SYNERGISE

D1.5 End-users' social challenges and acceptance of SYNERGISE solutions

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About the document

The SYNERGISE project's D1.5 report assesses the social acceptability of the project's tools and methods through an empirical study with first responders from the project. It identifies perceived social benefits and social challenges linked to acceptance, analyses their implications for technology uptake, and provides evidence-based insights to support the responsible design and integration of SYNERGISE solutions.

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Nature of the deliverable[1]	R

Dissemination level

PU	Public, fully open. e.g., website	✓
SEN	Sensitive, limited under the conditions of the Grant Agreement	
CL	Classified information under the Commission Decision No2015/444	

[1] Deliverable types:
R: document, report (excluding periodic and final reports). DEM: demonstrator, pilot, prototype, plan designs.
DEC: websites, patent filings, press and media actions, videos, etc. OTHER: software, technical diagrams, etc.

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Abbreviations

AI	Artificial Intelligence
CNBOP	Scientific and Research Centre for Fire Protection – National Research Institute / Centrum Naukowo-Badawcze Ochrony Przeciwpożarowej (Poland)
D	Deliverable
D1.2	Deliverable 1.2 "Ethics, legal, societal and inclusivity framework of FR operations"
D1.5	Deliverable 1.5 "End-users' social challenges and acceptance of SYNERGISE solutions"
EU	European Union
FR / FRs	First Responder/s
GDPR	Regulation (EU) 2016/679 (*General Data Protection Regulation*)
HRTA	Hellenic Rescue Team of Attica / Ελληνική Ομάδα Διάσωσης Αττικής (Greece)
ICT	Information and Communication Technologies
NG / NG1 / NG2…	Nominal Group (and number of the session)
NGT	Nominal Group Technique
RTC	Responder Technology Cluster
SBFF	The Södertörn Fire Brigade Association / Södertörns Brandförsvarsförbund (Sweden)
SYNERGISE	Project name: *"A novel integrated SYstem of Systems streNgthening tEchnical and logistical capacities to ensure better Response to emerGencies by synergIStically addrEssing FRs capability gaps"*
TDPs	Team Design Patterns
THW	The Federal Agency for Technical Relief / Technische Hilfswerk (Germany)
UAV	Unmanned Aerial Vehicle
WiSCE	Wiki Socio-Cognitive Engineering
WP	Work Package
WiSCE	Wiki Socio-Cognitive Engineering

Executive summary

D1.5 provides a comprehensive assessment of the social acceptability of the SYNERGISE technological solutions, analysing how first responders (FRs) perceive the social benefits, social challenges, and operational implications of integrating robotics, wearables, sensing systems, and AI-enabled decision-support tools into real emergency-response contexts. The analysis incorporates direct empirical evidence gathered through four Nominal Group Technique (NGT) sessions held with SYNERGISE' first response partners in Germany (THW), Greece (HRTA), Poland (CNBOP), and Sweden (SBFF). The NGT methodology, combining individual idea generation, group discussion, and structured quantified prioritisation, enabled a systematic identification and ranking of a total of 81 perceived social benefits and challenges, reflecting both shared priorities and organisation-specific nuances.

Across all sessions, **enhanced safety**, both for the general population and for first responders, emerges as the strongest driver of acceptance, supported by improvements in **situational awareness**, **operational coordination**, and the **efficiency** and **accuracy** of detection and response tasks. These perceived benefits reinforce the project's ambition to contribute to a more **resilient**, **effective**, and **interoperable** European emergency-response ecosystem. At the same time, FRs highlighted several key barriers that could hinder adoption, underscoring the need for **responsible**, **transparent**, and **human-centred** implementation. **Privacy and data-protection** issues, **technological unreliability**, **ethical dilemmas**, and the **risk of overreliance** on **automation** are significant barriers that can hinder trust and uptake. These challenges demonstrate that successful technological innovation requires careful attention to **governance structures**, **training**, **communication**, and **meaningful human control**. Third, organisational and contextual factors also play a crucial role: FR organisations vary widely in **resources**, digital **maturity**, and **operational practices**. Without proactive measures to address inequalities, SYNERGISE risks reinforcing existing **technological divides**. Similarly, **public perceptions** of emergency technologies influence broader societal legitimacy: **transparent communication**, **community engagement**, and **demonstrable benefits** are essential for building **public trust**.

These insights underscore that successful adoption depends as much on responsible design, transparency, and organisational readiness as on technical performance. The deliverable synthesises these findings into a list of 10 key benefits and 10 key challenges, comprehensively covering the majority of topics included in the discussions. Based on that list, a set of practice-oriented recommendations that outline concrete actions for implementation across SYNERGISE work packages is presented, tailored for each of the benefits and challenges, with the aim of exploiting the drivers for acceptance, and mitigating the barriers, thus translating social insights into concrete operational guidance. These include strengthening interoperability, embedding privacy- and ethics-by-design principles, increasing transparency and communication, ensuring user-centred design, supporting equitable access across regions, and embedding training, trust-building and participatory processes throughout the project's development cycle, among other specific next steps.

Overall, the results demonstrate that the successful deployment of SYNERGISE solutions requires balancing technological innovation with social legitimacy. Ensuring alignment with end-user expectations, institutional cultures, societal values, and the European legal-ethical framework is essential for achieving trustworthy, effective, and sustainable integration of advanced technologies into first-response operations.

1. Introduction

This deliverable presents a comprehensive assessment of the social acceptability of the SYNERGISE project's technological solutions, with particular attention to how first responders (from now on, FR/FRs) and relevant stakeholders perceive the benefits, risks, and operational implications of integrating emerging technologies into real emergency-response contexts. Building on the regulatory, ethical, legal, and inclusiveness foundations established in Deliverable 1.2, D1.5 advances this analysis by incorporating empirical evidence obtained directly from end users across multiple countries. In doing so, the report ensures that social considerations are not treated as abstract or theoretical, but grounded in the expectations, concerns, and everyday realities of those who will ultimately use or be affected by SYNERGISE tools.

The increasing deployment of emerging technologies in crisis management introduces significant societal challenges apart from the operational opportunities. These technologies can improve safety, efficiency and situational awareness, as has been demonstrated, yet they simultaneously raise concerns related to privacy, accountability, training demands, organisational change and public trust, as the academic and policy literature indicates. Understanding how these issues are perceived by FRs (who operate in high-pressure, ethically sensitive environments) is essential for ensuring responsible and legitimate innovation. This deliverable therefore seeks to understand how FRs perceive the social benefits and social challenges associated with SYNERGISE technologies, and how these perceptions can guide responsible and sustainable implementation. The study focuses specifically on the views of the FR organisations participating in the project (THW, HRTA, CNBOP, SBFF). It does not aim to represent all European FR agencies or every operational scenario; instead, it provides an in-depth, qualitative–quantitative picture of acceptance dynamics. Also, as only SYNERGISE's FRs took part in the study, the results might be partially biased due to their knowledge and active participation in the project. However, including external participants who might be unfamiliar with these types of technology would have led to arguably bigger methodological pitfalls, negative biases or lack of detail. Additionally, it is relevant to note that the analysis is limited to social perceptions and does not assess technical performance, operational feasibility, or economic cost-effectiveness, although participants frequently linked their social judgments to these dimensions. Despite these boundaries, the results offer valuable insights for design, validation, training, governance, and communication strategies across the entire SYNERGISE lifecycle.

The deliverable is structured around a multi-layered approach. First, in Section 2, it revisits the key debates that shape the social impact of technological innovation in crisis management, including public trust, operational transparency, risk perception, data protection, organisational readiness, and the evolving relationship between human responders and automated or semi-autonomous systems. These themes provide the conceptual grounding necessary to understand how social acceptance emerges and why it may vary across contexts.

The core of the report is Section 3, the empirical study conducted through the Nominal Group Technique (NGT). This method was applied in four countries with participating FRs from the SYNERGISE project (Germany, THW; Greece, HRTA; Poland, CNBOP; Sweden, SBFF), enabling a structured yet highly interactive process of idea generation, clarification, discussion, and prioritisation. Participants identified a wide set of social benefits, such as improved safety, better situational awareness, faster victim identification, and stronger interoperability, as well as social challenges, including privacy concerns, technological complexity, cost-related barriers, ethical dilemmas, and risks of overreliance on automated systems. By combining qualitative insights with ranked voting, the NGT provides a rich and balanced perspective on what matters most to end users and how these perceptions may influence the real-world adoption of SYNERGISE's toolkit.

The findings reveal a nuanced acceptance landscape. Safety, both for responders and the general population, emerges as the strongest driver of acceptance, reinforced by perceived improvements in efficiency, situational awareness, and operational coordination, among other key topics (see subsection 3.2.7.1). At the same time, concerns related to data governance, training burdens, system reliability, ethical boundaries, and broader societal perceptions emerge as powerful barriers. These dynamics highlight the importance of responsible design, transparent and clear communication strategies, continuous user engagement, and careful integration of technologies into existing organisational routines and professional identities.

Section 4 then interprets these insights for the ongoing development and future deployment of SYNERGISE technologies. It translates the empirical results into concrete recommendations and contributes to the project's implementation roadmap, ensuring that SYNERGISE's technical evolution remains aligned with end-user expectations, societal values, and the legal-ethical frameworks that govern emergency response in Europe. In this way, the deliverable supports a development trajectory that exploits the social benefits and mitigates the social challenges, producing technically robust solutions while aligning with end-user expectations, societal values, and the legal-ethical boundaries that frame emergency response in Europe.

Section 5 summarises the key conclusions and implications of the social acceptability analysis for SYNERGISE's validation strategy. Section 6 compiles the full bibliography used throughout the deliverable, ensuring transparency and traceability of all sources, while the Annex contains the informed consent form used in the NGT sessions, documenting the ethical safeguards applied during data collection.

2. State-of-the-art of the social impact of emerging technologies for first responders

Recent advances in robotics, wearables, artificial intelligence (AI), and data-driven systems are reshaping emergency response ecosystems, promising faster, safer, and more efficient crisis management, while simultaneously introducing complex social, ethical, legal and legitimacy challenges, along with other end-users needs, that influence technology acceptance and trust (Damaševičius et al., 2023; Duca et al., 2024; Ng et al., 2021; Delmerico et al., 2019). The introduction of emerging technologies in high-stakes environments such as firefighting, disaster management, and medical emergencies often creates tensions between innovation and social expectations of human control, safety, accountability, and fairness (Visave & Cameron, 2024; Duca et al., 2024; Khasawneh et al., 2019). The literature increasingly highlights that the operational performance of these technological innovations alone does not determine long-term success; rather, it is the social environment, including responders' experiences, organisational cultures, and citizen perceptions, which plays a decisive role in shaping adoption and long-term impact and community buy-in (Prasanna & Huggins, 2016; Weidinger et al., 2024; Reuter & Spielhofer, 2017). The aim of this section is thus to provide a short overview of academic and policy debates on the social implications of technological developments for emergency scenarios.

2.1. Technological convergence and operational transformation

Building on this broader context, the convergence of emerging technologies such as Information and Communication Technologies (ICT), AI, wearables, sensor systems and human–machine teaming, into unified emergency platforms offers unprecedented situational awareness and interoperability opportunities. Yet such integration also reconfigures organisational routines and decision-making structures. Studies reveal that when systems automate sensing and coordination tasks, they introduce new dependencies between human operators and digital infrastructures (Allison et al., 2024; Damaševičius et al., 2023). This technological interdependence can enhance real-time response but may also generate operational vulnerabilities if interoperability or communication fails (Khasawneh et al., 2019; Manoj & Baker, 2007; Loft et al., 2021).

Recent European analyses reinforce these concerns. As highlighted by the DIREKTION project together with the Responder Technology Cluster (RTC), in their policy brief titled *"Strengthening Responder Technology in Disasters"* (2025)[2], "ensuring the resilience and preparedness of our first responders is more critical than ever", especially in the face of "increasingly complex and unpredictable crises". The report stresses that future-proofing responder capabilities requires "moving from a reactive to a proactive approach to innovation based on professional and expert foresight, prevention and anticipation". This aligns with SYNERGISE's objective of delivering enhanced sensing, interoperability and decision-support functions that respond directly to evolving capability gaps.

The RTC document also emphasises structural gaps that modern technology development must address:

- First, "capability development planning serves as a cornerstone… for identifying gaps, anticipating future threats, and aligning security research investments with operational needs", underscoring the need for integrated robotics–sensor platforms capable of supporting foresight and rapid detection.

[2] Report available at: https://drmkc.jrc.ec.europa.eu/events-news/all-news#news/432/details/28908/strengthening-responder-technology-in-disasters-policy-brief-released. The RTC is an informal and voluntary subset of the *Community for European Research and Innovation for Security* (CERIS), facilitated by the *Crisis Management Information Network Europe* (CMINE). It is made-up of 20 projects working on the development of solutions for emergency response, including SYNERGISE.

- Second, responder organisations are encouraged to "create a team in charge of monitoring innovation, research, development and testing of new technologies and concepts, and incorporating new technologies to improve operations", a challenge the SYNERGISE toolkit explicitly addresses through co-design, testing cycles and mission-level fusion.
- Third, technology development advances must directly target operational gaps, since the RTC calls for solutions that "directly support and protect emergency responders at operational level" and are "adaptable, usable and efficient in real-world disaster scenarios".

Examples in other EU-funded projects such as CURSOR (search and rescue robotics), DARLENE (augmented reality for law enforcement agencies) and ASSISTANCE (situation awareness tools and training for FRs), demonstrates that advanced technology increases operational performance only when accompanied by other efforts such as ethical, legal and privacy assessments; continuous practitioner–developer dialogue; transparent data governance; and social-acceptance processes. In particular, the RTC report (2025) recommends to: "promote the development and use of AI technologies according to ethical and legal requirements, to enhance data-driven foresight as well as disaster preparedness and response"; "beside the introduction of new technology, support training frameworks with ethical/legal frameworks for more effective adoption"; "promote the development and use of ethical and explainable AI technologies to enhance disaster preparedness and response"; and "increase technology acceptance in emergency responder organisations by including innovation management as an ordinary task into these structures", among other key takeaways. These projects and end-users networks collectively show that technological sophistication is insufficient if the organisational, human, and normative foundations required for deployment are missing. As the RTC stresses, responder technologies must remain "practical, interoperable, and aligned with the evolving needs of those who safeguard our communities", a recurrent theme across recent disaster resilience projects.

The success of convergent systems, thus, depends not only on technical interoperability but also on ethical and institutional interoperability, ensuring that technological systems complement, rather than constrain, professional autonomy and established risk cultures (Delmerico et al., 2019; Weidinger et al., 2024). For example, rescue robotics can reduce human exposure and extend sensing in hazardous zones, though authors stress the need for greater robustness, versatility and ease-of-use before routine deployment, an acceptance issue as much as a technical one (Delmerico et al., 2019; Queralta et al., 2020).

Altogether, as technologies become more tightly integrated into operational practice, the problems identified across the aforementioned policy brief (RTC, 2025)–capability gaps, interoperability shortcomings, insufficient foresight, uneven innovation uptake—, reemerge as core determinants of how responders perceive and interact with automated tools. This shift takes the discussion from system-level technological convergence to the more granular and socially shaped dynamics of user-level acceptance and trust.

2.2. Trust, acceptance and human-machine interaction

In that sense, trust and perceived usefulness are central to the acceptance of innovation among FRs. Empirical evidence shows that frontline professionals evaluate technologies not only by performance metrics but also by perceived reliability, transparency, and their fit with existing practices (Prasanna & Huggins, 2016; Weidinger et al., 2021; Fujimori et al., 2022; Shapira & Cauchard, 2022). Automation bias refers to the human tendency to over-rely on automated recommendations, leading to errors of commission (following incorrect advice) or omission (failing to act when automation misses something). In high-stakes domains such as emergency response, this bias can reduce vigilance and undermine situational awareness, especially when systems appear highly reliable. Research shows that clear feedback, uncertainty cues, and training that emphasises critical evaluation of automated outputs are essential to mitigate automation bias and maintain safe, balanced human–automation teaming (Parasuraman & Riley, 1997). In general, trust

develops over time. Trust calibration is not a one-time event but a dynamic process in which first responders continuously update their trust based on system performance, transparency, and the match between expectations and real-world experience. Proper calibration prevents both over-trust (e.g., relying too heavily on automated cues) and under-trust (e.g., disuse of tools despite reliable performance), which is essential in high-risk, time-critical operations. Research on longitudinal trust calibration in human–robot teams shows that repeated, predictable, and explainable interactions support stable and appropriate trust over time, ultimately improving safety, coordination, and technology acceptance (De Visser et al., 2020). Furthermore, it has been demonstrated that acceptance of the technology increases when users feel that tools respect their expertise and enhance (not replace), their decision-making capacity (Weidinger et al., 2024; Brar et al., 2022; Duca et al., 2024). Conversely, limited training, lack of feedback mechanisms, or opaque algorithmic outputs can foster distrust, so organisational endorsement and participatory implementation processes play a critical role in legitimising technological adoption (Baetzner et al., 2022; Bevan et al., 2022; Kruijff-Korbayová et al., 2021). This suggests that perceived reliability, transparency, adjustability and complementarity are pivotal for securing buy-in among FRs and their organisations.

In particular, with regard to the transformation of professional roles due to human-machine interaction, it is frequently highlighted that automation introduces both relief and tension. While intelligent systems can reduce cognitive load and increase efficiency, research on human–machine teaming demonstrates that excessive automation may diminish experiential knowledge and adaptive improvisation during crises, creating also uncertainty about accountability and human agency (Ng et al., 2021; Visave & Cameron, 2024; Khasawneh et al., 2019; Loft et al., 2021).
Adaptive automation in search-and-rescue requires transparent coordination mechanisms that keep humans meaningfully in control while allowing robots to autonomously take over tasks in hazardous or time-critical conditions. Work agreements—explicit, shared understandings of roles, responsibilities, and handover moments—have been shown to strengthen human–robot cooperation by reducing ambiguity, supporting predictability, and ensuring that automation adapts to the responder's needs and situational constraints (Mioch, Peeters & Neerincx, 2018). Ethical analyses of robot-assisted SAR highlight that such agreements must be grounded in core human values, including safety, accountability and human dignity, ensuring that autonomous behaviours respect professional judgement and societal norms even under extreme operational pressure (Harbers et al., 2017). This transformation towards automation challenges established hierarchies and risk cultures, demanding new ethical guidelines for shared decision-making between humans and autonomous agents (Nussbaumer et al., 2021; Smids et al., 2019). Other ethical debates arise when time-critical decisions intersect with algorithmic decision-support, reinforcing the requirement for "meaningful human control" (Enqvist, 2023; Loft et al., 2021; Battistuzzi et al., 2021). Thus, maintaining a balance between efficiency and professional identity remains key for preserving legitimacy and morale within FR's organisations. These concerns about trust and interaction naturally extend to the governance of the data that underpins such systems, making privacy and public legitimacy essential pillars of technological acceptance.

2.3. Data governance, privacy and public legitimacy

Another frequently identified challenge in the literature appears with regard to privacy and surveillance anxieties, as emerging technologies in crisis management rely increasingly on continuous data collection, from wearable sensors to drone or robotic imaging. Work referencing General Data Protection Regulation (GDPR)-relevant risks highlights concerns about continuous localisation of responders, biometric capture via wearables, and drone imaging (Battistuzzi et al., 2021; Damaševičius et al., 2023; Carpenter et al., 2016). Concerns over ownership, third-country data transfers, and long-term storage have prompted calls for governance models that integrate data minimisation and contextual consent (Visave & Cameron, 2024; Hrymak et al., 2023), including clear purpose limitation, access control, data-minimisation, and communication about storage/retention (including third-country processing) to sustain legitimacy. Mismanagement or

perceived misuse of personal or sensitive data risks eroding trust not only in specific tools but also in the institutions deploying them (Ventrella, 2020; Battistuzzi et al., 2021). These concerns are not only legal-compliance issues; they are also social-licence issues that can depress participation by FRs and chill public cooperation if left unaddressed.

Public reactions to visible technologies such as drones or robotic systems for public purposes (i.e. emergency, security) strongly shape their social legitimacy. When citizens perceive these tools as enhancing safety and transparency, support tends to increase; however, associations with surveillance, militarisation or loss of human contact can generate resistance (Heen et al., 2018; Aydin, 2019; Wang et al., 2023). Transparency in communication, such as explaining purposes, limitations, and benefits, emerges as a key determinant of public acceptance (Schmidt et al., 2020; Ryan et al., 2019; Visave & Cameron, 2024). Published authors agree that legitimacy grows when emergency technologies are presented as public-interest tools embedded in democratic accountability frameworks rather than opaque instruments of control (Wang et al., 2023; Damaševičius et al., 2023). However, even when public acceptance is high, systemic inequalities and organisational conditions can shape who benefits from innovation and who risks being left behind, prompting attention to issues of access, ethics, and governance.

2.4. Inequality, organisational conditions and ethical governance

The uneven diffusion of advanced technologies among different communities and European FR organisations also emerges as a critical concern. Smaller municipalities and volunteer-based units may lack resources for acquisition, training, or maintenance, resulting in a growing digital divide (Calle Müller et al., 2024; Lee et al., 2024; Weiss et al., 2018; Manoj & Baker, 2007), which risks generating "technologically advanced" versus "technologically excluded" regions, undermining the cohesion and solidarity underpinning EU resilience policy. Such heterogeneity threatens institutional fragmentation and inconsistent service quality, weakening system-level legitimacy if citizens perceive postcode-dependent protection (Calle Müller et al., 2024; Delaney et al., 2024). Addressing these disparities requires models combining affordable acquisition paths, capacity-building mechanisms and shared infrastructures ensuring that technological innovation benefits all communities equally (Calle Müller et al., 2024; Doke et al., 2020; Titko & Slemenský, 2025; Baetzner et al., 2022).

