ASSISTANCE

Adapted situation awareneSS tools and tallored training curricula for increaSing capabiliTie and enhANcing the proteCtion of first respondErs

European Commission

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Human Factor impact assessment

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ASSISTANCE

Nowadays different first responder (FR) organizations cooperate together to face large and complex disasters that in some cases can be amplified due to new threats such as climate change in case of natural disasters (e.g. larger and more frequent floods and wild fires, etc) or the increase of radicalization in case of man-made disasters (e.g. arsonists that burn European forests, terrorist attacks coordinated across multiple European cities).

The impact of large disasters like these could have disastrous consequences for the European Member States and affect social well-being on a global level. Each type of FR organization (e.g. medical emergency services, fire and rescue services, law enforcement teams, civil protection professionals, etc.) that mitigate these kinds of events are exposed to unexpected dangers and new threats that can severely affect their personal safety.

ASSISTANCE proposes a holistic solution that will adapt a well-tested situation awareness (SA) application as the core of a wider SA platform. The new ASSISTANCE platform is capable of offering different configuration modes for providing the tailored information needed by each FR organization while they work together to mitigate the disaster (e.g. real time video and resources location for firefighters, evacuation route status for emergency health services and so on).

With this solution ASSISTANCE will enhance the SA of the responding organisations during their mitigation activities through the integration of new paradigms, tools and technologies (e.g. drones/robots equipped with a range of sensors, robust communications capabilities, etc.) with the main objective of increasing both their protection and their efficiency.

ASSISTANCE will also improve the skills and capabilities of the FRs through the establishment of a European advanced training network that will provide tailored training based on new learning approaches (e.g. virtual, mixed and/or augmented reality) adapted to each type of FR organizational need and the possibility of sharing virtual training environments, exchanging experiences and actuation procedures.

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Disclaimer

Executive Summary

The ASSISTANCE project provides new technologies and solutions to improve the protection and capabilities of First Responders. A particular interest of the project was the study and assessment of human factors by a dedicated Work Package (WP8).

The main aims of this deliverable are to 1) provide insights into Societal Aspects and Gender Dimension in disasters response and innovation and 2) to present the evaluation and the main results of human factors (gender, ethical, legal and societal) within the ASSISTANCE project. The main conclusions are summarized as follows:

1) Societal Aspects and Gender Dimension
    - The Societal Impact Assessment revealed that the most likely societal impacts of the project were directly related to the current societal needs of First Responders.
    - Whereas regional differences warrant further research overall one third of EU citizens are likely to take an active part in disaster response thus contributing to enhance the capabilities of First Responders.
    - Risk propensity and coping in First Responders do not depend on gender. However male First Responders are found to be more than male First Responders.
    - Women perceive higher risks than men but both genders do not differ in their attitudes toward disaster preparedness.

2) Human factor impact assessment in ASSISTANCE
    - The project has been gendered sensitive and the proposed technologies protect First Responders, no need to specifically focus on gender. Two further adaptations were identified in relation to sex differences i.e the size of sensors wore in ears and the thresholds for the hard rate sensors.
    - Ethical strengths reported by end users in relation to the technologies include feelings of empowerment, integration with technologies, supportiveness and team resilience. Sense of being too observed, overwhelmed by too much information and the risk of less empathic with the victims were the reported ethical weaknesses.
    - The project was found to be compliant with the data protection regulations (the Regulation EU 679/2016 (“GDPR”), the Directive EU 2016/680, European Data protection Board decisions) and low ethics risks considering the characteristics of the processing carried out using the technologies.
    - End-users perceived that the technologies improve their current situation. The most striking improvements were found to be associated with learning, decision-making and protection. These societal impacts are perfectly aligned with the main objectives of the project. Nevertheless, the proposed technologies did not produce a clear change in the overall attitudes towards technology in terms of trust and confidence.

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Acronyms

AR	Augmented Reality
AT	Analysis tool
D#.#	Deliverable number #.# (D1.1 deliverable 1 of work package 1)
DoA	Description of Action of the project
EC	European Commission
EMS	Emergency Medical Service
EU	European Union
H2020	Horizon 2020 Programme for Research and Innovation
IQR	Interquartile range
IFC	Informed Consent Form
FR	First Responder
GD	Gender Dimension
GELS	Gender, Ethical, Legal and Societal
KPI	Key Performance Indicator
M#	#th month of the project (M1=May 2019)
MT	Monitoring tool
PTSD	Post-Traumatic Stress Disorder
R&D	Research and Development
R&I	Research and Innovation
RQF	Research Quality Framework
SA	Situation Awareness
SIA	Societal Impact Assessment
SO#	Specific Objective
VR	Virtual Reality
WP	Work Package
SAT	Self-Assessment tool
SIA	Societal Impact Assessment
S&S	Safety and Security
T#.#	Task number #.# (T8.1 work package 8 task 1)

1. Introduction

The ASSISTANCE project aims at improving the protection and capabilities of First Responders through technology when dealing with disasters. A key focus of the project is tackling non-technological aspects (WP8). This deliverable summarizes the methods used and the key findings generated when assessing human factors. Human factors here refer to internal and external factors which may influence/change the performance and behaviours of people within the context of disaster response and the use of safety technologies.

1.1. Purpose

The main aims of this deliverable are to 1) provide insights into societal aspects and gender dimension in disaster response and innovation for resilient societies and 2) to present the evaluation of the ASSISTANCE project and its outcomes from a non-technical perspective (gender, ethics, legal and societal).

1.2. Scope

This deliverable represents the final achievement of Milestone MS12 "Societal (including gender) impact assessment done" including the Objective O6 and the corresponding KPIs according to the DoA (Table 1).

Objective	KPI	Target
O6. To measure the societal impact of the project.	Questionnaires for measuring the citizens security perception improvement due to ASSISTANCE use.	> 250 (Survey on EU citizens)
	SIA (Social Impact Assessment) guideline of best practices	1 (Deliverable 8.6)
	Detailed Report on Gender Dimension Strategy (GDS)	1 (Deliverable 8.4)

Table 1 KPIs and targets achieved and reported in this deliverable (D8.7).

First the document summarizes the methods, results and conclusions derived from two tasks: Societal Impact Assessment (SIA) (T8.4) and Gender Dimension (GD) (T8.5). Second the document presents the results of the application of the GELS Toolkit designed within the project to integrate, monitor and evaluate non-technical aspects that was applied during the three pilot demonstrations conducted in Izmir (Turkey), Rotterdam (Netherlands) and Linares (Spain).

1.3. Structure and contents

The document is structured into three main parts, apart from this introduction. Section 2 summarizes the case studies to gain knowledge of the societal impacts and the gender dimension in the context of disaster response and safety technologies. Section 3 presents the results of the application of the GELS toolkit to assess ASSISTANCE from a non-technical point of view, e.g., regarding gender, ethics, legal and societal aspects. Section 4 provides the main conclusions of human factors assessment.

2. Actions to gain knowledge

2.1. Societal Aspects

The ASSISTANCE project has net effects upon First Responders as end-users and citizens as indirect beneficiaries, and therefore the society. Hence, there was a need to ensure that technologies and solutions of the project were affordable and customized to cover the end-users needs from a societal perspective. The complexity of such potential effects is apparent as they may take place at different levels, in many ways and several fields (economy, education, policy, environment, health and safety, etc.).

The Societal Impact Assessment was inspired by complex problem-solving and followed the guiding principles displayed in Table 2.

From the beginning	Addressing the DoA requirements (related to concerns and needs of the European Commission) while trying to find answers to simple and general questions from the early stages like how the project would change the individuals and communities? And similarly how the individuals and communities would change the project?
Effort on essentials	Simplifying and focusing on the essentials to get a satisfactory analysis. In our case we paid attention to the current and possible future state of stakeholders (First Responders and citizens).
Divide and conquer	Dividing the problem (Societal Impacts) into parts and addressing these individual parts before connecting them to make a whole. In total we conducted 7 “mutually exclusive” case studies.
Feedback & feedforward	Getting information/opinions about the current situation (what needs to change?) and how the future situation would be (what is likely to change and how?). In our case this was done by collecting perceptions, opinions and experiences from citizens, project partners and end-users throughout different phases of the project.
Multimethod approach	Applying different scientific-based methods (quantitative and qualitative) and participatory research during the project (e.g. anticipatory and scenario-based). For this project we conducted online surveys, workshops and focus groups.

Table 2 Guiding principles for the analysis of societal aspects in ASSISTANCE.

These guiding principles were used to address the first three research questions that guide the societal impact study:

- *What are the potential effects of the project?*
- *What are the past experiences and societal needs of first responders?*
- *What is the public perception regarding the problem at hand?*

The following sections deal with these questions through three different case studies.

2.1.1. What are the potential effects of the project?

Motivation: The first aim was to understand whether the project and its outcomes will result in a positive change to society and, more importantly, in which aspects. This first case study was conducted to identify/anticipate the potential effects. A twofold objective was achieved: 1) to establish a consensus on the identification and prioritization of likely societal impacts and 2) to encourage people involved in the project to think about and discuss non-technical impacts.

Method: We faced two main challenges. Firstly, the conceptual nature and variety of impacts. Secondly, the uncertainty when attempting to track the future effects of the project. To minimize these problems, we accomplished a top-down constructive process to define as many likely impacts as possible from several societal domains (Table 3).

Domain	Impact category	Domain	Impact category
Health and Safety (HS)	HS1) Injury HS2) Mental/physical demands on duty HS3) Healthcare HS4) Comfort/mobility HS5) Assistance of injured FRs HS6) Physical protection HS7) Citizens response/evacuation	FRs Organization (O)	O1) Decision-making O2) Management O3) Planning and procedures O4) Intervention strategies O5) Workforce organization O6) Division of labour O7) Recruitment
Training for FRs (T)	T1) Curricula T2) Qualifications T3) Promotion T4) Fitness T5) Pedagogical tools T6) Use of technologies T7) Specialization	Culture (C)	C1) Tradition and values C2) FRs reputation C3) Risk perception C4) Self-protective behaviour C5) Tactical/strategic knowledge C6) Citizens' awareness C7) Acceptance of technology
Society (S)	S1) Working-life balance S2) Gender equality/equity S3) Interaction between coworkers S4) Interaction between FRs and citizens S5) Voluntary service S6) Vulnerable population S7) Community involvement	Research and Innovation (RI)	RI1) Multidisciplinary RI2) Collaboration on science and education RI3) Targeting of future research RI4) Dissemination RI5) Research skills/ overall research capacity RI6) Staff development RI7) Gendered perspective
Economy (E)	E1) Financing E2) Investments E3) Commercialization E4) Productivity E5) Job creation E6) Wage/salary E7) Cost of product/service	Policy (P)	P1) Political and executive decisions P2) Standards and references P3) Privacy and data protection P4) Rights and freedoms P5) Right to information P6) Ethical compliance P7) Retirement

Table 3 Societal domains and impact categories considered for the Delphi process.

Then we used a Delphi group decision-making technique[2,3] involving the project partners. It comprised two survey stages and a 45 min teleconference (24th March 2020). In stage 1, participants (n=26) were asked to independently rank the proposed likely impacts. The questions were: "*To what extent do you think the ASSISTANCE project would change aspects related to*…" followed by statements describing the proposed categories. Each item was scored on a 6-point Likert scale, ranging from "*Definitely not*" to "*Definitively"*. The consensus for each category was defined by the criteria described in Table 4. Then, the likely impacts were rated as 1) "*High*" (fulfil all criteria), 2) "*Moderate*" (fulfil two criteria) and 3) "*Low*" (fulfil one or none of the criteria). Responses to questions/statements in Round 1 were presented to participants in the teleconference. Afterwards, in Round 2, participants (n=22) were asked again to rank the 29 statements that survived the previous round. This time the statements of the questionnaire included the median scores from Round 1.

