# Bridging Gaps, Building Futures: How DIREKTION Innovates for Global Disaster Resilience

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**ABSTRACT**

The DIREKTION project, funded under Horizon Europe, aims to revolutionize disaster resilience through advanced technology and collaboration. Addressing the challenges posed by climate change, infrastructure vulnerabilities, and dynamic population densities, it seeks a paradigm shift in emergency responses. By integrating innovative technologies with the practical needs of responders and policymakers, DIREKTION enhances cross-sectoral harmonization and fosters stakeholder communication. Early outputs include drafts of the DIREKTION Assessment and Screening Framework and D-SAT tool, establishing a foundation for future development. The project's presentation at ISCRAM invites valuable feedback and engagement, highlighting its commitment to improving disaster management practices and fostering a more resilient society.

**Keywords**

Disaster resilience, Capability-based approach, Stakeholder collaboration, Emergency response management.

## INTRODUCTION

In response to the increasing complexity and frequency of disasters, the DIREKTION project was initiated in October 2023 and is scheduled for a 36-month duration. Funded under the Horizon Europe's cluster 3 security call HORIZON-CL3-2022-SSRI-01, the project aims to improve disaster resilience through a combination of technological innovation and collaboration among multiple stakeholders. The need for DIREKTION arises from multiple challenges, including climate change, aging infrastructure, geopolitical instabilities, and the complexities of managing dense, dynamic populations. These challenges necessitate a new approach to emergency responses, which DIREKTION seeks to address by fostering better knowledge sharing and developing technologies that address the needs of emergency responders and policymakers.

The project focuses on integrating innovative technologies into disaster management practices through thorough assessments of existing solutions, identifying gaps, and prioritizing future research and innovation efforts. It utilizes outputs from previous EU Horizon projects and creates a network of industry stakeholders, small and medium-sized enterprises (SMEs), research organizations, and practitioners to build a more resilient and prepared society.

This paper presents the DIREKTION project, outlining its goals, methodology, and expected impact on disaster resilience and crisis management. We invite the research and practitioner communities to join a collaborative dialogue to improve our collective ability to anticipate, respond to, and recover from disasters.

## BACKGROUND

Facing escalating challenges like climate change, technological disruptions, and societal shifts, there is an urgent need to enhance civil security and crisis management capabilities. The European Union has launched the Horizon Europe call HORIZON-CL3-2022-SSRI-01 under its flagship research and innovation program, aimed at advancing research and innovation in this field (European Commission). One of the projects funded under this initiative is DIREKTION, designed to bolster disaster resilience and management using innovative technologies and methodologies. Horizon Europe's Cluster 3, titled "Civil Security for Society," aims to improve security through solutions for combating crime and terrorism, managing borders, enhancing cybersecurity, and building disaster-resilient societies (European Commission). The DIREKTION project supports these goals by adopting an integrative approach to crisis management that emphasizes advanced technology and cross-sectoral collaboration.

The increasing impacts of climate change, evidenced by more frequent and severe weather events (Kron et al., 2019, p. 82), alongside new technologies, including those developed to cope with climate change, such as electric mobility (Liu et al., 2023, p. 9), that present new firefighting challenges, underscore the urgency of these initiatives. These developments complicate traditional disaster response mechanisms and underscore the need for a flexible, comprehensive approach to civil security. The mission of the DIREKTION project aligns with Horizon Europe's broader goal of creating innovative, inclusive, and sustainable solutions to contemporary challenges. Strengthened Security Research and Innovation (SSRI), a key focus of the program, advocates for transcending sector-specific biases and dismantling existing silos that impede the spread of common security solutions (European Commission).