With respect to other dimensions such as the organisational and psychological one, the integration of complex technologies into high-stress environments introduces new challenges. Responders face cognitive overload, shifting hierarchies, and ambiguous accountability structures when interacting with autonomous systems (Misra et al., 2020; Butler et al., 2024; Khasawneh et al., 2019; Delmerico et al., 2019). Ethical oversight frameworks, including ethics-by-design processes, participatory design and ethical impact assessments, are increasingly recommended to prevent "ethical drift" and maintain alignment with humanitarian values (Nussbaumer et al., 2021; Machiri et al., 2023; Germani et al., 2024; Moitra et al., 2022). Advancing on this human aspect of technological advancements for work tasks, organisational cultures that encourage reflection, peer dialogue and inclusive decision-making have been shown to improve resilience and moral clarity among responders (Bevan et al., 2022; Lawn et al., 2020; Schwepker et al., 2020).

From the EU regulatory landscape perspective, the Union Civil Protection Mechanism, the Cyber Resilient Act, unmanned aircraft systems' regulations, and most importantly the Artificial Intelligence Act and the General Data Protection Regulation (GDPR), establish the baseline for lawful and responsible deployment of emerging technologies in disaster response. However, as prior paragraphs have shown, and more studies note, legal compliance alone is not sufficient to guarantee ethical and social legitimacy (Visave & Cameron, 2024; Díaz-Rodríguez et al., 2023; Petersen & Büscher, 2015). A growing body of research advocates for adaptive governance models that integrate human-rights impact assessments, transparency obligations, participatory mechanisms and citizen oversight (Laux et al., 2024; Lennard, 2025; Nussbaumer et al., 2021). Such

approaches enable continuous ethical monitoring across the technology lifecycle, reinforcing institutional accountability and sustaining public confidence.

2.5. Towards an integrative understanding of social impact in first response

Taken together, these organisational, ethical and societal factors underline the need for integrative, multidimensional approaches capable of capturing the full spectrum of social impacts associated with technological innovation in first response. In fact, recent literature also moves towards interdisciplinary and multidimensional frameworks that combine quantitative and qualitative indicators to assess social acceptance and impact, including trust, perceived fairness, inclusiveness and community resilience (Reuter & Spielhofer, 2017; van Haaster et al., 2017; Corvo et al., 2021; Baetzner et al., 2022). Scholars argue that social acceptance is not a static attitude but a dynamic process evolving through interaction, communication and learning (Weidinger et al., 2024; Prasanna et al., 2016; Aloudat et al., 2014; Shapira & Cauchard, 2022; Ryan et al., 2019). Integrated approaches linking ethical, organisational and societal dimensions provide a more accurate picture of how technological innovation reshapes the social fabric of emergency-response ecosystems.

In alignment with this perspective, the following Section 3 demonstrates that integrated analytical approaches linking ethical considerations, organisational conditions, and broader societal perceptions provide a more comprehensive understanding of how technological innovation reshapes emergency-response ecosystems, particularly in relation to the SYNERGISE project. Such cross-dimensional frameworks capture not only performance outcomes but also the evolving social fabric in which SYNERGISE solutions will be deployed.

3. Evaluation of social acceptability of SYNERGISE solutions

3.1. Methodology overview

This deliverable combines a structured review of ethical, legal, social, and operational considerations with an empirical assessment of technology acceptance. The analysis is based on a multi-country nominal group technique (NGT) conducted with FRs from the SYNERGISE's project (THW, HRTA, CNBOP and SBFF), enabling the systematic identification, discussion, and prioritisation of perceived social benefits and challenges of SYNERGISE technologies. Each group followed a standardised process involving idea generation, clarification, and individual scoring, allowing for both qualitative insights and quantitative comparisons across contexts. The resulting data were ranked and synthesised to identify key thematic patterns and to inform recommendations for responsible design, user engagement, and future project activities, as can be seen in section 4.

3.2. Identification of benefits and challenges of SYNERGISE's solutions

3.2.1. Nominal Group Technique

For D1.5, it was decided to use the NGT with project end-users, a mixed-methods technique. This type of research allows for the exploration of questions that may not be best answered by purely quantitative approaches due to technical complexity or limited information available, and has an exploratory nature that can uncover dimensions that would otherwise be overlooked (Bachman & Schutt, 2017; Bush et al., 2020). Therefore, the aim is not to gather representative and generalisable findings to all contexts, but to explore the insights of end-users in the SYNERGISE context. Thus, this methodology was used to capture the perspectives of experts in the field of first response.

The NGT was originally developed by Delbecq & Van de Ven (1971) and can be considered a variation of small focus groups, brought together to reach a consensus that is quantifiable. Information is gathered by asking individuals to respond to questions posed by a moderator, and then participants are asked to prioritise the ideas or suggestions of all group members. The adequacy of nominal groups to the objectives of SYNERGISE lies mainly in their nature as a consensus-building methodology, which is defined below:

> *"NGT is a highly structured technique combining characteristics of an individual survey and a focus group. Its structure limits researcher influence and influence from group dynamics. It increases the likelihood of equal participation for all group members and equal influence of (conflicting) values and ideas. NGT can be used in an exploratory (phase of a) study, can be used to generate hypotheses about topics which are relatively unfamiliar to the researcher, or to become familiar with the ideas found to be relevant to a research population that is socially and culturally different from the researcher. NGT is particularly relevant in applied research as a decision-making tool and as a consensus method" (Vander Laenen, 2015, p.11).*

The Nominal Groups sessions are structured as follows, particularly adjusted for this SYNERGISE's activity:

1. Define the task (in the form of a question about the (1) perceived social benefits and (2) social challenges related to social acceptability of SYNERGISE, in writing and visible to the group, ensuring that the question is understood by all).
2. Individual generation of ideas. Participants were asked to individually write down in the chat 3 short sentences related to the question, for 5 minutes.

3. Record all ideas. They were typed into an Excel file by the moderator while sharing the screen.
4. Clarification and discussion of ideas. For around 20-30 minutes, each of the ideas generated was addressed in order to obtain clarification: similar ideas were grouped, rephrased and merged, or divided into several ones. Newly created ones were also allowed to be introduced.
5. Rank or prioritise ideas. Individually, each participant selected what they considered to be the top 5 social benefits/challenges and scored them from 5 points (top 1 benefit/challenge) to 1 point (top 5 benefit/challenge), giving a different score to each of them.
6. Quantitatively determine priority. When these scores were typed into the Excel file, it automatically showed quantitative results. The moderator also explained to the participants what these results meant.

The process prevents any one person from dominating the discussion, encourages all members of the group to participate, and results in a set of prioritised solutions or recommendations that represent the group's preferences. Thus, these are the reasons for using nominal groups (De Ruyter, 1996; Vander Laenen, 2015; Hugé & Mukherjee, 2018):

1. Consensus is promoted as a result.
2. Moreover, its structure ensures the establishment of conclusions that lead to concrete results, and allows the proliferation of a large number of synthetically developed ideas.
3. Consideration is given to minority positions.
4. Participants in the group are encouraged to participate in order to ensure the success of the ideas which do not depend on the brilliance of the presentation or the dominant position of any member.
5. The process minimises unproductive conflicts (unproductive conflicts are minimised because each group member has the opportunity to contribute equally).
6. In addition, it helps to clarify options and order them. By using this structured approach, one can prioritise and sort the available options into a manageable number.

It should be noted that the influence of group dynamics and the varying experience and knowledge of SYNERGISE of participants cannot be completely disregarded. Furthermore, as with any study, eliminating bias entirely is a challenging undertaking. In this sense, it is possible that this study may be influenced by a degree of bias, given that it has involved the participation of FRs that are already engaged with SYNERGISE. Consequently, these FRs may have a higher level of acceptance background towards the development of these solutions. It is also true, however, that FRs outside of SYNERGISE have limited knowledge of the specifics of the tools being developed, given that such tools are pioneering and not currently used in day-to-day operations. Therefore, if another range of participants had participated, not many information could be elicited as their experience with similar toolkits could be limited, potentially leading to a lack of formed opinion regarding the potential benefits and challenges associated with such developments, which would also render the study partially biased.

3.2.2. Procedure implemented in SYNERGISE

In this regard, four nominal groups with FRs of SYNERGISE were conducted to provide evidence for evaluating the main socio-economic, moral and legal factors that underlie the design of solutions of the project, as well as its impact on end users. The goal of these groups was, therefore, to address ethical, legal, socio-economic issues and related matters through this consensus building method to carry out a qualitative and quantitative analysis with the aim of formulating recommendations for the improvement of SYNERGISE's tools in order to improve its impact and increase the acceptance of these tools from an end-user and social perspective. Thus, participants

were asked to reply taking into account the complete toolkit being developed in SYNERGISE[3], while considering both their professional experience in the field of first response and their condition as European citizens that can also be impacted by these technologies.

With regard to the characteristics of the participants, a sample of FRs belonging to each of the SYNERGISE's end-users entities were selected for each session. Each session was scheduled together with each organisation to find a suitable slot that could ensure session's length without causing them to neglect their responsibilities as FRs. Due to difficulties in scheduling, some entities have a lower participation rate than others. Prior to the sessions, all participants provided their informed consent, having been informed of all the characteristics and objectives of the study (see Annex I). For each group, a minimum of five participants and a maximum of eight were recruited to facilitate a rich discussion and reliable results. In the end, the nominal groups conducted ranged between five and seven participants. While recommendations vary, the number of participants for a nominal group is typically limited to no more than nine participants (Delbeck et al., 1975), while other authors suggest around six participants (McMillan et al., 2014), although the ideal number of participants depends on the purpose, methodological requirements of each study, and practical and human factors (Barkhuizen, 2014). For example, some studies have been carried out with as few as 2 and as many as 30 participants (Harb et al., 2021). Finally, the nominal group sessions were held via online videoconference during October 2025 (see table 1).

Table 1. Summary of details from the Nominal Groups with each SYNERGISE's end-user

SYNERGISE's end-user	Date	Participants	Session length
THW (The Federal Agency for Technical Relief / *Technische Hilfswerk*)	14th October 15:00h CET	7	162 minutes
HRTA (Hellenic Rescue Team of Attica / *Ελληνική Ομάδα Διάσωσης Αττικής*)	21st October 17:30h CET	5	150 minutes
CNBOP (Scientific and Research Centre for Fire Protection – National Research Institute / *Centrum Naukowo-Badawcze Ochrony Przeciwpożarowej*)	23rd October 13:00h CET	4	136 minutes
SBFF (The Södertörn Fire Brigade Association / *Södertörns Brandförsvarsförbund*)	29th October 15:00h CET	6	118 minutes

Concerning the sessions' specific details, after ensuring that every participant was online, the methodology of the NGT was briefly explained to them, and the research questions were presented for each session. As these questions imply, each nominal group was divided in two parts, with the same participants: firstly, social benefits were discussed, followed by a short coffee break and finally a discussion on social challenges. These questions were designed to allow participants to respond both from their perspective as FRs and as citizens who may be positively and negatively impacted by the solutions:

[3] As described in SYNERGISE's D1.3 "Technical Specifications and Toolkit Architecture": 1) Autonomous robotic swarms (ANYmal, OWLs, SNAKE, and UAVs outdoor) for exploration and victim detection; 2) Smart wearables for monitoring vital signs, gases, explosives and localisation; 3) Augmented reality tools for training, videoconferencing, visualisation and robotic control; 4) Deployable communications network (5G, satellite, LAN); 5) AI-enabled data fusion and alerting; 6) Command and control system / incident management; and 7) Human-machine interactions.

1) $Q_{Benefits}$: *Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main* **social benefits** *of SYNERGISE that could contribute positively to its social acceptance?*

2) $Q_{Challenges}$: *Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main* **social challenges** *of SYNERGISE that could contribute negatively to its social acceptance?*[4]

Before analysing the results from each entity's nominal group, it is important to note a certain aspect related to the nature of the benefits and challenges identified by the participants. Some components identified by the participants, whether benefits or challenges, might have a bigger social nature than others, which may refer to circumstantial, logistical or pure operational aspects of SYNERGISE. Also, the phrasing of some challenges by the participants may lead the reader to understand that the challenge derives from the tool itself, rather than possible circumstances affecting the tool in the future. Regarding this aspect, even if some benefits or challenges cannot be considered purely social aspects, or are unchangeable by their very nature, or are defined in an affirmative sense, two fundamental points need to be emphasised. First, that interpretation should be focused primarily on those aspects that can be addressed and adjusted. Second, that the benefits and challenges identified should not be taken for granted, but refer to the potential, both positive and negative, of the SYNERGISE specifics solutions in the future. In this sense, for example, a challenge called "fear of the technology from civilians" would not refer to a current situation in SYNERGISE, but to a potential negative element, which may or may not arise in the future, affecting the sustainability of the solutions and their social acceptability.

[4] These questions aims to identify the factors that may lead to a greater or lesser acceptance. In this sense, the more present the benefits perceived are or will be in SYNERGISE, the greater the acceptance level. Conversely, the more challenges perceived and present in the next stages of the project, the less acceptable it will be for the end-users. In addition, when talking about benefits and challenges, participants were told that these refer to all topics that may be related to the project from different areas: ethical, legal, social, economic topics, and so on, to avoid focusing only on operational aspects.

3.2.3. Nominal Group #1: THW

Participants	7 representatives from THW + moderator (Alejandro Nicolás Sánchez, PLUSETHICS)
Date	14th October, 2025
Beginning	15:00h CEST
End	17:41h CEST
Total length	162 minutes

3.2.3.1. Nominal Group #1: benefits

*Q_B: Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main **social benefits** of SYNERGISE that could contribute positively to its social acceptance?*

The nominal group with THW focused on identifying the main social **benefits** of the SYNERGISE tools and methods. Initially, participants produced a total of 23 ideas, which were discussed, refined, and finally reduced to 9 (see Table 2). The discussion evolved progressively from operational and technical considerations to broader social and institutional aspects, such as legitimacy, trust, and European collaboration.

The first set of ideas revolved around the identification and mitigation of risks, leading to a distinction between "identify and localize potential risks remotely" and "be alerted if there are health-related issues with first responders." Participants initially considered merging them, but finally agreed to keep both, as the first referred to environmental or operational hazards affecting everyone on site, while the second addressed personal health and safety as a social benefit for FRs themselves. The latter was later reformulated as "being alerted if there are health-related issues with FR increases confidence and safety feeling," emphasizing the psychological and trust-related dimension of safety in high-risk operations.

Another core discussion concerned situational awareness and decision-making. Several ideas, such as "better situation overview," "increased safety and quicker response," and "better rescue management," were identified as conceptually similar and merged into the broader statement "increased and quicker situational awareness for everybody (particularly FR and decision makers regarding resources and management)." Closely related, the idea "identify the presence and location of trapped victims remotely and faster than today" was maintained as independent, since participants agreed it addressed the societal value of saving lives more efficiently, rather than only internal coordination. A complementary idea—"increase confidence in alive victims and the absence of alive victims, cleared worksites"—was kept separate to highlight how technological certainty supports both operational accuracy and ethical decision-making in rescue priorities.

A third group of ideas referred to European collaboration and legitimacy. Initial proposals such as "international consortium using these technologies can increase legitimacy of EU funding," "improve European collaboration and exchange between FRs," and "increase independence from American/Asian solutions" were discussed together. Participants agreed that they expressed related but distinct notions: one concerning legitimacy of EU investment (linked to public trust and accountability), another to interoperability and shared development across European FRs agencies, and a third to strategic autonomy in critical technologies. The legitimacy idea was ultimately refined as "international consortium using these technologies can increase legitimacy of EU funding by creating something good and valuable for all citizens."

Finally, participants discussed the social image of technology. Two ideas—"positive usage of technology (drones and other remotely controlled) may lead to better image of drones and similar" and "more trust toward FR agencies"—were merged into "positive usage of technology increases

trust towards FR agencies." This reflects the view that the visible, responsible, and successful use of advanced technologies can improve public perception and confidence in FRs, countering recent negative associations of drones or automated systems.

Table 2. Benefits provided by the participants of THW (initial/final ideas)

INITIAL IDEAS	FINAL IDEAS
1. Identify and localize potential risks remotely	1. Identify and localize potential environmental risks remotely for everyone
2. Be alerted if there are health related issues with FR	2. Being alerted if there are health related issues with FR increases confidence and safety feeling
3. Identify the presence and location of trapped victims remotely and faster than today	3. Identify the presence and location of trapped victims remotely and faster than today
4. Better situation overview	4. Increase confidence in alive victims and the absence of alive victims, cleared worksites
5. Increased safety for FR/less risk exposure, quicker response, sooner start of potential rescue operation, potentially more confidence if alive victims	5. International consortium using these technologies can increase legitimacy of EU funding by creating something good and valuable for all citizens
6. Increase safety and be able to help more quickly	6. Increased and quicker situational awareness for everybody (particularly FR and decision makers regarding resources and management)
7. International consortium --> Technologies usable by many first responders --> Legitimacy due to EU funding	7. Positive usage of technology (drones and other remotely controlled may lead to better image of drones and similar) increases trust towards FR agencies
8. Networking and learning from each other	8. Improve European collaboration and exchange between FRs, as technologies are developed together and usable by many first responders
9. Faster detection of the victims	9. Increase independence from American / Asian solutions through developments in Europe
10. Increased situational awareness for FR and decision makers	
11. Better rescue management	
12. Positive usage of drones and other remotely controlled may lead to not only negative image of drones and similar (especially now after several drone incidents)	
13. Faster identification of cleared worksites (no more potential victims)	
14. Remote assessment	
15. Reduced risks and danger to FR and disaster victims	
16. Safe operations of FR, feeling safer during risky operations	
17. More trust toward FR agencies	
18. But there is also a risk to be too technology dependent	
19. Making use of EU knowledge, IPs, money/funding etc. to creating something good and valuable for "all" EU citizens	
20. More coordinated (rescue) approach	
21. Increased likelihood of finding victims alive	
22. Improve European collaboration and exchange btw FRs, as something is developed together	
23. Increase independence from American / Asian solutions through developments in Europe	

As shown in Table 3 and Figure 1, the most voted benefits were idea number 6 ("increased and quicker situational awareness for everybody," 68,6% of maximum votes, ranked in the top 5 by 86% of participants) and idea number 3 ("identify the presence and location of trapped victims remotely and faster than today," 62,9% of maximum botes, also given a point by 86% of participants). Both express that SYNERGISE's greatest perceived social contribution lies in making emergency response more efficient, transparent, and evidence-based, thereby reinforcing citizens' confidence that technological progress directly enhances public safety. They were followed by idea 1 ("identify and localize potential environmental risks remotely for everyone," 48,6%) and idea 2 ("being alerted if there are health-related issues with FR increases confidence and safety feeling," 37,1%), highlighting that safety and prevention remain the foundation of social acceptance, both for FRs and the public they serve. Idea 4 ("increase confidence in alive victims and the absence of alive victims, cleared worksites," 28,6%) complements these by emphasizing certainty and reassurance in life-saving decisions. The ideas related to legitimacy, cooperation, and European autonomy—numbers 5, 8 and 9—received fewer votes (between 8% and 23%) but were interpreted as expressing the long-term social dimension of SYNERGISE. Participants acknowledged that social

acceptance depends not only on operational efficiency but also on trust in European innovation, fairness in public spending, and visible collaboration across borders. Finally, idea 7 ("positive usage of technology increases trust towards FR agencies," 8,6%) was seen as symbolically important despite its low score, as participants linked it to the broader image of responsible innovation and the need to improve how citizens perceive technology-mediated rescue work.

In conclusion, the group agreed that SYNERGISE's social benefits are primarily associated with enhancing situational awareness, safety, and confidence—both for FRs and the public—while also reinforcing trust in technology, legitimacy of EU investment, and European interoperability in disaster management.

