# Public Activity Final Report D1.3

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# Executive Summary

Climate change is increasing the frequency and intensity of natural hazards such as floods, droughts and other extreme weather events. The World Economic Forum's 2019 global risk report lists such natural disasters as one of the biggest threats to society. While recent global events may have shifted the focus of society, climate change problems persist and are linked to a variety of other problems such as mass migration. While limiting humans influence on climate change is important in reducing this threat, measures to make societies and the environment more resilient to its effect are also essential.

Given these issues, and with the benefit of various new technologies and growth sectors (Artificial Intelligence, Nature-Based solutions, remote sensing etc.), the development of climate adaptation innovations is becoming more prevalent. Despite the need for climate adaptation measures, innovations often struggle to reach the end-user market and become implemented. The primary reasons for this are that; innovations are not developed with adequate consideration of their market, innovations are not properly tested (and therefore trusted), and innovations are not suitably marketed to end-users and investors.

The EU Horizon 2020 project **BRIGAID** was initiated to **BRI**dge the **GA**p for **I**nnovations in **D**isaster resilience by providing integral, on-going support for climate adaptation innovations. The project was established in response to the EASME call number DRS-09-2015 for projects on "Disaster Resilience & Climate Change" under the topic "Science and innovation for adaptation to climate change: from assessing costs, risks and opportunities to demonstration of options and practices". This Public Activity Report is a required deliverable of the project that aims to provide a summary on the project's achievements, experiences and lessons learned.

BRIGAID has guided the development of innovations from prototype to commercial deployment by providing innovators with methods and tools designed to increase the social, technical, and market readiness of their innovations. The resources developed by BRIGAID have also been made available for future innovators, and take the form of three 'pillars of support'; 1) a testing and implementation framework to evaluate and enhance innovations; 2) business development and financing framework for increasing market readiness; and 3) resources to boost market outreach to end-users and innovators, such as pitch deck guidelines and an online innovation sharing platform (https://climateinnovationwindow.eu/).

The testing and implementation framework (TIF) consists of three main resources. First, a pan-European database has been developed showing potential climate hazards (e.g. coastal floods, heatwaves, windstorms etc.) at various geographic scales and climate scenarios. This database provides innovators with key information to estimate the market for an innovation. Second, the TIF tool has been developed to evaluate key performance indicators of the technical, environmental, sectoral, societal and (if applicable) cyber-security components of innovations. The tool has been rigorously tested in workshops and with innovators connected to BRIGAID. Finally, methods to assess the impact of 'clusters of innovations' within a specific region have been developed. End-users can utilise these methods to identify innovations that complement each other in reducing a variety of climate risks.

For the marketing and business development of innovations, BRIGAID has again developed three main resources. 'Market Scoping' helps innovators to evaluate the 'market attractiveness' of their innovations, accounting for both the hazard and societal factors that affect the innovation uptake. The 'Market Analysis Framework' is a web-based toolbox to assess the market potential of innovations and guide product developers in identifying and exploiting business opportunities. During the BRIGAID project, guided workshops using the tool were provided for 21 innovators, who provided highly positive feedback on its impact. Finally, business development and investment resources provide an overview of different types of investors, funding schemes and funding options available. As part of this work, the business case for a 'funding platform' has been created, in which both innovators and investors can identify the best connections to grow their respective businesses.

During the project, marketing and dissemination was primarily focused on attracting innovators and end-users to participate in the project, and then promoting the BRIGAID innovations and methods. This was achieved through conferences, social media platforms, policy briefs and websites, and resulted in connecting 120 innovations to BRIGAID and numerous success stories of uptake and investment. 'Communities of innovation' have also set up, which will help future innovators to connect to end-users in their region and share ideas and knowledge. To boost these local and regional communities, BRIGAID organized local workshops and events in locations such as the Netherlands, Belgium and Albania, and set up testing facilities in Romania. BRIGAID has also connected with existing innovation communities where available, such as for drought in southern Spain.

These resources to support innovators were continuously tested and improved and over the lifetime of the BRIGAID project by applying them to specific current innovations identified as being highly promising in tackling floods, droughts, extreme weather or combinations of all three (multi-hazards). 120 innovations participated in the project, after being identified by the various project partners in a stocktaking phase. A select number of innovations were involved in testing and financial assistance, based on careful assessment of their technical readiness, green components, and qualitative aspects such as testing feasibility, vision and promising value.

The project has helped in the development, marketing and implementation of some of the most promising climate disaster resilience innovations in Europe. The technologies employed by these innovations include drones, 3D printing, blockchain, IT applications, machine learning and biological systems. Various innovations have developed new versions of applications of their products (e.g. LeafSkin, CENTAUR), while others have reached the market and are being implanted (EvapoControl, BlueBloqs).

Innovators, end-users, policy makers and other stakeholders have shown their support for BRIGAID, and the project has already contributed significantly to the development, marketing and uptake of innovations in Europe. The tools and resources made available by BRIGAID will undoubtedly positively affect future innovators as well as end-users, investors and of course the general public. Instruments to expand these tools and resources are still being considered, as well as plans to build on the strong innovation communities fostered by the Europe wide consortium.

# 1. Introduction: Climate change and innovation

## 1.1 Disaster risk and climate change

Each year the World Economic Forum (WEF) publishes the Global Risk Report[1] to highlight global threats and how they relate to each other. The threats are categorised and compared in terms of risk, which is classically defined as a combination of both the probability (or likelihood) of an event occurring and the impact if it does occur. Such evaluations can often be subjective, so input for the risk report is obtained from over 800 members of the WEF community. The full set of risks identified is given in Appendix A, and environmental threats are considered by the report not only very likely, but among the most impactful on society.

Of course, many of these threats directly link or overlap, such as extreme weather and natural disasters in the environmental category (green). In these cases, the threats cannot be considered in isolation. To visualise these links, the report also provides a network showing the strength of the connections between all threats (Figure 1). From this it can be clearly seen that societal risks (in red) such as migration, infection and water and food crises are heavily linked to extreme weather events, and in many cases may be one of the primary causes of societal disasters.

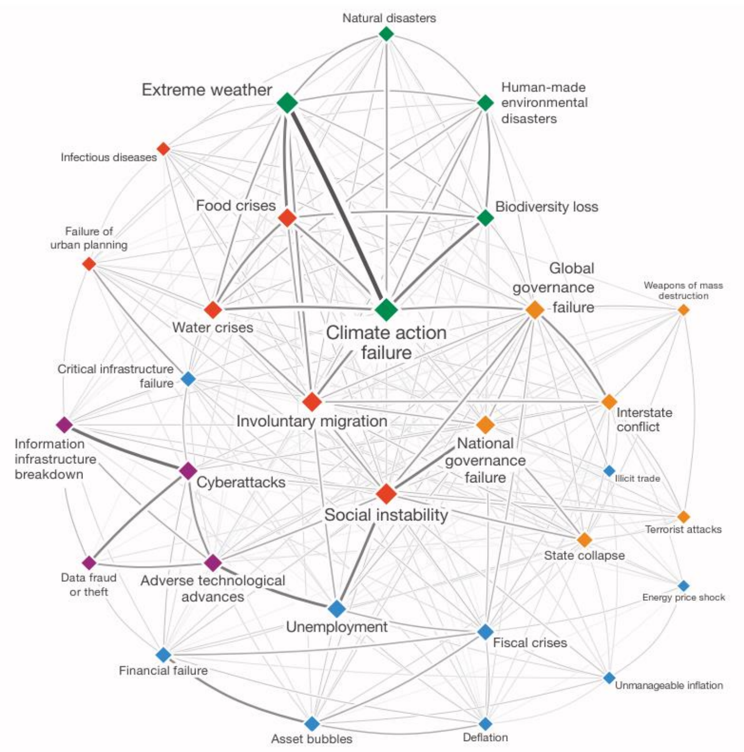



*Figure 1: Global risks interconnections according to Global Risk Report 2020 (World Economic Forum)*

One of the central nodes of the network in Figure 1 is the failure of climate action goals, such as those set out in the 2015 Paris agreement. While some articles of the Paris agreement focus on mitigation of climate change (e.g. attempting to limit the increase in global temperatures to 1.5 degrees Celsius from pre-industrial era levels), many others focus on the adaptation of society to future climate scenarios. Articles 7 and 8 require countries to 'enhance adaptive capacity, strengthen resilience and reduce vulnerability' to the effects of climate change hazard such as extreme weather. Achieving this goal, and thereby reducing the impact of climate change disasters, is key in preventing many of the global threats highlighted by the WEF.

A natural disaster is considered to occur when a (natural) hazard, such as a flood, causes fatalities or damage to property and the environment. The increased energy introduced to the meteorological system due to climate change is expected to increase the frequency and intensity of various natural hazards, such as;

- Floods (coastal, riverine, and rainfall driven),
- Droughts, and
- Extreme weather (e.g. heatwaves and storms).

When trying to reduce the impact of disasters caused by these hazards, a useful paradigm is the disaster risk management cycle (Figure 2). Here, reducing the impact of disasters is broken down into 4 periods; 1) the preparation immediately prior to an event, 2) the response immediately after or during an event, 3) the long term recovery from an event and 4) the mitigation of society to future events.

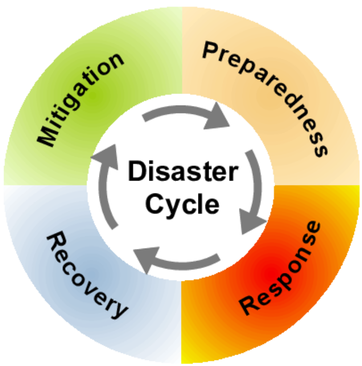



*Figure 2: Disaster management cycle*

Effective disaster management requires attention to all four of these stages, and each stage presents different challenges for risk managers. As discussed above, these challenges are likely to become more acute in the coming years.

## 1.2 Innovations for disaster resilience

To overcome the challenges associated with climate change disasters, new approaches, tools and measures are being developed. This is the focus of multiple climate change 'innovators' across Europe and elsewhere. Academic institutions, private companies and government agencies have, in recent years, paid closer attention to the need for solutions and tools to adapt to climate change effects, resulting in a large increase in the amount of research being undertaken and prototypes being developed. The innovations being developed address all four stages of the disaster risk management cycle given above, particularly the preparation phase (e.g. early warning and detection systems, temporary defences) and the mitigation phase (e.g. remote sensing and permanent defences).

Part of the reason for the surge in innovation development is the abundance of new technologies and datasets available to innovators. Many innovations arise not because of a completely new discovery, but through a novel application of an existing technology. Recent technological advances that are being used for climate change adaptation innovations include those given in Table 1.

*Table 1: New technologies and growth fields contributing to climate change adaptation innovation*

| | |
|---|---|
| Remote sensing and UAVs (drones): | The resolution of satellite imagery in space and time has improved significantly in recent years, and can now include information outside the visual spectrum such as infra-red data. Satellite datasets are also becoming more freely available, and post-processing services are providing more detailed information for developers. This has allowed innovators to develop new disaster detection and forecasting methods, as well as present geospatial information to end-users to mitigate against future disasters.<br><br>Unmanned Aerial Vehicles (UAVs or drones) have become more accessible on the market, and many climate change innovations are making use of this technology. As with the satellite data, UAVs can provide remote sensed geospatial data about potential or on-going events for decision makers. |
| Machine learning | With increased computational power and improved algorithms, artificial intelligence or machine learning technologies have become popular in many scientific disciplines. Climate change adaptation is no different, and the technology is being utilised in various innovations to solve complex problems or gain insights into large datasets. |
| 3D printing | Many climate change adaptation measures involve the precise design and installation of objects in areas vulnerable to natural hazards. This is especially true for measures used to protect against erosion from coastal and riverine flood events. Mass production of these objects has been boosted in recent years by advances in 3D printers and printing materials, allowing climate change adaptation innovators to develop products that are easily scalable in design. |
| Blockchain technology | Monitoring systems are essential in understanding and predicting natural hazards and the information from these systems often need to be de-centralised to protect against cyber threats or server failures. A useful technology in this respect is blockchain, in which 'ledgers' of information can be kept at multiple locations or sensors. Using blockchains in this form also connects it to another emerging technology; the internet of (automated) things. |

| | |
|---|---|
| Nature-based solutions | Although the concept of Nature-based solutions (or NBS) is not a technology, the idea has been significantly advanced and promoted in recent years. The EU defines NBS as "Solutions that aim to help societies address a variety of environmental, social and economic challenges in sustainable ways. They are actions inspired by, supported by or copied from nature". In this respect, they can be seen as methods that work with nature to achieve societal goals such as disaster risk reduction.<br><br>Given that climate change is the cause of the increased frequency and intensity of disasters being tackled though innovation, it follows logically that innovations that have a reduced or positive impact on the environment will be favoured by end-users. This is in preference to the 'grey-infrastructure' or engineered solutions that were traditionally adopted, such as concrete defences. |

However, despite the growing demand for climate change adaptation innovation and the abundance of new technologies available to innovators, many innovations still struggle to reach the end-user market. One of the main reasons for this is that (regardless of how ingenious an innovation may be) various practical issues must be addressed by innovators before products can be implemented. Some of the most important issues include; business development, financing of product development, understanding practical implementation and reaching the end-user market. Overcoming these problems, in cooperation with innovators and end-users, is the primary goal of BRIGAID.