Criteria for Round 1	Criteria for Round 2
Median ≥4[4]	Median >4[4]
Scores 4-6 >50% of participants[5]	Scores 4-6 ≥ 80% of participants[4]
IQR ≤ 2[6]	IQR ≤ 1.5[6]

Table 4 Consensus criteria for the two rounds. Scores 4-6 correspond to "*Probably*", "*Very probably*" and "*Definitely*" responses.

The questionnaires were anonymous, and no personal data was gathered or processed. However, the respondents were given information on the activity and on its anonymous character and checked a relevant box prior to filling in the questionnaires (agreement part of the survey form).

Results: First Responders and technical partners may have different perspectives and differ in their responses. Mann-Whitney U test was conducted to determine whether there was a difference in responses between FRs (n=10) and the rest of partners (n=16). The results indicated non-significant difference between groups, (Health and Safety U= 51.52, *p*=.131; FRs Organization U=62, *p*=.342; Training for FRs U=69, *p*=.561; Society U=62.5, *p*=.381; Culture U=71.5, *p*=.653; Policy U=61, *p*=.314; Research and Innovation U=70, *p*=.597; Economy U=72.5, *p*=.691). We failed to reject the null hypothesis and conclude that there was no difference in responses between the two groups.

In total 27 categories were rejected during the first round (Figure 1). The inclusion criteria of the second round were more rigorous (Table 4). Results from this round were used to develop the final list of likely impacts and to define the subject matters to conduct Societal Impact Assessment (Table 5).

[2] Rowe G, Wright G. (1999). The Delphi technique as a forecasting tool:issues and analysis. Int J Forecast. 15:353–75.

[3] Vogel C, Zwolinsky S, Griffiths C, Hobbs M, Henderson E, Wilkins E. (2019). A Delphi study to build consensus on the definition and use of big data in obesity research. Int J Obes (Lond). 43(12):2573-2586. doi:10.1038/s41366-018-0313-9

[4] Fitch, K. et al. (2000). The RAND/UCLA Appropriateness Method User's Manual. Santa Monica, CA: RAND Corporation, 2001. https://www.rand.org/pubs/monograph_reports/MR1269.html.

[5] Newton JT, Al-Rawahi S, Rosten A, Iricijan J. (2019). Achieving consensus on clinical examination and record keeping in NHS dentistry: a Delphi approach. Br Dent J.227(3):203-210. doi:10.1038/s41415-019-0531-0

[6] Basu S, La Distia Nora R, Rao NA, Jiang X, Fuady A. (2020). International Ocular TB Study Group. Prognostic factors for TB-associated uveitis in the Asia-Pacific Region: results of a modified Delphi survey [published online ahead of print, Jan 2]. Eye (Lond). 2020;10.1038/s41433-019-0743-1. doi:10.1038/s41433-019-0743-1

Out of the 11 categories in which a final consensus was reached, eight were highly associated with the expected outcomes of the project (i.e. increasing the protection of FRs and improving their capabilities): Health and Safety (2), Organization (3), Training (2) and Culture (1). The other three categories were related the Research and Innovation (3).

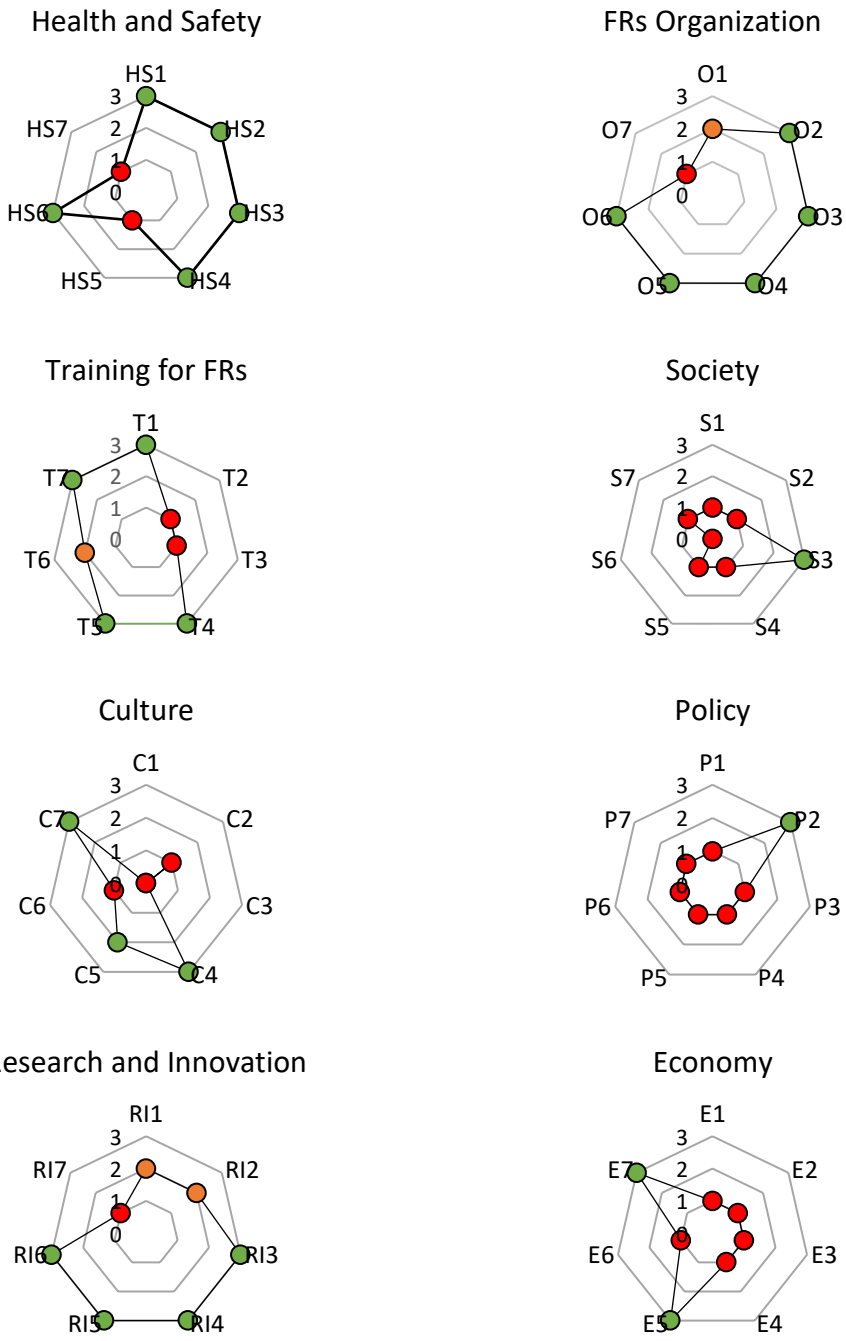

Figure 1: Results of the first round: high impacts (in green), moderate impacts (in orange) and low impacts (in red).

Results also showed another 10 categories close to reaching a definitive consensus (Moderate likely impact). Categories for Economy, Policy and Society domains did not reach consensus to be included in the top list. A possible explanation to these results is that it was not easy for participants to identify societal impacts. Some impacts cannot be evident at a glance with complex relations between technologies and their potential effects (e.g. macro-societal level).

Category	Measures			Likely impact	
	Median	%^	IQR*	Moderate	High
HS1.-Injury	5	100.0	1		
HS2.-Mental and physical demands	4	81.0	1		
HS4.-Comfort/mobility	4	85.7	1		
HS6.-Physical protection	5	90.5	1.5		
O1.-Decision-making	5	95.2	0		
O2.-Management	5	90.5	1		
O3.-Planning and procedures	5	95.2	2		
O4.-Intervention strategies	5	95.2	1		
O5.-Workforce organization	5	76.2	1.5		
T4.-Fitness	4	95.2	1		
T5.-Pedagogical tools	5	90.5	1		
T6.-Use of technologies	5	90.5	1		
T7.-Specialization	5	85.7	1.5		
C4.-Self-protective behaviour	4	81.0	1		
C5.-Tactical/strategic knowledge	5	81.0	1		
C7.-Acceptance of technology	5	95.2	2		
RI1.-Multidisciplinary	5	90.5	1		
RI3.-Targeting of future research	5	95.2	1.5		
RI4.-Dissemination	5	90.5	1		
RI5.-Research skills/capacity	5	90.5	2		
RI6.-Staff development	5	81.0	2		

^Percentage of the assigned scores 4-6: “Probably”, “Very probably” and “Definitely”
* IQR= Interquartile range that measures the spread of the middle half of the data around the Median

Table 5 Top list of likely impacts of the ASSISTANCE project.

This study was a suitable participatory and transparent approach to identify the potential effects of the project on society since the consensus among a group has more power than individual judgements. One of the main advantages of this approach was the participation and involvement of project partners to think about the societal consequences of the project and its developments. The response patterns of First Responders and technical partners did not differ significantly and technocentric and practical perspectives dominated the consensus process.

The main outcome of is study is an agreed a list of top impact categories (Table 5) that was used as a key reference to conduct Societal Impact Assessment during the project.

2.1.2. What are the past experiences/societal needs of First Responders?

Motivation: The second aim was to investigate the situation of First Responders from a societal perspective to gain knowledge about their needs. This information helped us to define whether the proposed technologies and solutions in ASSISTANCE will change/improve their current conditions i.e. their protection and sense of security, the way they organize and make decisions and their trust of technology.

Method: The original study (reported in D8.6) combined a survey and a focus group on past experiences. Here we report the questionnaire results especially useful to get an overall picture of the key societal issues. This study allowed us 1) to focus on actual information reported by First Responders, 2) to identify the key societal issues and 3) to pinpoint new chances for innovation. The survey was designed following the list of top likely impact categories (see Section 2.1.1). It covered First Responders' experiences on six subjects: health and safety (4 items), protection (5 items), decision-making (5 items), management (7 items), training-workforce (5) and technology use (14). Respondents were also asked to select the technologies they used and they also provided their gender, age, type of service, current position, and the number of years in service.

Due to the nature of this study and considering that no personal data would being collected or stored, written informed consent was not required. However, respondents gave consent to participate by filling in the agreement part of the survey form.

Results: A total of 132 respondents (112 males and 20 females) completed the survey. Table 6 shows the characteristics of the surveyed participants. It is important to note that 59% of respondents were firefighters in the frontline.

Variables	**Data**
Age (years): mean ± SD [min.-max.]	43.40 ± 9.77 [22-68]
Type of service *n* (%)	
Firefighters	96 (72.73)
Civil Protection	5 (3.79)
EMS	12 (9.09)
Police	17 (12.88)
Other	2 (1.52)
Current position *n* (%)	
Operational	98 (74.24)
Leading	30 (22.73)
Training	4 (3.03)
Years of experience *n* (%)	
<1 year	1 (0.76)
1-5 years	14 (10.61)
6-10 years	25 (18.94)
11-15 years	25 (18.94)
16-20 years	27 (20.45)
>20 years	40 (30.30)

Table 6 Characteristics of the first responders who participated in the survey.

Health and Safety: Results in Figure 2 revealed that 67% of respondents have been slightly injured (only First Aid needed and no more contact with healthcare services) and 20% have been seriously injured (both First Aid and then medical treatment by healthcare services). An important finding is that almost half of First Responders (49%) had experienced mental issues and 41% had suffered physical health issues derived from their work. More importantly, results also revealed that one-fifth of participants have been both slightly and seriously injured and that one fourth have suffered from health issues (mental and physical) due to their profession. Similarly, one out of ten have suffered every health and safety problem.