Table 3. Summary of THW's Nominal Group results on benefits

	VOTES			PARTICIPANTS	
IDEAS	**POINTS[a]**	**%[b]**	**M[c]**	**N[d]**	**%[e]**
1. Identify and localize potential environmental risks remotely for everyone	17	48,6%	2,4	4	57%
2. Being alerted if there are health related issues with FR increases confidence and safety feeling	13	37,1%	1,9	4	57%
3. Identify the presence and location of trapped victims remotely and faster than today	22	62,9%	3,1	6	86%
4. Increase confidence in alive victims and the absence of alive victims, cleared worksites	10	28,6%	1,4	4	57%
5. International consortium using these technologies can increase legitimacy of EU funding by creating something good and valuable for all citizens	3	8,6%	0,4	3	43%
6. Increased and quicker situational awareness for everybody (particularly FR and decision makers regarding resources and management)	24	68,6%	3,4	6	86%
7. Positive usage of technology (drones and other remotely controlled may lead to better image of drones and similar) increases trust towards FR agencies	3	8,6%	0,4	1	14%
8. Improve European collaboration and exchange between FRs, as technologies are developed together and usable by many first responders	8	22,9%	1,1	4	57%
9. Increase independence from American / Asian solutions through developments in Europe	5	14,3%	0,7	3	43%
TOTAL	105	-	-	7	100%

a *Total points given by all participants.*

b *The percentage is calculated in relation to the maximum possible score that each idea can obtain. In this case, as there are 7 participants and the maximum score by each is 5, the percentage is calculated out of 35 maximum points.*

c *Describes the mean number of votes provided by each participant.*

d *Number of participants that ranked the idea in their top five, thus giving it at least 1 point.*

e *Percentage of participants that ranked the idea in their top five.*

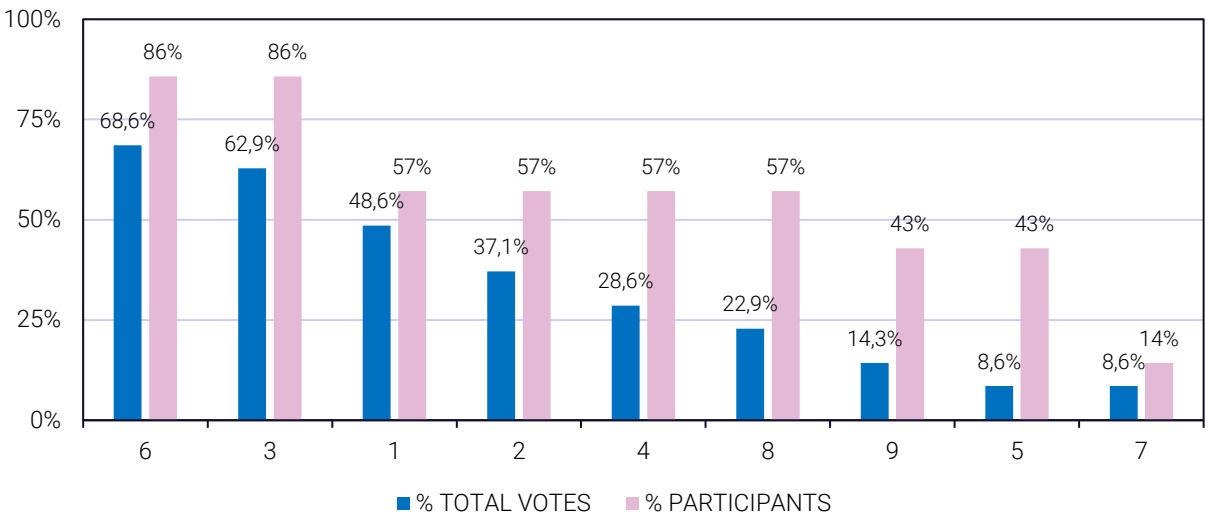

Figure 1. Ranking of benefits by THW

3.2.3.2. Nominal Group #1: challenges

*Q_C: Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main **social challenges** of SYNERGISE that could contribute negatively to its social acceptance?*

The nominal group concerning the social challenges of SYNERGISE involved the same THW participants and followed an identical methodological structure. In this second phase, the discussion focused on possible barriers to social acceptance and the conditions under which the introduction of new technologies could generate resistance or concern among FRs and citizens. Participants first generated 19 ideas, which after discussion and refinement were consolidated into 12 final ones (see Table 4).

The first block of ideas revolved around technological dependency and user acceptance. The initial proposals "dependence on (new) technology which people do not fully understand" and "high dependency from technology" were merged into "high dependency from technology (resources, risks, licenses, set-up time…)." Participants agreed that while technological innovation increases efficiency, it also generates operational fragility if systems fail, are too complex, or depend on unstable infrastructure. Closely related, the idea "less acceptance of technologies by FR due to lack of understanding" was kept separate, as it referred to the human and cultural aspects of adoption, pointing to possible skepticism or reluctance among some FRs when facing unfamiliar or opaque systems. Another important idea—"complex technology might increase the need of special training or even experts"—was discussed as a practical extension of this issue. Participants observed that over-specialization could lead to dependence on a smaller group of experts, limiting the availability of standard rescue teams and increasing costs. Similarly, "transportation issues with all the additional tools (i.e. batteries)" was raised as a logistical problem: extra equipment, restricted battery transport, and setup times might create friction during missions. These reflections show that the group viewed operational practicality as essential to social acceptance.

A second group of challenges focused on economic feasibility and sustainability. Participants discussed how "further development and maturing for commercializing project outcomes is too expensive and businesses don't see value of investing" and "new technology is too expensive for use on site" express different moments of the same concern. The first highlights the post-project risk that research results remain at prototype stage due to lack of private investment, while the second refers to market affordability for end users, especially volunteer-based or underfunded agencies. Both were maintained as separate ideas, as participants wanted to underline that financial sustainability affects both innovation continuity and everyday usability.

The group also examined broader ethical and regulatory challenges. The ideas "privacy concerns" and "who owns the data" were combined into "privacy concerns regarding access: who owns the data (both, health sensors of FR and images of victims), where is it stored, and who has access to it?" Participants stressed that transparency and data governance are key for trust, especially when data are stored in third countries or involve biometric information. A related but distinct concern—"misuse of personal data"—was kept as a separate statement, highlighting the potential for employers to misuse health data, which could deter participation in similar initiatives.

Other ideas raised pointed to symbolic and institutional aspects. The idea "a negative view of third persons on FR (i.e. FR just 'playing' with displays or drones)" was discussed in depth, as participants feared that the public might misinterpret the use of digital interfaces as detachment from real rescue work, affecting legitimacy and recognition. Similarly, "not good results of project may question the idea of EU-funded research projects" was retained to capture the risk of reputational damage if results do not meet expectations. The idea "good outcomes not generating influence on

society and politics" was also discussed but considered less relevant, since participants believed SYNERGISE would likely achieve visibility if successfully implemented. Finally, the idea "fear of being replaced by technology by FR" was kept, although participants agreed this concern was not widespread among FRs, who tend to view technology as a support rather than a competitor.

Table 4. Challenges provided by the participants of THW (initial/final ideas)

INITIAL IDEAS	FINAL IDEAS
1. Dependence on (new) technology, which people not (fully) understand	1. Less acceptance of technologies by FR due to lack of understanding
2. The "view" of third persons on FR (i.e. FR just "playing" with displays/game sticks/drones, instead of doing actual rescue work)	2. A negative "view" of third persons on FR (i.e. FR just "playing" with displays/game sticks/drones, instead of doing actual rescue work)
3. Privacy concerns	3. Privacy concerns regarding access: who owns the data (both, health sensors of FR and images of victims), where is it stored (third-country limitations) and who has access to it?
4. Ensuring data protection especially with vital data. Employers might abuse them to quit unhealthy employees. Similar research projects could not get fire brigades to participate due to this aspect.	4. Misuse of personal data: ensuring data protection especially with vital data (employers might abuse them to quit unhealthy employees) might decrease participation from FR in similar research projects
5. Who owns the data (both, health sensors of FR and images of victims) and who has access to it?	5. High dependency from technology (resources, risks, licenses, set-up time…)
6. High dependency from technology	6. Complex technology might increase the need of special training or even experts (less availability of usual FR) which will less likely be accepted
7. More equipment to be used means more training / exercise which may decrease the available time to train other important topics	7. Further development and maturing for commercialising of project outcomes is too expensive and businesses don't see value of investing
8. Complex technology might increase the need of special training or even experts which will less likely be accepted	8. New technology is too expensive for use on site (to be purchased by FR /market uptake after research)
9. Good project results, BUT too expensive for use on site (to be purchased)	9. Good outcomes not generating influence on society and politics
10. Possibly little influence on society and politics, as relatively unknown?	10. Transportation issues with all the additional tools (i.e. batteries)
11. New technologies are good, but require more training	11. Not good results of project may question the idea of EU funded research projects
12. Transportation issues with all the additional tools	12. Fear of being replaced by technology by FR
13. Costs, new technology is expensive	
14. Charging time for batteries as they cannot be transported fully charged on a plane	
15. License issues due to used frequencies (differ from country to country)	
16. Not good results of project may question the idea of EU funded research projects	
17. Digitization of SAR-Technologies poses additional risks of failure due to Wi-Fi / Cellular difficulties	
18. Negative perception of bystanders as FRs will spend more time looking at screens and not working in the rubble pile	
19. Requirement for even more in-depth training leads to reduced number of FRs	

As shown in Table 5 and Figure 2, the most voted challenge was idea number 5 ("high dependency from technology," 71,4% of maximum votes, ranked in the top five by 86% of participants). This shows a strong collective concern about reliability and resilience, as excessive dependence on technology could create new risks or reduce autonomy in emergencies. It was followed by idea 7 ("further development too expensive," 51,4%, given points by 71% of participants) and idea 2 ("a negative view of third persons on FR," 45,7%, voted by 71% of participants), indicating that economic feasibility and social perception are also key factors in acceptance.

Ideas related to data governance and privacy—numbers 3 and 4—received 37,1% and 14,3% of the maximum votes, ranking mid-range but sparking extensive debate. Participants agreed that transparency in data access, storage, and ownership is critical for ensuring trust among users and avoiding the negative experiences that have limited participation in previous projects. Idea 6 ("complex technology might increase the need of special training") and idea 8 ("new technology too

expensive for use on site") also received moderate support (31,4% and 34,3%), reaffirming that usability and affordability remain intertwined concerns.

The lower-ranked ideas—"less acceptance of technologies by FR due to lack of understanding" (2,9%), "transportation issues" (5,7%), "not good results may question EU-funded projects" (5,7%), "fear of being replaced by technology" (0%) and "good outcomes not generating influence on society and politics" (0%)—were mentioned as contextual but still relevant. Participants noted that even if these issues are not central, they reflect latent perceptions that could emerge if implementation is not accompanied by adequate training, communication, or visible success.

In conclusion, participants agreed that the main social challenges for SYNERGISE lie in balancing technological ambition with reliability, affordability, and public trust. The discussion showed that acceptance will depend on keeping tools understandable, practical, and ethically sound, ensuring that they complement human expertise rather than replace it, and that their cost, complexity, and data management remain proportionate to their social value.

Table 5. Summary of THW's Nominal Group results on challenges

	VOTES			PARTICIPANTS	
IDEAS	POINTS	%	M	N	%
1. Less acceptance of technologies by FR due to lack of understanding	1	2,9%	0,1	1	14%
2. A negative "view" of third persons on FR (i.e. FR just "playing" with displays/game sticks/drones, instead of doing actual rescue work)	16	45,7%	2,3	5	71%
3. Privacy concerns regarding access: who owns the data (both, health sensors of FR and images of victims), where is it stored (third-country limitations) and who has access to it?	13	37,1%	1,9	4	57%
4. Misuse of personal data: ensuring data protection especially with vital data (employers might abuse them to quit unhealthy employees) might decrease participation from FR in similar research projects	5	14,3%	0,7	2	29%
5. High dependency from technology (resources, risks, licenses, set-up time...)	25	71,4%	3,6	6	86%
6. Complex technology might increase the need of special training or even experts (less availability of usual FR) which will less likely be accepted	11	31,4%	1,6	4	57%
7. Further development and maturing for commercialising of project outcomes is too expensive and businesses don't see value of investing	18	51,4%	2,6	5	71%
8. New technology is too expensive for use on site (to be purchased by FR /market uptake after research)	12	34,3%	1,7	4	57%
9. Good outcomes not generating influence on society and politics	0	0,0%	0,0	0	0%
10. Transportation issues with all the additional tools (i.e. batteries)	2	5,7%	0,3	2	29%
11. Not good results of project may question the idea of EU funded research projects	2	5,7%	0,3	2	29%
12. Fear of being replaced by technology by FR	0	0,0%	0,0	0	0%
TOTAL	105	-	-	7	100%

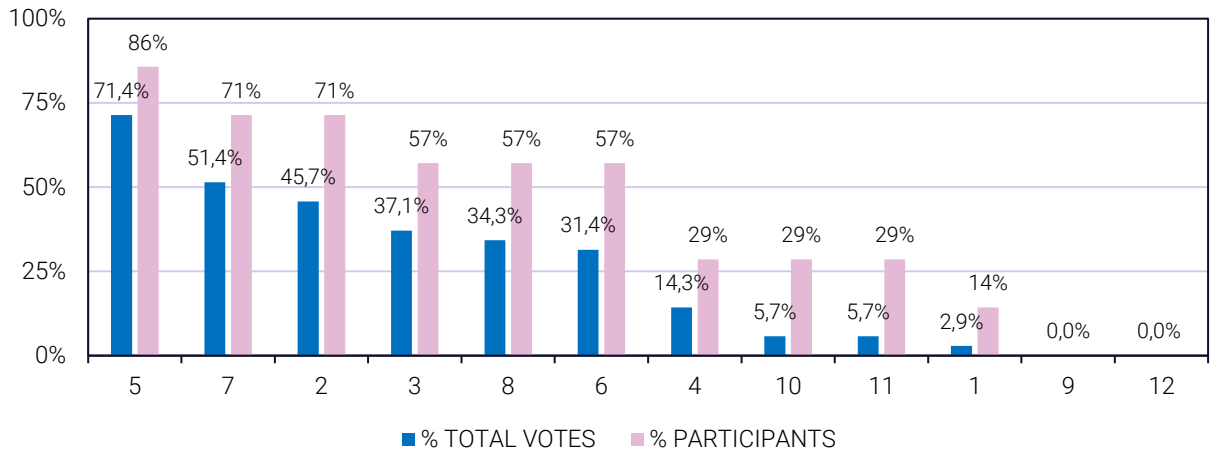

Figure 2. Ranking of challenges by THW

3.2.4. Nominal Group #2: HRTA

Participants	5 representatives from HRTA + moderator (Alejandro Nicolás Sánchez, PLUSETHICS)
Date	21st October, 2025
Beginning	17:30h CEST
End	20:00h CEST
Total length	150 minutes

3.2.4.1. Nominal Group #2: benefits

*Q_B: Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main **social benefits** of SYNERGISE that could contribute positively to its social acceptance?*

Participants initially produced 13 ideas, which after clarification, discussion, and reformulation were reduced to 12 final statements (see Table 6). The refinement process involved specifying who benefits, clarifying ambiguous wording, and merging overlapping proposals to reach a set of well-defined and distinct ideas. The discussion moved gradually from concrete operational aspects to more social and psychological dimensions, especially those connected to safety, efficiency, and trust in technology.

The first group of ideas focused on safety and protection of FRs. The initial statement "safety improvement" was reformulated as "safety improvement for FR (protection in the field)" to explicitly mention the target group and operational setting. The participants decided not to merge it with "reduced risk for FRs", as the latter was later rewritten as "reduced risk for FRs due to robotic platforms can enter dangerous environments before humans" to stress the causal mechanism — risk reduction achieved through robotic mediation. Both were thus kept as complementary. A related set of statements concerning health and well-being evolved from "FR safety in the field in terms of protection, same in terms of health monitoring". This was divided into two ideas: "prevention of harmful health conditions due to health monitoring," which emphasized the preventive function of monitoring, and "FR's anxiety decreases during the operations as he/she understands that he/she is being monitored in case of emergency (wearables, localisation, etc.)," which highlighted psychological reassurance increasing acceptance. Participants considered that this second idea captured the emotional dimension of safety and decided to keep it separate, though thematically connected to physical protection.

The second major theme addressed operational efficiency and decision-making. The idea "faster actions" was rephrased as "faster actions (i.e. detection and rescue of victims) for the FR in the field / command center" to specify the kind of acceleration expected and the double perspective of field units and coordination teams. Similarly, "faster decisions" was expanded into "better real-time decision making due to accuracy/quality of data, time readiness and variety of sources", including these three criteria that improve this decision-making: technologies help achieve and analyse accurate data, sending faster information to the command center, and from a varied range of sensors that reach a better situation awareness. From this group also derived "swifter decision of go/no-go in the field, for a non-human presence (robot) can transmit info (conditions, etc.)," a new reformulation that explicitly introduced the role of robotic assistance in enabling safe and informed tactical choices.

A third cluster of ideas related to demonstrable impact and social legitimacy. The original statement "increased social acceptance of technology through real impact" was reformulated as "proving that technologies create real impact (saving lives, protection of people)," replacing the expectation ("increased acceptance") with the condition for it ("proving"). This change underlined

that acceptance depends on verifiable, tangible and demonstrable results rather than assumptions. The idea "FR speed improvement by using autonomous robots in the hot zone" was slightly expanded to "FR speed improvement by using autonomous robots in the hot zone together with humans," specifying that collaboration—rather than substitution—between robots and humans was central to trust. The notion of inter-agency coordination, initially mentioned as "cooperation between different teams with various mentalities," was kept and refined to emphasise the social dimension of learning and interoperability across organisational cultures.

Finally, some ideas revolved around experience and validation. "More experienced teams of the field" was reworded as "more experienced teams of the field based on new technologies and more agencies" to make explicit that experience arises from both technological and institutional learning. Meanwhile, "testing better the safety of the new technology (on the field)" was retained with only minor adjustments, as participants considered that demonstrated safety of tools before deployment was itself a prerequisite for public and professional confidence.

Table 6. Benefits provided by the participants of HRTA (initial/final ideas)

INITIAL IDEAS	FINAL IDEAS
1. Safety improvement	1. Safety improvement for FR (protection in the field)
2. Faster actions	2. Faster actions (i.e. detection and rescue of victims) for the FR in the field / command center
3. Faster decisions	3. Better real-time decision making due to accuracy/quality of data, time readiness and variety of sources
4. (1) FR safety in the field in terms of protection, (2) same in terms of health monitoring, (3) better FR operations coordination	4. Prevention of harmful health conditions due to health monitoring
5. Faster detection and rescue of victims	5. Reduced risk for FRs due to robotic platforms can enter dangerous environments before humans
6. Reduced Risk for FRs (Robotic platforms can enter dangerous environments first)	6. Proving that technologies create real impact (saving lives, protection of people)
7. Better Coordination and Real-Time Decision Making	7. FR speed improvement by using autonomous robots in the hot zone together with humans
8. Increased Social Acceptance of Technology Through Real Impact	8. Better cooperation/coordination between different teams with various mentalities
9. FR safety/speed improvement by using autonomous robots in the hot zone	9. More experienced teams of the field based on new technologies and more agencies
10. Cooperation between different teams with various mentalities	10. Testing better the safety of the new technology (on the field)
11. More experienced teams of the field	11. FR's anxiety decreases during the operations as he/she understands that he/she is being monitored in case of emergency occurs (wearables, localisation, etc).
12. Testing better the safety of the new technology	12. Swifter decision of go / no go in the field, for a non-human presence (robot) can transmit info (conditions, etc)
13. (for wearables) FR's anxiety decreases during the operations as he understands that he is being monitored in case of emergency occurs.	

As shown in Table 7 and Figure 3, the most voted benefit was idea number 1 ("safety improvement for FR (protection in the field)"), receiving 80% of maximum possible votes and given at least a point by all participants, meaning that it was ranked in the top five by everyone in the group. This indicates that safety and protection remain the strongest drivers of social acceptance. The second and third ranked benefits were idea 3 ("better real-time decision-making," 56%, voted by 100% of participants) and idea 4 ("prevention of harmful health conditions due to health monitoring," 52%, voted by 60%), both reinforcing that information quality and proactive health care are valued forms of technological contribution. Idea 5 ("reduced risk for FRs due to robotic platforms") followed with 36%, again emphasizing that minimizing exposure to danger is central to acceptance.

Other ideas, such as "faster actions" (24%) and "swifter decision of go/no-go in the field" (24%), though scoring lower, were considered operationally essential in demonstrating efficiency and reliability. Meanwhile, less-voted but symbolically relevant benefits—ideas 6, 7, and 8 ("proving that technologies create real impact," "FR speed improvement by using autonomous robots," and "better cooperation/coordination between different teams")—represent the social and institutional layer of

acceptance, where innovation credibility, cross-team trust, and visible impact on lives saved reinforce legitimacy. The lowest-ranked ideas (9, 10, and 11, without points) still highlight complementary aspects—professional learning, field testing, and psychological reassurance—showing that acceptance also relies on how technology is perceived to support the human side of rescue work.

In conclusion, participants agreed that the main social benefits of SYNERGISE are centred on safety, improved decision-making, and visible operational impact. The combination of enhanced protection, smarter coordination, and tangible results is seen as key to building both trust in technology and public recognition of its social value.