## 1.3 BRIGAID

BRIGAID is a 4-year Horizon 2020 project that started in April 2016, in response to an EASME call on "Disaster Resilience & Climate Change" under the topic "Science and innovation for adaptation to climate change: from assessing costs, risks and opportunities to demonstration of options and practices".

The multi-disciplinary project consortium consisted of 24 commercial, academic and governmental partners linked to many innovation networks and end users across Europe, as listed in Table 2. BRIGAID coordinates and clusters research and innovation activities on climate change impacts by utilizing these networks and by building on recent and ongoing European projects.

**BRIGAID's** objective was to **BRI**dge the **GA**p for **I**nnovations in **D**isaster resilience by providing integral, on-going support for climate adaptation innovations. This is achieved by guiding the development of innovations from prototype to commercial deployment and providing innovators with methods and tools designed to increase the social, technical, and market readiness of their innovations.

These innovation support methods are visually represented in **Error! Reference source not found.** by the 'three pillars' of BRIGAID that help innovations reach the end market. Similarly, end-users are provided with a better to link to innovations, allowing for better evaluation or even influence over development. These aspects of support are undertaken in three Work Packages (WPs) and section 0 provides details of the work done in relation to these support pillars, i.e. the achievements of the;

- Technical and Implementation support (WP5),
- Business development and financing support (WP6), and
- Market outreach and dissemination support (WP7).

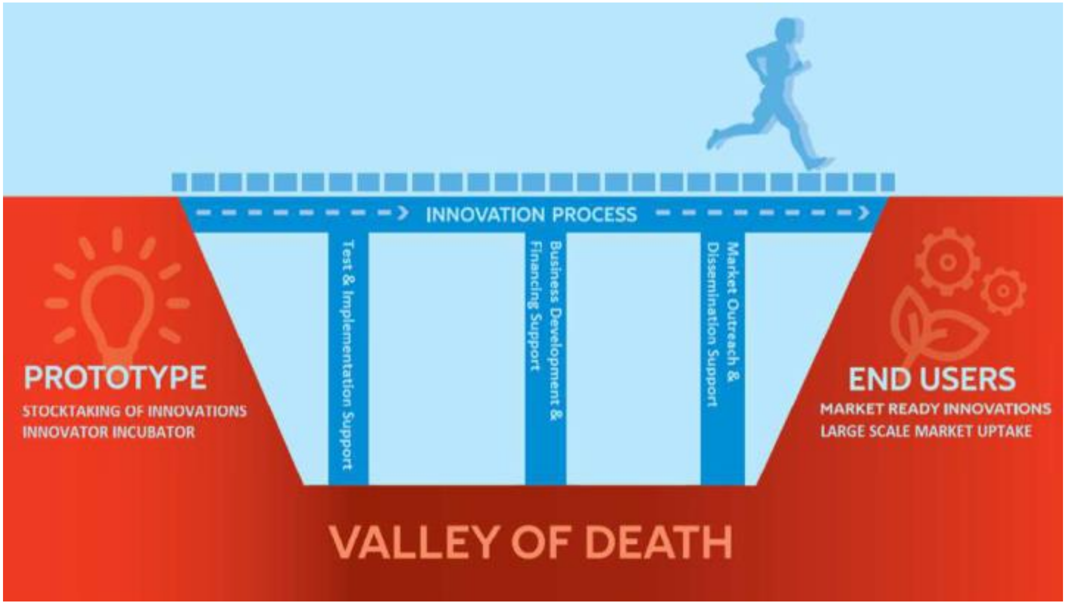



*Figure 3: The BRIGAID support structure to help innovators reach the market*

As well as developing these support methods for innovators in general, BRIGAID used the methods to guide and support over 120 existing innovations throughout the lifetime of the project. Given the valuable assistance that was offered by BRIGAID, careful selection of innovations accepted for support in the project was necessary. The innovations had to be sufficiently developed so that the fundamental concepts behind the innovation were well-formed and thus ready for testing, development, marketing and implementation support. The readiness of innovations was defined using Technical Readiness Levels (TRLs - Figure 4), where innovations with TRLs 4 -8 were selected to participate in the project with reduced groups selected for further marketing support and testing.

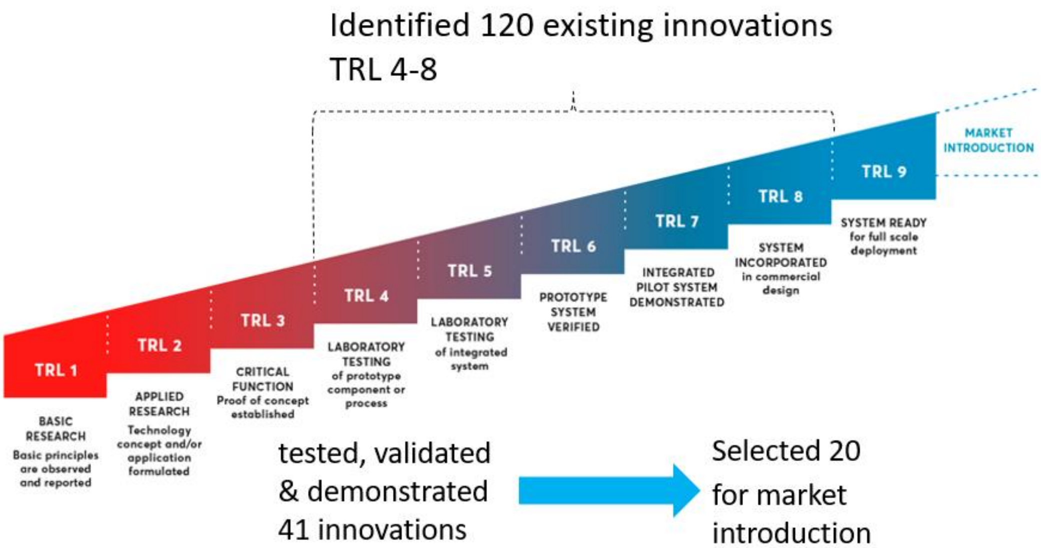



*Figure 4: TRL levels and brief descriptions, alongside number of innovations supported in project*

As well the required TRLs, the innovations that participated in the project also had to contribute to the project's goal of increasing the EU's resilience to climate change hazards. While a broad range of innovation types were considered for support, the innovations should fall into one of three main climate risks; floods, droughts and extreme weather. Figure 6 shows how some specific aspects of these hazards are expected to increase in intensity due to future climate change.

Each of the hazard types is the topic of a work package (WP), in which testing and development of innovations related to that hazard are undertaken. The work packages also created frameworks for the long-term structural development of innovations that would minimize the impact of the respective hazards in Europe and beyond. Some details about these hazards are given below.

Floods (WP2)

Annually, floods cause more damage worldwide than any other natural disaster [2], and climate change is likely to increase the frequency and intensity of their occurrence throughout Europe. BRIGAID supports innovations that increase resilience to coastal, riverine and rainfall-induced floods, at all stages of the disaster risk management cycle.

Droughts (WP3)

Extended periods of water scarcity and heat-stress causes significant damage to food production, ecological systems and societal well-being, and climate change is expected to exacerbate these effects in the future [3]. Monitoring and detection systems are becoming more widely available in identifying these risks, and water resource management innovations help to reduce the impact on society.

Extreme weather (WP4)

Various other natural hazards are also expected to be affected by climate change, such as wildfires, windstorms, heat waves, heavy rainfall. Numerous innovations related to these hazards are supported by BRIGAID in this work package, as well as innovations that address multiple hazards, such as software decision support systems.

In total, BRIGAID consists of eight work packages, of which six directly relate to the three support mechanisms and three climate hazards that the project addressed. The other two work packages relate to the overall project management (WP1) and ethics (WP8) of the project. The leaders of each work package are highlighted in Table 2.

*Table 2: Consortium partners and designated work package leaders.*

| Number | Partner | Country | Work Package Leader |
|---|---|---|---|
| 1 | Technical University of Delft | Netherlands | 1, 5, 8 |
| 2 | HKV Consultants | Netherlands | 2 |
| 3 | FutureWater | Netherlands | 3 |
| 4 | KU Leuven | Belgium | 4 |
| 5 | Ecologic Insititute | Germany | 6 |
| 6 | Off course (previously L'Orangerie Studio) | Spain | |
| 7 | University of Bologna | Italy | |
| 8 | Rina Consulting | Italy | |
| 9 | Thetis | Italy | |
| 10 | International Center for Research on the Environment and the Economy (ICRE8) | Greece | |
| 11 | MIGAL Galilee research institute | Israel | |
| 12 | AquaProject | Romania | |
| 13 | I-Catalist | Spain | 7 |
| 14 | National Territorial Planning Agency | Albania | |
| 15 | Geomatics Research & Development | Italy | |
| 16 | Spectrum Construct | Romania | |
| 17 | Instituto Superior de Agronomia (Higher institute of Agronomy) | Portugal | |
| 18 | Université catholique de Louvain | Portugal | |
| 19 | Gestao Integrada e Fomento Florestal (Integrated Management of Forest Fires) | Belgium | |
| 20 | University of Oxford | UK | |
| 21 | National Administration Apele Romane | Romania | |
| 22 | Civil Engineering University of Bukarest | Romania | |
| 23 | The Funding Company | Netherlands | |
| 24 | Bureau Veritas | Poland | |

The tasks assigned to these partners within the work packages can be seen in the Project Handbook (D1.1). The timetables for these tasks and corresponding deliverables varied, but were roughly structured around three ‘innovation cycles’ over the course of the project (Figure 5). In each cycle innovations were considered, developed and tested over 6 month periods. Innovations that were found to be not ready for market deployment had the chance to be improved and tested again later innovation cycles. This approach meant that the general support mechanisms for future innovations could be iteratively improved during the project, while at the same time supporting multiple existing innovations.

The interaction between innovations and end users was further promoted by organizing conferences involving end users, innovators and other stakeholders; Venice (November 2017), Romania (June 2019), and Delft (scheduled for September 2020).