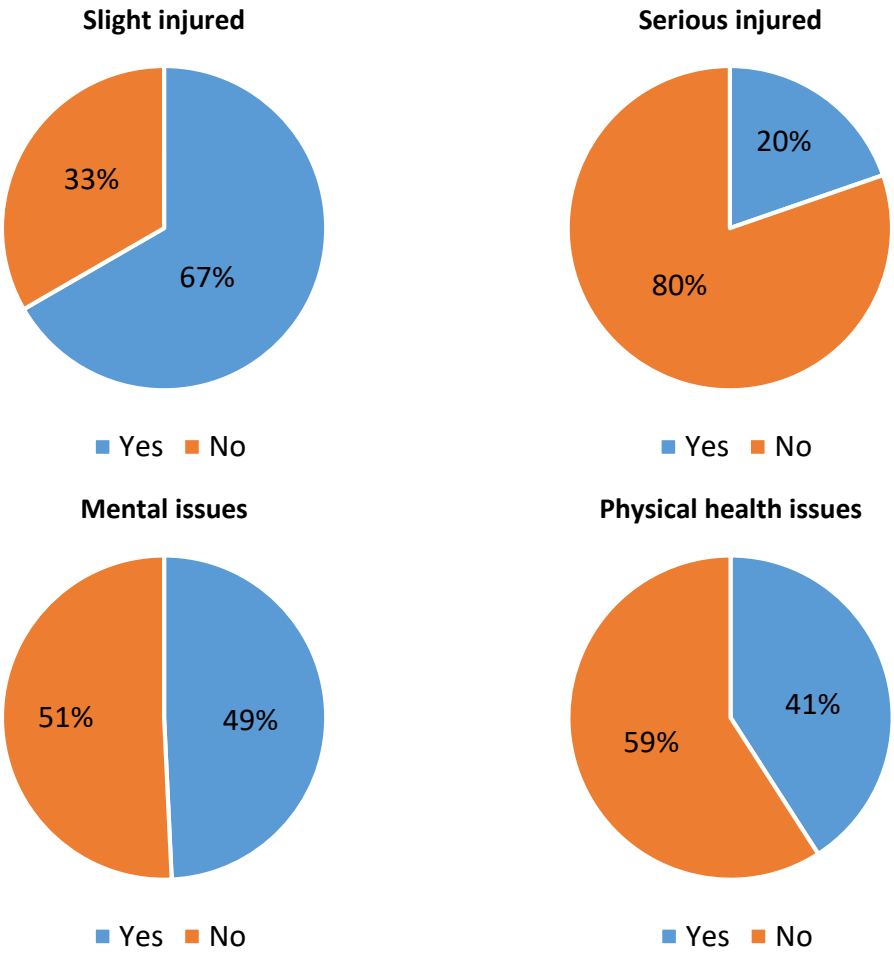

Figure 2: Responses of First Responders related to Health & Safety.

Protection: The statement "*Risk taking is part of first responding*" was supported by most surveyed participants (Median= 4; IQR=2). The majority of First Responders agreed that their work was mentally demanding (Median= 5; IQR=1). Personal Protective Equipment (PPE) was appropriate for around half of respondents (Median= 4; IQR=1) and such equipment did not cover all possible hazards for 45% of respondents (Median= 3; IQR=2). Finally, protective equipment for COVID-19 was appropriate for most respondents (Median= 4; IQR=2).

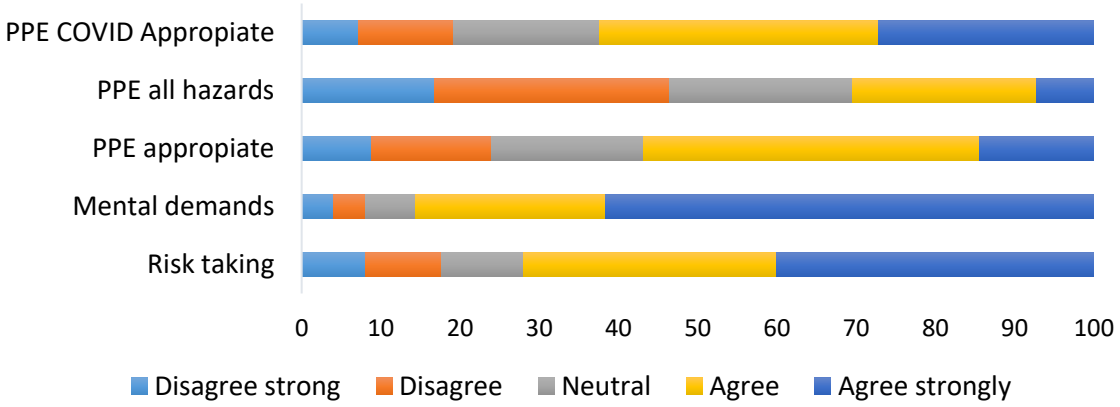

Figure 3: Responses (%) of First Responders related to Protection. PPE (Personal Protection Equipment)

Decision making: Figure 4 shows the results regarding past experiences in decision making. First Responders agreed that the amount of information was a key factor to make better decisions (Median=5; IQR=0). In most cases, decisions were made considering all possible alternatives (Median= 4; IQR=1) even under pressure. Most First Responders (72.8%) reported mistakes under tense and hostile situations (Median= 3; IQR= 2) and (64.8%) recognized that COVID 19 changed their way to make decisions (Median=3; IQR=2). Interestingly, the high majority (96 %) reported that they relied on their own experience for decision-making (Median = 4; IQR=1).

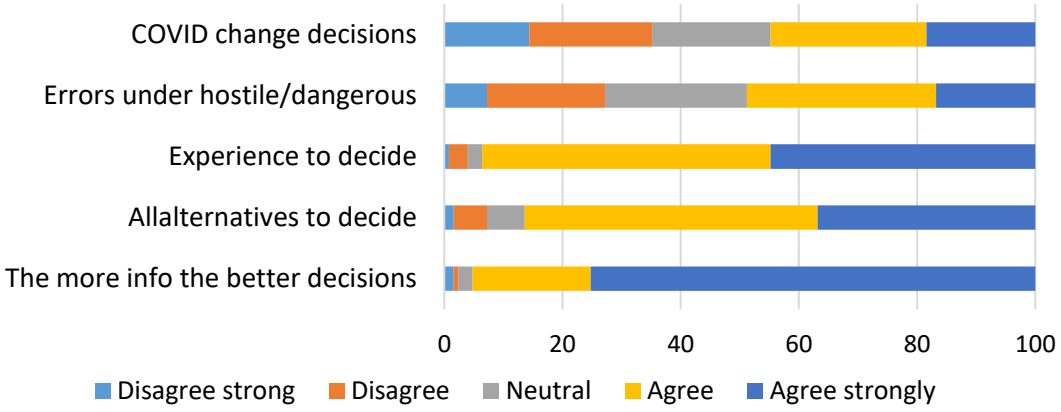

Figure 4: Responses (%) of First Responders related to Decision-making.

Management: The results reported in Figure 5 allowed us to identify the lack of agreement between First Responders regarding tactics and protocols (not constantly updated for 48.8% and updated for 36.8%) and the coordination of emergency teams (not always well-coordinated for 32.8% and well-coordinated for 43.2%). However, respondents had a favourable opinion on management and most agreed that women had the same opportunities to advance as men in their profession (75% of female respondents and 76.2% of male respondents).

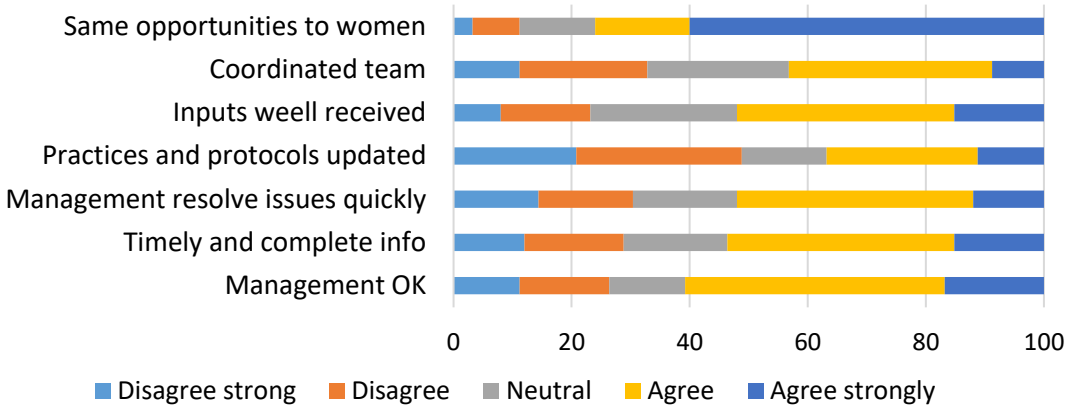

Figure 5: Responses (%) of First Responders related to Decision-making.

Training-workforce: Figure 6 shows thoughts of respondents regarding training. 55.29% of respondents reported that training was suitable to them (Median=4; IQR=2), 50.75% stated that trainees were adequately supervised (Median=4; IQR=2). 59.84% reported that their unit/area did a good job of training new personnel (Median=4; IQR=2). More personnel were supported by 58.33% of respondents (Median=4; IQR=1.5) and 48.48% though that the level of staffing was insufficient to handle emergencies/disasters (Median=3; IQR=2).

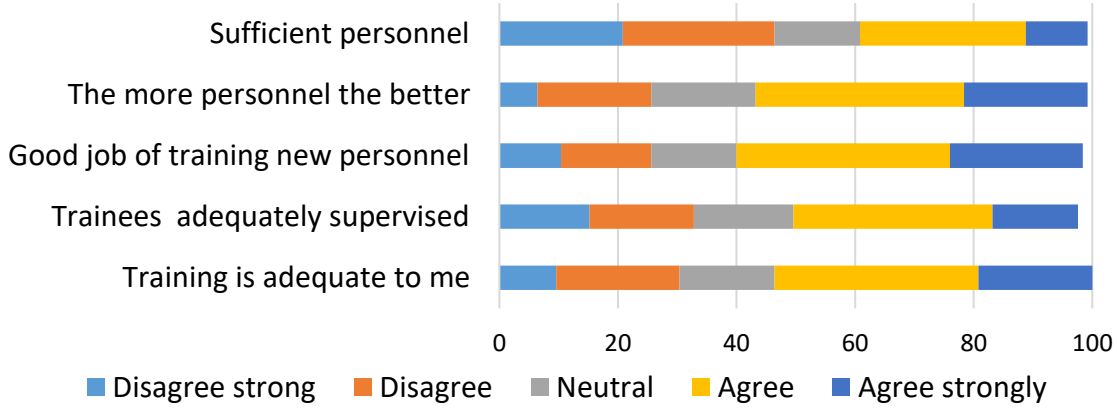

Figure 6: Responses (%) of First Responders related to Decision-making.

Technology: Figure 7 shows the number of technologies used by the surveyed participants and Figure 8 shows the frequency of use. Note that the surveyed technologies are essentially those proposed by the ASSISTANCE project. Interestingly, most respondents (78.02%) reported the use of one (43.18%) or two (34.84%) of the listed technologies. The technology most frequently used was wearables (78.03%) as it includes a wide variety of devices (GPS, sensors and/or other devices) followed by Situation Awareness Platforms (SA) (31.82%), Drones (30.30%) and Predictive models/simulations (20.45%). Robots (4.55%), Virtual Reality for training (VR) (6.06%) and Augmented Reality (AR) for training (3.79%) were the less used technologies.