DIREKTION's integrative approach to crisis management emphasizes advanced technology and cross-sectoral collaboration. By connecting a "network of networks" that includes established fire and rescue organizations, academics, research entities, industry stakeholders, and policymakers, DIREKTION facilitates a comprehensive strategy to address capability needs and gaps, technology screening and sourcing, assessment of technology and project results, co-development of technologies, research programming, and practical standardization aligned with practitioner needs. Additionally, acknowledging the critical role of human factors in crisis management, DIREKTION focuses on designing user-centric solutions tailored to the requirements and capabilities of first responders and affected communities, aiming to enhance both technological and social capacities for effective crisis response.

This collaborative model, supported by Horizon Europe’s framework, underlines the significance of international cooperation and knowledge sharing in addressing global security challenges. DIREKTION exemplifies the program’s vision for a unified European research area focused on societal safety and well-being. Reflecting on DIREKTION's alignment with the objectives of Horizon Europe’s Cluster 3 demonstrates that the project is not just a response to a funding opportunity but a strategic effort to push the boundaries of civil security research and innovation, embodying the EU’s dedication to using scientific research for societal benefits and setting new standards in disaster resilience and crisis management.

## METHODOLOGY

In this paper, we detail the methodology adopted by the DIREKTION project, aimed at addressing the fragmented nature of the research projects and the small-scale, highly fragmented security market. Recognizing the limitations of existing taxonomies based solely on technological solutions, DIREKTION employs a capability-based approach to enhance cross-sectoral and cross-departmental harmonization, improve access to research results and market solutions, and foster communication among interdisciplinary stakeholders in civil security. This methodology leverages the results of prior research (e.g. ACRIMAS[1], ResiStand[2], FIRE-IN[3], MEDEA[4]) and integrates the 13 functional areas identified in the European Commission's study of the EU security market (Deloitte LLP et al., 2022), facilitating a comprehensive mapping of capability needs and solutions.

The project is structured into seven interdependent work packages (WPs) (see Figure 1), each with specific objectives.