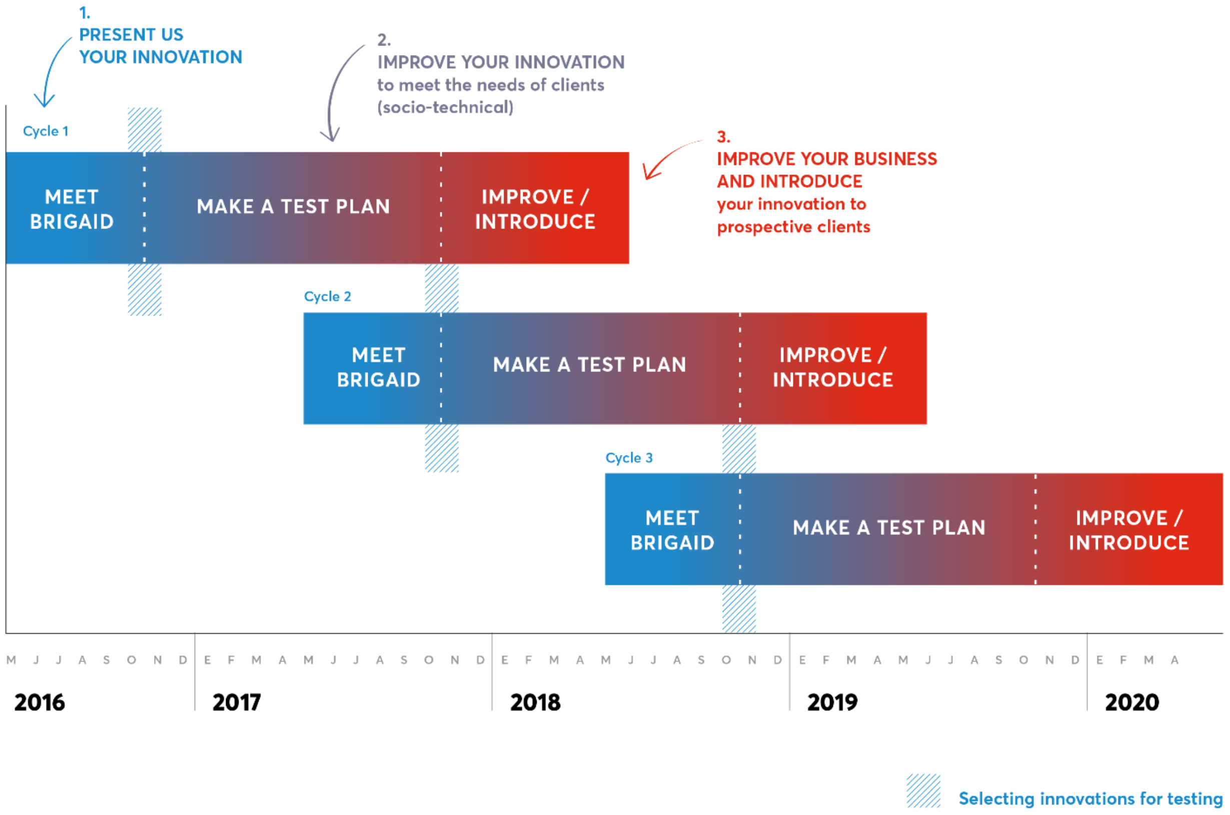



*Figure 5: Innovation cycles over the course of BRIGAID*

This Public Activity Report is a required deliverable of the BRIGAID project that aims to provide a summary on the 'project's achievements, experiences and lessons learned'. The first chapter provides a background on the impetus behind the project (climate change disaster and innovation) as well as an outline of the structure of the BRIGAID project. The general support tools and resources developed for innovators are described in section 2, while some specific innovations supported by the project are highlighted in section 3. An outlook of the achievements of the project is given in section 4.

As this report is only a brief summary on the results of the project, the text often refers to other deliverable documents generated by the project that provide more detail. These references generally use the code for the deliverables given in Appendix A (for example, D1.2 is the second deliverable from the first work package), and interested readers are encouraged to consult these documents to find out more.

# 2. BRIGAID's tools for innovators

## 2.1 Test and implementation framework (WP5)

Currently there is no internationally accepted framework for assessing the readiness of innovations to reduce climate disaster risk. To fill this gap, BRIGAID has developed a standard, comprehensive Testing and Implementation Framework (TIF), the first pillar of BRIGAID's innovation support. The TIF is designed to provide innovators with a framework for innovation and guidelines for assessing an innovation's technical effectiveness, its social acceptance, and its impact on key socio-economic and environmental sectors. The framework is explained in detail in D5.2, and the main components are briefly described below.

### *2.1.1 Current and future estimates of climate risks*

During the research and development process for creating and developing an innovation prototype, it is important that an innovator understands the potential size and geographic market available for their product. For this reason, estimates of climate risks were evaluated at national, regional and local administrative areas (see example in Figure 6, above). These maps are generated for the climate risks and associated indicators given in Table 3.

*Table 3: Climate risks evaluated in TIF and associated indicators.*

| Hazard | Indicator |
|---|---|
| Coastal Floods | Storm surge height with a 100-year return period in meters above water levels with a 10-year return period under historical climate |
| River Floods | River water level with a 100-year return period in meters above water levels with a 10-year return period under historical climate |
| Droughts | Maximum number of consecutive days when precipitation is less than 1 mm |
| Heat waves | Total number of heat waves in 30 years, where heat wave is a period of more than 5 consecutive days with daily maximum temperature exceeding the mean maximum temperature of the May to September season for the control period (1971–2000) by at least 5°C. |
| Wildfires | Average daily Forest Fire Danger Index |
| Windstorms | 99$^{th}$ percentile of daily wind speed in m/s |
| Heavy Precipitation | Daily precipitation with a 5-year return period in mm |

The use of the indicators allows innovators to gauge the number of geographical regions that their product would be applicable to, based on the current risk protection it offers. In the coastal flooding example in **Error! Reference source not found.**, the percentage of regions that can be protected by defences of a certain height are shown. These estimates are further refined by adjusting the distributions based on the GDP and population of the regions. Finally, the risks have been evaluated for the current climate conditions as well as two potential future climate scenarios (RCP4.5 and 8.5 [4]), providing innovators with long-term information on the applicability of their product. This statistical information can be used by future innovators in the advanced market development techniques developed in WP6, and was also used to define testing conditions for innovations within the BRIGAID project.

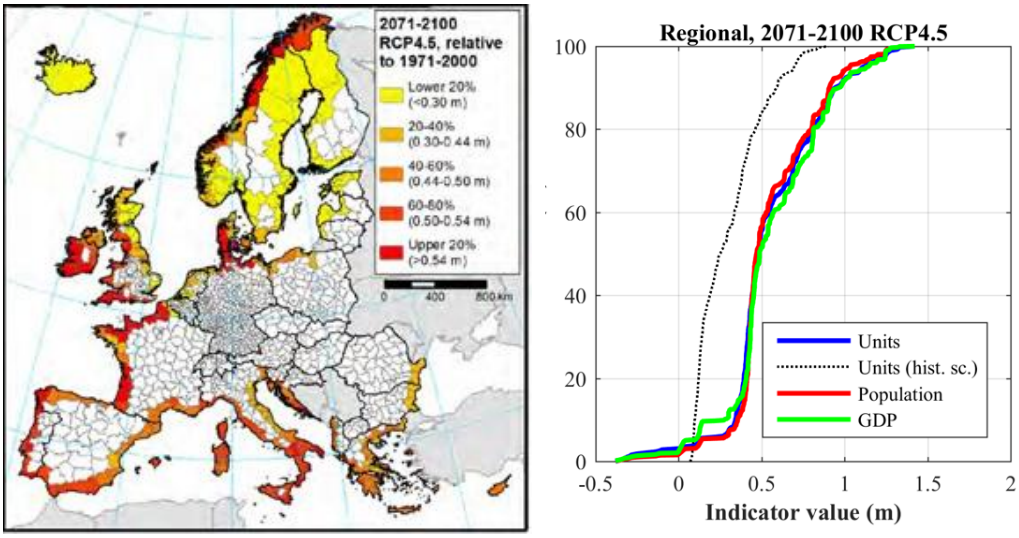



*Figure 6: Example of information available from loading conditions estimation. Left: Expected future increase in indicator of coastal floods (metres above sea level). Right: The percentage of coastal regions in Europe requiring a certain level of coastal flood protection. For more information see Deliverable 5.5*

### *2.1.2 Assessing innovations and the TIF tool*

Following on from the development phase, innovators will generally perform an iterative procedure of refining and adapting an innovation. One of the aims of this procedure is to ensure it meets the technical requirements of risk reduction. However, as well as satisfying these technical requirements, many regions and institutions are eager to implement measures that include co-benefits for the environment and different sectors.

To help innovators assess the strength of the innovations in relation to these technical, environmental, sectoral and societal requirements, BRIGAID has provided a comprehensive review and assessment methodology as described in D5.5. Innovators can use these procedures to improve their innovations, but for quick assessments, performance indicators have been made for different components of the four fields. These performance indicators are defined under the below headings and are embedded in the TIF tool.

- Technical: Technical Effectiveness, Durability, Reliability and Flexibility
- Environmental: Environmental Design, Environmental Impact and Ecological Impact
- Sectoral Impacts: Agricultural, Energy, Forestry, Health, Infrastructure and Tourism
- Societal concerns: psychometric, inflexibility, usability, responsibility.

The TIF tool combines the assessment methods developed for each of these into overall results as per Figure 7. A cyber-security component has also been included in the tool to assess the performance of innovations in which cyber-security is relevant. The performance of the cyber-security field is based on aspects of confidentiality, integrity and availability.

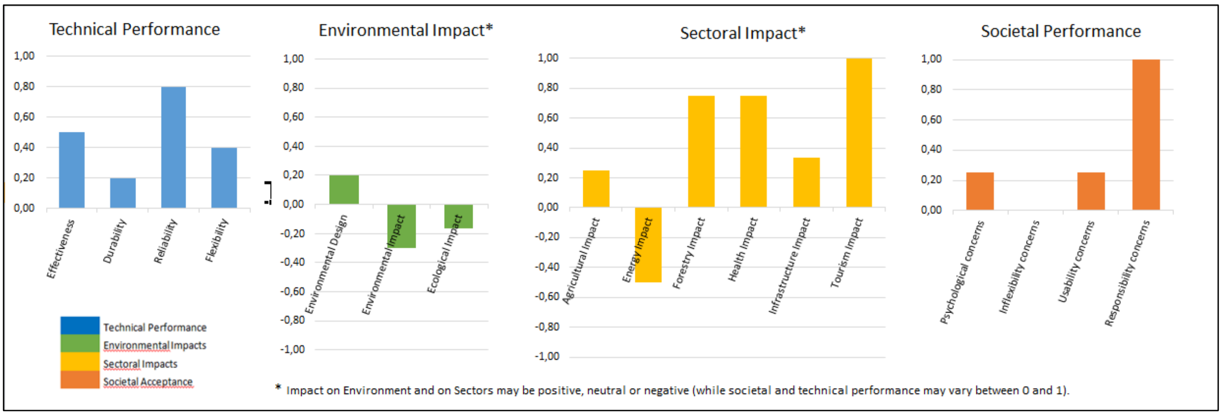
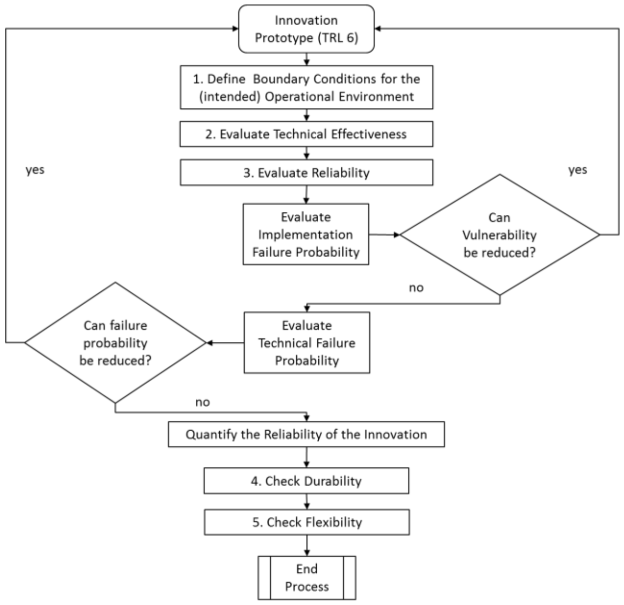



*Figure 7: Example assessment results from the TIF tool*

The tool exists both in excel format and as an online application. As well as supporting the development process of future innovators, the tool was used during the project's innovation cycles to check how innovations that were supported were improving. It was also tested with specific groups of end users, for example with Dutch water authorities during a workshop in Delft in February 2019.

More in-depth assessment of innovations can be made using the entire framework as described in D5.5. These include procedures to assess the technical performance of an innovation, as well as methods to understand the socio-cultural preferences of end-users in relation to innovations (Figure 8).