Table 7. Summary of HRTA's Nominal Group results on benefits

	VOTES			PARTICIPANTS	
IDEAS	**POINTS**	**%**	**M**	**N**	**%**
1. Safety improvement for FR (protection in the field)	20	80%	4,0	5	100%
2. Faster actions (i.e. detection and rescue of victims) for the FR in the field / command center	6	24%	1,2	2	40%
3. Better real-time decision making due to accuracy/quality of data, time readiness and variety of sources	14	56%	2,8	5	100%
4. Prevention of harmful health conditions due to health monitoring	13	52%	2,6	3	60%
5. Reduced risk for FRs due to robotic platforms can enter dangerous environments before humans	9	36%	1,8	3	60%
6. Proving that technologies create real impact (saving lives, protection of people)	2	8%	0,4	2	40%
7. FR speed improvement by using autonomous robots in the hot zone together with humans	2	8%	0,4	2	40%
8. Better cooperation/coordination between different teams with various mentalities	3	12%	0,6	1	20%
9. More experienced teams of the field based on new technologies and more agencies	0	0%	0,0	0	0%
10. Testing better the safety of the new technology (on the field)	0	0%	0,0	0	0%
11. FR's anxiety decreases during the operations as he/she understands that he/she is being monitored in case of emergency occurs (wearables, localisation, etc).	0	0%	0,0	0	0%
12. Swifter decision of go / no go in the field, for a non-human presence (robot) can transmit info (conditions, etc)	6	24%	1,2	2	40%
TOTAL	75	-	-	5	100%

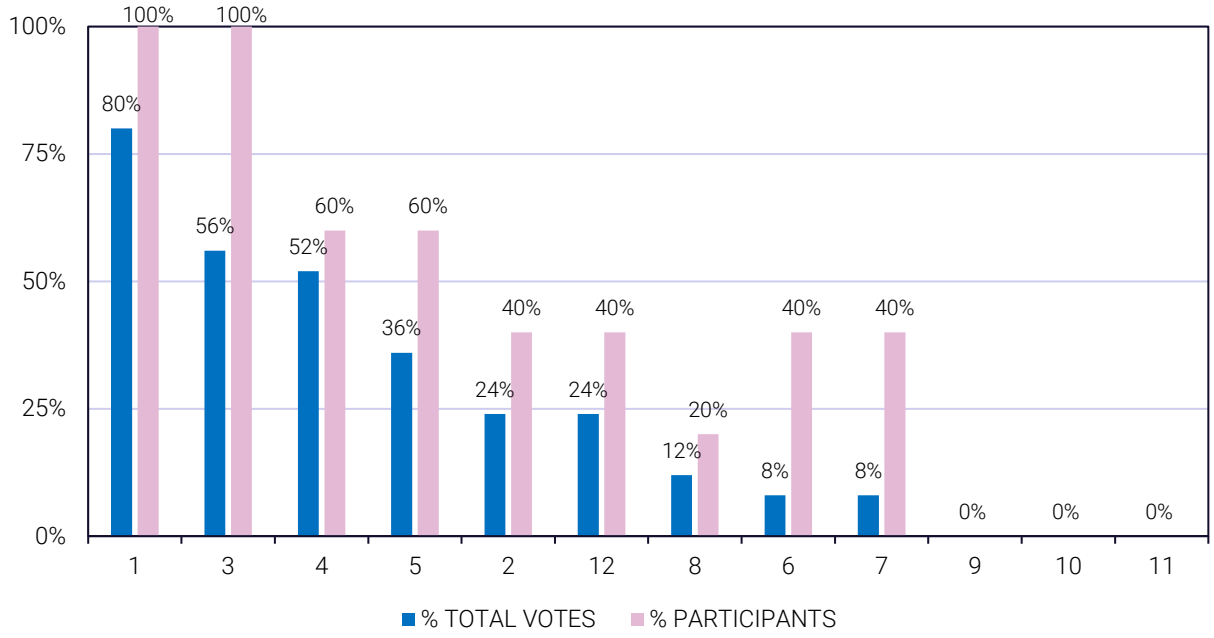

Figure 3. Ranking of benefits by HRTA

3.2.4.2. Nominal Group #2: challenges

*Q_C: Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main **social challenges** of SYNERGISE that could contribute negatively to its social acceptance?*

Participants generated 17 initial ideas, which after discussion, clarification, and reformulation were consolidated into 14 final ones (see Table 8). The refinement process involved distinguishing between technical and social challenges, merging overlapping items, and specifying causes and perceived effects to make the statements more precise.

The first group of ideas referred to time, preparation, and operational complexity. The initial concept "increased preparation and deployment time for the FR teams" was kept with minimal change, as all participants agreed that new technologies would inevitably demand longer preparation phases and that this could delay action. A related idea, "familiarization with this technology may take a long time for FRs to be able to use it", was retained as a separate statement, capturing the long-term training effort required before tools become routine. Similarly, "perception of needed knowledge/training might lead to delay to accept" was maintained to reflect the psychological and subjective side of resistance, where perceived difficulty itself slows down acceptance.

A second thematic cluster focused on technological dependency and reliability. The original idea "false sense of dependency on FR technologies in the field" was reformulated as "false sense of reliability of FR technologies in the field leads to dependence" to shift the emphasis from dependence as a behaviour to the illusion of reliability as its root cause. Participants agreed that misplaced confidence in machines could make users less cautious or flexible in critical moments. Closely related was "technical failure that leads to poor or non-results," which was kept unchanged, and "physical accident that involves robots," whose wording was only slightly adjusted to clarify the physical dimension of risk regarding this specific set of technologies from SYNERGISE. Both statements express the concern that malfunction or mishandling may directly damage the reputation of the technology. Complementing this group, "lack of trust in technology and fear of failure" (previously "fear of failure") was refined to integrate the emotional and perceptual components, describing how uncertainty about reliability could reinforce scepticism among both professionals and the public.

A third group of discussions centred on privacy, ethics, and data governance. Two overlapping statements—"privacy and data protection issues, especially regarding victims" and "privacy and personal data concerns"—were merged and rephrased into "privacy and personal data concerns (technologies may be perceived as surveillance; fear of use of data by third parties, especially outside emergency situations; lack of consent by victims)." This detailed wording was added during the session to capture multiple aspects of the same issue: perception of surveillance, use of data beyond intended contexts, and impossibility of obtaining informed consent from victims. In parallel, "ethical dilemmas and responsibility issues (ethical questions about making life-and-death decisions by machines)" was discussed slightly, as participants highlighted that even hypothetical scenarios in which machines assist decision-making could raise moral concerns about agency and accountability, which lives to save or when to decide to enter or not certain risky locations.

The fourth set of ideas related to societal and emotional reactions. The new idea "incident generating negative social feelings" was added during the discussion to capture that a single visible failure, crash, or misuse could damage public perception and trust. In a similar vein, "fear of reduction of the human role" was rephrased to include the notion that citizens and responders might feel that technology undermines human expertise and intuition, though participants agreed it overlapped partly with the "trust and reliability" cluster. Meanwhile, "technology may not be

accepted in communities of countries with different cultural backgrounds" was kept separate to recognise cultural variation in acceptance, especially regarding autonomy and machine-led operations, particularly outside European context.

Finally, participants discussed structural and information-related challenges. The idea "smaller cities or regions may not have the resources to adopt such technologies" pointed to inequality of access to these technologies, mainly from the economic point of view. Another concern was "too much info gathered in the command center may compromise fast decision-making," which was kept as a standalone idea to underline the paradox that excessive data may slow down rather than accelerate responses.

Table 8. Challenges provided by the participants of HRTA (initial/final ideas)

INITIAL IDEAS	FINAL IDEAS
1. Increased preparation and deployment time for the FR teams	1. Increased preparation and deployment time for the FR teams
2. False sense of dependency on FR technologies in the field	2. False sense of reliability of FR technologies in the field leads to dependence
3. Privacy and data protection issues, especially regarding victims	3. Incident generating negative social feelings
4. Technical failure that leads to poor or non-results	4. Technical failure that leads to poor or non-results
5. Accident that involves robots	5. Physical accident that involves robots
6. Scepticism regarding autonomous vehicles due to non-mature technology	6. Fear of reduction of the human role (people might feel that technology undermines human expertise and experience)
7. Cost of the program	7. Privacy and personal data concerns (technologies may be perceived as surveillance; fear of use of data by third parties, especially outside emergency situations; lack of consent by victims).
8. Privacy and rights issue	8. Lack of trust in technology and fear of failure (people may question the reliability, safety, and decision-making of "machines", including autonomous vehicles)
9. Incident / technical failure	9. Smaller cities regions may not have the resources to adopt such technologies. Risk of creating "technologically advanced" versus "technologically excluded" communities.
10. Fear of reduction of the Human Role (people might feel that technology undermines human expertise and experience)	10. Ethical dilemmas and responsibility issues (ethical questions about making life-and-death decisions by machines)
11. Privacy and Personal Data Concerns (the use of drones, sensors, and tracking systems may be perceived as surveillance and also fear of use of data by governments or third parties, especially outside emergency situations.	11. Too much info gathered in the command center may compromise fast decision-making
12. Lack of Trust in Technology and Fear of Failure (people may question the reliability, safety, and decision-making of "machines)	12. Technology may not be accepted in communities of countries with different cultural backgrounds
13. Smaller cities regions may not have the resources to adopt such technologies. Risk of creating "technologically advanced" versus "technologically excluded" communities.	13. Familiarization with this technology may take long time for FRs to be able to use it, along with the usual preparations and exercises.
14. Ethical Dilemmas and Responsibility Issues (ethical questions about making life-and-death decisions by machines)	14. Perception of needed knowledge / training might lead to delay to accept
15. Too much info gathered in the command center may compromise fast decision-making	
16. Technology may not be accepted in communities of countries with different cultural backgrounds	
17. Familiarization with this technology may take long time for FRs to be able to use it, along with the usual preparations and exercises.	

As shown in Table 9 and Figure 4, the most voted challenge was idea 2 ("false sense of reliability of FR technologies in the field leads to dependence"), receiving 70,8% of maximum votes and ranked in the top five by 80% of participants. This result highlights a major social concern: that excessive trust in machines may erode professional judgment and preparedness, creating new vulnerabilities. The next most voted challenges were idea 1 ("increased preparation and deployment time for FR teams," 37,5%), idea 8 ("lack of trust in technology and fear of failure," 37,5%), and idea 10 ("ethical dilemmas and responsibility issues," 37,5%), showing a balance between operational, perceptual, and ethical dimensions of risk. Idea 3 ("incident generating negative social feelings," 33,3%) and idea 7 ("privacy and personal data concerns," 25%) followed, reinforcing that public perception and data governance remain sensitive areas for acceptance.

Lower-ranked ideas, such as “technical failure that leads to poor or non-results” (20,8%) and “smaller cities or regions may not have the resources to adopt such technologies” (20,8%), were considered secondary but still important in shaping long-term social trust. The least voted ones—including “too much information gathered in the command center,” “technology may not be accepted in communities with different cultural backgrounds,” and “perception of needed training leading to delay”—were acknowledged as potential implementation challenges that, although less central, could influence specific contexts or adoption phases. Finally, “physical accidents involving robots,” “fear of reduction of the human role,” and “familiarization taking long time” did not receive votes but were retained for completeness, as participants agreed these issues might gain relevance once technologies become more visible in field operations.

In conclusion, participants considered that the main social challenges for SYNERGISE revolve around overreliance on technology, data protection, and public trust. The refinement process showed a progressive move from generic technical concerns to nuanced social perceptions—emphasising that successful adoption depends on ensuring reliability, protecting rights, and maintaining a clear, responsible human role in technology-assisted rescue operations.

Table 9. Summary of HRTA’s Nominal Group results on challenges

	VOTES			PARTICIPANTS	
IDEAS	**POINTS**	**%**	**M**	**N**	**%**
1. Increased preparation and deployment time for the FR teams	9	37,5%	1,8	4	80%
2. False sense of reliability of FR technologies in the field leads to dependence	17	70,8%	3,4	4	80%
3. Incident generating negative social feelings	8	33,3%	1,6	2	40%
4. Technical failure that leads to poor or non-results	5	20,8%	1,0	2	40%
5. Physical accident that involves robots	0	0,0%	0,0	0	0%
6. Fear of reduction of the human role (people might feel that technology undermines human expertise and experience)	0	0,0%	0,0	0	0%
7. Privacy and personal data concerns (technologies may be perceived as surveillance; fear of use of data by third parties, especially outside emergency situations; lack of consent by victims).	6	25,0%	1,2	2	40%
8. Lack of trust in technology and fear of failure (people may question the reliability, safety, and decision-making of “machines", including autonomous vehicles)	9	37,5%	1,8	2	40%
9. Smaller cities regions may not have the resources to adopt such technologies. Risk of creating “technologically advanced” versus “technologically excluded” communities.	5	20,8%	1,0	1	20%
10. Ethical dilemmas and responsibility issues (ethical questions about making life-and-death decisions by machines)	9	37,5%	1,8	3	60%
11. Too much info gathered in the command center may compromise fast decision-making	2	8,3%	0,4	1	20%
12. Technology may not be accepted in communities of countries with different cultural backgrounds	2	8,3%	0,4	1	20%
13. Familiarization with this technology may take long time for FRs to be able to use it, along with the usual preparations and exercises.	0	0,0%	0,0	0	0%
14. Perception of needed knowledge / training might lead to delay to accept	3	12,5%	0,6	3	60%
TOTAL	75	-	-	5	100%

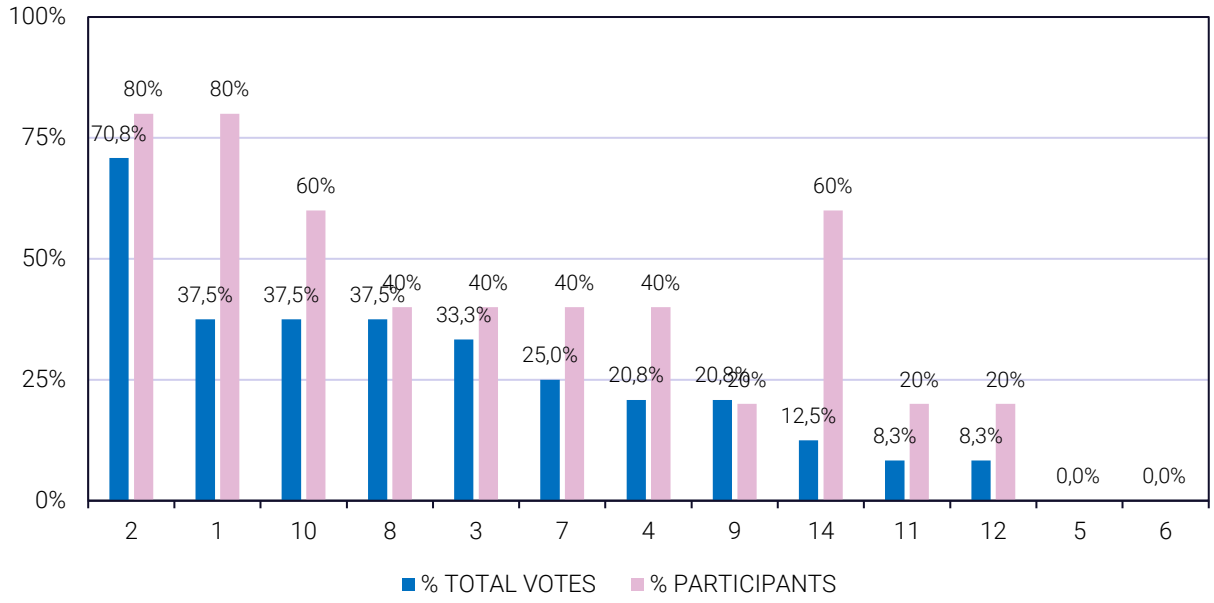

Figure 4. Ranking of challenges by HRTA

3.2.5. Nominal Group #3: CNBOP

Participants	4 representatives from CNBOP[5] + moderator (Alejandro Nicolás Sánchez, PLUSETHICS)
Date	23rd October, 2025
Beginning	13:00h CEST
End	15:16h CEST
Total length	136m

3.2.5.1. Nominal Group #3: benefits

*Q_B: Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main **social benefits** of SYNERGISE that could contribute positively to its social acceptance?*

Following the same methodological approach as in previous sessions, participants first produced 17 initial ideas, which after clarification, merging, and refinement were reduced to 6 final benefits (see Table 10). The discussion moved from general reflections on safety and trust to more operational notions related to coordination, interoperability, and public visibility of technological innovation. Throughout the discussion, participants progressively clustered their reflections into four thematic areas: safety, efficiency and effectiveness, coordination and coherence, and public and social trust. These clusters structured the debate and the subsequent refinement process.

The first cluster concerned safety, which participants described as one of the most fundamental social values underpinning technological acceptance. From several initial ideas—such as "improving safety of the community," "safety of those who deliver help," and "technology that enlarges the chance of getting rescued"—two complementary benefits were identified: "better protection and safety of the population during emergency situations" and "increased safety for rescuers." The group decided to maintain both because they address distinct beneficiaries and dimensions of the same concept. The first reflects the visible improvement of public safety and the reassurance citizens feel when rescue systems are perceived as faster, more reliable, and better

[5] Initially, 5 participants from CNBOP were expected to take part in the session, but 1 had to leave at the beginning due to other duties, resulting in a sample of 4.

equipped. The second captures the social value of protecting those who perform rescue work, emphasising that technologies which reduce physical risk to FRs also reinforce the moral legitimacy of innovation. The rewording of both ideas focused on clarity, replacing generic terms such as “community” or “those who deliver help” with explicit references to “population” and “rescuers,” in order to make the scope of the benefit clear and measurable.

The second cluster referred to efficiency and effectiveness. Participants agreed that one of SYNERGISE’s most relevant social impacts is its capacity to make rescue operations faster, more coordinated, and more accurate. The discussion merged several initial proposals—“increase effectivity of first responders,” “faster and more effective rescues,” and “bringing rescue to another level”—into the idea “improve and increase the effectiveness/efficiency of operational activities by new technologies.” This reformulation deliberately combined qualitative and quantitative notions (“improve” and “increase”) to reflect progress in both precision and speed. Closely linked to this, the group decided to keep a separate idea, “facilitation of proper communication during rescue operations (i.e. faster diagnosis and decisions thanks to the integrated platform),” as participants considered that the ability to communicate and exchange data effectively is the main enabler of operational efficiency. This formulation was expanded with an explanatory clause referring to the integrated platform, highlighting that communication tools directly translate technological innovation into concrete social benefit.

The third cluster centred on coordination and coherence, reflecting participants’ belief that SYNERGISE’s social impact extends beyond individual operations to the level of institutional cooperation. Several original statements—“better coordination between services and countries,” “greater trust and coherence of services’ actions,” and “interoperability between institutions”—were merged into a single idea: “greater trust and coherence of services’ actions – interoperability between countries/institutions, transparent decisions.” The new wording added references to transparency and interoperability, considered essential to demonstrate fairness, mutual reliability, and the European dimension of crisis management. Participants emphasised that visible coordination among agencies and across borders increases efficiency but also strengthens public legitimacy, showing that decisions are made collaboratively and in a consistent way.

Finally, the fourth cluster addressed public and social trust, which participants viewed as both an outcome and a prerequisite for the success of innovation. Two initial proposals—“increased public trust in emergency services” and “building trust in innovation by popularizing the results”—were merged and reformulated into “increased public trust in emergency services by popularizing new technologies and their impact on society.” The addition of the phrase “by popularizing” was meant to underline that awareness and outreach are integral to acceptance, since citizens’ confidence grows when they can see and understand the benefits of technological development in rescue work. Participants agreed that this form of trust is cumulative and can reinforce the overall perception of emergency services as modern, transparent, and reliable institutions.

Table 10. Benefits provided by the participants of CNBOP (initial/final ideas)

INITIAL IDEAS	FINAL IDEAS
1. Improving safety of community	1. Facilitation of proper communication during rescue operations (i.e. faster diagnosis and decisions thanks to the integrated platform)
2. Increase effectivity of first responders	2. Increased public trust in emergency services by popularizing the new technologies and their impact on society
3. Facilitation of proper communication during rescue operations	3. Better protection and safety of the population during emergency situation
4. Better coordination between services and countries	4. Increased safety for rescuers
5. More people saved – faster diagnosis and decisions thanks to the integrated platform	5. Greater trust and coherence of services' actions – interoperability between countries/institutions, transparent decisions
6. Increased public trust in emergency services	6. Improve and increase the effectiveness/efficiency of operational activities by new technologies
7. Better protection of the population during emergency situation	
8. Increased safety for rescuers	
9. Greater trust and coherence of services' actions – interoperability between countries/institutions, transparent decisions	
10. Faster and more effective rescues – integrated situational awareness + drones/robots and 3D maps	
11. Improve and increase the efficiency of operational activities	
12. Building trust in innovation by popularizing the results	
13. First responders (social image) image as a modern and safe duty	
14. Rise of quality of help we deliver	
15. Safety of those who deliver the help	
16. Technology, that enlarges chance of getting rescued	
17. Bringing rescue to another level that give the society benefits of being taken care of in any accident	

As shown in Table 11 and Figure 5, the most voted benefit was idea number 3 ("better protection and safety of the population during emergency situations"), which received 90% of the maximum score and was voted by all participants. It was followed closely by idea number 4 ("increased safety for rescuers"), with 80% of votes, confirming that safety—understood as protection for both citizens and professionals—is perceived as the core of SYNERGISE's social legitimacy. Ideas 6 ("improve and increase the effectiveness/efficiency of operational activities by new technologies") and 1 ("facilitation of proper communication during rescue operations") ranked next, with 50% and 45% of votes respectively, showing that efficiency and communication are considered one of the most visible indicators of technological progress. The remaining two ideas—number 5 ("greater trust and coherence of services' actions – interoperability between countries/institutions, transparent decisions") and number 2 ("increased public trust in emergency services by popularizing new technologies")—received 30% and 5% respectively but were discussed as central for the long-term consolidation of trust, transparency, and European coherence.

In conclusion, participants agreed that SYNERGISE's main social benefits can be understood through the interaction of four dimensions: safety, efficiency, coordination, and trust. The refinement process transformed broad and abstract notions into clear, operationally grounded statements, showing that social acceptance arises from two areas: technical success, and visible improvements in protection, transparency, and the perceived reliability of innovation.