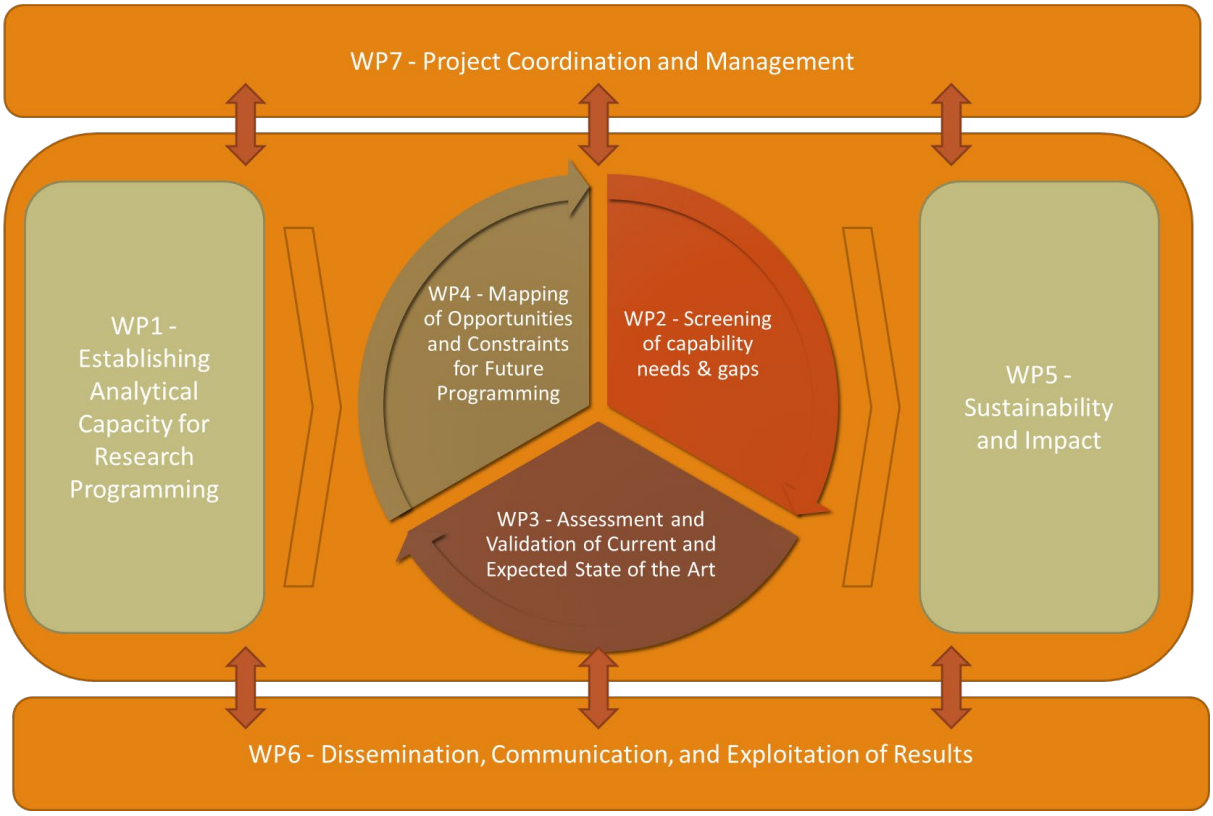


**Figure 1. work package structure of DIREKTION**

In *WP1 - Establishing Analytical Capacity for Research Programming,* the cornerstone of DIREKTION's methodology, a common, sustainable framework that underpins the entire project is being developed. This work package draws upon a wide range of sources, including previous research findings and the taxonomy of the EU Security Market study, to establish a comprehensive categorization system. This system is designed to facilitate the identification and classification of capability needs and solutions, thereby addressing one of the critical challenges: the fragmentation of the security market. By developing a common language and framework for capability needs, WP1 lays the foundational groundwork for the project's success, enabling more effective communication and collaboration among stakeholders.

The WPs 2 to 4 built an iterative process of 3 cycles over the project duration, starting with WP2. *WP2 - Screening and Mapping of Capability Needs & Gaps* focuses on the meticulous identification of current and future capability needs and gaps within the security domain. This involves a thorough analysis of operational requirements, technological advancements, and emerging threats to ensure that the project's efforts are squarely targeted at areas of critical need. WP2's objective is to systematically map out these needs and gaps, providing a clear direction for research and innovation activities. This mapping process is essential for prioritizing research efforts and ensuring

[1] https://cordis.europa.eu/project/id/261669
[2] https://cordis.europa.eu/project/id/700389
[3] https://cordis.europa.eu/project/id/740575
[4] https://cordis.europa.eu/project/id/787111

that the project's outcomes are both relevant and impactful in addressing real-world security challenges.

Based on the WP2 outcome *WP3 - Assessment and Validation of Current and Expected State of the Art* is pivotal in evaluating the operational capacity of existing and forthcoming solutions against identified capability needs. This work package employs a rigorous validation process to assess the alignment, efficacy, and potential of solutions to meet the articulated needs. By involving practitioners and stakeholders in this assessment, WP3 ensures that the solutions are not only technologically advanced but also practically viable and tailored to operational contexts. This alignment between solutions and needs is crucial for the successful operationalization and adoption of new technologies in the security sector.

*WP4 - Mapping of Opportunities and Constraints for Future Programming* undertakes a comprehensive analysis of the factors that influence the successful implementation and uptake of new solutions under consideration of the WP2 and WP3 findings. This includes examining market drivers, barriers to standardization, and the ethical and societal implications of security innovations. By identifying these opportunities and constraints, WP4 provides valuable insights that inform the strategic direction of future research programming. This work package plays a crucial role in ensuring that DIREKTION's efforts are not only technologically sound but also market-ready and socially responsible.

