999696,

— via the following form: european-union.europa.eu/contact-eu/write-us_en.

FINDING INFORMATION ABOUT THE EU

Online
Information about the European Union in all the official languages of the EU is available on the Europa website (european-union.europa.eu).

EU publications
You can view or order EU publications at op.europa.eu/en/publications. Multiple copies of free publications can be obtained by contacting Europe Direct or your local documentation centre (european-union.europa.eu/contact-eu/meet-us_en).

EU law and related documents
For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex (eur-lex.europa.eu).

EU open data
The portal data.europa.eu provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.

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