Table 11. Summary of CNBOP's Nominal Group results on benefits

	VOTES			PARTICIPANTS	
IDEAS	POINTS	%	M	N	%
1. Facilitation of proper communication during rescue operations (i.e. faster diagnosis and decisions thanks to the integrated platform)	9	45%	2,3	4	100%
2. Increased public trust in emergency services by popularizing the new technologies and their impact on society	1	5%	0,3	1	25%
3. Better protection and safety of the population during emergency situation	18	90%	4,5	4	100%
4. Increased safety for rescuers	16	80%	4,0	4	100%
5. Greater trust and coherence of services' actions – interoperability between countries/institutions, transparent decisions	6	30%	1,5	3	75%
6. Improve and increase the effectiveness/efficiency of operational activities by new technologies	10	50%	2,5	4	100%
TOTAL	60	-	-	4	100%

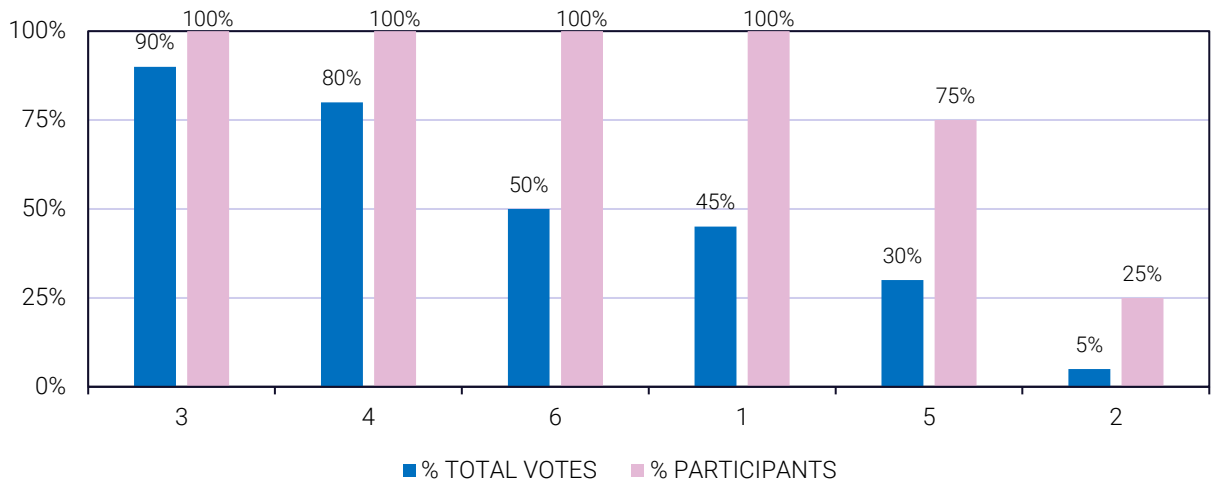

Figure 5. Ranking of benefits by CNBOP

3.2.5.2. Nominal Group #3: challenges

*Q_C: Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main **social challenges** of SYNERGISE that could contribute negatively to its social acceptance?*

After the brainstorming phase, 16 initial ideas were discussed and refined into 11 final challenges (see Table 12). The discussion naturally evolved around interrelated clusters, such as technological reliability and human readiness, data governance and surveillance perception, and cost and institutional adaptation, among others.

The first and most debated topic was the balance between full trust and distrust toward technology. Participants examined how both overconfidence and scepticism could undermine effective adoption. From the FRs' side, ideas such as "too strong trust for technology," "lower level of self-preparation," and "fear of the technology and lack of training" were discussed together. They were finally separated into two refined statements: "lower level of self-preparation of FR because of full trust in technology," which captures the risk that excessive reliance on automated systems could reduce professional attentiveness and self-sufficiency, and "fear of the technology and lack of training," which emphasises the opposite problem—resistance or anxiety linked to insufficient familiarisation and the perceived burden of responsibility. From the civilian perspective, the group refined "fear of the technology" and "civilian overconfidence in technologies reduces their resilience" as complementary dimensions of public perception. The first refers to citizens'

reluctance to accept autonomous or data-driven systems in rescue operations, often due to lack of understanding or emotional unease. The second points to the risk that people, overly trusting in technology, may neglect self-preparedness or underestimate the importance of human expertise. Together, these ideas reveal a shared concern that both extremes—blind faith and rejection—can damage social acceptance, highlighting the need for clear communication and education to promote a realistic understanding of technological roles and limits.

A second major area of concern related to data governance and the perception of surveillance. Participants raised multiple overlapping concerns about privacy, data protection, and cybersecurity, initial ideas that were refined into "privacy and data protection (GDPR) – continuous location of rescuers, biometric data from wearables, images from drones," "the sense of surveillance and the chilling effect of being watched," and "cybersecurity ransomware attacks on rescue infrastructure, video/audio leaks", with the group distinguishing between two layers: legal-technical compliance and social perception. They agreed that the continuous collection of location, biometric, and visual data might reduce acceptance due to the operational and legal burden of handling and processing such sensitive data types, apart from the public and FR perception of such intrusive technologies. A similar challenge focused on the subjective feeling of surveillance, phrasing it with "chilling effect" to stress that this discomfort could arise even in the absence of real data misuse, simply from the feeling of being monitored. However, it is essential to note that a long debate was held regarding the low probability of this happening from SYNERGISE in the future, due to both the absence of current surveillance technologies outside rescue situations, or the usually increased acceptance level held by society in disaster scenarios. Some participants wanted this challenge to be deleted due to being controversial and not present in SYNERGISE, while other stressed that it could be relevant in the future, with civilians not being happy with their information being recorded and processed (video or images including their faces or, potentially, the dead bodies of familiars, etc). Due to its importance, it was thus decided to keep it. Another challenge was also kept separate to highlight the potential of dealing with "cybersecurity ransomware attacks" on this kind of data, to reflect a more technical risk that nonetheless has direct social repercussions, affecting citizens' confidence in the integrity of emergency systems. These three ideas were repeatedly linked to the broader issue of trust in institutions, since breaches or perceived surveillance could easily erode public and professional confidence in new technologies, regardless of their actual functionality or intent.

The third cluster involved economic cost and institutional adaptation. The ideas "formal adaptation for using the technology" and "high cost of implementing new technologies" were reformulated into "formal adaptation for using the technology (i.e. organisational level, legal frameworks, operational procedures and interoperability, ethical guidelines...)" and "high economic cost of implementing new technologies against expected effectiveness." The refinement added explicit references to the levels—organisational, legal, ethical—where adaptation must occur, while linking cost concerns to expectations of measurable benefit. Participants agreed that technologies that are too expensive or complex for smaller services might create inequities between regions and lower overall acceptance. Similarly, if legal and procedural frameworks lag behind, even beneficial tools may be met with hesitation or face bureaucratic delays. Cost, therefore, was seen not as a purely financial issue, but as one that intersects with fairness, accessibility, and institutional readiness.

Finally, one idea stood out as an independent concern: "disbelief of civilians in professional services". Participants, despite not dedicating too much time for this idea in the discussion, they considered it as an independent factor shaping public attitudes toward technological innovation.

Table 12. Challenges provided by the participants of CNBOP (initial/final ideas)

INITIAL IDEAS	FINAL IDEAS
1. Community can feel "spying" by technology	1. Formal adaptation for using the technology (i.e. organisational level, legal frameworks, operational procedures and interoperability, ethical guidelines...)
2. Doubts about technology failure in critical moments	2. High economic cost of implementing new technologies against expected effectiveness
3. Too strong trust for technology	3. Lower level of self-preparation of FR because of full trust in technology
4. Formal adaptation for using the technology	4. Fear of the technology from civilians
5. High cost of implementing new technologies	5. Civilian overconfidence in technologies reduces their resilience
6. Lower level of self-preparation of FR because of full trust in technology	6. Disbelief of civilians in professional services
7. Fear of the technology	7. Privacy and data protection (GDPR) – continuous location of rescuers, biometric data from wearables, images from drones
8. Overconfidence in civilian resilience (from their perspective)	8. The sense of surveillance and the chilling effect of being watched (i.e. wearable data for FR; drones for civil society) - Using technology beyond rescue
9. Disbelief of civilians in professional services	9. Autonomy reliability and technology failure
10. Fear of cost versus expected effectiveness, rationalizing of expenses	10. Cybersecurity ransomware attacks on rescue infrastructure, video/audio leaks.
11. Privacy and data protection (GDPR) – continuous location of rescuers, biometric data from wearables, images from drones;	11. Fear of the technology and lack of training (responsibility of FR over the technology)
12. The Sense of Surveillance and the Chilling Effect of Being Watched - Using Technology Beyond Rescue	
13. Autonomy Reliability and Technology Failure - Who Takes Responsibility?	
14. Cybersecurity ransomware attacks on rescue infrastructure, video/audio leaks.	
15. Interoperability and vendor dependency – closed formats etc.	
16. Fear of the technology and lack of training	

Altogether, as shown in Table 13 and Figure 6, the voting results show that CNBOP participants identified eleven interconnected challenges combining technical, ethical, and social dimensions. The most critical were idea 9 ("autonomy reliability and technology failure"), idea 7 ("privacy and data protection"), and idea 2 ("high economic cost of implementing new technologies against expected effectiveness"), which together represented almost 70% of total votes. These were interpreted as the core barriers to social acceptance, reflecting concerns that technical malfunction or unclear accountability could undermine confidence, that data collection practices must remain transparent and compliant, and that investments should be demonstrably proportional to tangible social and operational benefits. Mid-ranked ideas—1 ("formal adaptation for using the technology"), 3 ("lower level of self-preparation of FR because of full trust in technology"), 4 ("fear of the technology from civilians"), 10 ("cybersecurity ransomware attacks"), and 11 ("fear of the technology and lack of training")—were viewed as operational and perceptual barriers that could intensify the main risks if not properly managed. Participants emphasised that without adequate institutional adaptation, user training, and cyber resilience, even reliable technologies may be resisted or misunderstood by both professionals and the public. Finally, the least voted challenges—5 ("civilian overconfidence in technologies reduces their resilience"), 6 ("disbelief of civilians in professional services"), and 8 ("the sense of surveillance and the chilling effect of being watched")—were considered contextual but socially relevant, reflecting broader anxieties about trust, responsibility, and visibility. Together, these results suggest that SYNERGISE's social acceptance depends on demonstrating reliability, ethical governance, and clear human oversight in its technological applications.

In conclusion, the CNBOP group identified that the main social challenges for SYNERGISE arise from maintaining the right balance between confidence and caution, ensuring robust data governance, and achieving institutional adaptation and economic proportionality. The refinement process allowed participants to clarify how both overreliance and fear, combined with privacy concerns and implementation costs, could undermine legitimacy. Ultimately, participants agreed

that sustained social acceptance will depend on SYNERGISE's ability to demonstrate reliability, protect data responsibly, and show that technology enhances rather than replaces human expertise and institutional trust.

Table 13. Summary of CNBOP's Nominal Group results on challenges

	VOTES			PARTICIPANTS	
IDEAS	POINTS	%	M	N	%
1. Formal adaptation for using the technology (i.e. organisational level, legal frameworks, operational procedures and interoperability, ethical guidelines...)	3	15%	0,8	2	50%
2. High economic cost of implementing new technologies against expected effectiveness	10	50%	3,3	3	75%
3. Lower level of self-preparation of FR because of full trust in technology	5	25%	1,3	2	50%
4. Fear of the technology from civilians	3	15%	0,8	1	25%
5. Civilian overconfidence in technologies reduces their resilience	1	5%	0,3	1	25%
6. Disbelief of civilians in professional services	0	0%	0,0	0	0%
7. Privacy and data protection (GDPR) – continuous location of rescuers, biometric data from wearables, images from drones	14	70%	3,5	3	75%
8. The sense of surveillance and the chilling effect of being watched (i.e. wearable data for FR; drones for civil society) - Using technology beyond rescue	0	0%	0,0	0	0%
9. Autonomy reliability and technology failure	17	85%	4,3	4	100%
10. Cybersecurity ransomware attacks on rescue infrastructure, video/audio leaks.	4	20%	1,0	2	50%
11. Fear of the technology and lack of training (responsibility of FR over the technology)	3	15%	0,8	2	50%
TOTAL	60	-	-	4	100%

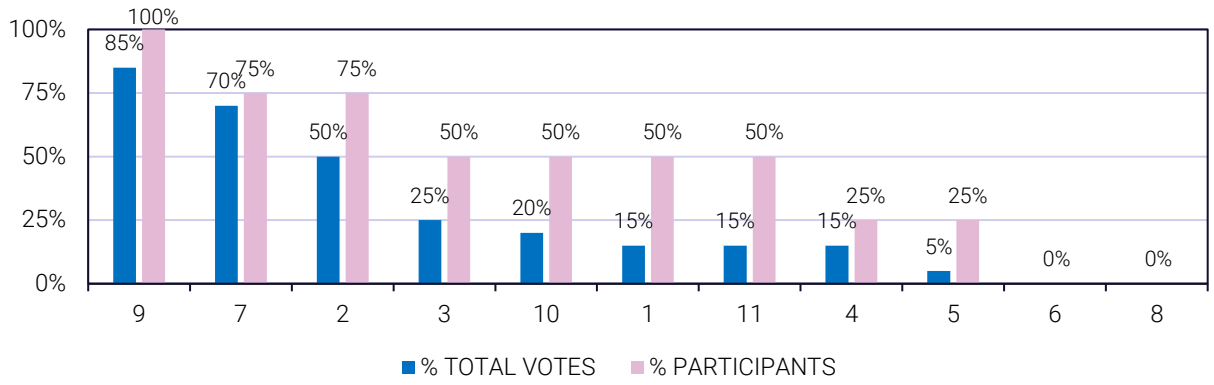

Figure 6. Ranking of challenges by CNBOP

3.2.6. Nominal Group #4: SBFF

Participants	6 representatives from SBFF + moderator (Alejandro Nicolás Sánchez, PLUSETHICS)
Date	29rd October, 2025
Beginning	15:00h CEST
End	16:58h CEST
Total length	118m

3.2.6.1. Nominal Group #4: benefits

*Q_B: Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main **social benefits** of SYNERGISE that could contribute positively to its social acceptance?*

The nominal group with SBFF participants began with a broad list of 18 initial ideas regarding the potential social **benefits** of SYNERGISE, which were consolidated into 10 final ideas (see Table 14).

The conversation moved progressively from practical operational gains to broader institutional and societal impacts, reflecting an understanding that social acceptance depends both on immediate benefits for FRs and on visible public value.

A key early theme was networking and co-development between FRs and technology developers. Initial formulations such as “networking between first responders and use of technology,” “cooperation with other countries rescuers”, “cooperation with technical partners (industry)” and “working across borders” were debated together. Participants agreed that the core benefit lies learning from what technologies other FRs agencies are using and implementing. This led to the refined formulation “networking between FRs and technology developers to improve products and methods,” removing the more simple and duplicated ones. Participants stressed that close collaboration with developers ensures tools are realistic and effective, while contact with other national services enables shared methods and broader expertise. This also connected to the benefit of “familiarity with new products, technologies, work methods,” which participants retained as a separate idea to emphasise hands-on exposure and learning from each other beyond technology.

A central theme was safety and operational performance. Ideas such as “improved safety for first responders,” “safety of first responders,” and “contributing to a more resilient rescue service” were discussed together. Participants agreed these represented a single, core value: that SYNERGISE could reduce risks in the field and strengthen the overall protection of emergency personnel, which led to the unified final statement “improved safety for first responders.” Speed and coordination were also emphasised early in the discussion, with comments noting that better awareness and an integrated toolkit could “provides faster and more coordinated crisis response for community resilience,” adding the societal perspective to reflect that improved speed and coordination ultimately benefit communities’ safety and confidence during emergencies.

The discussion also addressed professional legitimacy and trust, both internally and externally. Ideas such as “taking new technology to end users,” “professional trust that we are using the latest technology,” and “public trust for FR agencies” were examined together. Participants concluded that internal professional confidence and public trust reinforce each other, but opted to keep two distinct formulations: “taking new technology to the end users enhances professional trust”, referring to FRs’ perspective, and “proper implementation enhances public trust for FR agencies.” This reflected a belief that technology adoption strengthens both internal identity and external legitimacy when deployed responsibly.

Another set of ideas centred on modernising rescue services and increasing efficiency. Statements like “develop new technology for the future,” “modern rescue service to fit society better,” and “contributing to a more resilient rescue service” were merged into “developing a more modern rescue service to fit society better”, reflecting a belief that SYNERGISE could help emergency services remain relevant, competent, and trusted in a risk-evolving society. Finally, participants highlighted cross-country and cross-cultural understanding. Two ideas—“understand how organisation works in different countries” and “variety of tools can tailor response to different needs”—were kept because they brought distinct value: one emphasised learning across cultures and systems, the other inclusiveness and capability breadth to meet varied community needs and reach places, communities and contexts that could not be reached before.

Table 14. Benefits provided by the participants of SBFF (initial/final ideas)

INITIAL IDEAS	FINAL IDEAS
1. Networking between first responders and use of technology	1. Networking between first responders and technology developers to improve products and methods
2. Improved safety for first responder	2. Improved safety for first responders
3. Safety of first responders	3. Provides faster and more coordinated crisis response for community resilience
4. Provides faster and more coordinated crisis response	4. Taking new technology to the end users enhances professional trust
5. Taking new technology to the end users	5. Knowledge and understanding of EU projects, development and funding
6. Cooperation with other countries rescuers	6. Developing a more modern rescue service to fit society better
7. Knowledge and understanding of EU projects, development and funding	7. Proper implementation enhances public trust for FR agencies
8. Develop new technology for the future	8. Understand how the organisation works (operationally, viewpoints, risk assessment, etc) in different countries for both FR and citizens
9. Cooperation with technical partners (industry)	9. Familiarity of new products, technologies, work methods
10. Developing a more modern rescue service to fit society better	10. Variety of tools can tailor response to the different needs of the community
11. Contributing to a more resilient rescue service	
12. Public trust for FR agencies	
13. Professional trust that we are using the latest technology available	
14. Understand how the organisation works in different countries	
15. Get to know new viewpoints, values from other countries	
16. Familiarity of new products, technologies, work methods	
17. With many different tools hopefully we can account for more and different needs of the public community. so inclusion.	
18. Working across borders is a way of including and understanding for both FR and citizens	

The voting results, as Table 15 and Figure 7 demonstrate, reinforced the central importance of collaboration and modernisation. The highest-ranked benefit was idea 1 ("networking between first responders and technology developers"), receiving 70% of the maximum possible score, voted at least a point by 83% of participants. This confirms the strong belief that co-design with practitioners is essential for socially legitimate technological innovation. The next most valued was idea 6 ("developing a more modern rescue service to fit society better," 63,3%, ranked in the top five by all participants), signalling that alignment with contemporary risks and expectations is perceived as a key driver of public trust.

Operational safety and efficiency were also highly valued. Idea 2 ("improved safety for first responders," 46,7%) and idea 3 ("provides faster and more coordinated crisis response," 43,3%) were both ranked in the top three by a majority, showing that tangible field benefits remain central to social acceptance. The mid-range results — idea 9 ("familiarity of new products," 26,7%) and idea 8 ("understand how the organisation works in different countries," 23,3%) — point to the importance of capability building and cultural learning, even if perceived as secondary outcomes.

Lower-ranked items, including idea 4 ("taking new technology to the end users enhances professional trust," 10%), idea 7 ("proper implementation enhances public trust," 6,7%), and idea 10 ("variety of tools to tailor community needs," 10%), were still recognised but seen as downstream effects once core operational and organisational improvements are achieved. One idea remained unvoted, "knowledge and understanding of EU projects, development and funding", emphasising that showing the real impact of EU funds is marginal, yet should not be neglected.

Overall, participants viewed SYNERGISE's social benefits as layered: first ensuring responder safety and performance, then modernising institutions, and ultimately building trust and inclusivity. The refinement process revealed that acceptance is expected to grow from visible operational success, practical involvement in development, and the demonstration that innovation aligns rescue services with evolving societal needs.

Table 15. Summary of SBFF's Nominal Group results on benefits

	VOTES			PARTICIPANTS	
IDEAS	POINTS	%	M	N	%
1. Networking between first responders and technology developers to improve products and methods	21	70,0%	3,5	5	83%
2. Improved safety for first responders	14	46,7%	2,3	4	67%
3. Provides faster and more coordinated crisis response for community resilience	13	43,3%	2,2	4	67%
4. Taking new technology to the end users enhances professional trust	3	10,0%	0,5	3	50%
5. Knowledge and understanding of EU projects, development and funding	0	0,0%	0,0	0	0%
6. Developing a more modern rescue service to fit society better	19	63,3%	3,2	6	100%
7. Proper implementation enhances public trust for FR agencies	2	6,7%	0,3	1	17%
8. Understand how the organisation works (operationally, viewpoints, risk assessment, etc) in different countries for both FR and citizens	7	23,3%	1,2	2	33%
9. Familiarity of new products, technologies, work methods	8	26,7%	1,3	4	67%
10. Variety of tools can tailor response to the different needs of the community	3	10,0%	0,5	1	17%
TOTAL	90	-	-	6	100%

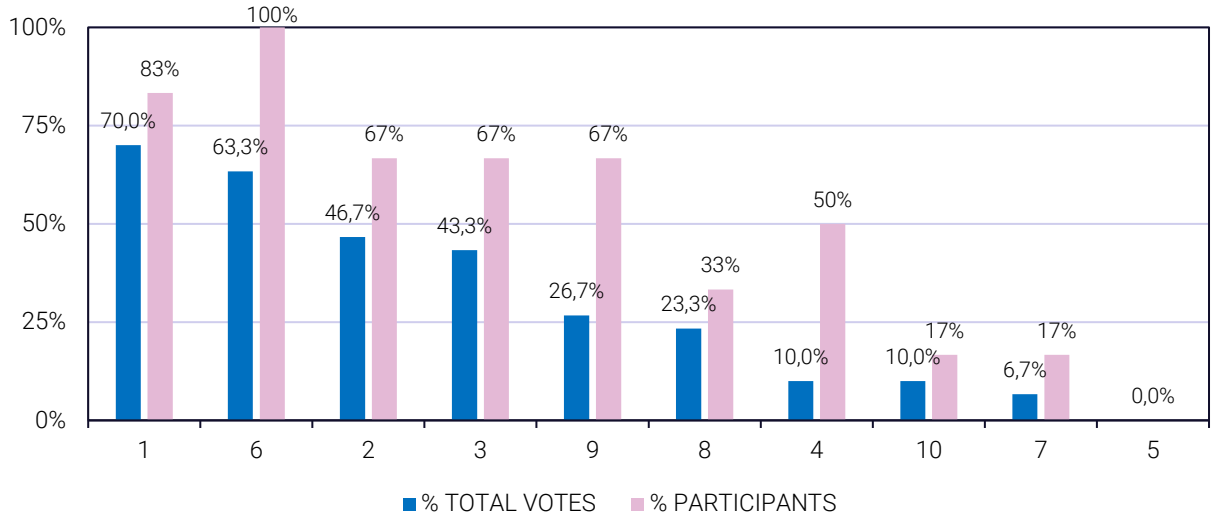

Figure 7. Ranking of benefits by SBFF

3.2.6.2. Nominal Group #4: challenges

*Q_C: Taking into account both your professional experience in the field of first response and your condition as a European citizen, what do you identify as the main **social challenges** of SYNERGISE that could contribute negatively to its social acceptance?*

From the outset, listing a total of 17 ideas that were later reduced to 7 **challenges** (Table 16), participants focused on how the introduction of SYNERGISE tools might impact everyday operational realities, the relationship between FRs and the public, and the internal culture of emergency services.