*WP5 - Sustainability and Impact* is dedicated to fostering innovation and enhancing multi-stakeholder cooperation within the DRS community. Through the establishment of networking activities and the introduction of awards for innovation, WP5 aims to build a vibrant ecosystem that supports the exchange of ideas, resources, and best practices. This work package is instrumental in promoting the uptake of new technologies and methodologies, ensuring that DIREKTION's outcomes have a lasting impact on the field of civil security.

*WP6 - Dissemination, Communication, and Exploitation of Results* seeks to amplify the reach and impact of DIREKTION's findings and innovations. By implementing a targeted communication strategy, this work package ensures that the project's results are effectively shared with a broad audience, including industry partners, SMEs, researchers, and practitioners. It should be noted here that the aim is an exchange and not a one-dimensional flow of information. WP6 plays a vital role in establishing a platform for the dissemination and exploitation of solutions, facilitating the transfer of knowledge and technology from the research domain to operational practice.

WP7: Project Coordination and Management ensures the seamless execution and governance of the DIREKTION project. Entrusting the steering role to practitioners from the consortium, this work package embodies the project's commitment to a capability-driven approach. By involving practitioners in the leadership and decision-making processes, WP7 guarantees that the project's developments are closely aligned with the needs and realities of the DRS community, fostering innovation that is both relevant and impactful. Our approach emphasizes a capability-driven strategy for developing new solutions, involving practitioners early in the research process to ensure that future innovations meet operational requirements and market expectations.

By incorporating a mix of foresight capabilities, operational assessments, and strategic cooperation, DIREKTION aims to bridge the gap between demand and supply, facilitating the development of solutions that are both innovative and practically applicable. This methodology not only aims to overcome market fragmentation but also establishes a sustainable framework for enhancing civil security research and innovation, ensuring that future projects are aligned with the real-world needs of practitioners and stakeholders.

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## PRELIMINARY RESULTS AND STATE OF THE PROJECT

The DIREKTION project, in its initial stages, has made considerable progress in developing its foundational elements, namely the DIREKTION Assessment and Screening Framework and the associated DIREKTION Solution Assessment Tool (D-SAT) drafts and its supporting user guide. These preliminary outputs are critical in shaping the project's approach to identifying capability needs and gaps within the domain of Disaster Resilient Societies (DRS), as well as in screening and assessing existing and state-of-the-art technologies. Although these outputs are currently in draft form, they mark a significant step towards establishing a structured methodology for enhancing disaster resilience through innovative technology uptake.

**DIREKTION Assessment and Screening Framework (DASF)**

The DIREKTION Assessment and Screening Framework (DASF) has been developed within DIREKTION's work package 'Establishing Analytical Capacity for Research Programming' (WP1). It resulted in the initial version of a robust framework of methods for identifying capability needs and addressing gaps, as well as implementing screening and assessment processes, to be used for programming future research.

To create the initial DASF, existing methods from both EU projects and external sources are screened beforehand. Methods that align with the needs of the DIREKTION project, either partly or fully, are integrated into the DASF. One of the challenges in developing the DASF was dealing with the complexity of how disaster management is organised, as EU Member States have their own organisational crisis and disaster management structures, culture, traditions and administrative arrangements which are not expected to be changed easily. This has caused a lack of common standardized language in the disaster resilience domain in the EU. Therefore, to identify and describe capability needs and gaps of the EU and all its Member States, a harmonized and well-balanced approach is needed which takes into account the differences in the way they have organized disaster management and the need for standardized terminology. While reviewing existing methods, it became evident that the ResiStand[5] project (H2020) developed a generic framework for disaster management tasks (Stolk et al., 2017). This framework covers all phases of the disaster management cycle – preparedness, response, recovery, mitigation – with the aim of establishing standardized terminology and practices. This framework from ResiStand helped shape the DASF. For practical reasons scoping within the disaster management cycle was needed. The current DASF mainly focuses on the preparedness and response phase instead of elaborating on the entire disaster management cycle; as these are typically the phases in which first response organizations are involved in. Another important role has the FIRE-IN methodology. The FIRE-IN project aimed to enhance the capability development process in the Fire & Rescue sector across Europe. The FIRE-IN method, at its core, consists of an iterative process of identifying capability gaps by workshops and assessing solutions. (Sakkas et al., 2023)