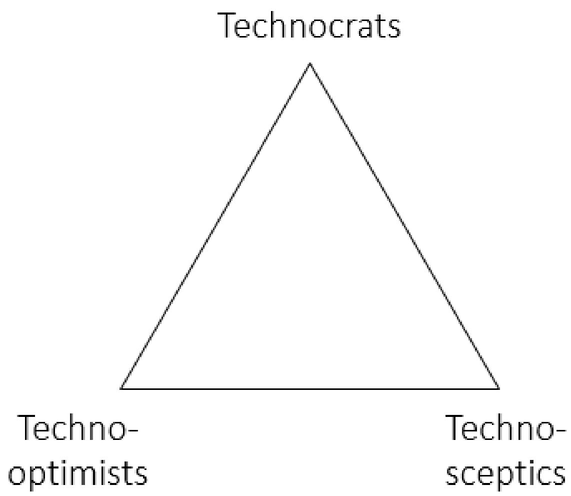




*Figure 8: Components of detailed analysis methods provided by the complete TIF; example procedure developed to assess and improve technical performance (left), and sociocultural preferences (right).*

### *2.1.3 Clusters of Innovation*

For the reduction of climate hazards in a particular area, combinations or clusters of innovations may be required, and the overall impact of these combinations can often be more than the sum of the impacts of the individual innovations. Depending on the hazards particular to a region, the cluster of innovations can be used to tackle multiple different hazards, or the same hazard from different approaches. A framework to identify potential clusters and select optimal combinations in terms of social, environmental and economic risk reduction has been developed as part of BRIGAID (D5.7). As well as the obvious benefits for the decision makers of a particular region, the framework can also be used by innovators that wish to combine with other available innovations or develop new innovations based on the results.

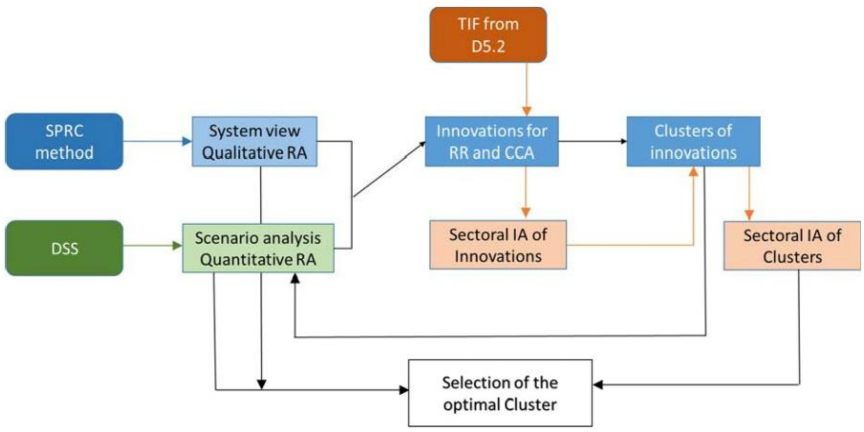



*Figure 9: The methodology for the assessment of innovation clusters. RR=risk reduction, RA=risk assessment, IA=impact assessment, CCA=climate change adaptation*

The framework combines the Source-Pathway-Receptor-Consequence (SPRC) conceptual model with Decision Support Systems (DSS) as per Figure 9, and also uses input from the TIF. The framework was successfully tested as a means to identify clusters of innovation for the reduction of climate hazards in 3 case studies;

- Urban flooding in Antwerp, Belgium
- River floods in Dresden, Germany.
- Coastal floods in Celsenatico, Italy. As an example, the following cluster of innovations was proposed;
    - Temporary flood defences in the urban historical area, such as: NOAQBoxwall and SLAMDAM
    - Flip-flap cofferdam dike, to offer a variable protection to coastal floods.
    - Multi-functional dikes, such as the OBREC device, that can be integrated in the small marina jetties to offer protection from waves and contemporarily produce energy.
    - Green roofs such as HYDROVENTIV, to reduce risk from extreme rainfalls and heat waves and at the same time reduce risk from flooding in the urban area.
    - Early warning systems, such as the Application framework with drone systems and MyWaterLevel app.

## 2.2 Business Development and financing (WP6)

WP6 was designed to go beyond producing a standard, consumable overview of the market (a traditional market analysis report), and instead aimed at enhancing the overall capacity and competitiveness of innovators and their organisations. For this reason, a major focus of work package 6 was to support the business development of innovations within BRIGAID, and the results of these efforts are described in section 0. However, the methods and reports developed to achieve this support have been converted into comprehensive guidance material for future innovators. This guidance is detailed in three reports described below; the market scoping report (D6.1), the MAF+ and business plan report (D6.2) and the PPIF and funding applications report (D6.3), and supported by online tools such as http://maf.brigaid.eu/,

### *2.2.1 Market Scoping*

The market scoping report (D6.1), helps BRIGAID innovators identify regions within Europe where potential business opportunities could emerge based on current conditions and expected impacts of climate change. The report builds on the spatial climate risks identified in the TIF (2.1.1) by including regional market information relevant to innovators such as hazard potential, exposed elements, potential impacts, adaptive capacity and market attractiveness. These results are presented per hazard category and can be further categorised per region (see example in Figure 10). This facilitates the identification of markets that have a high potential of adopting innovative climate change adaptation measures whilst also differentiating between specific hazards.

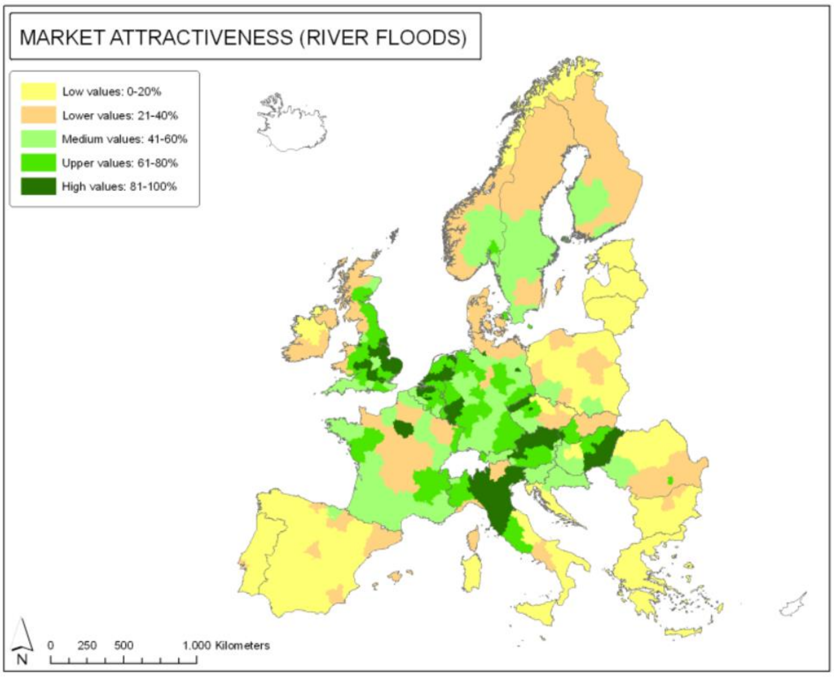



*Figure 10: Example output from market scoping report; market attractiveness for river floods in Europe per region*

### *2.2.2 Market Analysis Framework*

The Market Analysis Framework (MAF) was originally created to analyse the market for water information products and services. Through BRIGAID, the MAF+ has been developed into a web-based toolbox to assess the market potential of innovations and guide product developers in identifying and exploiting business opportunities. The MAF+ has been designed as a free stand-alone resource available to all, however, innovators in the BRIGAID project additionally received personalised guidance and support in completing the exercises within the toolbox. These innovators have provided highly positive feedback on the process (see deliverable D1.3), and future climate innovators are invited to complete an assessment using the MAF+ online, or contact the BRIGAID team for personalised guidance.

The MAF+ is an online collaboration facility that compiles 12 market analysis and business development exercises designed to be completed by non-specialists in these topics. A description of the methodology behind the product is given in D6.2.

| | |
|---|---|
| **Setting the scene** | Business Model Canvas I<br>PESTEL analysis |
| **Identifying and selecting a target group** | Value Proposition Canvas<br>Market Segmentation<br>Attractiveness Scorecard |
| **Assessing market attractiveness** | Market Size estimation<br>Market Growth Rate estimation<br>Cost-Volume-Profit Analysis |
| **Analysing the competition** | Porter's 5 Forces<br>Heat Map |
| **Identifying priority actions** | Advanced SWOT Analysis |
| **Wrapping up the assessment** | Business Model Canvas II |

*Figure 11: The six steps and twelve exercises of the MAF+ assessment*

### *2.2.3 Business plan and investment framework*

Once innovators have assessed the potential market for their product, an important next step is to create a high quality business plan that can attract investment. To support innovators in this, BRIGAID developed the Business Plan Development Process; a set of online tools that can be combined with in-person sessions. Public-Private Investment and Funding model (PPIF) has also been developed to assists innovators in acquiring investment and to provide an overview of different types of investors, funding schemes and funding options available. A simplified version of the framework is given in Figure 12 below, where investment opportunities are graphed in terms of their sustainability and risk tolerance. Overall, this part of the project has enabled innovators to evaluate and improve the market and investment readiness of their innovations

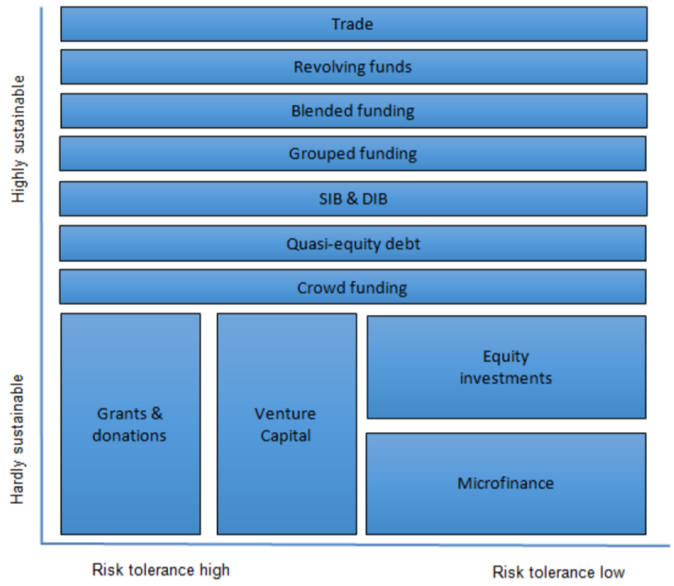



*Figure 12: The public-private investment framework*

Within this work package the business case for a 'funding platform' was also developed, which expands on the Innovation Sharing Platform described in section 2.3.2. The proposed model for this business would allow both innovators and investors to pick and choose the best connections to grow their respective businesses.

## 2.3 Market outreach and dissemination support (WP7)

### *2.3.1 General dissemination activities*

In order to attract innovators and other stakeholders to participate in BRIGAID, early and continued promotion of the project and its goals was required. A first step was the creation of a project website and twitter account (Figure 13) providing contact information, event details and general information. The website also included a video summary the project aims, downloadable deliverables (see Appendix A) and links to tools and materials developed by BRIGAID. With these dissemination methods in place, calls for innovations that would be supported by the project could be made. This was achieved through various media platforms, conferences and the networks of the BRIGAID partners. Combining these external innovations with innovations already developed by partners within the consortium meant that the total intake of innovations reached 120, from an original target of 75-100.