A first prominent topic concerned financial prioritisation and resource allocation. Several initial comments emphasised that technology "can be expensive for communities," that "the cost could be something citizens are not willing to put", and that "cost-driven implementation could undermine acceptance". Participants reiterated that emergency services are often required to justify expenditures publicly, and if technology consumes budget at the expense of core operational needs, not showing real impact, community support may erode ("society doesn't want us to work with development"). This concern evolved into the final idea "prioritising costs (economic, resources, time, etc) in development and implementation of technologies (i.e. lack of resources

elsewhere, lack of impact)" acknowledging not only monetary burdens but also the risk of diverting time and organisational resources. The group repeatedly stressed that FRs services operate under constrained budgets and public scrutiny; therefore, SYNERGISE must demonstrate real efficiency gains, not abstract promise, to be accepted.

This concern flowed naturally into a second theme: preserving direct human interaction and maintaining public trust. Multiple participants voiced worries that increased focus on screens and tools could "lead to less human interaction", or "can be seen as we are not doing anything to help at an incident", or can produce a "shifting focus from reality," undermining the human dimension of rescue work. In emergency settings, victims and bystanders expect personal reassurance, hands-on support, and human judgement. The consolidation of ideas around "shifting towards interacting with technology instead of the person that is in need loses society's trust" reflected a belief that legitimacy in first response is partially symbolic: the act of looking someone in the eye and physically assisting them builds trust. Technology that interrupts that connection risks appearing cold or inattentive, even if technically helpful. Closely linked was the fear of overreliance on technology harming traditional competencies. Participants highlighted that "traditional proven methods" may be neglected if attention shifts excessively to digital solutions. The consolidation into the challenge "takes focus away from traditional proofed methods instruments causes risks of overreliance on technology" recognised that physical skill, situational intuition, and improvisation remain essential in chaotic environments.

The third central theme revolved around operational simplicity and task focus. Several participants warned that technology can "overcomplicate things," where tools seem useful in theory while adding burdens during emergencies. One participant mentioned: "what if we don't need that much data?". Comments such as "in some cases KISS (*keep it simple, stupid*) is the best option" and warnings about "missing the point" if solutions do not match real-time field needs reflected a strong preference for usability. The refined challenge "overcomplicating things instead of keeping it simple" encapsulated this worry. Participants emphasised that frontline tasks cannot tolerate cognitive overload, extra interface handling, or reliance on systems that may not align with the pace of crisis decision-making.

Another idea focused on training burden and adoption feasibility. Participants noted that responders already juggle extensive training, and that the "limited time for complicated training for FR" could present a barrier. The group stressed that if mastering new systems demands large investment in training hours uptake could be slow or uneven across personnel. And the final challenges acknowledged, but less discussed due to their clarity, concerns and fears of personal data misuse, or digital accountability and blame. On one hand, personal data processing and misuse could lead reduce trust on the public side. On the other hand, the idea of "leaving a digital trail" reflected the concern that logged data could later be used to scrutinise responders' decisions in difficult situations, which might lead to responders hesitating to use tools if they perceive heightened liability exposure.

Overall, the SBFF discussion framed social acceptance as dependent on showing that technology supports field realities, preserves human connection, respects public expectations, and strengthens core emergency competencies, not replacing them.

Table 16. Challenges provided by the participants of SBFF (initial/final ideas)

INITIAL IDEAS	FINAL IDEAS
1. Cost driven when implemented. Can lower the acceptance.	1. Prioritising costs (economic, resources, time, etc) in development and implementation of technologies (i.e. lack of resources elsewhere, lack of impact)
2. More technology can lead to less human interaction	2. Overcomplicating things instead of keeping it simple
3. Society don't want us to work with development	3. Concerns about personal privacy and data misuse could reduce public trust
4. The cost could not be something citizens are willing to put into first responders	4. Limited time for complicated training for FR
5. Too much focus on the tech input can be seen as we are not doing anything to help at an incident	5. Shifting towards interacting with the technology instead of the person that is in need loses society's trust
6. Prioritising costs in implementation may undermine acceptance	6. Leaving digital trail may hinder FR to use tech if one is held accountable in aftermath (i.e. blame game if things don't work out)
7. Can be expensive for community's	7. Takes focus away from traditional proofed methods instruments causes risks of overreliance on technology
8. Overcomplicating things. It's not what the person/community need i.e. missing the point.	
9. Concerns about personal privacy and data misuse could reduce public trust	
10. Overcomplicated costs too much and is too slow	
11. More need of complicated education	
12. Technology can interfere and hinder first responders. Shifting focus from reality	
13. To expensive technology	
14. Less developing of traditional methods because the focus lies on technology.	
15. Leaving digital trail may hinder FR to use tech if one is held accountable in aftermath. i.e. blame game if things don't work out	
16. Takes focus away from traditional proofed methods instruments	
17. In some cases KISS (*keep it simple, stupid*) is the best option.	

The voting results (Table 17 and Figure 8), reinforced the discussion's emphasis on practical legitimacy and alignment with operational culture. The highest-rated challenge, "prioritising costs" (93,3% of maximum votes, ranked in the top five by all participants), underscores that financial credibility is seen as the cornerstone of social acceptance. Participants clearly believe that if SYNERGISE tools are perceived as expensive or as diverting resources from frontline needs, both internal and public support could weaken. In this group's perspective, value must be demonstrable and proportional to investment. The second- and third-ranked concerns—"risks of overreliance on technology" (73,3%) and "shifting focus from the person in need" (63,3%)—together illustrate that maintaining human-centred practice is fundamental. These ideas reflect a belief that technological systems must protect, and not threaten, the relational, human and skill-based identity of emergency services. Participants acknowledged that legitimacy in crisis response depends heavily on human presence, reassurance, and improvisational competence; any perception of technology diminishing these qualities could result in public scepticism.

Mid-range votes went to "limited time for complicated training" (33,3%), "overcomplicating things" (20%) and "leaving a digital trail may hinder FR to use tech" (16,7%). These point to organisational adoption risks: adoption will lag if tools require excessive training commitment or understanding of complex procedures that slow down rescue, or if responders fear punitive retrospective analysis. Conversely, "concerns about privacy and data misuse" received no votes. This does not imply dismissal of the issue, but rather that, relative to operational credibility and public-interaction concerns, it was seen as less immediate in this group's perspective.

Taken together, the results suggest that for SBFF participants, SYNERGISE's social acceptance hinges on demonstrated efficiency, respect for human-centred practice, operational simplicity, and economic justification. Technical innovation is welcomed only if it visibly strengthens the ethos and capabilities of frontline rescue work.

Table 17. Summary of SBFF's Nominal Group results on challenges

	VOTES			PARTICIPANTS	
IDEAS	POINTS	%	M	N	%
1. Prioritising costs (economic, resources, time, etc) in development and implementation of technologies (i.e. lack of resources elsewhere, lack of impact)	28	93,3%	4,7	6	100%
2. Overcomplicating things instead of keeping it simple	6	20,0%	1,0	5	67%
3. Concerns about personal privacy and data misuse could reduce public trust	0	0,0%	0,0	0	0%
4. Limited time for complicated training for FR	10	33,3%	1,7	4	67%
5. Shifting towards interacting with the technology instead of the person that is in need loses society's trust	19	63,3%	3,2	6	100%
6. Leaving digital trail may hinder FR to use tech if one is held accountable in aftermath (i.e. blame game if things don't work out)	5	16,7%	0,8	4	67%
7. Takes focus away from traditional proofed methods instruments causes risks of overreliance on technology	22	73,3%	3,7	6	100%
TOTAL	90	-	-	6	100%

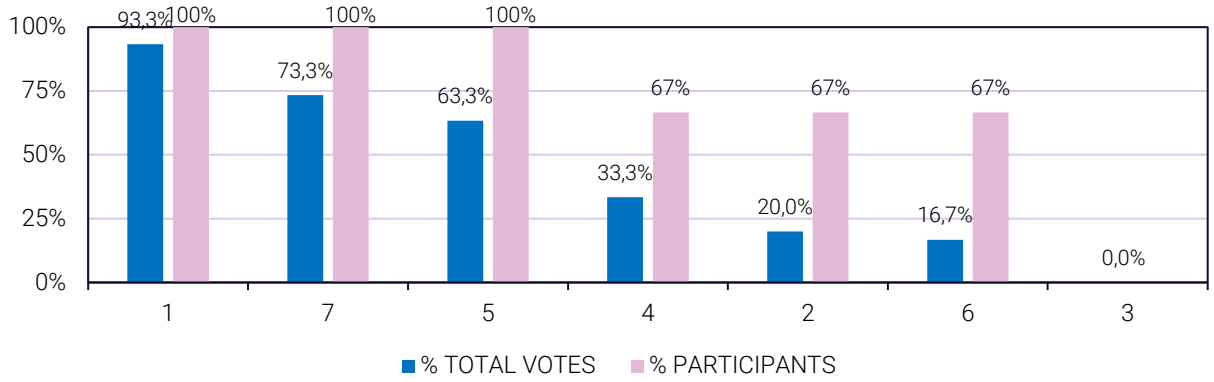

Figure 8. Ranking of challenges by SBFF

3.2.7. Comparative and cross-case analysis of NG results

To synthesise the diverse inputs generated across the nominal groups, a ranking of the identified social benefits was required. The NGT produces a structured set of prioritised items within each group, yet these lists remain inherently context-dependent and fragmented if considered in isolation. Ranking the complete list of benefits of all nominal groups enables the integration of these parallel outputs into a coherent analytical framework, making it possible to identify cross-cutting priorities, areas of convergence, and the relative salience of each benefit from a multi-stakeholder perspective. This comparative ordering thus transforms dispersed group-level preferences into a consolidated evidence base, which can subsequently inform decision-making, guide the refinement of project tools, and support the formulation of socially responsive recommendations.

Given the unequal number of participants across the nominal groups, it was decided to use percentages of votes to ensure the comparability and methodological robustness of the results. Raw point allocations reflect priorities within each individual group but are not directly comparable when the total number of available points varies. Normalising the data through percentages allows each group's contribution to be weighted proportionally, preventing larger groups from exerting disproportionate influence on the overall ranking.

A comprehensive analysis of these results will provide thematic convergences that can serve as a synthesis of key areas of interest for SYNERGISE, both in terms of exploiting potential social benefits and exercising caution when addressing potential social challenges that may affect acceptability.

3.2.7.1. Summary of ranked results

Table 18. Total ranking of social benefits provided by all NG's participants, ordered by maximum points percentage within each group

SOCIAL BENEFIT	DESCRIPTION	MAX POINTS %[6]
1. Better protection and safety of the population during emergency situations	Demonstrating clear improvements in public protection reinforces the perception that advanced systems meaningfully enhance societal wellbeing, strengthening confidence in technological interventions and promoting broad acceptance of SYNERGISE across communities.	90%
2. Safety improvement for FR (protection in the field)	Increasing protection for responders highlights the system's capacity to reduce operational risks, strengthening trust among end users and institutions and encouraging adoption of SYNERGISE in demanding real-world environments.	80%
3. Increased safety for rescuers	Reducing exposure to dangers for rescuers aligns with public expectations for ethically responsible innovation, enhancing support for the integration of SYNERGISE within mainstream emergency response practices.	80%
4. Networking between first responders and technology developers to improve products and methods	Strengthened collaboration ensures that technological solutions address real operational needs, enhancing trust in their relevance and usability and increasing willingness among practitioners to adopt SYNERGISE tools.	70%
5. Increased and quicker situational awareness for everybody (particularly FR and decision makers regarding resources and management)	More rapid access to accurate information improves coordination and decision-making, fostering confidence that SYNERGISE adds measurable value during emergencies and supports informed, timely interventions.	68,6%
6. Developing a more modern rescue service to fit society better	Aligning rescue operations with contemporary expectations demonstrates adaptability and relevance, reinforcing institutional legitimacy and strengthening support for integrating SYNERGISE into existing emergency service frameworks.	63,3%
7. Identify the presence and location of trapped victims remotely and faster than today	Faster and more precise victim identification underscores the system's life-saving potential, enhancing perceptions of social benefit and increasing acceptance among both professional users and the wider public.	62,9%
8. Better real-time decision making due to accuracy/quality of data, time readiness and variety of sources	Enhanced data availability and precision improve operational decisions, demonstrating functional reliability and fostering confidence among stakeholders in the value of adopting SYNERGISE technologies.	56%
9. Prevention of harmful health conditions due to health monitoring	Early detection of health risks through continuous monitoring reassures responders and supervisors, promoting positive attitudes toward integrated technological systems that prioritise wellbeing and safety.	52%
10. Improve and increase the effectiveness/efficiency of operational activities by new technologies	Demonstrated gains in operational efficiency emphasise the practical benefits of technological support, strengthening institutional motivation to integrate SYNERGISE into routine and high-stakes activities.	50%
11. Identify and localize potential environmental risks remotely for everyone	Remote identification of hazardous conditions reduces exposure and supports prevention, reinforcing trust in the system's ability to protect both responders and citizens during evolving emergency scenarios. Remote identification of hazardous conditions reduces exposure and supports prevention, reinforcing trust in the system's ability to protect both responders and citizens during evolving emergency scenarios.	48,6%
12. Improved safety for first responders	Heightened safety for responders illustrates the system's protective value, encouraging organisational acceptance and aligning technological deployment with ethical expectations for risk reduction.	46,7%
13. Facilitation of proper communication during rescue operations (i.e. faster diagnosis and decisions thanks to the integrated platform)	Improved communication flow supports coordinated decision-making and smoother operations, highlighting the added value of integrated platforms and reinforcing the perceived usefulness of SYNERGISE.	45%

[6] Percentage in relation to the maximum possible score that each idea could obtain in each group.

SOCIAL BENEFIT	DESCRIPTION	MAX POINTS %[6]
14. Provides faster and more coordinated crisis response for community resilience	More efficient crisis coordination contributes to stronger community resilience, reinforcing the perception that SYNERGISE delivers tangible societal benefits and merits public support.	43,3%
15. Being alerted if there are health related issues with FR increases confidence and safety feeling	Real-time alerts strengthen responders' sense of security and provide reassurance to command centres, promoting trust in monitoring technologies embedded within SYNERGISE.	37,1%
16. Reduced risk for FRs due to robotic platforms can enter dangerous environments before humans	Using robotic systems to explore hazardous areas reduces human risk exposure, showcasing ethical and operational advantages that support acceptance of robotic integration within SYNERGISE.	36%
17. Greater trust and coherence of services' actions – interoperability between countries/institutions, transparent decisions	Cross-service interoperability and transparent processes enhance legitimacy and reliability, building public and institutional trust in SYNERGISE as a harmonising technological framework.	30%
18. Increase confidence in alive victims and the absence of alive victims, cleared worksites	Reliable confirmation of victim status reduces uncertainty, supports decision-making during rescues, and strengthens confidence in SYNERGISE as a dependable tool in critical situations.	28,6%
19. Familiarity of new products, technologies, work methods	Increased exposure to innovative tools and procedures reduces uncertainty, supports smoother organisational transitions, and encourages long-term acceptance of SYNERGISE as part of everyday professional practice.	26,7%
20. Faster actions (i.e. detection and rescue of victims) for the FR in the field / command center	Demonstrating accelerated detection and rescue processes highlights operational benefits, reinforcing perceptions that SYNERGISE improves emergency response timelines and supports effective, timely interventions during critical incidents.	24%
21. Swifter decision of go / no go in the field, for a non-human presence (robot) can transmit info (conditions, etc)	Providing rapid, reliable environmental information through robotic systems enables more confident decision-making, reinforcing trust in technology-supported judgement during high-risk scenarios and encouraging acceptance of SYNERGISE tools.	24%
22. Understand how the organisation works (operationally, viewpoints, risk assessment, etc) in different countries for both FR and citizens	Gaining insight into organisational practices across countries strengthens mutual understanding, supports coordinated responses, and highlights the value of adopting unified technological frameworks such as SYNERGISE.	23,3 %
23. Improve European collaboration and exchange between FRs, as technologies are developed together and usable by many first responders	Joint development across European organisations strengthens interoperability, fosters mutual trust, and reinforces acceptance of SYNERGISE as a shared, harmonised solution capable of improving coordinated emergency responses.	22,9%
24. Increase independence from American / Asian solutions through developments in Europe	Enhancing Europe's technological autonomy reinforces strategic confidence, encourages institutional trust in locally developed solutions, and increases acceptance of SYNERGISE as a secure, regionally governed system.	14,3%
25. Better cooperation/coordination between different teams with various mentalities	Improved collaboration across diverse teams demonstrates organisational advantages, supporting acceptance of SYNERGISE as a tool that enhances cohesion and strengthens collective operational effectiveness.	12%
26. Taking new technology to the end users enhances professional trust	Direct access to advanced technological tools empowers frontline practitioners, increases confidence in innovation processes, and supports the professional acceptance of integrating SYNERGISE into established workflows.	10%
27. Variety of tools can tailor response to the different needs of the community	Offering a diverse set of technological capabilities allows responses to be adapted to specific community needs, reinforcing perceptions of SYNERGISE as a flexible, socially responsive solution.	10%
28. International consortium using these technologies can increase legitimacy of EU funding by creating something good and valuable for all citizens	Demonstrating tangible societal benefits produced through EU collaboration enhances the perceived legitimacy of public investment and strengthens support for adopting SYNERGISE across different stakeholder groups.	8,6%
29. Positive usage of technology (drones and other remotely controlled may lead to better image of drones and similar) increases trust towards FR agencies	Responsible and effective deployment of advanced technologies improves public perceptions of emergency services, reinforcing trust and supporting the broader acceptance of systems integrated into SYNERGISE.	8,6%
30. Proving that technologies create real impact (saving lives, protection of people)	Demonstrating measurable life-saving outcomes and clear protective benefits reinforces the perceived societal relevance of SYNERGISE and strengthens acceptance of technological enhancements within emergency response contexts.	8%

SOCIAL BENEFIT	DESCRIPTION	MAX POINTS %[6]
31. FR speed improvement by using autonomous robots in the hot zone together with humans	Increased operational speed enabled by collaborative human-robot actions highlights efficiency gains and encourages broader acceptance of robotic capabilities integrated within the SYNERGISE system.	8%
32. Proper implementation enhances public trust for FR agencies	Showing that advanced systems are implemented competently reinforces perceptions of reliability and professionalism, supporting public acceptance of technological tools deployed through SYNERGISE.	6,7%
33. Increased public trust in emergency services by popularizing the new technologies and their impact on society	Communicating clear societal benefits of technological innovation strengthens public confidence in emergency agencies and supports acceptance of SYNERGISE as part of modern service delivery.	5%
34. More experienced teams of the field based on new technologies and more agencies	Access to advanced technological systems supports ongoing skill development and broadens organisational experience, strengthening long-term acceptance of SYNERGISE within emergency response communities.	0%
35. Testing better the safety of the new technology (on the field)	Demonstrating rigorous field testing and validation reassures stakeholders about safety, reliability, and ethical compliance, thereby supporting institutional and public acceptance of SYNERGISE technologies.	0%
36. FR's anxiety decreases during the operations as he/she understands that he/she is being monitored in case of emergency occurs (wearables, localisation, etc).	Continuous monitoring offers reassurance during high-risk operations, reducing stress and fostering favourable attitudes toward integrating SYNERGISE's tracking and support capabilities.	0%
37. Knowledge and understanding of EU projects, development and funding	Improved awareness of EU initiatives and funding mechanisms strengthens institutional trust, encouraging acceptance of SYNERGISE as part of a broader European framework of technological development.	0%

The ranking of social benefits (Table 18), illustrates a clear and consistent direction in how different stakeholder groups perceive the value of SYNERGISE and the conditions under which its tools and methods are likely to be socially accepted. Across the nominal groups, the most highly prioritised benefits converge around a central theme: technology is accepted when it visibly enhances safety, reduces risk, and strengthens emergency response capabilities. The two most highly rated items—improved protection and safety for the population, and improved safety for FRs—highlight that acceptance is strongly anchored to the system's potential to save lives and prevent harm. During the nominal group discussions, participants repeatedly emphasised that technologies capable of locating victims more rapidly, detecting environmental hazards in advance, and reducing exposure of FRs to dangerous conditions are deemed inherently legitimate. This cluster of benefits aligns with the broader expectation that SYNERGISE must demonstrate operational added value that is directly observable in the field, such as faster rescue times, more confident go/no-go decisions, and more accurate risk assessments.

A second group of benefits relates to situational awareness, real-time decision support, and cross-agency coordination. High-ranked benefits such as increased and quicker situational awareness and improved real-time decision-making indicate strong demand for tools that integrate information from multiple sources (e.g., UAV imagery, sensor data, environmental indicators) into a clear operational picture. Participants highlighted that, in practice, this enhanced awareness supports better distribution of resources, reduces confusion during fast-changing incidents, and enables more coordinated teamwork across agencies. These advantages feed directly into acceptance, as stakeholders view SYNERGISE as a facilitator of organised, evidence-based response rather than an additional burden.