The DASF consists of a set of four methods that include ten steps in total. In Figure 3 these steps are shown as a linear set of subsequent steps. The complete set of steps is meant to be executed regularly, to get an updated insight in the most actual capability needs, capability gaps, potential solutions and to regularly update the roadmap for EU-Research opportunities. As such, the DASF provides the basis for a sustainable process for research programming.

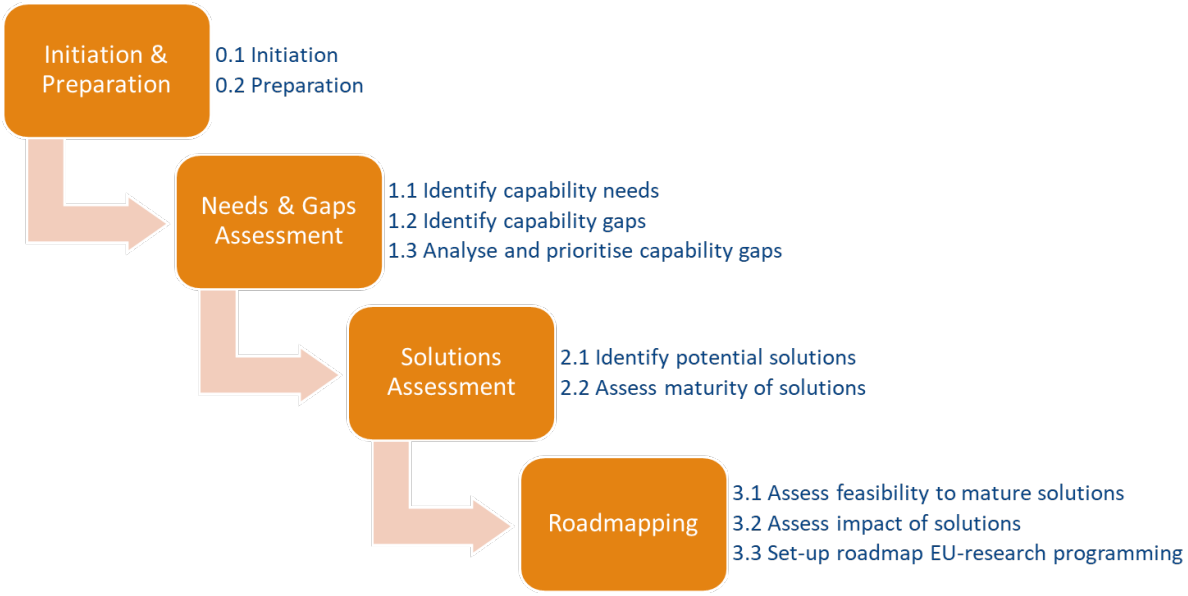


**Figure 2: Overview of the methods and steps in the DASF**

The initial phase, "Initiate and Prepare," is divided into two sub-steps:

- Step 0.1 – Initiation: This step involves preliminary activities that define the framework for the subsequent assessment cycle. Key actions include assigning roles and responsibilities to participants, determining the scope of the assessment (e.g., general disaster response or focusing on specific threat mitigation), and overall project planning.

[5] https://cordis.europa.eu/project/id/700389

- Step 0.2 – Preparation: Following initiation, this step involves preparatory actions to ensure readiness for further assessment and screening in later steps. Activities include identifying, selecting, and informing stakeholders, developing necessary documentation, and preparing supporting tools for steps 2 (Needs and Gaps Assessment) and 3 (Solution Assessment).