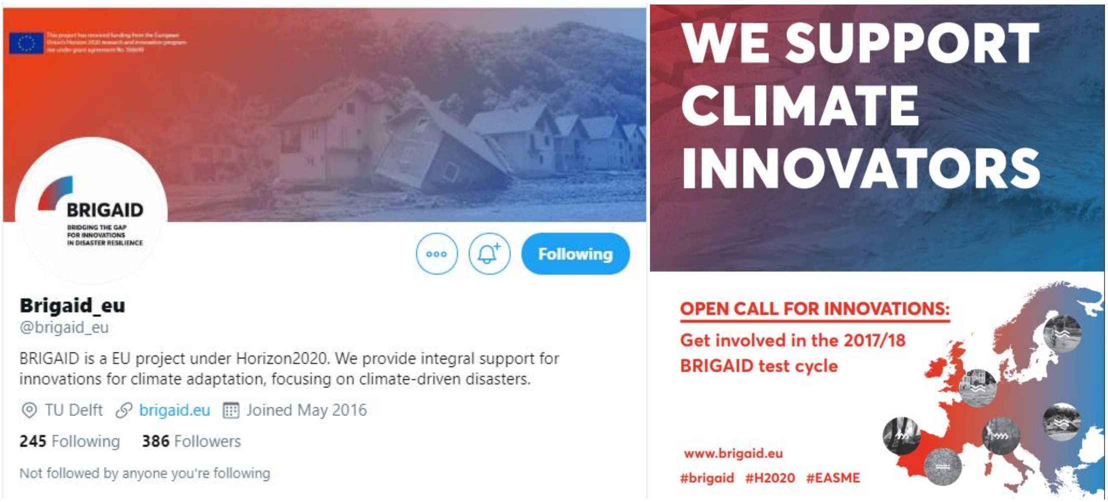



*Figure 13: BRIGAID Twitter account (left) and call for innovators (right)*

As well as attracting innovators to become involved in the project, BRIGAID also used its communication outlets to ensure that the lessons learned and support mechanisms developed were shared with the EU and general public. A useful medium for this information was the distribution of various newsletters and policy briefs, such as those about the TIF (D7.5) and MAF (D7.10). BRIGAID organised numerous regional and project wide conferences throughout Europe, inviting innovators, end-users and other stakeholders to present on various topics. These conferences are listed below, with the major public conferences highlighted in bold. BRIGAID representatives were also present at the conferences of 'sister projects' to BRIGAID (RESIN, RESCCUE, EU-CIRCLE, PLACARD).

- Delft, NL (May 2016)
- Leuven, BE (Nov 2016)
- Berlin, DE (May 2017)
- **Venice, IT (November 2017)**
- Lisbon, PO (Apr 2018)
- Cartagena, ES (Oct 2018)
- **Bucharest, RO (June 2019)**
- Tirana, AL (Oct 2019)
- **Delft, NL (Postponed until September 2020)**

Moreover, to boost local and regional communities, BRIGAID has organized local workshops and events such as national workshops with local innovators and end users in the Netherlands, Belgium and Albania.

### 2.3.2 Climate innovation window

As well as attracting innovations to the project, and communicating the results, work package 6 was also tasked with promoting innovations from within the BRIGAID project. An important tool in doing this was the development of an innovation sharing platform called the Climate Innovation window (CIW). The goal of this platform was to share and promote innovations alongside their performances, requirements, test reports and user experiences. The innovations can be filtered according to hazard type, topic and development stage. The platform also highlights the innovations that were selected for testing and business support. This innovation promotion provided by the CIW was boosted by regular advertising through the project's twitter account, featuring 'innovations of the day' and similar tweets.

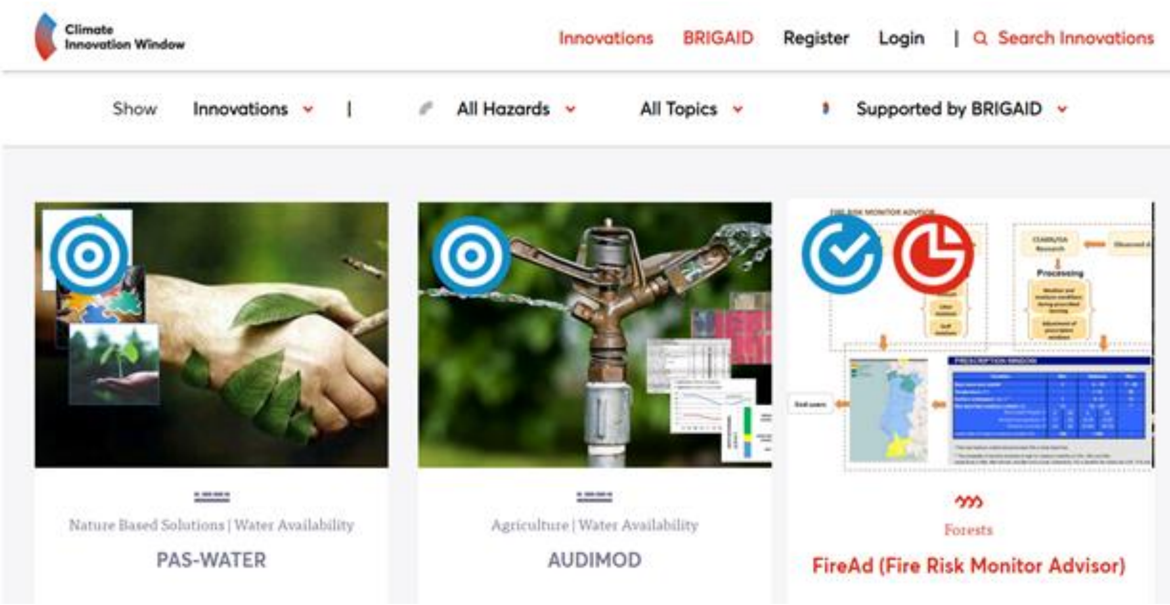



*Figure 14: CIW website*

In collaboration with WP6, a business case has been developed for an expanded version of the CIW, which would act as a marketplace to connect innovators, end-users, qualified investors, and grants and fiscal incentives advisors throughout Europe. Current and future innovators can also avail of the Pitch Deck tools (https://pitchdecks.brigaid.eu/) developed by the project to develop brief attractive presentations for their products,

### 2.3.3 Communities of Innovation

Because climate adaptation requirements vary regionally, the development and implementation of innovations will often benefit from the sharing of local experiences, knowledge and institutional barriers. To help facilitate this, BRIGAID worked to develop Communities of Innovation (CoIs) for the risk reduction of areas with common problems and environmental conditions. The (CoI's) are social networks composed of several geographically connected actors (innovators, end users, sectoral users, investors and societal interest groups) with a common goal or aim. These networks of organizations and individuals combine business, policy and management sectors, focused on bringing new products, new processes and new forms of organization, and providing valuable input, feedback and support for the creation of innovations.

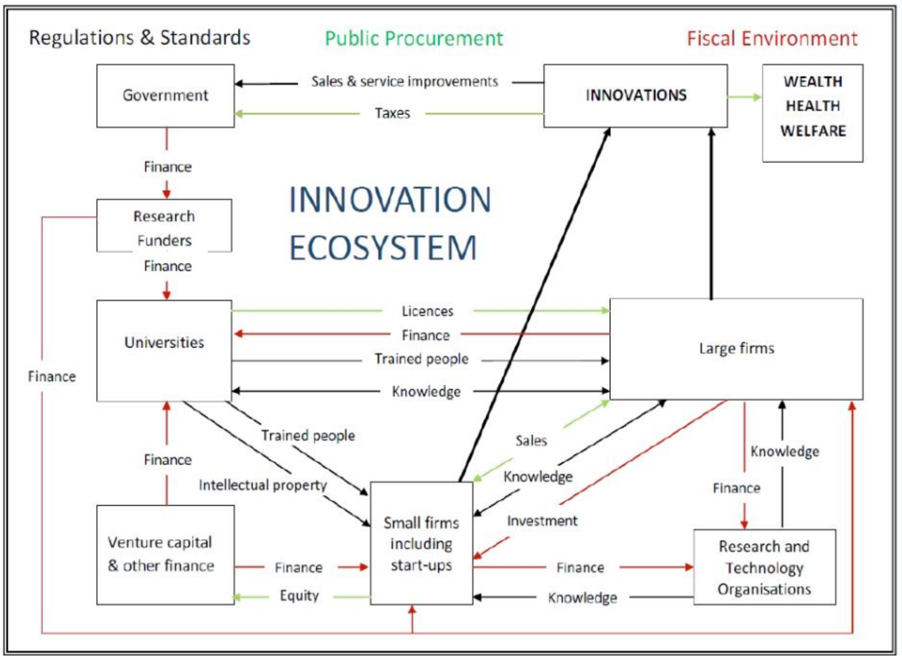



*Figure 15: Framework for the development of communities of innovation*

For the general design of the CoIs, BRIGAID developed; the 'innovation ecosystem' framework to structure the communities (Figure 15), physical and virtual arrangements for networking and interaction, and methods to ensure the communities were financially and administratively sustainable over time. These designs are described in deliverable report D7.8, while specific communities are discussed in D7.9. The current BRIGAID CoIs and other communities supported by the project are given in Table 4, alongside a brief description;

*Table 4: Communities of Innovation supported by BRIGAID*

| **Community location** | **Description** |
|---|---|
| Albania | Albania was an operational test site of innovations during BRIGAID, and this has helped develop a strong community of ministries, NGOs, companies and investors there. The community is organised by the National Territorial Planning Agency of Albania. |
| Antwerp (Belgium) | A community to tackle hazards such as urban flooding and heat stress has been developed in Antwerp. The city is one of the 'living labs' of the project where urban climate innovations can be tested. |
| Netherlands | The Dutch CoI (led by HKV and TU Delft) is still being developed and will primarily deal with floods. It aims to engage public authorities, i.e. Delfland Water Board, STOWA, Ministry of infrastructure and environment, as well as innovators. |
| Portugal | The primary focus of the Portuguese CoI is wildfires, led by local BRIGAID partners ISA and GIFF. The community also includes local agencies such as the Institute for Nature Conservation and Forests (ICNF) and Forest Owners organisation. |

| | |
|---|---|
| Spain | The Spanish CoI has established significant collaboration with the EU project PLACARD (PLAtform for Climate Adaptation and Risk reDuction). An important focus area is the water scarcity and drought issues in Southern Spain, where they have combined with the Irrigators community in the province of Cartagena. |
| Romania | The BRIGAID testing site 'Flood Prood Romania' created various opportunities for local innovators, and has been key in setting up the Romanian CoI. The project is led by the Romanian National Water Authority (NAAR) |
| Venice region (Italy) | Using the BRIGAID conference in Venice as an initial platform, an innovation community is being developed primarily focused on flood hazard. The community will include the Venice Water Authority, Civil Protection Agency and local innovators. |

*Figure 16: Communities of innovation activities in; (clockwise from top-left) the Netherlands, Romania, Albania and Antwerp.*

# 3. Innovations supported by BRIGAID

## 3.1 Introduction

In total, 120 innovations were identified to participate in BRIGAID and utilise the various support mechanisms described in section 2. Although the project attempted to include as many innovations as possible, some innovations were not chosen because they did not meet the criteria for technical readiness or applicability to climate risk reduction. During the project, 40 innovations went through testing, with the aim being to advance the innovation in terms of its social, technical, and market readiness, and to bring it step-by-step closer to successful market uptake. The first stage of testing was completed using the TIF tool (section 2.1), followed by tests to determine the technical performance of the innovation.

Of the innovation tests, 19 were conducted on innovations that had already been developed by BRIGAID consortium partners, and the rest from external partners. The external innovations that underwent testing were selected through a ‘stocktaking’ phase described in D2.3, based on their technical readiness, green components, and qualitative components such as testing feasibility, vision and promising value. In some cases, assessing the technical performance required financial support. BRIGAID was able to provide this support for 11 innovations, selected from the external candidates based on the above criteria. Deliverable 2.2 gives the final test reports for all tested innovations in the project. Table 7 shows the number of innovators supported under each hazard category as well as those supported that were classified as addressing multiple hazards.

*Table 5: Summary table of support provided to innovators in BRIGAID*

| INNOVATIONS | PARTICIPATED | TECHNICAL TESTING | TESTING FINANCED | MAF SUPPORT |
|---|---|---|---|---|
| FLOODS | 30 | 12 | 2 | 4 |
| DROUGHTS | 30 | 13 | 4 | 1 |
| EXTREME WEATHER | 30 | 11 | 3 | 6 |
| MULTI-HAZARD | 30 | 3 | 2 | 5 |
| TOTAL | 120 | 39 | 11 | 16 |

Through the promotion, testing and support mechanisms provided by BRIGAID, participating innovations have shown impressive progress over the project lifetime. Brief descriptions of some example innovations and their progress are given for each hazard category below, but the reader is encouraged to browse the climate innovation window for more detail as well as the full collection of BRIGAID innovations.