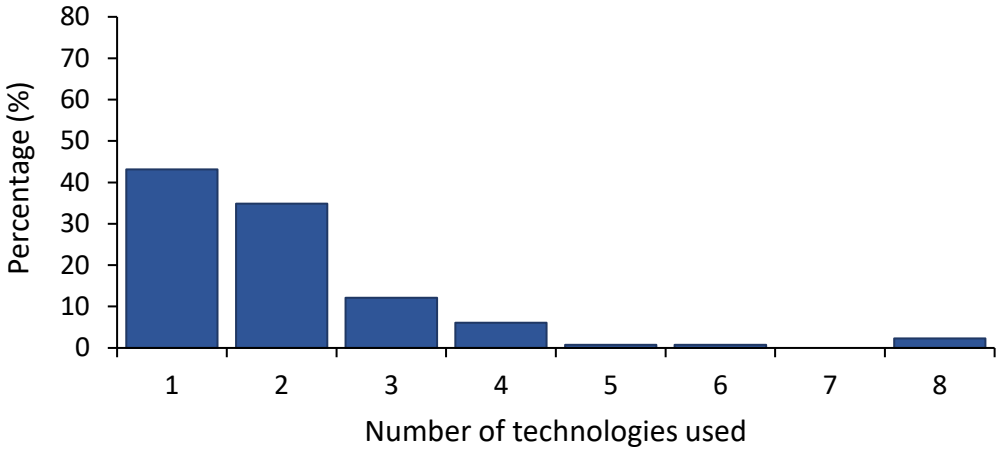

Figure 7: Number of technologies used by respondents.

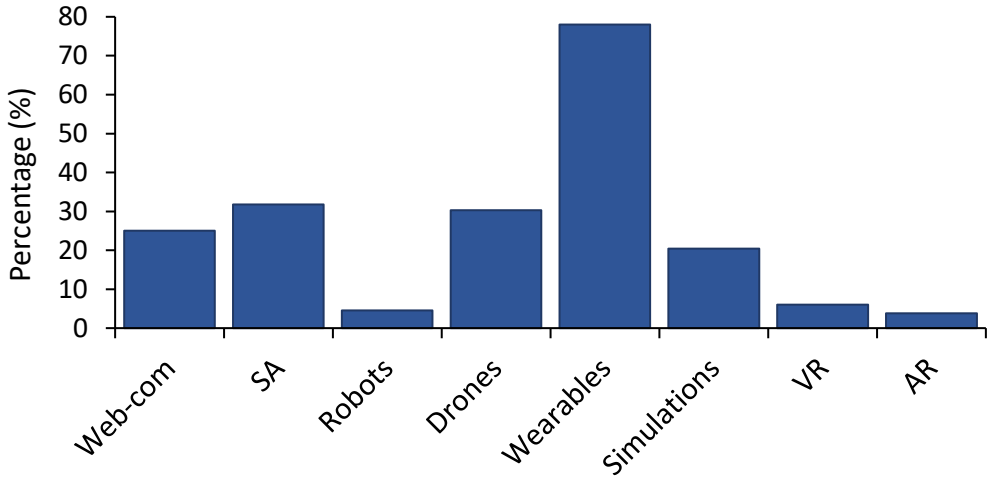

Figure 8: Frequency of each technology used by respondents.

The results summarized in Figure 9 are of particular importance as they provide insights of the First Responders' encounters with technologies. Overall, first respondents considered that technology was useful but not determinant. 59.84 % considered that technology was supportive (Median 4; IQR=1) and 74.23 % think that technology made their work easier (Median=4; IQR=2). Importantly, 60.6% of respondents felt safer using technology in their operations (Median=4; IQR=1) and 72.2% declared that technology avoided risk taking behaviours (Median=4; IQR=1). Respondents also had a positive opinion of the use of technology (i.e. VR) in training for disasters (68.93%) and ordinary first responding activities (62.82%). Most respondents (79.53%) also reported that technology helped them to learn new ways for dealing with disasters (Median=4; IQR=1). Yet, 68.93% recognized that technology had changed their ways of doing their job (Median=4; IQR=1.25) and the majority (83.33%) stated that technology gave them new skills (Median=4; IQR=1).

Importantly, when it comes to the confidence in technology the responses were not so conclusive. 46.21% fully trusted technology and 28.03% did not (Median=3; IQR=2). Similarly, 43.93% would rely on technology for making life or death decisions and 37.77% would not (Median=3; IQR=2). Responses that confronted technology vs humans were also inconclusive. Relying on technology to avoid human errors was supported by 35.57% and not supported by 40.14% of respondents (Median=3; IQR=2). Finally, the idea that computer-based management is safer and more effective than human-centred management was only approved by 28.76% and not approved by 37.11 % of respondents (Median=3; IQR=2).

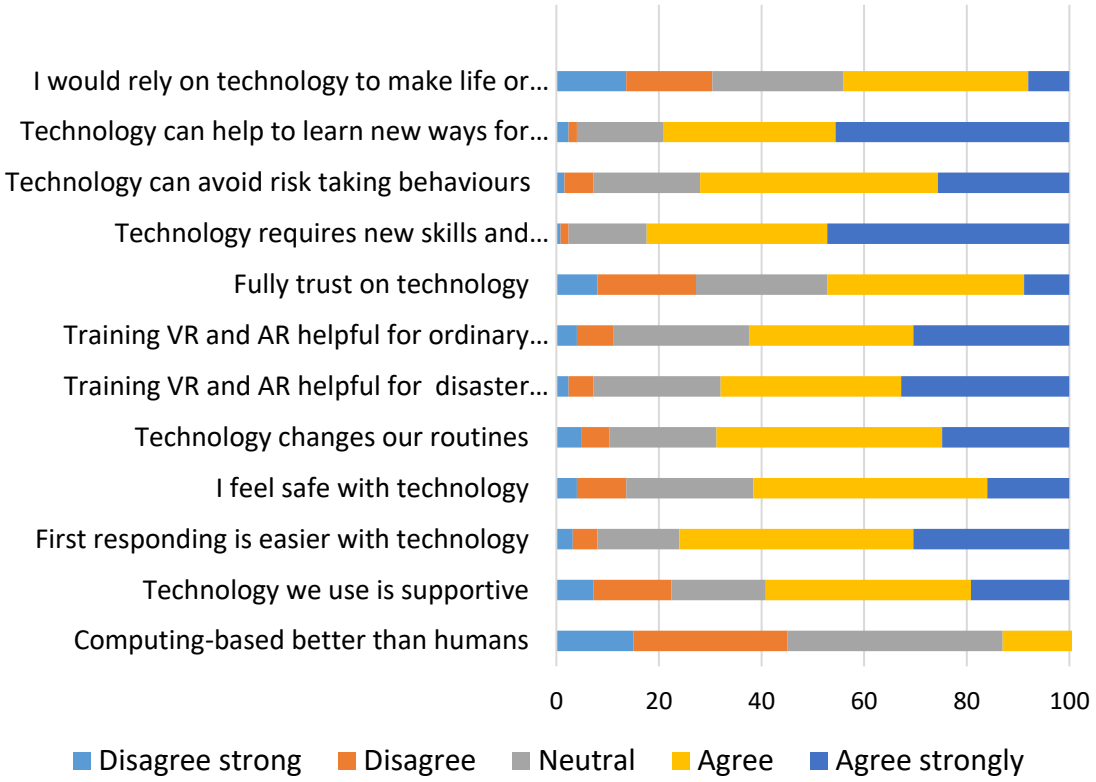

Figure 9: Self-reported experiences and opinions (%) of First Responders regarding technology.

This study increased our understanding of the current situation of First Responders (end-users) i.e. the state of end-users of being safe and protected from danger or harm. It was particularly useful to get an overall picture of the key societal issues vs technology and to identify the actual needs that can be used to guide innovation from a societal perspective. The presented results showed the following societal targets that can be addressed by ASSISTANCE:

- Reducing/minimizing health and safety problems.
- Improving decision making (e.g. avoiding mistakes) while lowering mental demands.
- Enhancing workforce and operational conditions (i.e. protocols and coordination).
- Expanding the process of learning the needed skills through new technologies.
- Reaching higher levels of trust and confidence in technology.

2.1.3. What is the public perception of disasters?

Motivation: The third aim was to gain insights into the public perception for a better definition and targeting of the ASSISTANCE project. The active participation of individuals and communities is one of the main principles of the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR)[7]. Bottom-up participatory and learning processes are the main suggested mechanisms in which citizens can act by themselves and/or together with emergency services.

However, for an effective implementation of such strategies we need first to measure the motivation (as a behavioural precursor) of the public. Hence this study allowed us the possibility to explore the role EU citizens may play in disaster response which is related to one of the main aims in ASSISTANCE i.e. improving the first responding capabilities.

Method: The previous case study, reported in D8.6, explored risk perception and attitudes toward preparedness in disasters. In this study we show the potentials of the collected datasets by using the Protection Motivation Theory (PMT) as a theoretical framework (Figure 10) to investigate the intention of citizens to protect themselves and therefore participate/collaborate with First Responders as active agents in disasters.

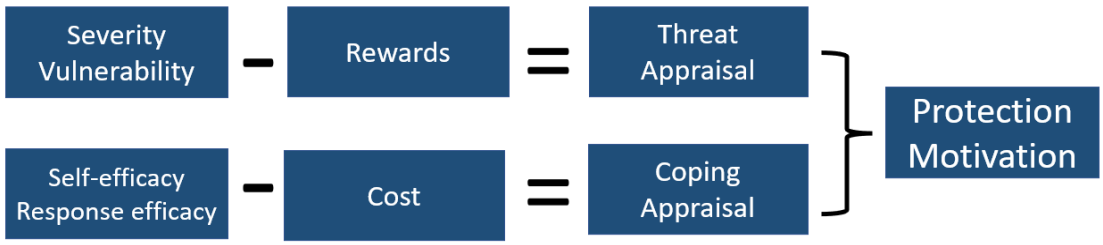

Figure 10: Protection Motivation theoretical framework.

We used the self-reported data of an online questionnaire on EU citizens (n=1.014) conducted during Task 8.4 from 1st to 14th November 2020 to measure Threat Appraisal (TA) and Coping Appraisal (CA) to infer the Protection Motivation (PM) of citizens. The items of the original questionnaire reflect the variables to measure these constructs (Table 7).

To appraise the threat, people consider if there are Rewards (R) for continuing the behaviour (i.e. getting ready is not worthwhile) on the one hand; and the Severity (S) of the negative consequences and their Vulnerability (V) to those consequences on the other hand. For the coping appraisal, people evaluate the Response-Efficacy (RE) i.e. whether they feel that the proposed behaviour response is efficient, and the Self-Efficacy (SE) i.e. whether they themselves are efficacious regarding that response and what the response Costs (C) are.

[7] Sendai Framework for Disaster Risk Reduction 2015-2030. United Nations. https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030

Construct	Variable	Item
Threat Appraisal (TA)	Severity (S)	*If* occur in your vicinity, what in your view is the impact for you and your family?*
	Vulnerability (V)	*How likely do you consider that* will occur nearby?*
	Rewards (R)	*Getting ready is not worthwhile because:* • *It won't make a difference (Uselessness)* • *It is not my responsibility (Buck-passing)* • *It doesn't matter; disasters don't happen where I live (Denial)*
Coping Appraisal (CA)	Self-efficacy (SE)	*Which statement best represents your ability to deal with*.*
	Response efficacy (RE)	*Getting ready is worthwhile because:* • *It is easier to get back to normal (Resilience)^* • *I can have information about what to do (Information)* • *Acting makes me worry less (Confidence)*
	Cost (C)	*Getting ready is not worthwhile because:* • *It takes too much time and effort (Cost)*
**Extremes weather conditions, Fire and Hazardous materials accident*		

Table 7 Survey questions related to PMT.