The Needs and Gaps Assessment comprises:

- Step 1.1 – Identify capability needs: Using risk and trend analyses, historical accident data, scenarios, and consultations with end-users and experts, this step gathers capability needs for disaster resilience and security (DRS) activities within the EU, for the present and future.
- Step 1.2 – Identify capability gaps: This involves comparing existing disaster management capabilities with the identified needs to highlight capability gaps.
- Step 1.3 – Analyse and prioritise capability gaps: The identified gaps are analyzed to assess their impact on current and future DRS capabilities, determining which gaps should be prioritized for resolution.

Solution Assessment includes:

- Step 2.1 – Identify potential solutions for bridging the gaps: This step involves gathering information on potential solutions, including mature solutions available on the market, as well as prototypes and promising research activities.
- Step 2.2 – Assess maturity of potential solutions: The maturity of these solutions is evaluated based on technical, societal acceptance, integration, and commercialization aspects.

The Roadmapping phase is structured into three sub-steps:

- Step 3.1 – Assess feasibility to mature potential solutions: For solutions still in development, this step assesses the feasibility of developing these into fully mature solutions, including potential challenges toward commercial availability.
- Step 3.2 – Assess impact of potential solutions: This step evaluates the potential impact of solutions on bridging one or more capability gaps.
- Step 3.3 – Set-up roadmap for EU-Research Programming: Aims to propose a research programming roadmap for the short (3 years), medium (5-10 years), and long terms (15+ years), integrating findings from the previous steps to plan future DRS research in Horizon Europe.

#### DIREKTION Solution Assessment Tool (DSAT)

DSAT is designed to support emergency management organisations in systematically comparing and assessing multiple solutions in the context of identified and prioritised capability gaps. The tool builds on the core principles of maturity models. Maturity models have been successfully applied across a range of fields to assess capability. A maturity model is “essentially a classification scheme that places patterns in developing organizational capabilities under a certain capability stage, assuming linear progression from an existing mature state to a higher maturity level” (United Nations Development Programme [UNDP], 2022, p. 10)

D-SAT is an excel based tool that is designed to be easily accessible to multiple users. It involves four components that can be flexibly combined to suit assessment needs. The different components are targeted at different stakeholder groups, with the overarching aim of supporting collaboration and dialogue between supply and demand side actors, successful solution development, and market entry and uptake. D-SAT focuses on two key stakeholder groups. Solution providers (see Figure 2, in orange) and emergency management organisations (Figure 2, in blue) and their interaction in the context of innovation (orange and blue).