## 3.2 Floods (WP2)

### *3.2.1 Example Innovation: CENTAUR (UK)*

CENTAUR is an autonomous monitoring and control system that can be deployed on existing water drainage infrastructure. The idea is to make better use of available capacity in current drainage networks (especially in urban areas) to prevent flooding and overflow. To do this, CENTAUR uses a telemetry and monitoring system coupled with an autonomous Artificial Intelligence based control. As part of the testing of this innovations, BRIGAID funded the building of a small-scale testing facility at the University of Sheffield, which has become a significant part of the 'sales pitch' of the innovation. This testing was for a brand new application of the software for use in the reduction of CSOs (combined sewer outflows) during flood events. A brief video describing the product can be found with this link.


*Figure 17: CENTAUR's basic processing steps (left) and testing facility (right)*

### *3.2.2 Example Innovation: Flip-Flap Coffer dam (RO)*

The Flip-Flap Cofferdam is designed to protect areas prone to river flooding, while being unobtrusive and maintaining recreational access to the river bank in normal conditions. It can be used as boardwalk (walkway) around the clock. If a flood is forecast, it can be raised into a vertical position and locked into the concrete gutter. In this position it acts just like a regular flood protection wall. The test results were highly positive in terms of protection offered by the barrier and installation times.

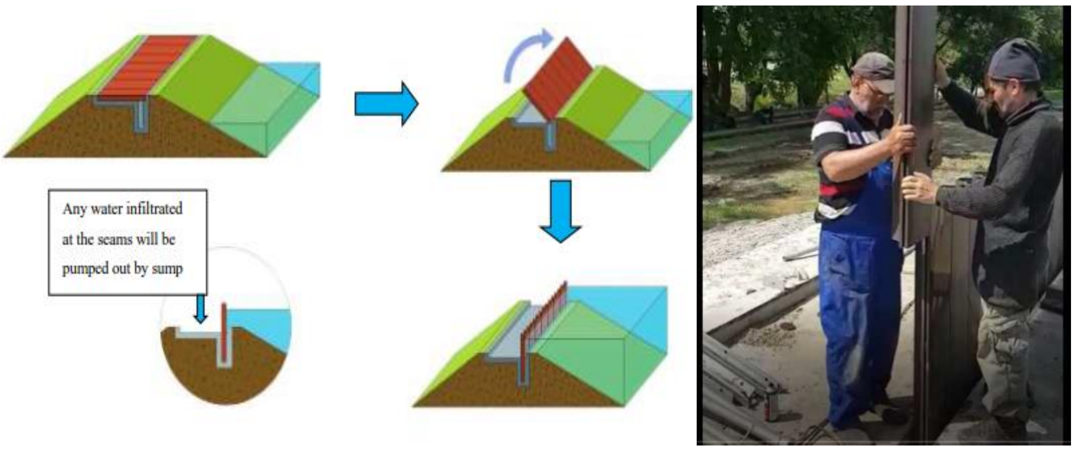



*Figure 18: Basic design of Flip-flap cofferdam (left) and installation (right)*

### *3.2.3 Example Innovation: Application Framework with Drone system (IT)*

This ICT System for monitoring and early warning of flooding can perform a variety of tasks providing data to a Decision Support System. It can be linked on site sensors (e.g. along a river); deployable systems like drones and social media streams (for both data acquisition and dissemination). Testing was conducted on data-handling components such as; acquisition, storage, retrieval and representation, significantly improving the technical performance of the innovation. A brief video describing the product can be found with this link.

## 3.3 Droughts (WP3)

### *3.3.1 Example Innovation: Evapo-Control (ES)*

Evapo-Control is a product from Arana Water Management in Spain, consisting of floating connected Polyethylene covers that suppress evaporation losses and algae growth in water reservoirs. The innovation was identified to tackle droughts in arid and semi-arid regions where the primary source of water comes from small farm dams. Floating covers reduce evaporation loss by reflecting solar radiation and blocking rising water vapour, with the added benefit of reducing algae growth.

BRIGAID supported the innovation in a series of technical tests related to UV light lifespan, water losses, wind resistance and algae growth, helping it grow from a TRL 5 to TRL 8 (see Figure 4). The BRIGAID tools also encouraged sustainable thinking for the product, with a new plan to use recyclable materials. The innovation was officially launched onto the market in April 2019, and the media and conference promotion performed by the project means that end-users present at the BRIGAID conference in Cartagena are already implementing this solution.


DIARIO DE ALMERÍA
En la batalla del coronavirus: mantenemos nuestra cita en los quioscos con despliegue informativo sobre la pandemia

FINANZAS

Coberturas flotantes reducen hasta un 75% la evaporación de agua en balsas

• El prototipo, Evapo-Control, también controla el crecimiento de algas y evita los olores

Ensayos de la Politécnica de Cartagena para la empresa lorquina Arana Water Management. / UNIV. POLITÉCNICA CARTAGENA

F. MATURANA - AGENCIAS

Últimas noticias Más leído

1 Coronavirus: Habla uno de los célebres portadores del ataúd: "Debemos celebrar la muerte"

2 La Cámara de Comercio pide mayor celeridad a las administraciones con las ayudas

3 Casillas tras su infarto: "Volver a jugar va a ser difícil"

4 UGT contabiliza 7.388 ERTE en Almería un mes después del Estado de Alarma

5 Vuelve a rodar el balón en la Liga de Turkmenistán

*Figure 19: Prototype testing of Evapo-Control (left) and media coverage (right)*

### *3.3.2 Example Innovation: Mole – Underground soil moisture sensor connected to the cloud (IT)*

Measuring soil moisture at 30-100 cm depth provides a centralized view of the agricultural crop status and the overall irrigation system. However, the cost of underground sensors and their connectivity limits the applicability of the smart irrigation concept. MOLE is a new sensing-without-sensor concept for monitoring soil moisture. The basic schematisation is given in Figure 20, but more information can be found at the company website. Through BRIGAID's testing a new machine learning based model for soil moisture has been implemented for the innovation. The tests showed that accurate measurements can be retrieved with the learning system after just two days of monitoring.

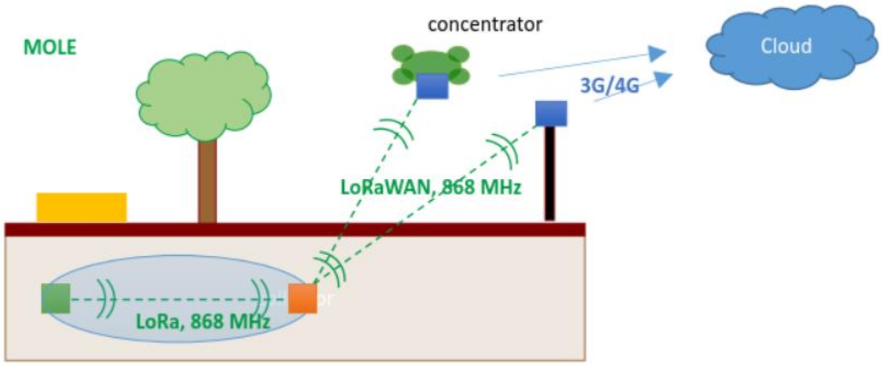



*Figure 20: Basic schematisation of the MOLE innovation*

### *3.3.3 Example Innovation: The Portable Natural Biological System (IL)*

The Portable Natural Biological System (P-NBS) is a modular and mobile solution developed by AYALA Water & Ecology for energy-free sewage treatment technology. The system is based on portable units design according to international dimensions of sea containers that can be transported by trucks. A brief video describing the product can be found with this link. Testing has shown impressive results for water treatment, and upcoming activities for the innovators include; implementing and testing the solution in alternative scenarios, identifying European markets for the innovation, and further promotion through conferences and marketing materials.

*Figure 21: Staged biological treatment in P-NBS*

## 3.4 Extreme weather (WP4)

### *3.4.1 Example Innovation: The Smart Blue-green Roof System: HYDROVENTIV (FR)*

The Hydroactive Smart Roof System (HYDROVENTIV) innovation consists of modular trays device for retaining and dissipating rain water on a roof, with outflow control delayed, piloted by a remote system control for optimizing water resources. The system aims to both reduce the urban flood hazard and regulate rain water storage on the roof. This has extra benefits for biodiversity and thermal cooling in cities. A brief video describing the product can be found through this link, while information about a large-scale test in the city of Antwerp can be found here. With the help of BRIGAID, runoff and evaporation rates have been tested and interest in the product has increased significantly.

*Figure 22: (Top) Hydroventiv installation in Antwerp. (Bottom) Innovation schematisation*

### *3.4.2 Example Innovation: F3 Fire Free Fibres Blankets (AL)*

GREENFIX f³ is a natural solution to protect and mitigate against wildfires, while also reducing erosion on sloped banks. The product is composed of unique grass fibres specially treated according to best environmental practices, so that the fire free fibres are 100 % biodegradable within 36 to 60 months. The product has been installed at a test site in Albania, vulnerable to both erosion and fire due to inattentive cigarette smoking.

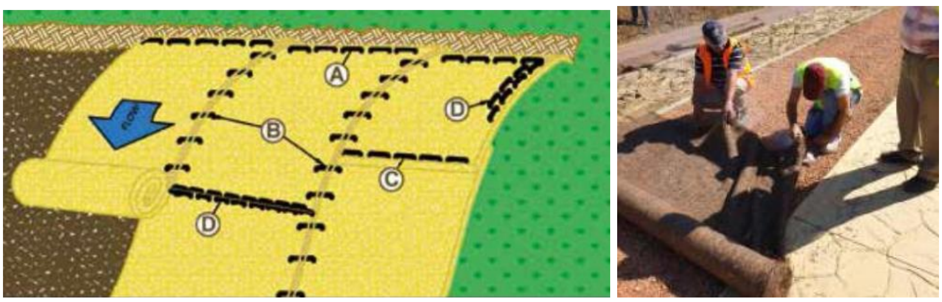



*Figure 23: F3 installation guide (left) and implementation in Albania*

### *3.4.3 Example Innovation: Active Eco-Wildfire Management System (PO)*

This solution is a method for wildfire hazard analysis and forest fuel management. Forest fuel management requires a significant allocation of human and financial resources, so their planning should aim to optimize the effects on the change of fire behaviour due to the implementation of management measures. The proposed methodology takes advantage of the natural capacity of Mediterranean ecosystems to be resilient to fire. Tests at a site in Portugal showed the methods managed to protect forested areas from the immediate and long-term threats of wildfires.

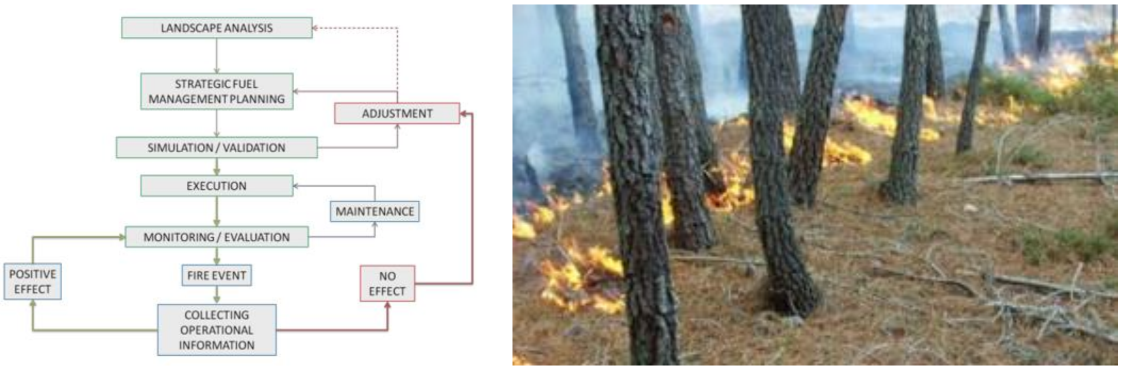



*Figure 24: (Left) workflow for implementation and testing of innovation. (Right) prescribed burning*

## 3.1 Multi Hazard (WP2, 3 and 4)

### *3.1.1 Example Innovation: BlueBloqs (NL)*

Bluebloqs is a visible, scalable and customisable solution to collect, treat and retain rainwater at building, street or neighbourhood level, making it suitable for uncoupling and aquifer storage and recharge for later use. This highly flexible and prefabricated system integrates bio-filtration technology and flow control in a modular product that can be easily applied alongside the curb in residential areas, in squares, industrial sites and parking lots. A brief video describing the product can be found through this link. With the help of BRIGAID testing was conducted on water treatment capabilities, and the product is now being used to provide water for sporting facilities in Rotterdam.