A factor analysis was carried out to compress the data and identify correlations. The principal component method (PCA) was used to check that the underlying components in the survey questions fit the extract the factors. The varimax method was used to rotate the factors and yield orthogonal, interpretable factors. Note that components were selected when they have an eigenvalue above 1. The factors can explain 65 % of the total variance. All factor loadings were higher than 0.7, indicating high construct validity (Table 8).

Item	Loading	Cronbach α
Severity (S)		0.75
S1 Extreme weather conditions	.815	
S2 Fire	.800	
S3 Hazardous materials	.811	
Vulnerability (V)		0.65
V1 Extreme weather conditions	.797	
V2 Fire	.743	
V3 Hazardous materials	.721	
Rewards (R)		0.81
R1 Useless	.853	
R2 Buck-passing	.819	
R3 Denial	.839	
Self-efficacy (SE)		0.67
SE1 Extreme weather conditions	.797	
SE2 Fire	.796	
SE3 Hazardous materials	.729	
Response Efficacy (RE)		0.66
RE1 Resilience	.770	
RE2 Information	.791	
RE3 Confidence	.728	

Table 8 Factor loadings and Cronbach alpha.

Then we performed a reliability analysis for each group of variables of the corresponding factor, whereby the Cronbach α is calculated in each case. This indicated how well the variables measure the same, i.e. whether the factor value variables can be formed or not. For all factors Cronbach´s Alpha was ≥ 0.65, which is acceptable (Table 8).

As a next step, the CA and TA were measured to compute the Protection Motivation (PM). The responses to each item were summed to create composite scores for each variable (e.g. S, V, SE, RE and R) and then normalized. The TA, CA and PM were expressed as a ratio between -1 and 1. The PM resulted from the differences between the TA (*TA=(S+V)-R*) and CA (*CA=(SE+RE)-C*) where values > 0 indicate intention to engage in disaster response (adaptive) and values< 0 otherwise (maladaptive).

Results: We compared the sociodemographic characteristics of those surveyed with the Eurostat census data[8]. The Eurostat for adults (aged 20 years and over) shows 52% females given a 2.27 % point (pp) difference between our data and the EU population. The age of respondents (20-69 years) was quite representative with an average difference of 4.69 % (pp). Yet, there was an over-representation from respondents <29 years (absolute difference of 9.93%) and an under-representation from respondents >60 years (absolute difference of 7.68%). Dwelling type of our sample had absolute differences of 8.8% for cities, 0.3 % for towns and 9.2 % for rural areas when compared with Eurostat data. Education level (Secondary and University: sample= 91.4 % vs EU population= 79.50 %) and occupation (people in the labour force; sample= 69 % vs EU population = 77.10 %) had differences but reasonably represented in our study.

Figure 11 shows the box plots of scores for TA (Mean=0.187; SD=0.309), CA (Mean=0.256; SD=0.355) and PM (Mean=0.141; SD=0.269). Based on the resulted PM scores we defined three categories of citizens (Figure 12):

- *Adaptive* (66%)*:* Those citizens who are motivated to protect themselves and/or participate in disaster response (*PM* scores > 0).
- *Equal* (6%)*:* Those citizens who are undecided (*PM* scores = 0).
- *Maladaptive* (28%)*:* Those citizens who are not motivated to protect themselves and/or participate in disaster response (*PM* scores < 0).

One third of respondents reported being motivated, suggesting that this proportion of EU citizens are likely to take an active part in disaster response (Figure 12).

Additionally, we explored the datasets produced from different countries (Table 9). On average TA was higher in Mediterranean countries (Spain, Italy). The Kruskal-Wallis H test was conducted, and significant differences were found (Chi square = 23.64, p <.001, df = 4). Pairwise comparisons using Dunn's post hoc showed significant difference on TA between France-Spain (p=.04), France-Sweden (p<.01), Italy-Poland (p<.001), Italy-Sweden (p<.001), Poland-Spain (p<.001) and Spain-Sweden (p<.001).

[8] Eurostat database (2021). Population demographic info 2021. European Commission. Retrieved from https://ec.europa.eu/eurostat/data/database

Differences were also significant for CA (Chi square = 52.60, *p* <.001, df = 4). These differences are mainly due to the low CA scores reported by Spanish respondents that significantly differed from the other countries (*p*<.001).

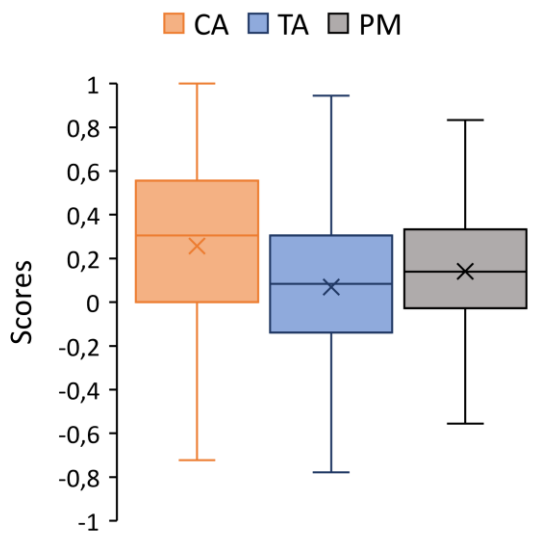

Figure 11: Box plots of the scores for CA (Coping Appraisal), TA (Threat Appraisal) and PM (Protection Motivation) of respondents.

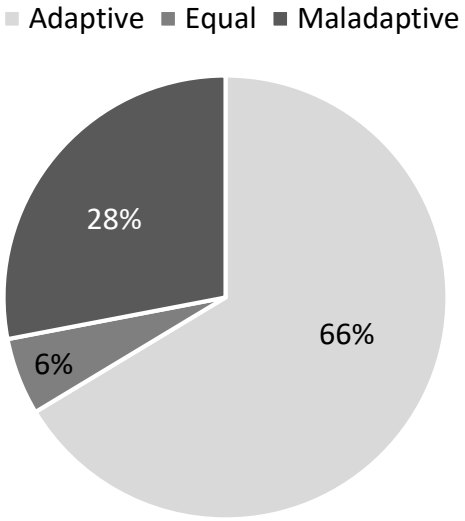

Figure 12: Proportion of Adaptive citizens (PM>0), Equal citizens (PM=0) and Maladaptive citizens (PM<0).

The Kruskal Wallis test also showed a significant effect of the country of residence on PM (Chi square = 12.93, *p* =.01, df = 4). From Table 9 it is possible to see higher average PM scores reported by Italians. Pairwise comparisons using Dunn's post hoc revealed significant different on PM between Italy-France (*p*=0.03), Italy-Poland (*p*<.01), Italy-Spain (*p*=.04), Italy-Sweden (*p*<.001). Significant differences were also found between France-Sweden (*p*=.04) and Spain-Sweden (*p*=.03).

Country	TA (Mean ± SD)	CA (Mean ± SD)	PM (Mean ± SD)
France	0.19 ± 0.35	0.26 ± 0.33	0.14 ± 0.28
Italy	0.22 ± 0.27	0.33 ± 0.31	0.18 ± 0.24
Poland	0.14 ± 0.30	0.28 ± 0.32	0.12 ± 0.27
Spain	0.24 ± 0.28	0.09 ± 0.38	0.14 ± 0.27
Sweden	0.11 ± 0.30	0.30 ± 0.35	0.10 ± 0.26

Table 9 Mean and Standard Deviation of scores for TA, CA and PM across different countries.

In relation to sociodemographic variables our results indicated that profession (Chi square = 5.92, *p* =.20, df = 4), education level (Chi square = 3.80, *p* =.28, df = 3) and age (Chi square = 0.72, *p* =.69, df = 2) did not influence PM. However, we found statistical differences when comparing dwelling types *city* (0.11 ± 0.25), *town* (0.16 ± 0.28) and *rural area* (0.13 ± 0.26) of respondents (Chi square = 6.38, *p*=.04, df = 2) with higher PM scores produced by respondents living in towns (<50.000 inhabitants).

As mentioned, ASSISTANCE aimed at improving the protection of First Responders but also their capabilities. It is argued here that the participation of citizens in disaster response is likely to improve the First Responders capabilities. Datasets produced here not only have scientific value but also have the potential to inform policymakers and First Responders for developing risk management policies as well as training and communication campaigns for citizens, thus improving disaster response and resilience of society in Europe.

2.2. Gender Dimension

The integration of GD involves questioning stereotypes and investigating gender needs, attitudes and behaviours to enhance the knowledge, technologies and innovations produced. Here GD was addressed to examine whether and how gender could be relevant to the ASSISTANCE project. GD usually relies on the researchers due to the variety of subject matters and contexts. But essentially GD involves two processes: 1) research to find gender differences/similarities and 2) explain gender differences when found. The first process involves pure research activities (e.g. data collection, data processing, and analysis) the second process is interpretative (explaining underlaying mechanisms) and seeks practical solutions to mitigate gender issues. The general approach for gender analysis involved five iterative steps defined for research interventions during the project (Table 10).

1. Setting objectives	A rethinking about priorities while considering gender aspects i.e. how to address the potential implications of strategic choices and implementation activities in terms of gender. For instance, whether gender may impact on constraints and opportunities for a rapid response (FRs and citizens).
2. Identifying target groups	Participatory research was planned and used. This needed the identification of the target groups and participants likely to be involved i.e. First Responders, project partners and citizens.
3. Setting methods and techniques	Gendered Innovations methods[9] were used as reference. Key questions and qualitative and quantitative research techniques were defined in this step (e.g. research planning, participatory research, engineering innovation and gender monitoring).
4. Data collection, analysis and reporting	The application of methods and techniques described in step 3 involving data collection, data processing (e.g. statistical hypothesis testing) and reporting (including null results that may represent important findings). The number and scope of such actions depended on the specific conditions and opportunities during the project (target groups involvement, women availability, etc.).
5. Examples (case studies) of GD	Outcomes of previous steps (including case studies) reported in the GDS guideline (D.8.4) and this deliverable (D8.7). These outcomes included main conclusions.

Table 10 Overall approach used to study Gender Dimension in ASSISTANCE.

[9] Gendered Innovations. https://genderedinnovations.stanford.edu/

These steps were used to address to the following questions:

- *Does gender matter in risk propensity, coping and resilience of First Responders?*
- *Does gender matter in risk perception and preparedness of citizens?*

2.2.1. Does gender matter in risk propensity, coping and resilience of FRs?

Motivation: ASSISTANCE is devoted to the protection of First Responders. Therefore, a pertinent analysis was conducted to investigate gender effects on the potential behaviours and attitudes of First Responders.

The specific research questions investigated were: 1) Does gender influence risk propensity exerted by First Responders on duty? 2) Do female and male First Responders differ in their resilience and coping strategies with stressors? Risk propensity here refers to be attracted to, or the willingness to tolerate, options that entail a potentially high risk of loss on duty. Resilience is defined as the ability to bounce back from stress as well as coping with such stress adaptively.

This study allowed us to draw conclusions about safety behaviour and self-protection of First Responders and to define the potential improvements provided by the ASSISTANCE technologies and solutions from a gendered perspective.

Method: A web-based survey was carried out from January 14th to February 21st, 2021. The questionnaire comprised three validated scales (in the public domain) to investigate gender in risk propensity and resilience in First Responders (FRs): Risk Propensity Scale (RPS)[10], Brief Resilience Scale (BRS)[11,12,13] and Brief Resilience Coping Scale (BRCS)[14,15] (Table 11). An additional question was included to complement the RPS (AQ1) asking participants whether they had experienced benefits from risk taking behaviours on duty.