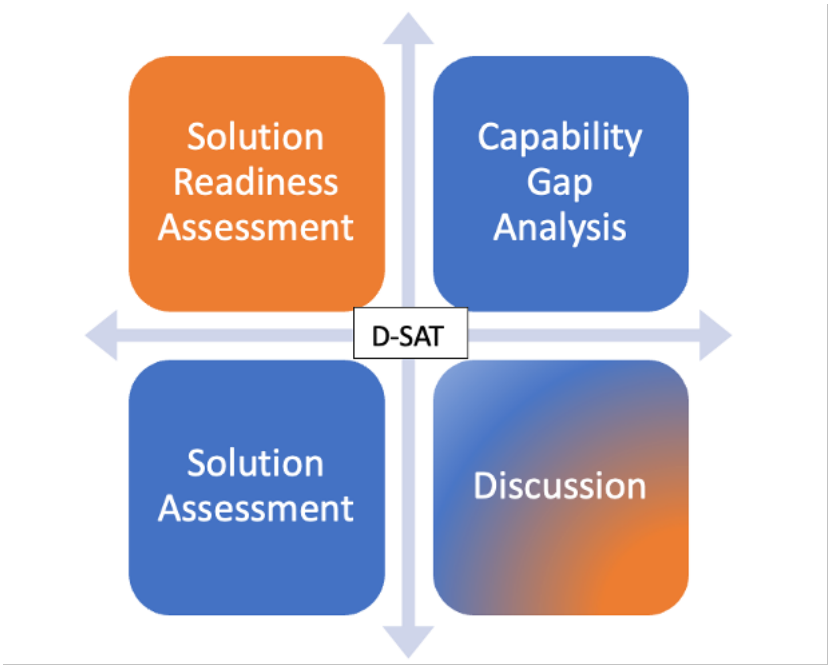


**Figure 3: D-SAT Components by Stakeholder Type**

The 'Solution Readiness Assessment' component is completed by the solution provider and provides information on the readiness of the solution on a variety of scales: technology; societal; manufacturing; integration; commercialisation; legal, privacy, and ethical; and security. This component is intended to provide a structured space to capture information on the readiness of the solution and builds on the ongoing work of the EU-funded project MultiRATE[6].

In the 'Capability Gap Analysis' component the assessment owner will score identified capability gaps using a maturity scale (from 0-5). The maturity of capability gaps is analysed by capability elements: infrastructure; interoperability; technology; human; organisation; regulatory., building on the results of the EU-funded project MEDEA. Results are then assigned a complexity domain according to the Cynefin framework (Snowden & Rancati, 2021) and matched with potential solution functionalities drawing on the results of the EU Security Market study. (Deloitte LLP et al., 2022). This analysis of capability gaps will provide a baseline assessment and allow users to determine the level of response required when choosing and investing in a solution.

In the 'Solution Assessment' component the assessment owner score solutions (from 1-5) against two sets of criteria. The first assesses the likelihood that a solution(s) will improve the maturity of your capability elements. The second assesses the importance of several high-level priorities for the adoption and implementation of the solution being assessed. These are grouped according to three intersecting topics: 1) legal, societal and ethical; 2) user needs; and 3) market. These groupings are flexible and often overlap with one another. The level of importance of these factors varies depending on the kind of solution being assessed. For example, the relationship between these factors and solutions based on AI technologies is rapidly evolving. At the same time changes in supply chains and the shift to thinking in terms of the environmental costs of manufacturing and production are changing how we assess the value of current solutions. Thus, the importance of these factors is linked to the context of the specific solution assessment and its expected use case.

In the 'Discussion' component a range of questions are presented to promote discussion about the factors that enable and hinder the adoption and implementation of solutions. These questions are grouped according to three broad topics: 1) Solution Adoption and Implementation; 2) Solution Impact; and 3) Innovation collaboration, with a focus on EU research. These questions have been adapted from previous DRS research (e.g. ResiStand) and designed to promote the process of reflecting on the value of engaging in innovation collaboration and the adoption of innovation outcomes and results. And to support the identification of potential barriers and enables for the uptake of research and innovation results.

If the solution is on or close to market, the assessment results can help to guide and refine the procurement process. The assessment results should allow emergency management organizations to see if the solution will meet their

[6] https://cordis.europa.eu/project/id/101073929

capability gap needs and provide guidance on how best to use resources. If the solution is still under development, the results can be used to guide collaboration and engagement with providers on what is needed next, either for the solutions assessed or future needs identification. A comparison of the readiness levels assigned to the solution by the solution provider and the results of the assessment will help to see how well supply and demand perspectives are aligned. Finally, repeating the assessment process will allow emergency management organizations to check if the solution has improved their maturity score over time, or if further investment is required. Repeating the capability gap analysis, even without a solution to assess, will also allow emergency management organizations to track how their capability gap needs have evolved over time.

Extant literature has highlighted the role innovation solutions play in the disaster management, especially in the face of an evolving risk landscape (Izumi, et al. 2019; Rahman and Fang, 2019). Research has also demonstrated the bi-fold challenges related to 1) bringing innovative solutions to market (Butler, 2008) and 2) achieving meaningful uptake and adoption of solutions. This is further complicated by a lack of frameworks dedicated to the assessment of innovation potential of solutions (Klessova et al, 2022). Add to this, the fact that responder organisations are traditionally slow to adapt their existing practices and techniques, there is a well-established need for supportive tools to improve demand and supply interaction in the context of innovation assessment (Webster and Gardener, 2019; Nepelski and Van Roy, 2021).