A third thematic cluster concerns modernisation, interoperability, and European collaboration. Benefits related to developing a more modern rescue service and strengthening cooperation between FRs and technology developers scored strongly, indicating recognition that emergency management increasingly requires shared standards, common platforms, and mutual learning. Several participants noted that technologies co-developed with end users and tested collaboratively across countries not only increase technical performance but also enhance trust in the solutions and in the EU's capacity to develop valuable public-safety tools. Lower-ranked benefits—such as improved public perception of drones, increased legitimacy of EU funding, and greater European independence from external technologies—were less frequently prioritised, but they still reveal important contextual factors. While these benefits may not influence acceptance immediately at the operational level, they contribute to the long-term cultural embedding of SYNERGISE tools, shaping how both professionals and citizens view the role of technology in disaster response.

The following list summarises 10 distinct thematic drivers of acceptance derived from all 37 benefits identified by the participants:

1. Enhanced safety and protection for the population: direct life-saving potential and reduced exposure to harm increase societal legitimacy and acceptance.

2. Increased safety, health monitoring, and protection of FRs: wearables, remote sensing, and autonomous tools support a safer operational environment for FRs.

3. Improved situational awareness and real-time operational clarity: integrated information flows enable quicker understanding of events and better prioritisation of resources.

4. Faster and more accurate identification of victims and hazards: remote detection, localisation, and environmental risk assessments enhance rescue efficiency.

5. More efficient and evidence-based decision-making during emergencies: data-driven operational choices contribute to coherent, timely, and accountable crisis management.

6. Modernisation, innovation, and professionalisation of rescue services: advanced systems align emergency response with contemporary societal expectations and technologies.

7. Strengthened collaboration and interoperability between responders and developers: joint development and testing processes improve usability, trust, and cross-country harmonisation.

8. Increased public trust through transparent, coordinated, and legitimate emergency actions: interoperability, consistent communication, and visible professionalism reinforce public confidence.

9. Positive societal perception and acceptance of emerging technologies: constructive exposure to drones, robots, and advanced tools improves societal attitudes and reduces resistance.

10. Greater strategic autonomy and European value creation: developing EU-centered technologies enhances long-term legitimacy and reduces dependency on external suppliers.

Table 19. Total ranking of social challenges provided by all NG's participants, ordered by maximum points percentage within each group

SOCIAL CHALLENGE	DESCRIPTION	MAX POINTS %
1. Prioritising costs (economic, resources, time, etc) in development and implementation of technologies (i.e. lack of resources elsewhere, lack of impact)	High development and implementation costs may be perceived as disproportionate to expected benefits, reducing institutional willingness to allocate resources and weakening acceptance of SYNERGISE across financially constrained organisations.	93,3%
2. Autonomy reliability and technology failure	Concerns about autonomous systems malfunctioning during critical operations undermine confidence in technological decision-support, decreasing trust in SYNERGISE's reliability and discouraging adoption by responders and managers.	85%
3. Takes focus away from traditional proofed methods instruments causes risks of overreliance on technology	Fear that technology might displace established, validated practices may generate hesitation among practitioners, reducing acceptance of SYNERGISE as a complement rather than a replacement of trusted operational methods.	73,3%
4. High dependency from technology (resources, risks, licenses, set-up time...)	Heavy reliance on complex infrastructures introduces operational vulnerabilities, raising doubts about resilience and continuity and diminishing acceptance of SYNERGISE in environments valuing independence and rapid mobilisation.	71,4%
5. False sense of reliability of FR technologies in the field leads to dependence	Overconfidence in technological outputs may compromise situational judgement, creating concerns about responders becoming dependent on automated insights and reducing acceptance of SYNERGISE's role in emergencies.	70,8%
6. Privacy and data protection (GDPR) – continuous location of rescuers, biometric data from wearables, images from drones	Continuous tracking and sensitive-data collection provoke concerns about privacy, consent, and proportionality, decreasing trust in SYNERGISE and discouraging participation from responders or citizens affected by surveillance.	70%
7. Shifting towards interacting with the technology instead of the person that is in need loses society's trust	Concerns that technology may distance responders from victims can erode public trust, reducing acceptance of SYNERGISE in contexts where human empathy and presence are considered essential.	63,3%
8. Further development and maturing for commercialising of project outcomes is too expensive and businesses don't see value of investing	High post-project development costs may discourage commercial actors from investing, creating doubts about long-term sustainability and reducing acceptance of SYNERGISE as a viable solution capable of reaching real operational deployment.	51,4%
9. High economic cost of implementing new technologies against expected effectiveness	Significant implementation expenses combined with uncertainty about measurable effectiveness may reduce stakeholders' confidence, limiting their willingness to support or adopt SYNERGISE within financially constrained emergency service environments.	50%
10. A negative "view" of third persons on FR (i.e. FR just "playing" with displays/game sticks/drones, instead of doing actual rescue work)	Public misinterpretations of responders' use of advanced interfaces may undermine perceived professionalism, reducing societal trust and acceptance of SYNERGISE tools during highly visible operations requiring legitimacy and credibility.	45,7%
11. Increased preparation and deployment time for the FR teams	Longer preparation requirements may be viewed as obstructing rapid response, weakening perceptions of operational efficiency and reducing acceptance of SYNERGISE's integration into time-critical workflows.	37,5%
12. Lack of trust in technology and fear of failure (people may question the reliability, safety, and decision-making of "machines", including autonomous vehicles)	Persistent doubts about technological accuracy, safety, and automated decision-making may weaken stakeholders' confidence, reducing acceptance of SYNERGISE in critical situations where reliability and predictable behaviour are essential.	37,5%
13. Ethical dilemmas and responsibility issues (ethical questions about making life-and-death decisions by machines)	Concerns about assigning responsibility for automated decisions raise ethical tensions, reducing societal willingness to accept SYNERGISE in critical operations involving potential harm or life preservation.	37,5%
14. Privacy concerns regarding access: who owns the data (both, health sensors of FR and images of victims), where is it stored (third-country limitations) and who has access to it?	Uncertainty about data ownership, storage jurisdiction, and access rights can erode trust, reducing acceptance of SYNERGISE's data-intensive components among responders and affected communities.	37,1%
15. New technology is too expensive for use on site (to be purchased by FR /market uptake after research)	High acquisition or operational costs may prevent agencies from purchasing SYNERGISE tools after the project, reducing real-world uptake and limiting acceptance among organisations operating with restricted operational budgets.	34,3%

SOCIAL CHALLENGE	DESCRIPTION	MAX POINTS %
16. Incident generating negative social feelings	A single negative technological incident may reinforce public anxieties or misconceptions, overshadowing broader benefits and significantly weakening societal acceptance of SYNERGISE tools in future operations.	33,3%
17. Limited time for complicated training for FR	Demanding training requirements may exceed available time for responders already managing intensive duties, reducing confidence in their ability to use SYNERGISE tools effectively and lowering acceptance.	33,3%
18. Complex technology might increase the need of special training or even experts (less availability of usual FR) which will less likely be accepted	Increased reliance on specialised expertise may strain staffing and reduce operational flexibility, lowering acceptance of SYNERGISE among teams favouring simplicity and rapid deployment.	31,4%
19. Privacy and personal data concerns (technologies may be perceived as surveillance; fear of use of data by third parties, especially outside emergency situations; lack of consent by victims).	Perceived surveillance risks may create discomfort among responders and civilians, reducing trust and willingness to engage with SYNERGISE technologies in sensitive operational contexts.	25%
20. Lower level of self-preparation of FR because of full trust in technology	Concerns that reliance on automated systems may weaken responders' traditional skills could reduce acceptance of SYNERGISE, particularly in contexts where personal preparedness remains vital for operational effectiveness.	25%
21. Technical failure that leads to poor or non-results	Potential malfunction during critical operations raises serious doubts about technological dependability, reducing stakeholders' trust and discouraging the incorporation of SYNERGISE systems into demanding, high-risk emergency environments.	20,8%
22. Smaller cities regions may not have the resources to adopt such technologies. Risk of creating "technologically advanced" versus "technologically excluded" communities.	Limited financial and technical capacity in smaller regions may restrict adoption of SYNERGISE tools, raising concerns about unequal access and reducing broader acceptance across communities with differing resource availability.	20,8%
23. Cybersecurity ransomware attacks on rescue infrastructure, video/audio leaks.	Risks of ransomware attacks or sensitive data leaks undermine confidence in digital security, reducing organisational willingness to integrate SYNERGISE technologies into essential rescue infrastructures dependent on trust and reliability.	20%
24. Overcomplicating things instead of keeping it simple	Overly complex systems may hinder daily use and reduce operational fluidity, limiting acceptance of SYNERGISE among responders who prioritise intuitive, easily deployable technologies in emergency conditions.	20%
25. Leaving digital trail may hinder FR to use tech if one is held accountable in aftermath (i.e. blame game if things don't work out)	Concerns that detailed digital records may expose responders to retrospective blame can discourage full use of SYNERGISE technologies, reducing acceptance in operational contexts where professional accountability feels uncertain.	16,7%
26. Formal adaptation for using the technology (i.e. organisational level, legal frameworks, operational procedures and interoperability, ethical guidelines...)	Extensive organisational adjustments—including legal, procedural, and interoperability updates—may be viewed as burdensome, reducing willingness to integrate SYNERGISE tools into established structures requiring stability and predictability.	15%
27. Fear of the technology from civilians	Civilian apprehension toward unfamiliar technological devices may disrupt trust during emergencies, reducing overall public acceptance of SYNERGISE deployments in situations requiring reassurance, clarity, and visible human presence.	15%
28. Fear of the technology and lack of training (responsibility of FR over the technology)	Responders who feel insufficiently trained or excessively responsible for technical outcomes may distrust automated systems, limiting their willingness to adopt SYNERGISE tools in demanding operational environments.	15%
29. Misuse of personal data: ensuring data protection especially with vital data (employers might abuse them to quit unhealthy employees) might decrease participation from FR in similar research projects	Concerns that sensitive physiological or health-related data could be misused by employers may discourage responders from participating in SYNERGISE activities, weakening trust and reducing acceptance of data-intensive technologies.	14,3%
30. Perception of needed knowledge / training might lead to delay to accept	Perceptions of extensive training needs may create hesitation among responders already facing heavy operational workloads, delaying acceptance of SYNERGISE tools despite their potential efficiency improvements.	12,5%

SOCIAL CHALLENGE	DESCRIPTION	MAX POINTS %
31. Too much info gathered in the command center may compromise fast decision-making	Excessive information flows in command environments may slow decision-making and create uncertainty about operational benefits, reducing confidence in SYNERGISE's capacity to genuinely improve emergency coordination processes.	8,3%
32. Technology may not be accepted in communities of countries with different cultural backgrounds	Differences in cultural attitudes toward technology may reduce acceptance of SYNERGISE, particularly in communities where limited familiarity or scepticism toward digital tools affects trust in emergency-response innovation.	8,3%
33. Transportation issues with all the additional tools (i.e. batteries)	Transporting additional equipment such as batteries or specialised devices may complicate field logistics, limiting enthusiasm for adopting SYNERGISE tools in dynamic rescue scenarios where mobility and speed are essential.	5,7%
34. Not good results of project may question the idea of EU funded research projects	Suboptimal project outcomes may weaken stakeholder confidence in EU-funded innovation, reducing willingness to support or adopt SYNERGISE technologies and potentially influencing broader perceptions of publicly financed research initiatives.	5,7%
35. Civilian overconfidence in technologies reduces their resilience	If civilians become overly dependent on technological support, perceptions of declining personal resilience may emerge, reducing public support for SYNERGISE as a tool aligned with community preparedness values.	5%
36. Less acceptance of technologies by FR due to lack of understanding	Limited understanding of technological functions may produce scepticism among responders, reducing confidence in SYNERGISE tools and hindering their integration into routine field practice or critical operations.	2,9%
37. Good outcomes not generating influence on society and politics	Positive outcomes that do not translate into visible societal or political influence may weaken perceptions of relevance, reducing long-term support for SYNERGISE among policymakers and broader communities.	0%
38. Fear of being replaced by technology by FR	Concerns that technological tools could diminish or replace professional roles may reduce responder confidence, limiting acceptance of SYNERGISE solutions perceived as undermining established human expertise. |	0%
39. Physical accident that involves robots	Potential accidents involving robotic platforms may heighten safety concerns, reducing trust in SYNERGISE and discouraging adoption in operational settings requiring close coordination between responders and automated systems.	0%
40. Fear of reduction of the human role (people might feel that technology undermines human expertise and experience)	Perceived threats to human expertise may challenge professional identity and reduce acceptance of SYNERGISE, particularly in environments where experience, judgement, and human-led decision-making are highly valued.	0%
41. Familiarization with this technology may take long time for FRs to be able to use it, along with the usual preparations and exercises.	Extended familiarisation periods combined with existing training obligations may strain responder capacity, limiting acceptance of SYNERGISE in high-pressure environments requiring rapid preparedness and efficient skill acquisition.	0%
42. Disbelief of civilians in professional services	Pre-existing distrust toward emergency services may reduce acceptance of SYNERGISE technologies, especially in communities sceptical of institutional effectiveness and hesitant to embrace tools linked to formal authorities.	0%
43. The sense of surveillance and the chilling effect of being watched (i.e. wearable data for FR; drones for civil society) - Using technology beyond rescue	Perceptions of constant surveillance through wearables or drones may create discomfort among responders and civilians, limiting acceptance of SYNERGISE when technologies appear to extend beyond legitimate rescue purposes.	0%
44. Concerns about personal privacy and data misuse could reduce public trust	Concerns about improper handling or secondary use of personal data may erode public trust, limiting acceptance of SYNERGISE in scenarios involving sensitive, high-risk, or emotionally charged information flows.	0%

On the social challenges side (Table 19), the ranking similarly reveals coherent clusters of concern that may hinder acceptance if not addressed proactively. The most prominent barriers relate to cost, reliability, and overdependence, indicating that stakeholders are sensitive not only to technological benefits but also to organisational feasibility and operational risk. High development and implementation costs were frequently mentioned as major obstacles, particularly in smaller or resource-limited regions where budgets for technological innovation are constrained. Concerns about the reliability of autonomous functions—especially fear of system failures during high-risk operations—emerged as equally significant. As participants emphasised, even a single malfunction could undermine trust among both responders and the public, which underscores the critical importance of robust testing, transparent performance indicators, and clear fallback procedures.

A second major category of challenges centres around privacy, surveillance, and data protection. Items related to continuous tracking, storage of sensitive biometric data, drone-generated imagery, and unclear data-access rights were consistently ranked as strong concerns. Responders expressed unease about being constantly monitored, while civilian-related discussions highlighted fear of surveillance in already stressful emergency contexts. These concerns are not only legal or ethical issues; they are acceptance issues, as perceived intrusiveness can reduce willingness to adopt or support the use of SYNERGISE tools. This is especially relevant for technologies involving wearables, body sensors, geolocation, and aerial information gathering.

A third cluster relates to training, complexity, expertise requirements, and workload. Complex systems requiring specialised knowledge, extended training, or reliance on technical experts were flagged as concerns that could slow adoption or reduce operational buy-in. Some participants noted that FRs already face significant training burdens, and systems that increase cognitive load or preparation time may be met with hesitation. Challenges linked to uneven resource distribution—particularly differences between large cities and smaller or rural regions—highlight risks of creating "technologically advanced" and "technologically excluded" areas, which could undermine SYNERGISE's perceived fairness and utility across Europe.

Less frequently prioritised challenges still provide valuable insights into longer-term or indirect acceptance dynamics. These include cultural resistance to technology in some communities, civilian fears that technology may diminish human presence in rescue situations, risks of digital blame and accountability, and doubts about whether positive project results will meaningfully influence policy. Even challenges with 0% votes, such as concerns about responders being replaced by technology or civilians distrusting emergency services, reveal underlying anxieties that may resurface in future stages of adoption or in specific regional contexts.

The following list summarises 10 distinct thematic barriers to acceptance derived from all 44 challenges identified by the participants:

1. Financial burden and cost–effectiveness concerns: high development, implementation, acquisition, and long-term maintenance costs reduce feasibility and uptake.

2. Risks of technological unreliability and system failure: autonomy failures, technical malfunctions, and operational downtime threaten trust and credibility.

3. Overreliance on technology and erosion of traditional skills: concerns that technology may replace validated methods or reduce responders' preparedness.

4. Privacy, data protection, and surveillance anxieties: biometric monitoring, geolocation, drone imagery, and unclear data governance raise concerns for both responders and civilians.

5. Complex training requirements and increased cognitive workload: specialised training needs, limited time, and fear of operational responsibility reduce frontline acceptance.

6. Ethical dilemmas regarding autonomy, responsibility, and human role: fears of reduced human agency, accountability gaps, and moral unease regarding machine-assisted decisions.

7. Cybersecurity vulnerabilities and risks of data breaches: ransomware, leaks, and infrastructure attacks reduce institutional confidence in digital systems.

8. Public misinterpretation and negative social perceptions of technology use: concerns that FRs appear distracted or "playing with devices" undermine legitimacy.

9. Unequal access to technology across regions and organisations: resource differences risk creating technologically advanced and excluded communities, affecting fairness and uptake.

10. Cultural resistance, distrust in institutions, and weak societal resilience: scepticism toward emergency services, fear of technology, or overconfidence diminishing civilian preparedness.

The benefits and challenges form complementary perspectives: one highlights what SYNERGISE must amplify, and the other what it must mitigate. The combined insights provide a detailed roadmap for improving adoption, tailoring communication, and designing ethically robust and socially aligned technologies.

4. Recommendations for practice and implementation roadmap

Building on the conceptual foundations outlined in Section 2 and the empirical insights generated through the multi-country NGT exercises in Section 3, this section translates the identified social benefits, concerns, and operational needs into concrete, actionable recommendations for the SYNERGISE development trajectory. The cross-case analysis showed that first responders' acceptance of emerging technologies is shaped by items such as functional performance, organisational readiness, cognitive load, perceived trustworthiness, ethical safeguards, and the broader socio-technical environment in which tools are deployed. Section 4 therefore provides a structured pathway for addressing these factors systematically throughout the project.

From a human-factors perspective, the responsible development and deployment of SYNERGISE technologies requires a transdisciplinary and participatory socio-cognitive approach, ensuring that first responders, engineers, human factors experts and other stakeholders jointly shape system behaviour and operational use (Harbers et al., 2017). To ground these recommendations in a rigorous design methodology, SYNERGISE is adopting a WiSCE (Wiki Socio-Cognitive Engineering), provided by a partner in the consortium, TNO, which offers a structured approach for integrating human, organisational, ethical, and technological dimensions in complex socio-technical systems. It emphasises iterative development cycles where system requirements evolve from the interplay between operational tasks, human cognitive capabilities, organisational practices, and contextual constraints, focusing on real working conditions and ensuring that design decisions respond directly to situated user needs and operational realities. Ultimately, it is a tool that captures the iterative, incremental process, and maintains and re-uses the design rationale underlying human–technology teamwork. By integrating theoretical foundations, team and interaction design patterns, and structured design-and-evaluation methods into a coherent knowledge base, it supports continuous refinement of system behavior, roles, and interactions over time (Neerincx et al., 2019). This approach ensures that insights from the field (among other things laid down in the report) tests, prototypes, and evaluations feed back into reusable models and tools, enabling consistent, transparent, and evidence-based development across successive project cycles. Within this methodology, Team Design Patterns (TDPs) serve as practical building blocks that capture recurring interaction challenges and solutions in human–machine teaming, including the hard (technical) and soft (social-cognitive) dependencies (Verhagen et al., 2024; Enqvist, 2023; van der Waa et al., 2020; van Diggelen et al., 2018). TDPs enable developers to translate first responders' needs (identified in Section 3) into design principles that enhance coordination, resilience, shared situational awareness, and trust calibration between humans and AI-enabled systems. In this sense, core outcomes such as the WiSCE and TDPs will collectively constitute the backbone of the SYNERGISE implementation logic, ensuring that technology design remains aligned with social expectations, cognitive workflows, ethical principles, and organisational structures. Well-designed patterns improve *human factors and performance* outcomes, such as (shared) situation awareness, workload harmonisation, trust calibration, real-time decision-making and cross-agency coordination (e.g., by providing shared mental models, predictable automation behavior, and stable role expectations). They also promote *responsible data and AI use* through explicit operational structures, transparency, and traceability. Finally, aiming at the development of a shared library of validated TDPs across partner countries will reinforce *European collaboration*, and contribute to the development of coherent, trustworthy and interoperable crisis-response procedures.

The roadmap that follows operationalises these methodological pillars by linking each major benefit and challenge identified by first responders to a set of concrete actions and responsible Work Packages. The recommendations are grouped into thematic benefits and challenges which directly mirror the patterns emerging from Section 3. This ensures full traceability between user insight and project action, and supports a development pathway that is both socially grounded and technically robust.