The English versions of the scales were translated by the project partners into Swedish (RISE), Italian (CEL), Turkish (AAHD), Polish (PIAP) Dutch (IFV) and Spanish (UC). The target participants of this survey were first responders (FRs) who were/will be -directly or indirectly- participating in disaster response including firefighters, police officers, emergency medical service and civil protection personnel. In addition to the type of service, participants were classified as operational, leading and training personnel.

[10] Meertens, R. M. & Lion, R. (2008). Measuring an Individual's Tendency to Take Risks: The Risk Propensity Scale. Journal of Applied Social Psychology, 38 (6), 1506-1520

[11] Smith, B.W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P. and Bernard, J. (2008). The Brief Resilience Scale: Assessing the Ability to Bounce Back. International Journal of Behavioral Medicine,15, 194-200.

[12] Smith, B.W., Epstein, E.E., Oritz, J.A., Christopher, P.K., & Tooley, E.M. (2013). The Foundations of Resilience: What are the critical resources for bouncing back from stress? In Prince-Embury, S. & Saklofske, D.H. (Eds.), Resilience in children, adolescents, and adults: Translating research into practice, The Springer series on human exceptionality (pp. 167-187). New York, NY: Springer.

13 Windle, G., Bennett, K.M., & Noyes, J. (2011). A methodological review of resilience measurement scales. Health and Quality of Life Outcomes, 9:8.

14 Sinclair, V. G., & Wallston, K.A. (2004). The development and psychometric evaluation of the Brief Resilient Coping Scale. Assessment, 11 (1), 94-101.

15 Smith, B.W., Dalen, J., Wiggins, K., Tooley, E., Chistopher, P., & Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. International Journal of Behavioural Medicine, 15, 194-200.

This study followed the ethical requirements stated in the project and was performed under ethical principles. The questionnaire was anonymous, and the privacy policy of the individual's posted information was noted. Due to the nature of this study and considering that no personal data would being collected or stored, written informed consent was not required. However, respondents gave consent to participate by filling in the agreement part of the survey form. The study was approved by the Ethical Committee of the University of Cantabria.

Construct	Items	Scale
Risk Propensity	RPS1. Safety first	*Scale 1-9 1=Totally disagree; 9=Totally agree*
	RPS2. I do not risk with my health	
	RPS3. I prefer to avoid risks	
	RPS4. I take risks regularly	
	RPS5. I really dislike not knowing what is going to happen	
	RPS6. I usually view new risks as a challenge	
	AQ1. I have experienced benefits from risky actions	
	RPS7. I view myself as:	*Scale 1-9 1= risk avoider; 9= risk seeker*
Resilience	BRS1. I tend to bounce back quickly after hard times	*Scale 1-5 1=strongly disagree; 5=strongly agree*
	BRS2. I have a hard time making it through stressful events (R)	
	BRS3. It does not take me long to recover from a stressful event	
	BRS4. It is hard for me to snap back when something bad happens (R)	
	BRS5. I usually come through difficult times with little trouble	
	BRS6. I tend to make a long time to get over set-backs in my life (R)	
Coping	BRCS1. I look for creative ways to alter difficult situations	*Scale 1-5 1= Does not describe me; 5=Describes me very well*
	BRCS2. Regardless of what happens to me, I believe I can control my reaction to it	
	BRCS3. I believe that I can grow in positive ways by dealing with difficult situations	
	BRCS4. I actively look for ways to replace the losses I encounter in life	

Table 11 RPS, BRS, BCRS items and available response options.

Results: Among 366 respondents, 5 participants who did not specify their gender and chose the option "Prefer not to say" were excluded from the analysis as they constitute a very small sample size. Hence, the final sample consisted of 361 participants whose characteristics are reported in Table 12.

A Chi square test of independence showed that there was no significant association between gender and seeking for promotion, χ^2 (1, N = 361) = 1.07, p = .30.

Table 13 displays the statistical results when comparing male versus female First Responders. It has become well-accepted that women are more risk averse than men[16]. Our results showed no significant gender differences in risk propensity, despite females (Mean=34.81, SD=8.98) attaining higher scores than males (Mean=33.51, SD=9.24). Hence, it is possible to state that female First Responders can be as prone to risk-taking on duty as their gender counterparts. To increase our understanding of risk propensity and to explore the potentiality of the generated dataset we conducted an additional statistical analysis for firefighters in the frontline. Results revealed a difference between females (Mean=36.72, SD=7.38) and males (Mean=34.29, SD=9.03) in the general risk-taking tendency, t(210)=1.95, p=.026, one tailed. Then, we compared firefighters in the frontline with less than 10 years of experience and we confirmed again that females scored significantly higher risk propensity than males; t(89)=2.40, *p*=.009, one tailed.

Variables	**Overall** ***(n=361)***	**Male** ***(n=242, 67%)***	**Female** ***(n=119, 33%)***
Age, years	41±11	41±11	39±10
Type of service *n* (%)			
Firefighters	273 (75.62)	183 (75.62)	90 (75.63)
Civil Protection	16 (4.43)	11 (4.55)	5 (4.20)
EMS	51 (14.12)	29 (11.98)	22 (18.49)
Police	21 (5.81)	19 (7.85)	2 (1.68)
Current position *n* (%)			
Operational	271 (75.06)	178 (73.55)	93 (78.15)
Leading	63 (17.45)	42 (17.36)	21 (17.65)
Training & education	27 (7.47)	22 (9.09)	5 (4.20)
Years of experience *n* (%)			
<1 year	10 (2.77)	7 (2.89)	3 (2.52)
1-5 years	77 (21.33)	51 (21.07)	26 (21.85)
6-10 years	56 (15.51)	35 (14.46)	21 (17.65)
11-15 years	70 (19.39)	41 (16.94)	29 (24.37)
16-20 years	56 (15.51)	34 (14.05)	22 (18.49)
>20 years	92 (25.48)	74 (30.58)	18 (15.13)
Seek for promotion? *n* (%)			
Yes	214 (59.28)	148 (61.16)	66 (55.46)
No	147 (40.72)	94 (38.84)	53 (44.54)

Table 12 Characteristics of First Responders participating in RPS, BRS, BCRS study.

First responders are high risk professionals who experience mental consequences due to their exposure to critical incidents as part of their job. Empirical evidence showed that women are likely to have higher rates of anxiety and posttraumatic stress disorder (PTSD)[17]. Our study confirmed this as there was a significant difference in resilience between male and female respondents (Table 13).

[16] Sarin, Rakesh K. and Wieland, Alice M. 2012. Gender Differences in Risk Aversion: A Theory of When and Why. Available at SSRN: https://ssrn.com/abstract=2123567 or http://dx.doi.org/10.2139/ssrn.2123567

[17] Berger, W., Coutinho, E. S. F., Figueira, I., Marques-Portella, C., Luz, M. P., Neylan, T. C., . Mendlowicz, M. V. Rescuers at risk: A systematic review and meta-regression analysis of the worldwide current prevalence and correlates of PTSD in rescue workers. 2012. Social Psychiatry and Psychiatric Epidemiology, 47(6): 1001–1011.

Results presented here also compared the self-reported capability to adapt positively to adversities or traumas that First Responders have experienced. Both males and females provided high resilient coping values. Moreover, the proportion of respondents who scored Low (3-13)/Medium (14-16)/High (17-20) resilient coping did not differ by gender, χ^2 (2, N = 361) = 5.67, p = .58.

Construct	Male (Mean ± SD)	Female (Mean ± SD)	*p*-value
Risk propensity	33.51 ± 9.24	34.81 ± 8.98	.20
Resilience	18.02 ± 2.94	16.33 ± 3.00	**<.001**
Coping	15.47 ± 2.71	15.82 ± 2.65	.38

Table 13 Mean scores, standard deviation and *p*-values obtained from Mann-Whitney U test. p-values in bold are statistically significant (α=0.05).

The psychological wellbeing of First Responders is one of the main societal aims of the ASSISTANCE project. A pertinent analysis was conducted in relation to gender differences/similarities on risk propensity, resilience and coping. Practically, this study provides information in addressing potential gender gaps (e.g. stereotypes) related to first responding activities. The following conclusions were drawn from this study:

- There were no gender differences in the general propensity of First Responders to take risks. Furthermore, results suggested that women firefighters in the front line were more risk takers than men firefighters. Higher achievement motivation in women firefighters (i.e. competition with a standard of excellence) may explain this difference.
- Female First Responders are likely to view themselves as less resilient to face job stressors than male first responders. Hence, female First Responders are likely to be more vulnerable when exposed to critical incidents and traumatic experiences.
- Male and female First Responders were good resilient copers. Both genders are capable to cope with stress in a highly adaptive manner. According to the results, they are expected to be goal directed, believe in their ability to address adverse situations, and usually succeed in their selected challenges.

2.2.2. Does gender matter in risk perception and preparedness of citizens?

Motivation: Exploring gender in attitudes and perceptions of citizens helped to improve our knowledge and integrate GD in the ASSISTANCE project. In this case study we processed disaggregated data to determine gender differences/similarities in citizens perceptions and attitudes towards disasters. The aims of this case study were: 1) to report on the methods for the gender analysis, 2) to briefly summarise the key findings and 3) to draw conclusions about the effects gender may have on disasters response.

Method: The survey was designed to cover people's risk perceptions and attitudes towards preparedness for disasters (Table 14). Risk perception focused on three factors: the likelihood of disasters to occur (L), the personally relevant impact if disasters occur nearby (I) and the perceived self-efficacy to face the disasters (E). Each question was asked in relation to extreme weather conditions, fires, earthquakes, hazardous material accidents and terrorist attacks.

In addition, 9-item questions were included for disaster preparedness: four statements for the *Pros* and five statements for the Cons. For simplicity, the statements are expressed as Resilience, Information, Confidence, Assistance for the Pros and Uselessness, Buck-passing, Avoidance, Denial and Cost for the Cons (Table 14).

To measure an individual's risk rating (R) for each of the five hazards we computed the likelihood (L), the personal impact (I) and the perceived self-efficacy (E) through the following equation $R= (L \times I)/E$. The resulting scores were brought into the range between 0 and 1 for better understanding and further comparison with other datasets. To measure the attitudes towards preparedness, the responses to each item were summed to create composite scores (of *Pros* and *Cons*) for each respondent. The resulting scores were also normalized, and the overall attitudes were expressed as a ratio between -1 and 1 that resulted from subtracting the *Pros* score from *Cons* score.

Risk perception	
Likelihood	How likely do you consider that* will occur nearby?
Impact	If* occurs in your vicinity, what is the impact for you and your family?
Self-efficacy	Which statement best represents your ability to deal with*.
Preparedness	
Pros	Getting ready is worthwhile because: • It is easier to get back to normal (Resilience)^ • I can have information about what to do (Information) • Acting makes me worry less (Confidence) • If I am ready, I can help others (Assistance)
Cons	Getting ready is not worthwhile because: • It won't make a difference (Uselessness) • It is not my responsibility (Buck-passing) • I would rather not think about bad things happening (Avoidance) • It doesn't matter; disasters don't happen where I live (Denial) • It takes too much time and effort (Cost)
* Extreme weather conditions, Fire, Earthquake, Hazardous material accident, terrorist attack ^ words in parentheses were not included in the questionnaire	

Table 14 Survey questions.

Results: The sample (N=1.014) involved respondents from EU countries representative of northern (Sweden), southern (Italy and Spain), eastern (Poland) and western (France). Table 15 displays the characteristics of the surveyed participants.