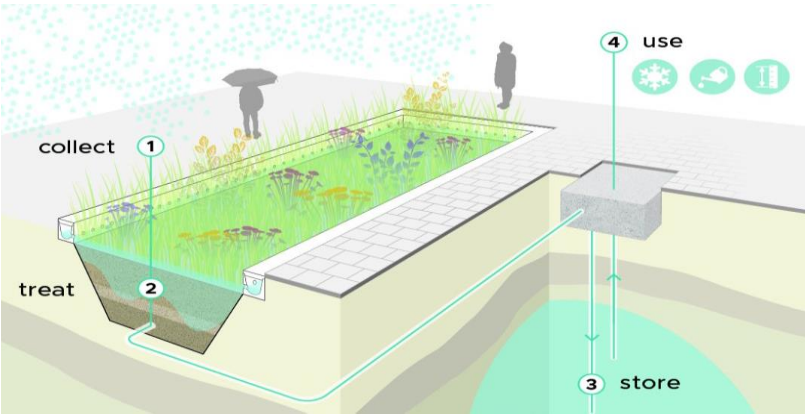



*Figure 25: Schematic of bluebloqs innovation*

### *3.1.2 Example Innovation: eEM-DAT (BE)*

eEM-DAT is a tool that uses a standardised and structured method to collect, validate and analyse climate-related disaster impact data for the purpose of disaster risk reduction policy. The tool is a web application based on the existing EM-DAT database (www.emdat.be) containing essential data on over 22,000 mass disasters in the world from 1900 to the present day. The new application will consist of an interface that can be used to enter disaster data on a local and regional level, including geo-location. This allows for a concentrated understanding of disaster impact on an area. An additional option is the extraction and visualisation of data by different variables, such as area, year or disaster type. As part of BRIGAID's involvement with the innovation, extensive user testing was conducted at a workshop, identifying potential implementations of the service as well as potential markets.

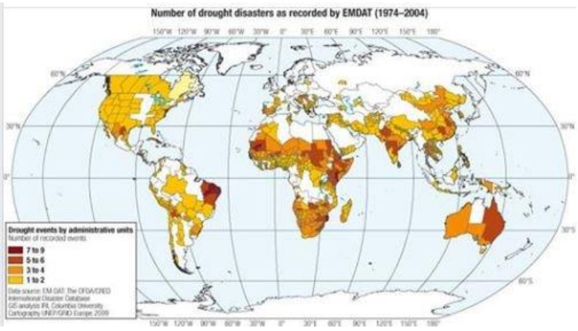



*Figure 26: (Left) Image from eEM-DAT database and (right) panel of testers.*

### *3.1.3 Example Innovation: Mobi-Kat (DE)*

Fraunhofer MobiKat has been designed to effectively support preparation and management of large-scale situations such as floods, droughts and other extreme weather. It supports fire-brigades, rescue organisations, disaster relief staff etc. with information about position and status of all forces and relief items in real-time as well as multiple decision support functionalities. It supports all phases of the crisis management life cycle: prevention, preparedness, mitigation, management and recovery. It is perfectly suited for rapid deployment in fast emerging situations due to a) its intuitive usability and b) flexible data interfaces.

While most components of the product are complete, some parts are still being developed. MobiKat made its successful debut during the Elbe flood in 2006. The system actively supported the civil protection staff of the city of Pirna in terms of visualization of complex situations and prognosis as well as in the optimization of operational planning. Since then, MobiKat was successfully further developed and applied in large-scale operations, e.g. hospital relocations, fire-fighting exercises and major public events. In addition, MobiKat was used for planning of fire and security requirements and planning of operational zones in the regions of Sächsische Schweiz-Osterzgebirge und Meißen as well as in the cities of Dresden and Leipzig.

# 4. Outlook and perspectives

BRIGAID can be considered highly successful in achieving and surpassing its goals in supporting innovation for climate adaptation and resilience. Over the project lifetime, a vast array of tools and resources for future innovators have been developed under three support components; testing and implementation, business development and market outreach. These resources will help progress the development and implementation of future innovations throughout Europe.

Regional estimates of current and future climate risks now provide innovators with vital information on the need for climate innovations, and these datasets have been augmented by socio-economic factors reflecting regional market attractiveness for innovation in Europe. The Technical Implementation Framework allows for the assessment of innovations, highlighting potential obstacles for innovators and providing an objective evaluation for end-users. Combined with the TRL ranking system, the TIF can become a standard for climate adaptation innovation assessment. The resources and tools in the framework will continue to be made available for innovators online, and further developments (as suggested in D5.5) may be possible in future projects.

For innovations that are close to market readiness, the business development methods created in BRIGAID can be of significant benefit. Using the information on markets generated through scoping, the Market Analysis Framework will help innovators exploit business opportunities. These can be turned into concrete business plans specific to climate innovation, and the investment framework ensures these business plans find the right audience. The MAF developed for BRIGAID remains available online for future innovators.

The innovators currently connected to the BRIGAID project will continue to benefit from the marketing outreach of the climate innovation window, while aspiring innovators can make use of the pitchdeck platform. As discussed, a detailed business plan has been made for the expansion of the CIW to better connect innovators, end-users and investors, and discussions are on-going as to how to enact this business plan. Future innovators will also be able to utilise the communities of innovation that have been developed by BRIGAID (see section 2.3.3) such as the one created around the newly built Flood Proof testing facility in Romania. Methods to expand the size and number of the current groups are also being considered.

The above support mechanisms have been tested on a large collection of innovations that were identified as some of the most promising for tackling climate disaster risk in Europe. A small selection of these innovators is highlighted in section 3, but many more can be found through the CIW. These innovations have shown impressive progress with the help of the project, and many are being implemented or receiving investment as a direct result of BRIGAID. However, numerous other innovations were identified as very promising by the project, and systems were set up to identify and evaluate future promising innovations. It is hoped, therefore, that such innovations can also be supported through a future instrument connected with the project.

Many of the most significant conclusions from the project have been disseminated in policy briefs and other media, but some important lessons learned during the project are summarised below;

- Innovation uptake takes time, particularly with larger government organizations, so a four year project is only a start.
- Innovation uptake often takes place at a regional / national level, requiring a regional approach (e.g. workshops addressing local needs in local language). During the project it became clear that there were differences in "innovation culture" and how well developed that innovation culture was between countries.
- It is crucial to involve the financial sector and funders of innovations (banks, investment organizations). in the communities of innovation at an early stage.

As described in relation to the BRIGAID support pillars, future extensions of the project envision developing and supporting; self-sustaining communities of innovation, a self-sustaining online community and database of climate change adaptation measures; and more inspiring climate change innovations. This would further contribute to a systemic change in the development, marketing and implementation of climate change innovations in Europe.

# Appendix A. Project Deliverables

*Table 6: BRIGAID public deliverables*

| Deliverable Number | Deliverable Title | Work Package Number | Lead Beneficiary | Type |
|---|---|---|---|---|
| D1.1 | Project Handbook | WP1 | 1 - DUT | Report |
| D1.2 | Societal Impact Report | WP1 | 1 - DUT | Report |
| D1.3 | Public Final Activity Report | WP1 | 1 - DUT | Report |
| D2.1 | Stocktaking Report WP2 | WP2 | 2 - HKV | Report |
| D2.2 | Development Report WP2 | WP2 | 2 - HKV | Report |
| D3.1 | Stocktaking Report WP3 | WP3 | 3 - FW | Report |
| D3.2 | Development Report WP3 | WP3 | 3 - FW | Report |
| D4.1 | Stocktaking Report WP4 | WP4 | 4 - KUL | Report |
| D4.2 | Development Report WP4 | WP4 | 4 - KUL | Report |
| D5.1 | Initial version of TIF | WP5 | 1 - DUT | Report |
| D5.2 | Full version of TIF | WP5 | 1 - DUT | Report |
| D5.3 | Clusters of innovations | WP5 | 7 - UNIBO | Report |
| D6.1 | Market Scoping Report | WP6 | 13 - ICA | Report |
| D6.2 | MAF+ and business plans | WP6 | 5 - ECO | Report |
| D6.3 | PPIF and funding applications | WP6 | 23 - TFC | Report |
| D7.1 | Communication and Dissemination Plan | WP7 | 13 - ICA | Report |
| D7.2 | Project Website | WP7 | 6 - LOR | Website |
| D7.3 | Innovation Sharing Platform (ISP) | WP7 | 6 - LOR | Website |
| D7.4 | Report on Communities of Innovation | WP7 | 13 - ICA | Report |
| D7.5 | Policy briefs on the TIFF, MAF+ and PPIF | WP7 | 13 - ICA | Report |

# Appendix B. Additional material

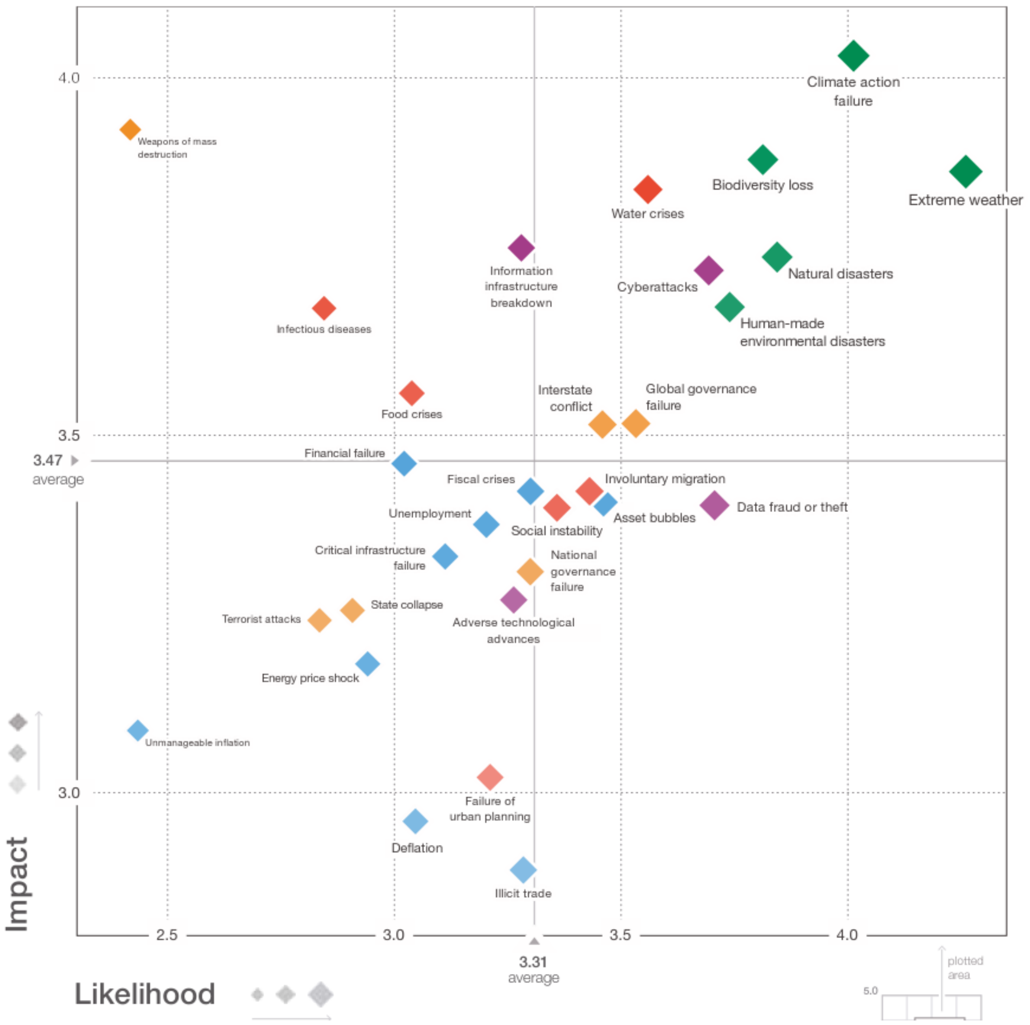



*Figure 27: Relative impact and likelihood of global threats according to Global Risk Report January 2020 (World Economic Forum)*