Table 20. SYNERGISE's acceptance roadmap, linking social benefits to specific WPs and actions

SOCIAL BENEFIT	FUTURE ACTIONS – RELEVANT WPs				
	1	2	3	4	5
1. Enhanced safety and protection for the population: direct life-saving potential and reduced exposure to harm increase societal legitimacy and acceptance.	Improve early hazard detection and rapid situational assessment through robots and integrated sensor networks WP2, WP3, WP4, WP5, WP6	Deploy robotic and drone systems to conduct remote inspections of hazardous or unstable areas WP6	Strengthen real-time information flow to HQ and field teams for faster population protection measures WP5, WP6	Establish public-facing alert and information channels that translate real-time robotic and sensor data into clear, actionable population-protection messages WP7	Integrate robotic-collected evidence into post-incident analyses to improve future protective strategies WP5, WP6, WP7
2. Increased safety, health monitoring, and protection of FRs: wearables, remote sensing, and autonomous tools support a safer operational environment for FRs.	Improve reliability and ergonomics of wearable systems WP4	Implement predictive health-monitoring models for FRs using wearable and physiological data streams WP4, WP5	Integrate robotic platforms in deployments to reduce FR exposure by performing initial hazard assessment WP2, WP3, WP4, WP5, WP6	Use robots and drones to provide remote visual, thermal, and chemical sensing WP2, WP3, WP4, WP5, WP6	Improve data fusion between wearable sensors, robots, drones, and command tools for real-time risk alerts WP2, WP3, WP4, WP5
3. Improved situational awareness and real-time operational clarity: integrated information flows enable quicker understanding of events and better prioritisation of resources.	Advance multimodal data-fusion engines capable of combining robotic, UAV, wearable and fixed-sensor data in real time WP5	Enhance real-time visualisation tools for decision makers through intuitive interfaces fed by robotic and sensor data WP2, WP3, WP4, WP5	Use robotics-assisted mapping to support fast creation of accurate operational maps WP2, WP3, WP4, WP5, WP6	Integrate real-time sensor streams (robotics, drones, wearables, fixed sensors) into a unified operational picture WP2, WP3, WP4, WP5; WP6	Establish continuous feedback loops from end users to refine real-time awareness tools and robotic deployment strategies WP6, WP7
4. Faster and more accurate identification of victims and hazards: remote detection, localisation, and environmental risk assessments enhance rescue efficiency.	Integrate all detection modules into a unified detection pipeline WP2, WP3, WP4, WP5, WP6	Deploy autonomous and semi-autonomous robots and drones for rapid victim and hazard search in inaccessible, confined, or high-risk zones WP2, WP3, WP4, WP5, WP6	Enhance AI models for victim localisation and hazard identification WP2, WP3, WP4, WP5, WP6	Strengthen real-time alerting mechanisms triggered by robotic detections WP2, WP3, WP4, WP5, WP6	Provide scenario-based training for FRs on robotic-assisted victim search, hazard recognition, and response coordination WP6
5. More efficient and evidence-based decision-making during emergencies: data-driven operational choices contribute to coherent, timely, and accountable crisis management.	Integrate all detection outputs supported by alerting into the command-and-control platform WP5	Deploy AI-driven decision-support modules using fused data from all systems WP2, WP3, WP4, WP5, WP6	Deploy a robust real-time operational dashboard integrating visualisations from robots WP6	Enhance interoperability between robotic systems, wearables, and command tools to ensure seamless information flow WP2, WP3, WP4, WP5, WP6	Provide training for FRs and command staff on interpreting robotic data, AI recommendations, and fusion outputs WP6
6. Modernisation, innovation, and professionalisation of rescue services: advanced systems align emergency response with contemporary societal expectations and technologies.	Establish standardised operational workflows that integrate advanced tools into everyday emergency response WP2, WP3, WP4, WP5, WP6	Develop harmonised training materials on robotics, AI tools, remote sensing, and decision-support systems WP6	Establish training, exercises, and knowledge-sharing activities to standardise modern response methods across Europe WP6, WP7, WP8	Support EU initiatives to modernise and implement innovative technologies in rescue organisations WP7, WP8	Integrate SYNERGISE tools into national and EU-level certification and accreditation schemes for first responders WP6, WP7, WP8

SOCIAL BENEFIT	FUTURE ACTIONS – RELEVANT WPs				
	1	2	3	4	5
7. Strengthened collaboration and interoperability between responders and developers: joint development and testing processes improve usability, trust, and cross-country harmonisation.	Maintain a permanent co-creation cycle between developers and first responders to refine tool requirements and improvements WP1, WP6, WP7	Maintain iterative testing cycles (CFTs, SFTs) to ensure interoperability and cross-validation of tools and services WP6	Create a shared interoperability framework (communication protocols, data formats, interfaces, safety standards) all WPs	Establish mixed teams of FRs and developers during all exercises to accelerate troubleshooting and improve usability WP6	Promote international collaboration among FR organisations and technical partners for cross-country alignment of robotic and digital solutions all WPs
8. Increased public trust through transparent, coordinated, and legitimate emergency actions: interoperability, consistent communication, and visible professionalism reinforce public confidence.	Develop clear communication protocols and SOPs for technology-supported emergency operations, ensuring transparency and public understanding of how decisions are made WP1, WP6, WP7, WP8	Strengthen coordination between field units, command centres, and technology systems to ensure coherent and legitimate emergency actions WP1, WP5, WP6	Maintain transparent reporting mechanisms on the use of robots and advanced technologies in emergency missions (what was used, why, and with what impact): all WPs	Engage with communities through demonstrations, workshops, conferences, and public-facing communication materials to familiarise citizens with emergency technologies WP6, WP7, WP8	Ensure robust ethical, privacy, and safety safeguards for all data flows and robotic operations, communicating these safeguards clearly to stakeholders WP1, WP5, WP6, WP8
9. Positive societal perception and acceptance of emerging technologies: constructive exposure to drones, robots, and advanced tools improves societal attitudes and reduces resistance.	Develop clear, accessible communication materials explaining how SYNERGISE technologies work and how they support safety WP1, WP6	Promote public demonstrations and interactive sessions showcasing SYNERGISE technologies in various settings WP1, WP6, WP7, WP8	Highlight real-world success stories from the project, showing examples where robots, wearables, and decision-support tools improved outcomes WP1, WP6, WP7	Provide training and outreach to communities to foster technological literacy WP1, WP6, WP7	Ensure alignment of SYNERGISE outputs with societal values, norms, and expectations, incorporating public feedback loops into project dissemination WP1, WP6, WP7
10. Greater strategic autonomy and European value creation: developing EU-centered technologies enhances long-term legitimacy and reduces dependency on external suppliers.	Promote an uptake by first response organisations by creating a roadmap for post-project commercialisation and certification of SYNERGISE technologies WP1, WP7	Facilitate cross-border collaboration to harmonise technical standards, operational interfaces, and regulatory frameworks WP1, WP6, WP7, WP8	Strengthen EU supply chains for key components (robots, sensors, data platforms) by mapping vulnerabilities and promoting EU-led alternatives WP1, WP6, WP7, WP8	Promote the development of EU-focused innovation clusters linking responders, academia, SMEs, and developers WP1, WP7, WP8	Establish a European knowledge base for robots and advanced disaster-management technologies WP1, WP6, WP7, WP8

Table 21. SYNERGISE's acceptance roadmap, linking social challenges to specific WPs and actions

SOCIAL CHALLENGE	FUTURE ACTIONS – RELEVANT WPs				
	1	2	3	4	5
1. Financial burden and cost–effectiveness concerns: high development, implementation, acquisition, and long-term maintenance costs reduce feasibility and uptake.	Conduct cost–benefit analyses of deploying SYNERGISE technologies in disaster scenario WP7	Identify operational efficiency gains through automation, predictive sensing, and advanced decision-support WP7	Benchmark SYNERGISE technologies against traditional methods to highlight cost savings WP6, WP7	Promote scalable deployment strategies to maximize cost-effectiveness across different contexts WP 6, WP7	Provide clear cost analyses and long-term maintenance estimates to all stakeholder groups WP7
2. Risks of technological unreliability and system failure: autonomy failures, technical malfunctions, and operational downtime threaten trust and credibility.	Develop rigorous testing and validation procedures for all SYNERGISE robotic, sensing, and software components WP6	Integrate redundancy, fail-safe mechanisms, and fallback modes into critical systems WP2, WP3, WP4, WP5	Implement continuous feedback loops from CFTs, and SFTs exercises' operators, and technical teams to improve system robustness WP6	Establish clear governance, ethical, and safety frameworks addressing reliability thresholds and system failure risks WP1, WP2, WP3, WP4, WP5, WP8	Train end-users on emergency protocols for handling technology malfunctions and system downtime WP6
3. Overreliance on technology and erosion of traditional skills: concerns that technology may replace validated methods or reduce responders' preparedness.	Design SYNERGISE tools to augment - not replace - human decision-making, ensuring operators remain in control WP1, WP2, WP3, WP4, WP5, WP6	Implement training programmes that include both technological operation and reinforcement of traditional field skills WP6	Communicate the complementary role of SYNERGISE technology to prevent misconceptions that robots or decision systems fully replace human expertise WP1, WP7	Encourage doctrine and SOPs that require verification of automated outputs using human judgment WP1, WP7, WP8	Develop fallback procedures and manual intervention protocols for use in case of system failure or unavailability WP1, WP2, WP3, WP4, WP5, WP6
4. Privacy, data protection, and surveillance anxieties: biometric monitoring, geolocation, drone imagery, and unclear data governance raise concerns for both responders and civilians.	Develop transparent data-handling policies explaining what data SYNERGISE systems collect, why, and how long it is retained WP1, WP7, WP8	Embed privacy-by-design principles into robotics, wearables, and C3I/IMS environments WP1, WP2, WP3, WP4, WP5, WP7	Define strong access control, data governance, and cybersecurity mechanisms for all SYNERGISE data flows WP1, WP2, WP3, WP4, WP5, WP7, WP8	Communicate clearly to the public and stakeholders how SYNERGISE data supports safety WP7	Provide data-use opt-in mechanisms, consent processes, and clear user rights where applicable WP1, WP6, WP8
5. Complex training requirements and increased cognitive workload: specialised training needs, limited time, and fear of operational responsibility reduce frontline acceptance.	Design intuitive, user-centred interfaces for robots, sensors, and decision-support systems WP1, WP2, WP3, WP4, WP5	Develop tiered training programmes tailored to different skill levels and user groups WP6	Use C3I/IMS for immersive, scenario-based training that builds confidence without overwhelming users WP5, WP6	Automate routine data-processing tasks and provide decision-support that simplifies - not complicates – information WP2, WP3, WP4, WP5	Deliver cross-technology training packages that cover robotics, wearables, sensors, and decision-support tools together WP6
6. Ethical dilemmas regarding autonomy, responsibility, and human role: fears of reduced human agency, accountability gaps, and moral unease regarding machine-assisted decisions.	Establish clear guidelines on levels of autonomy for robots and automated decision-support tools WP1, WP8	Define responsibility and accountability frameworks for human-technology collaboration WP1	Integrate ethical reasoning into design decisions through co-creation with users WP1, WP8	Build transparency features into SYNERGISE technologies, such as explainability of decision-support outputs WP1, WP5	Provide training to operators on ethical use of robotics, sensor data, and automated recommendations WP1, WP6, WP8

SOCIAL CHALLENGE	FUTURE ACTIONS – RELEVANT WPs				
	1	2	3	4	5
7. Cybersecurity vulnerabilities and risks of data breaches: ransomware, leaks, and infrastructure attacks reduce institutional confidence in digital systems.	Apply secure-by-design and encryption-by-default principles to data collected by robots, sensors, and mobile/wearable devices, where required WP2, WP3, WP4, WP5	Strengthen authentication, access control, and identity management for all operators and system components WP5, WP6	Establish secure communication channels between platforms, robots, sensors, UAVs, and command systems WP2, WP3, WP4, WP5, WP5; WP7	Provide cybersecurity training and awareness sessions for operators and decision-makers WP6, WP7	Establish continuous cybersecurity monitoring and incident-response procedures for SYNERGISE systems, including rapid isolation, logging, and recovery protocols WP5, WP6, WP7
8. Public misinterpretation and negative social perceptions of technology use: concerns that FRs appear distracted or "playing with devices" undermine legitimacy.	Develop clear, accessible explanations of how SYNERGISE technologies function and what problems they solve WP2, WP3, WP4, WP5, WP6	Promote real-world demonstrations to allow hands-on interaction with SYNERGISE tools WP6	Highlight real success stories showing societal benefits, such as improved safety, efficiency, and responder protection WP7, WP8	Monitor public perceptions through surveys, media analysis, and stakeholder feedback loops WP6, WP7	Integrate societal, ethical, and human-centred messaging into all SYNERGISE communication activities WP1, WP8
9. Unequal access to technology across regions and organisations: resource differences risk creating technologically advanced and excluded communities, affecting fairness and uptake.	Develop scalable technology deployment packages tailored for organisations with different resource levels WP6, WP7	Provide training, guidance, and onboarding support designed for diverse regions WP6	Offer low-cost or open-source elements of SYNERGISE tools to broaden adoption opportunities WP7	Demonstrate SYNERGISE tools in diverse contexts WP6, WP7	Build guidance on minimal-viable configurations for robotics, sensors, and decision-support tools WP2, WP3, WP4, WP5, WP6
10. Cultural resistance, distrust in institutions, and weak societal resilience: scepticism toward emergency services, fear of technology, or overconfidence diminishing civilian preparedness.	Monitor trust, cultural acceptance, and resilience over time with longitudinal social metrics WP1, WP6, WP7, WP8	Build transparent communication strategies emphasising accountability, safety, and human oversight WP7	Integrate resilience-building components in SFT exercises WP6	Ensure SYNERGISE tools are visibly human-centric, emphasising support rather than replacement WP2, WP3, WP4, WP5, WP6	Incorporate trust-building elements in training (scenario transparency, explainable AI, ethical guidance) WP6

5. Conclusions

This deliverable has examined the social acceptability and perceived impact of SYNERGISE technologies from the perspective of those who will use them in high-stakes, real-world emergency operations: end-users from SYNERGISE's consortium (FRs organisations: THW, HRTA, CNBOP, SBFF). The combination of state-of-the-art research and structured end-user engagement has highlighted several key insights that should guide the ongoing development and integration of the SYNERGISE system of systems.

First, the potential social benefits of SYNERGISE are widely recognised. Enhanced safety, both for the general population and for first responders, emerges as the strongest driver of acceptance, supported by improvements in situational awareness, operational coordination, and the efficiency and accuracy of detection and response tasks. These perceived benefits reinforce the project's ambition to contribute to a more resilient, effective, and interoperable European emergency-response ecosystem. Second, the concerns voiced by end-users underscore the need for responsible, transparent, and human-centred implementation. Privacy and data-protection issues, technological unreliability, ethical dilemmas, and the risk of overreliance on automation are significant barriers that can hinder trust and uptake. These challenges demonstrate that successful technological innovation requires careful attention to governance structures, training, communication, and meaningful human control. Third, organisational and contextual factors also play a crucial role: FR organisations vary widely in resources, digital maturity, and operational practices. Without proactive measures to address inequalities, SYNERGISE risks reinforcing existing technological divides. Similarly, public perceptions of emergency technologies influence broader societal legitimacy: transparent communication, community engagement, and demonstrable benefits are essential for building public trust. Finally, the deliverable highlights actionable pathways for ensuring that SYNERGISE technologies are socially robust. The recommendations and implementation roadmap provided in Section 4, including targeted measures across all WPs, translate social insights into concrete operational guidance.

In conclusion, SYNERGISE is well positioned to strengthen Europe's emergency-response capacities, but its success will depend on continuous engagement with end users, sustained attention to ethical and social dimensions, and deliberate integration of these considerations into technical development. SYNERGISE has the potential to deliver solutions that are technologically advanced, legitimate, trusted and widely adopted across Europe's diverse first responder communities, by aligning innovation with societal values, user expectations and legal-ethical frameworks.

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Annex – Consent form

(Provided via Google Forms in English with its translation to the mother tongue of each SYNERGISE's end-user entity)

[SYNERGISE] NOMINAL GROUP SESSION

Dear participant:

Thank you for registering the SYNERGISE Nominal Group session that will take place online on [insert date]

You are kindly asked to read and complete this form before the session. Estimated time is 5 minutes.

PARTICIPANT INFORMATION SHEET

You have been invited to take part as member of [insert end-user name], end-user organisation of the EU-funded project "SYNERGISE - A novel integrated SYstem of Systems streNgthening tEchnical and logistical capacities to ensure better Response to emerGencies by synergIStically addrEssing FRs capability gaps", coordinated by THE FEDERAL AGENCY FOR TECHNICAL RELIEF, tiina.ristmaee@thw.de.

Before making a decision on whether you want to participate or not, please read this document carefully.

Please ask all the questions you may have so you can be completely sure that you understand all the proceedings of the research, including risks and benefits.

This informed consent document may include words that you do not understand. If this is the case, please ask the researcher or any other member of the study to fully explain the meaning of the word or clarify pieces of information.

At all times, we assure the compliance with the current national and European legislation (General Data Protection Regulation).

Project Summary

The SYNERGISE project empowers first responders by unveiling an innovative toolkit, enhancing incident management and response efficiency.

Societies increasingly face considerable yet unpredictable risks from both man-made and natural hazards and climate change is also having a massive impact on society's vulnerability. First responders are among the first to arrive and provide assistance or incident resolution at the scene of disaster, therefore special care must be taken not to expose them to any physical or mental risk. Especially in those incidents in which multiple agencies collaborate and need to exchange information over an uncharted and hazardous area, a holistic and synergistic incident management approach as well as effective tools is crucial to preserve their protection and augment their situational awareness. SYNERGISE aims is to improve the management of natural and man-made disasters while fostering collaboration among first responders. This innovative, cost-effective, modular, and highly reliable toolkit is expected to increase mission effectiveness and enhance victim detection at highly challenging and complex incident sites. To improve first responders'

collaborative response and enhance efficiency and safety during the critical mission, SYNERGISE has set following objectives:

- To increase EU resilience and decrease societies' vulnerability against natural and man-made hazards by delivering a Novel Integrated Toolkit for Collaborative Response and Enhanced Situational Awareness (NIT-CRES) which appropriately addresses and further elaborates on Capability Gaps as identified by IFAFRI and is extensively validated by responders facilitating training and acceptance.
- To ensure uptake of the SYNERGISE solutions through wide communication and dissemination activities as well as efficient exploitation, business planning and market analysis.
- To integrate, test and validate SYNERGISE systems and services with the active engagement of users.
- To deliver a novel swarm of robots (aerial, OWL – legged, ANYmal and crawling/version enabled-SNAKE) for response missions.
- To deliver a reliable infrastructure-less indoor localisation system (as a wearable of First Responders) seamlessly patched with outdoor positioning infrastructure.
- To deliver a novel wearable attached to the garment of First Responders for vitals monitoring and active threats (e.g., hazardous gases, abnormal environmental conditions, etc.) detection and identification.
- To deliver advanced augmented reality services to operational & tactical response teams.
- To deliver ubiquitous, ad-hoc, rapidly deployable, high bandwidth field and HQ communications.
- To deliver enhanced C4I and IMS capabilities – Command, Control, Communication Coordination, and Intelligence (extraction) and Incident Management at the service of response agencies.
- To deliver a novel Human-Machine teaming framework to boost collaboration among FR teams and with their response tools.
- To increase civil protection effectiveness by significantly enhancing response performance in an international setting.
- To ensure societal, ethical, legal, privacy, security and inclusiveness requirements, best practices and regulations are followed advancing SYNERGISE sustainability.

Activity description

If you decide to take part, you will be asked to participate on a Nominal Group session as part of the Task 1.3 "Social, Legal, Privacy, Inclusiveness and Ethical Landscape for FRs operations", particularly for D1.5 "End-users' social challenges and acceptance of SYNERGISE solutions".

The nominal group technique can be considered a variation of small focus groups, brought together to reach consensus. Information is gathered by asking individuals to respond to questions posed by a moderator, and then participants are asked to prioritise the ideas or suggestions of all group members.

The process prevents any one person from dominating the discussion, encourages all members of the group to participate, and results in a set of prioritised solutions or recommendations that represent the group's preferences.

This session will be led by Plus Ethics (www.plusethics.com). Contact info@plusethics.com / anicolas@plusethics.com.

Your participation in this activity is completely voluntary and that you are free to withdraw from it at any time without explanation.

Your data will be stored for the duration of the project and may be stored after the completion of the project if justifiable grounds to do so exist, e.g. the necessity to retain the data in order to prove the reliability of the system or maintain the viability of the exploitation of the project.

CONSENT FORM

When providing your opinions, only your answers will be recorded, and this information will only be processed by project partners, held on the personal, and protected, computer drive of the researcher, and kept separate from the interview material. Therefore, your opinions will not be linked to your name or any other direct identifiers, and opinions that may identify you will not be made public in any case. Any security sensitive information will also be discarded for publication. Additionally, researchers use secure network servers to exchange information between project partners, and any e-mails inviting experts or discussing the research with participants will be deleted after the research is compiled into the relevant reports.

Personal Data Rights

As a data subject, you are bound by the General Data Protection Regulation (EU) and have the following rights:

1. access
2. rectification
3. erasure
4. restriction of processing
5. to be informed about recipients after a request for rectification, erasure or restriction of processing
6. data portability
7. to object
8. not to be subjected to automated individual decision-making, including profiling.

1. I have been informed of the project aims and goals: Yes/No

2. I consent to my participation in the research: Yes/No

3. I consent to my data being used in the future for research purposes only: Yes/No

PARTICIPANT IDENTIFICATION

Complete Name:

Email:

Organisation:

- THW (The Federal Agency for Technical Relief / Technisches Hilfswerk)

- CNBOP (Scientific and Research Centre for Fire Protection – National Research Institute / Centrum Naukowo-Badawcze Ochrony Przeciwpożarowej)

- HRTA (Hellenic Rescue Team of Attica / Ελληνική Ομάδα Διάσωσης Αττικής)

- SBFF (The Södertörn Fire Brigade Association / Södertörns Brandförsvarsförbund)