Risk perception: There were gender differences on hazards expressed as likelihood, personal consequences, and self-efficacy (Table 16). Females were more aware of disasters resulting from extreme weather and fire. Females also exhibited a higher perception of the potential consequences of extreme weather, fire and earthquake than males. The questions of this section included "what in your view is the impact for you and your family?" Female respondents perhaps felt more oriented towards home and family when they thought about the presented hazards. We confirm that gender is an important factor in the perceived abilities to deal with disasters. Males reported higher self-efficacies for all hazards than females. Overall, our results showed that the risks were judged significantly higher by females in all hazards (Table 17)..

Variable	Overall *(n=1.014)*	Male *(n=510, 50.3%)*	Female *(n=504, 49.7%)*	*p*-value
Age, years (Mean ± SD)	41±22.7	45±15.7	37±13.3	**< .001**
Dwelling type [n (%)]				.23
City	480 (47.34)	248 (24.46)	232 (22.88)	
Town	348 (34.32)	179 (17.65)	169 (16.67)	
Rural areas	186 (18.34)	83 (8.19)	103 (10.16)	
Country [n (%)]				.99
France	207 (20.41)	107 (10.55)	100 (9.86)	
Italy	202 (19.92)	100 (9.86)	102 (10.06)	
Poland	201 (19.82)	100 (9.86)	101 (9.96)	
Spain	203 (20.02)	103 (10.16)	100 (9.86)	
Sweden	201 (19.82)	100 (9.86)	101 (9.96)	
Education level [n (%)]				.23
No studies	11 (1.08)	7 (0.69)	4 (0.34)	
Primary	76 (7.5)	41 (4.04)	35 (3.45)	
Secondary	437 (43.10)	231 (22.78)	206 (20.32)	
University	490 (48.32)	231 (22.78)	259 (25.54)	
Occupation [n (%)]				**< .001**
Self-employed	95 (9.37)	56 (5.52)	39 (3.85)	
Employee	535 (52.76)	270 (26.63)	265 (26.13)	
Unemployed	146 (14.40)	43 (4.24)	103 (10.16)	
Retired	109 (10.75)	77 (7.59)	32 (3.16)	
Student	65 (12.72)	64 (6.31)	65 (6.41)	

Table 15 Baseline characteristics of study participants. Significant *p*-values in bold.

	Likelihood (L)				Impact (I)				S-efficacy (E)		
	1	2	3	4	1	2	3	4	1	2	3
Extreme weather											
Female (n)	49	131	241	83	51	246	163	44	174	286	44
Male (n)	67	144	228	71	91	231	147	41	113	332	65
p-value	**.038**				**.014**				**<.001**		
Fire											
Female (n)	31	105	270	98	50	231	165	58	111	309	84
Male (n)	46	130	245	89	73	228	174	35	71	300	139
p-value	**.019**				**<.001**				**<.001**		
Earthquake											
Female (n)	170	181	123	30	121	193	136	54	218	244	42
Male (n)	187	173	114	36	168	176	125	41	175	266	69
p-value	.508				**<.001**				**<.001**		
Hazardous material accident											
Female (n)	146	208	128	22	106	185	140	73	366	119	19
Male (n)	148	205	129	28	140	151	152	67	278	192	40
p-value	.774				.270				**<.001**		
Terrorist attack											
Female (n)	126	195	143	40	117	189	131	67	331	155	18
Male (n)	138	175	134	63	136	177	127	70	236	214	60
p-value	.594				.500				**<.001**		

Table 16 Gender comparison of risk perception. Significant p-values in bold.

Hazards/disasters	Male Mean ± SD	Female Mean ± SD	W	p-value
Extreme weather	0.21 ± 0.17	0.26 ± 0.19	150839	**<.001**
Fire	0.20 ± 0.15	0.24 ± 0.16	152388	**<.001**
Earthquake	0.15 ± 0.15	0.19 ± 0.16	144860	**<.001**
Hazardous Materials Accident	0.22 ± 0.19	0.25 ± 0.19	143337	**<.001**
Terrorist attack	0.23 ± 0.22	0.26 ± 0.22	143289	**<.001**

Table 17 Overall risk perception according to gender.

Preparedness: Most respondents were in favour of getting ready for disasters (Table 18). There were no significant gender differences for Resilience "it is easier to get back to normal", Information "people have information about what to do" and Confidence "taking action makes me worry less" as *Pros* of preparedness. Interestingly, the importance of preparedness for helping others (Assistance) was significantly higher for females than males. Around one fourth of respondents did not form an opinion for the *Cons* of preparedness and chose the neutral option "undecided" for Avoidance (28% females; 25% males), Denial (23% females; 25% males) and Cost (22% females; 24% males). No significant gender differences were found for Uselessness "getting ready won't make a difference", Buck-passing "It is not my responsibility", and Cost "It takes too much time, effort, or money". Yet, differences were statistically significant for Avoidance "I would rather not think about bad things happening" and Denial "It doesn't matter; disasters don't happen where I live". However, an interesting result was that gender differences in the composite scores for *Pros* and *Cons* of getting ready and the overall attitudes towards preparedness were not statistically significant (Table 19).

Pros	**Score**					***Cons***	**Score**				
	1	2	3	4	5		1	2	3	4	5
Resilience						Uselessness					
Female (%)	3	5	20	48	25	Female (%)	43	32	13	10	2
Male (%)	1	6	22	46	26	Male (%)	38	32	17	11	2
p-value	.954					*p*-value	.052				
Information						Buck-passing					
Female (%)	5	12	17	32	34	Female (%)	38	30	19	10	3
Male (%)	5	10	19	41	25	Male (%)	34	28	22	13	2
p-value	.094					*p*-value	.072				
Confidence						Avoidance					
Female (%)	3	6	18	46	28	Female (%)	22	21	28	23	6
Male (%)	1	7	23	44	25	Male (%)	25	25	25	19	5
p-value	.185					*p*-value	**.022**				
Assistance						Denial					
Female (%)	1	4	11	40	44	Female (%)	32	32	23	11	2
Male (%)	1	3	17	41	38	Male (%)	27	31	25	14	3
p-value	**.025**					*p*-value	**.037**				
						Cost					
						Female (%)	31	29	22	14	4
						Male (%)	27	29	24	15	5
						p-value	.103				

Table 18 Gender comparison for the *Pros*/*Cons* of preparedness. Significant p-values in bold.

	Male Mean ± SD	Female Mean ± SD	W	*p*-value
***Pros* "*Getting ready is worthwhile*"**	0.72 ± 0.18	0.73 ± 0.19	135463.5	.133
***Cons* "*Getting ready is not worthwhile*"**	0.33 ± 0.23	0.31 ± 0.21	123049.5	.239
Overall attitude (*Pros-Cons*)	0.39 ± 0.32	0.42 ± 0.33	135673.5	.125

Table 19 Overall attitudes towards preparedness according to gender.

Risk perception and preparedness: A question not directly addressed in this study was whether the perceived risk can motivate preparedness. We computed Spearman's rank correlation to assess the relationship be-tween our risk perception results (likelihood, impact, self-efficacy and overall risk perception) for each of the reported hazards and the overall attitudes towards preparedness. We found weak correlations for the gender groups in all cases (rho<0.20) suggesting that in our study the considered risk factors have a very low association with motivations to preparedness.

Datasets from an online survey on citizens' attitudes towards natural and man-made disasters were used to explore the differences between males (n=510) and females (n=504). Hence, the information collected can enable the study of how gender influences how people perceive and would behave in a disaster.

Results presented in this study constitute the first process of GD analysis (e.g. data collection, data processing, and analysis) and advocate to conduct the second process which is interpretative in nature. The gender discrepancies may reveal the underlying mechanisms apart from biological and physiological differences such as everyday life behaviours and beliefs as well as stereotypes derived from gender norms. Conceivably, socioeconomic and cultural differences between men and women are more evident in lower-income countries leading to a higher exposure of women to risks in case of a disaster. The present results suggest that gender differences in relation to risk perception of multiple hazards might still be present in European societies.

The different social roles and activities of men and women within the household and community are examples of how gender norms and ideals manifest. The role of nurturer and caregiver primarily played by women have been associated with a greater concern about the risk of potential disasters and well-being of others. Also, different gender roles can be reinforced in disasters because expectations for men and women are usually based on stereotypes. Our results suggest the same predisposition of females and males to seek prepared-ness. Women are slightly present in emergency planning and disaster management pro-grams but more involved in household and community care in practice and often ignored in official evaluations after disasters. It is argued here that gender skills may benefit prevention and mitigation of hazard situations.

Overall, these conclusions enriched the importance of GD perspective in research and innovation projects like ASSISTANCE and the importance of integrating such kind of studies.

3. Human factor impact assessment

3.1. GELS toolkit

The ASSISTANCE project included three pilot demonstrations to test the proposed technologies and solutions with the participation of end-users and stakeholders during the evaluation process. Whereas the requirements, functionalities, use cases and therefore the technical evaluations of technologies were designed from the early stages of the project and applied, there was also a need to address societal implications of such developments. In other words, the attitudes and behaviour of end-users and stakeholders when facing such technologies and solutions were part of the evaluation of the project through human factors impact assessment. Similarly, precautions and good plans for assessing non-technical aspects (e.g. ethic, legal, etc.) during the pilot demonstrations were required.

To our knowledge, there was no standardized methods for the analysis of human factors assessment during pilot demonstrations for this kind of project.

The GELS toolkit was proposed and used within ASSISTANCE to integrate, monitor and evaluate non-technical aspects for the pilot demonstrations. It is an original idea of CEL designed in collaboration with UC and, for legal aspects, with the support of E-Lex.

The toolkit comprises instruments to independently address Gender, Ethical, Legal and Societal issues. The matrix in Table 20 highlights the issues and the stages during which the process passes and the corresponding tools:

- Self-assessment tool (SAT): A sort of *Vademecum* to consider non-technical aspects when planning the pilot demonstrations.
- Monitoring tool (MT): An approach to watch and analyse carefully human factors during pilot demonstrations.
- Analysis tool (AT): A tool for researchers to assess non-technical aspects after pilot demonstrations.

The proposed matrix (Table 20) changes according to the stage moving from questions during the early stages (SAT), observation and supervision of the pilot activities (MT) to the analysis and evaluation (AT).

This guideline toolkit is also intended for those who may deal with other similar actions to ensure the integration, monitoring and evaluation of gender, ethical, legal, and societal issues in similar projects.

The following sections present the results when applying the GELS Toolkit to the pilot demonstrations conducted in ASSISTANCE project.

Stage	Tool	Key Issues			
		Gender [Gen]	**Ethics [Eth]**	**Legal [Leg]**	**Societal [Soc]**
		Gender integration and gender perspective	*Protection of participants*	*Privacy and data protection*	*FRs attitudes towards technology/training methods*
1. Design	Self-assessment tool [SAT]	Does the pilot integrate gender? How many women and men are expected to participate? What are their roles? [SAT-Ge]	Does the pilot require recruitment? Is Informed Consent Form required? Are there any risks for participants? [SAT-Eth]	What administrative legal actions for data protection might the pilot require? [SAT-Leg]	What target groups and main actors are planned to participate? What interactions are planned? What are the research and evaluation plans? [SAT-Soc]
2. Execution	Monitoring tool [MT]	Observe women and men performance Acquire data (e.g. participants self-reporting, opinion) Monitor changes (compare actual vs planned conditions) [MT-Gen]	Check compliance with ethical principles Monitor changes (compare actual vs planned conditions) [MT-Eth]	Check compliance with data protection and privacy (GPR) Monitor changes (compare actual vs planned conditions) [MT-Leg]	Observe participants performance and behaviour Acquire data (e.g. participants self-reporting, opinion) Monitor changes (compare actual vs planned conditions) [MT-Soc]
3. Evaluation	Analysis tool [AT]	Analyse and process data. Report main findings and deviations. [AT-Gen]	Analyse whether the ethical requirements and protective conditions of the pilot were as expected. Report main findings and deviations. [AT-Eth]	Analyse whether the legal requirements of the pilot complied with expectations. Report main findings and deviations. [AT-Leg]	Analyse and process data. Report main findings and deviations. [AT-Soc]

Table 20 GELS Toolkit framework used for the pilots conducted in ASSISTANCE.