# Appendix C. Supported Innovations

*Table 7: Innovations supported in BRIGAID with links for more information*

| Name (CIW) | Hazard | Topic | Country | Testing | Budget support | MAF Support |
|---|---|---|---|---|---|---|
| Halophyte Zeolite Wetlands (HZW) | Drought | Water Quality | Israel | Yes | | |
| IRRINET-IRRIFRAME | Drought | Agriculture | Italy | | | |
| New growing system for food vertical farming | Drought | Agriculture | Italy | | | |
| ThirdEye: Flying Sensors to support farmers' decision making | Drought | Agriculture | Netherlands | Yes | | |
| Bathymetry measurements with Fishfinders | Drought | Water Availability | Netherlands | | | |
| InfoSequia | Drought | Disasters + ICT | Spain | Yes | | |
| Water+ Furrow Diker | Drought | Agriculture | Spain | Yes | | |
| PrHo | Drought | Agriculture | Spain | | | |
| Irriframe - Acquacampus | Drought | Agriculture | Italy | Yes | | |
| PAS-WATER | Drought | Disasters + ICT | Spain | Yes | | |
| Hydroeconomic DSS tools for drought management | Drought | Disasters + ICT | Spain | | | |
| EVACOLD | Drought | Water Quality | Spain | | | |
| The honey olive grove | Drought | Agriculture | Spain | | | |
| V.E.R.A. project | Drought | Urban Areas | Italy | | | |
| AquaTag Remote | Drought | Agriculture | Netherlands | | | |
| Holistic soil restoration by means of organic regenerative agriculture | Drought | Agriculture | Spain | | | |
| FREEWAT | Drought | Disasters + ICT | Italy | | | |
| Raincast: A seasonal forecasting system for drought management | Drought | Disasters + ICT | Spain | | | |
| AUDIMOD | Drought | Disasters + ICT | Spain | Yes | | |
| GM4W - GeoGuard Module for Water vapor monitoring | Ex. weather | Disasters + ICT | Italy | Yes | | Yes |
| Active Eco-Wildfire Management System | Ex. weather | Forests | Portugal | Yes | | |
| FireAd (Fire Risk Monitor Advisor) | Ex. weather | Forests | Portugal | Yes | | Yes |
| Useful Wastes | Drought | Water Quality | Spain | | | |
| ORF-4R Evaluation for Organic Regenerative Farming | Drought | Agriculture | Spain | | | |
| SkyDowser | Drought | Disasters + ICT | Netherlands | | | |
| ArboDroughtStress | Drought | Disasters + ICT | Albania | | | Yes |
| Access to sustainable water by unlimited resources | Drought | Water Quality | Netherlands | | | |
| URBRAIN | Ex. weather | Urban Areas | Romania | Yes | | |
| OBREC | Floods | Energy | Italy | Yes | | |
| Application Framework with Drone system | Floods | Disasters + ICT | Italy | Yes | | |
| Toolkit Method | Floods | Disasters + ICT | Italy | Yes | | Yes |
| My Flood Risk | Floods | Disasters + ICT | Netherlands | Yes | | Yes |
| Flip-Flap cofferdam | Floods | Urban Areas | Romania | Yes | | |
| Action plan in case of dike failure | Floods | Water Safety | Romania | Yes | | |
| Expanded EM-DAT disaster database to the European level (eEM-DAT) | Multi-hazards | Disasters + ICT | Belgium | Yes | | |
| EVAPO-CONTROL | Drought | Agriculture | Spain | Yes | Yes | |
| ARIEL, soil moisture retrieval by microwave remote sensing | Drought | Agriculture | Spain | Yes | Yes | |
| GIS-WRAP | Ex. weather | Disasters + ICT | Spain | | | |
| Bufferblock | Ex. weather | Urban Areas | Netherlands | | | |
| Smart Rainfall System | Ex. weather | Disasters + ICT | Italy | | | Yes |
| Really cooling water bodies in cities | Ex. weather | NBS | Netherlands | | | |
| WaterView - IR2 | Ex. weather | Disasters + ICT | Italy | | | Yes |

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|---|---|---|---|---|---|---|
| Seed blanket for Extensive Green Roofs | Ex. weather | Urban Areas | Belgium | | | |
| EFESTO | Ex. weather | Forests | Italy | | | Yes |
| SenZ2 Wireless Level Radar | Ex. weather | Disasters + ICT | Netherlands | | | |
| Wildfire Defense Platform | Ex. weather | Forests | Portugal | | | |
| RECYCLE – Porous and Permeable Pavement Block | Ex. weather | Urban Areas | Italy | | | |
| Mole – An underground soil moisture sensor connected to the cloud | Drought | Agriculture | Italy | Yes | Yes | |
| Roads for Water | Ex. weather | Water Availability | Netherlands | | | |
| Modeling future population's vulnerability to heat waves | Ex. weather | Disasters + ICT | Lithuania | | | |
| NEFOCAST | Ex. weather | Disasters + ICT | Italy | | | |
| FIRECAST | Ex. weather | Disasters + ICT | Spain | | | |
| Draining pavement to support transit traffic and displace storm peak | Ex. weather | Urban Areas | Spain | | | |
| Helsinki's stormwater filtration unit | Ex. weather | Urban Areas | Finland | | | |
| A LAM model for regions with complex orography | Ex. weather | Disasters + ICT | Italy | | | |
| Permeable Polymer Concrete | Ex. weather | Urban Areas | Albania | | | |
| QoAir: A blockchain-based system for heatwave management in urban areas | Ex. weather | Disasters + ICT | Albania | | | |
| Unified Fire Protection Units and System-UFPUS | Ex. weather | Disasters + ICT | Albania | | | |
| Polder Roof (Polderdak) | Ex. weather | Water Availability | Netherlands | | | |
| Multiflexmeter | Drought | Agriculture | Netherlands | Yes | Yes | |
| The Portable Natural Biological System (P-NBS) | Drought | NBS | Israel | Yes | Yes | |
| RichWater | Drought | Water Quality | Spain | Yes | | |
| SCAN | Ex. weather | Disasters + ICT | Belgium | Yes | | |
| The Hydroactive Smart Roof System : HYDROVENTIV | Ex. weather | Water Availability | France | Yes | Yes | |
| Water from Heaven - Hemel(s)water | Ex. weather | Water Availability | Netherlands | Yes | Yes | Yes |
| NoFloods mobile barrier PRO | Floods | Water Safety | Denmark | | | |
| Floating cities with positive impact | Floods | NBS | Netherlands | | | |
| FLUTSCHUTZ Impoundment | Floods | Water Safety | Germany | | | |
| FLUTSCHUTZ Load Filter | Floods | Water Safety | Germany | | | |
| FLUTSCHUTZ Alignment Protection | Floods | Water Safety | Germany | | | |
| FLUTSCHUTZ DeichKADE | Floods | Water Safety | Germany | | | |
| PRAMo - Probabilistic Flood Risk Analysis Model | Floods | Disasters + ICT | Austria | | | |
| Flood Local Tool - Albania | Floods | Disasters + ICT | Albania | | | |
| NOAQ Tubewall | Floods | Water Safety | Sweden | | | |
| SLAMDAM | Floods | Water Safety | Netherlands | | | |
| Paint your city green! | Ex. weather | NBS | Belgium | Yes | Yes | |
| Alma raingarden | Ex. weather | NBS | Norway | Yes | | |
| GREENFIX f3 Fire Free Fibres Blankets | Ex. weather | NBS | Germany | Yes | | |
| Leaf.skin | Ex. weather | NBS | Spain | Yes | | |
| Tubebarrier | Floods | Water Safety | Netherlands | Yes | Yes | Yes |
| SimuRes | Floods | Disasters + ICT | UK | | | |
| HAZ-I | Floods | Disasters + ICT | Lithuania | | | |
| 3D Printed reef balls | Floods | Disasters + ICT | Albania | | | |
| Drini Watershed Management in Albania | Floods | Water Safety | Albania | | | |
| Flood forecasting system including levee performance | Floods | Disasters + ICT | Netherlands | | | |
| Floodcasting | Floods | Disasters + ICT | Belgium | | | |
| Maptionnaire | Floods | Disasters + ICT | Albania | | | |
| Self-erecting flood protection system | Floods | Water Safety | Germany | Yes | Yes | |
| CENTAUR | Floods | Disasters + ICT | UK | | | |
| Water retention through restoration of the sponge function of drained soils | Floods | NBS | Netherlands | Yes | | |
| Tiny House B.E.S.D.® | Multi-hazards | Urban Areas | Italy | | | |
| Flood planting at Erzeni river | Floods | NBS | Albania | Yes | | |
| Neptune Solutions Modular Flood Barrier System | Multi-hazards | Water Safety | UK | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Draining pavement to support transit traffic and displace storm peak | Multi-hazards | Urban Areas | Spain | | | |
| Green-skin permeable system for urban rainwater management | Multi-hazards | NBS | Spain | | | |
| All4Elevation | Multi-hazards | Disasters + ICT | Netherlands | | | |
| Polderroof | Multi-hazards | Urban Areas | Netherlands | | | Yes |
| MobiKat - Support for complex strategic and operative decision-making | Multi-hazards | Disasters + ICT | Germany | | | |
| Drone+LiDAR for Emergency Response | Multi-hazards | Disasters + ICT | Netherlands | | | |
| Futureproof peat meadow polder | Multi-hazards | NBS | Netherlands | | | |
| AdapKIT | Multi-hazards | Urban Areas | Italy | | | |
| Disaster Mitigation & Response Information System - DMRIS | Multi-hazards | Disasters + ICT | Albania | | | |
| Albania Alert (EWS) | Multi-hazards | Disasters + ICT | Albania | | | Yes |
| EWB Fire Water | Multi-hazards | Urban Areas | Netherlands | Yes | Yes | |
| Bluebloqs | Multi-hazards | Urban Areas | Netherlands | Yes | Yes | Yes |
| Dike Profile Generator | Multi-hazards | Water Safety | Netherlands | | | |
| My Water Level | Multi-hazards | Disasters + ICT | Netherlands | | | |
| Spatial Processes in HYdrology (SPHY) | Multi-hazards | Disasters + ICT | Netherlands | | | |
| MyFloodRiskProfile | Multi-hazards | Disasters + ICT | Netherlands | | | |
| EQA-river. Eco-friendly boat mill | Multi-hazards | Energy | Netherlands | | | |
| EQA-tidal. Sophisticated boat mill | Multi-hazards | Energy | Netherlands | | | |
| HAZUR DataManager for Climate Change | Multi-hazards | Disasters + ICT | Spain | | | Yes |
| Low cost meteorological stations | Multi-hazards | Disasters + ICT | Albania | | | |
| MyClimateServices.eu | Multi-hazards | Disasters + ICT | Austria | | | |
| SAEx–L (Signal of Atmosphere Extreme Locally) | Multi-hazards | Disasters + ICT | Albania | | | |
| Rainwater in kindegarden | Multi-hazards | Water Availability | Albania | | | |
| Danube Living Labs - Pilot application Potelu Living Lab Romania | Multi-hazards | Water Safety | Romania | | | |
| I-REACT | Multi-hazards | Disasters + ICT | Italy | | | |
| SolarDew | Multi-hazards | Water Quality | Netherlands | | | Yes |
| FlooDrought | Multi-hazards | Water Availability | Romania | | | |

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