DSAT aims to meet this need by providing a flexible tool to develop and strengthen collaborative solution assessment and better match supply and demand side needs (see Krikigianni et al, 2022). Existing efforts to do so have focused either on a specific solution type, primarily technology, or domain of application, e.g. flooding, wildfires. However, DSAT has been designed to be applied to a range of solution types, including methods and standards. In addition, it adopts an all-hazards approach, providing further flexibility.

The application of the tool will be tested in the context of the DIREKTION project to address a range of solution types across three stages of innovation readiness: 1) close to or on the market solution, 2) under development solutions, and 3) early-stage solutions. The assessment of these solutions will be matched to the identification and prioritization of current and future capability gaps. DSAT seeks to go beyond state-of-the-art approaches through the integration of existing best practices to develop a generalizable framework that will allow for a systemic assessment of solutions and provide a baseline for comparison of solutions across assessing organisations and actors.

As we prepare for the presentation at the International Conference on Information Systems for Crisis Response and Management (ISCRAM), these early results highlight the project's potential impact and its commitment to addressing the complex needs of disaster management. Presenting DIREKTION at this stage offers a dual benefit: it allows for the integration of valuable feedback from a diverse audience of experts, practitioners, and researchers, and it opens avenues for active engagement and collaboration within the project's growing network. This early dialogue is essential for refining the project's outputs and ensuring their relevance and applicability to the challenges faced by the DRS community.

By sharing these preliminary results, we invite constructive feedback and collaboration, laying a foundation for the iterative development of the DIREKTION project. This approach ensures that the project remains responsive to the evolving needs of disaster management and maximizes its contribution to the field.

## CONCLUSION

The DIREKTION project marks a significant advance in the field of disaster resilience and crisis management. As global societies face an increasing frequency and complexity of disasters, driven by factors such as climate change, technological advancements, and geopolitical shifts, there is a critical need for innovative approaches that enhance the capabilities of communities and emergency responders. Funded under the Horizon Europe framework, the DIREKTION project, part of the "Civil Security for Society" cluster, aims to fill current technological and operational gaps in disaster response while promoting a culture of preparedness that extends beyond traditional sectoral and national boundaries.

At the core of the project's methodology is a capability-based approach, which shifts the focus from reactive to proactive and predictive disaster management strategies. This approach involves evaluating existing solutions, pinpointing capability gaps, and focusing research and innovation efforts to develop technologies that meet the practical needs of frontline responders and policymakers. Such alignment is essential to ensure that technological advancements lead to real improvements in operational capacity during disaster responses.

DIREKTION is structured around seven work packages that collectively aim to achieve its ambitious objectives. These packages range from developing analytical capacities for research programming to enhancing sustainability and impact through multi-stakeholder cooperation. The project places a strong emphasis on dissemination, communication, and the exploitation of results to ensure the broad application and maximal impact of the

innovations developed.

Initial outcomes include the development of the DASF Framework and the D-SAT tool, which are major steps forward in structuring disaster management practices. The DASF Framework provides a systematic approach to research programming, while the D-SAT tool enables emergency management organizations to evaluate technological solutions against specific capability gaps. These achievements illustrate early successes in linking technological innovation with operational needs.

In conclusion, the DIREKTION project contributes significantly to enhancing disaster resilience. Through its methodological rigor, collaborative structure, and commitment to incorporating stakeholder feedback, DIREKTION not only pushes forward the state-of-the-art in crisis management but also builds foundations for a more resilient and capable society. As the project progresses, its focus on stakeholder engagement, capability-driven research, and feedback integration will be key to its ongoing success and relevance in an ever-changing world.

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