3.2. Gender

3.2.1. Motivation

Gender dimension (GD) is a key factor of the societal aspects in security. Section 2.2 and D8.4 report the actions carried out to understand GD (First Responders and citizens). We organized a focus group during the third pilot to gain direct feedback from the end-users regarding this subject-matter. The objectives were 1) to get an in-depth picture about perspectives, experiences and feedback of end-users, 2) to gain further knowledge on gender in disasters, 3) to foster discussion about gender issues in safety and 4) to assess the potential effects of ASSISTANCE developments from a gender viewpoint in technology experience.

3.2.2. Method

The focus group took place in Linares (Spain) on 16th June 2022. End users/partners of the project were invited to participate and gathered in a meeting room. An important requirement was ensuring the participation of at least 5 women. In total 8 First Responders participated: 4 females namely FR1-4 and 4 males namely MR1-4.

Participants signed an Informed Consent Form (ICF) beforehand. They also were informed that their participation was going to be recorded and they were told that if they no longer wished to take part in the focus group, they could leave at any time. All participants agreed to continue in the meeting. The topics of the focus group were divided into three blocks. Block 1 centred on gender vulnerability of citizens, Block 2 involved gender issues of vulnerability, risk propensity and resilience in First Responders and Block 3 was about the gender vs the ASSISTANCE project and its developments.

The focus group was led by two facilitators: Facilitator 1 was in the room and Facilitator 2 was remotely connected through Google Teams. A PowerPoint presentation with key information was shown by Facilitator 1 who asked primary questions to elicit discussion among participants. Once each discussion was launched the role of facilitators was to encourage the participants to enter the discussion and answer general questions but redirect any content-specific questions back to the group. The focus group lasted 51 min.

3.2.3. Results

Block 1: Unlike gender equality, the impact of gender in disasters is not usually discussed. Hence, we introduce participants to this block by providing two different perspectives of gender. The first showed a simplified table of the typical gender roles in response to disasters (Figure 13) extracted from past studies[18]. The second was a set of images showing “gentlemen” carrying “ladies” in floods (Figure 14). Whereas the first perspective was intended to provide scientific-based information the second image simply presented a gender stereotype.

[18] Enarson, E. (2006) SWS Fact Sheet: Women and Disaster.
http://nhma.info/uploads/resources/gender/SWS%20G%26D%20Fact%20Sheet.pdf

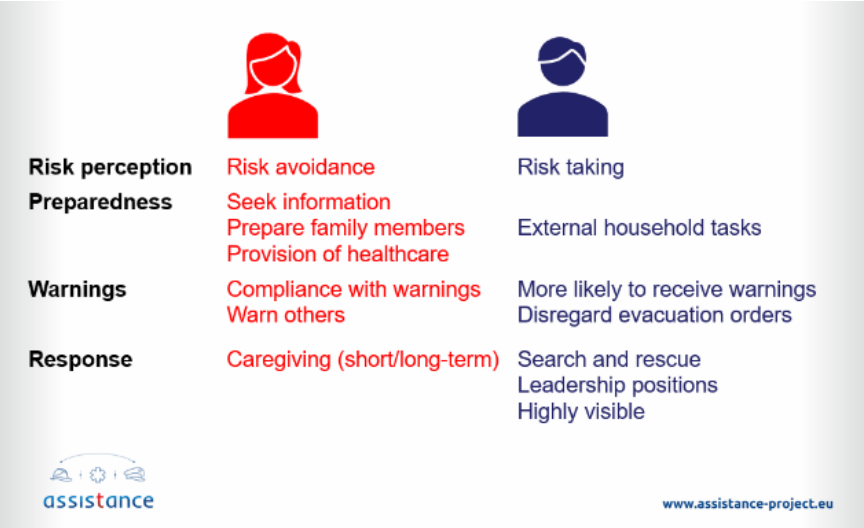

Figure 13: Typical gender roles in disasters.

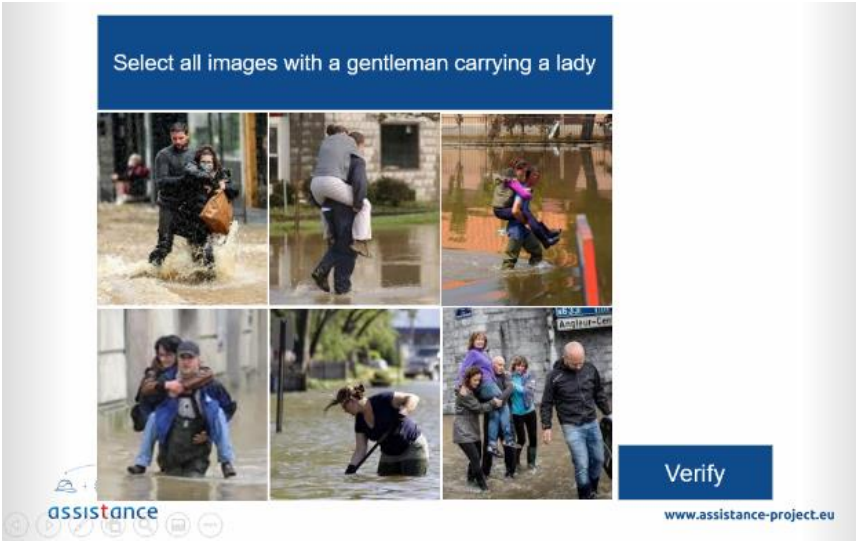

Figure 14: Stereotype of gender roles in disasters

Vulnerability: This part included the following questions.
Are women more vulnerable to disasters than men? This question was supported by the statement "*Natural disasters kill more women than men—both directly and indirectly around the world"*[19]. There was no consensus among the participants that discussed the vulnerabilities of both women (focused on maternity and primary protection) and men (risk takers more likely to make mistakes). MR1: *"Women are less likely to do strange things than do men"*. MR2*: "Men are more risk takers, they are more under risk and make more mistakes, so they are vulnerable.* MR3: *"Women have a clear scheme due to maternity and primary protection, so they are more vulnerable".*

[19] Eric Neumayer and Thomas Plümper. "The gendered nature of natural disasters: the impact of catastrophic events on the gender gap in life expectancy," 1981–2002. Annals of the Association of American Geographers, Volume 97, Issue 3, 2007.

Which contributing factors do you consider relevant? This question was supported by displaying a list of factors (i.e. Unequal gender norms, Gender roles and responsibilities -caregiving, Socio-economic status, Decision-making in the community, Participation in emergency preparedness…). Participants agreed that social structures (gender norms, decision making in communities) and poverty were relevant factors that contribute to women vulnerability when facing disasters. FR1 say that this is due probably because of social structures, tasks women are not allowed to do that in some way make them more vulnerable. For instance, "*not many women at certain age drive cars so they are more vulnerable*". FR2 said that poverty was a key vulnerability factor. "*Poor people are more prone to disasters and women too especially in rural and isolated areas*".

Do you think that women are less vulnerable in Europe? Why? Participants agreed that in Europe the overall picture of disasters is a little bit different. However, they also stated that Europe has diverse countries and cultures with different levels of gender relations (gender equality). MR1: *"…in Sweden we have a very high equality between the genders. We have a social way of thinking that is quite different from the southern parts of Europe or other places where religion may be place in how the roles between men and women are. So for us it could be a completely different answer than maybe Turkey, Italy or Spain*".

An interesting discussion arose about the expectations of citizens/victims and the mainstreaming of women as firefighters. The starting point was that some victims rejected to be rescued/assisted by female Firefighters due to gender stereotyping i.e. they expected a strong man rather than a woman. FR1: "*Sometimes when you arrive with all your gear on and everything I've been told at least twice when do the real fire department arrive?*". The main cause reported was gender norms and social structures i.e. expectations also produced by institutions (e.g. school, and workplaces) about how women and men should be and act. FR3: *"…sometimes if you have your full gear on and take it off and someone sees that you are a girl and says I didn't know there were female firefighters…sometimes questions are related to the hard job*". FR1: *"…that's what I said at the beginning. I think it's about social structures because in Sweden we still have young girls that don't think they are able to become firefighters because they are women*". Participants agreed that there is still a lot of work to do in mainstreaming female firefighters. FR1: *"…of course, we have lots of issues that we have to work with inside the fire department to get more women more attracted to being a firefighter, like fitting clothes and showers for women*". The use of inclusive language was also reported as a gender issue FR3: *"…every time you talk to someone, they say oh you're fireman sorry should I say, fire woman?".*

Block 2: The previous discussion led us to jump onto the next block on gender issues in First Responders.

Vulnerability: We provided the definition of vulnerability to participants referring to *the fact of being easily hurt physically and/or emotionally* to clarify that this concept is different than weakness i.e. not being strong or powerful. This part included the following questions:

Are female First Responders more vulnerable than men First Responders? The first reaction of participants was that females are as vulnerable as males. Then some nuanced the answer saying that sometimes and that this was a personal question. Men First Responders were labeled as risk takers and gender diversity was seen as a positive way in first response performances. For instance, MR1 reported: "*I have worked with a lot of female firefighters, and they are more calm whereas male firefighters act like look at me I'm the hero of the day! and they do stupid things and fall down and hurt themselves and not all, of course, but some were very prone to taking risks. There are that kind of people in the fire department".* Individual psychological and physical factors as well as training as an external factor were reported to be also important factors instead of gender condition. FR4 said: "*Yes, workmates say something different also for training. They have their own physiological and psychological situations. So, vulnerability not only depends on gender. Training is more important to be prepared".*

Which factors do you consider more relevant? This question was supported by some examples: Physical demands, gynecological issues, ill-fitting equipment, inadequate training, Post Traumatic Stress Disorder (anxiety, suicide), discrimination, harassment… Harassment was pointed out as one of the main factors by a veteran female firefighter who recognized improvements during the last years. FE1: "*I've been working out in the fire department for 15 years and I know more women that quit the job because of the discrimination and harassment*". Harassment was reported as an issue from the past by another female firefighter who reported not being aware of such things today. FR4: "…for the three years I've been working, I haven't felt anything of that, of the harassment or but I've heard how it was before. For me personally, only positive things".

In relation to physical tests of applicants, the same physical tests for males and females were reported in firefighting in Sweden. This was not the case for police officers in Spain where recruiting is divided by genders with a minimum of 40% women by law. MR4 said: "even in such positive conditions the gender ratio in Spanish police is around 80-20". MR3 added that: "In my fire brigade we have parity and there is no gender difference because we act as a team. No matter the gender".

Initially, physical barriers were not seen as a direct problem, just the cause of few females in firefighting, but a personal challenge by FR3: "*Physical barriers? I do not see them…if you really want to be a firefighter, you have to…, it's just ridiculous because there are so many strong girls out there*". Interestingly physical strength was seen as one important skill in firefighting on duty but not definitive. FR3: "*…there are certain things you need to do, some heavy tools and ladders that of course you need to be able to lift and move as well as your male colleagues…you need to do your best, of course, but resilience and other things are also important because you do a lot of heavy job for a long time*". Then respondents provided clarifications with examples of situations, and they were in favour of fitness rather than simply physical strength. FR3: "*What if I get stuck in a house or if there is a big man and you need to drag him out from a burning building, then not many girls can do that. And I say, well. How many guys can do that alone? Either you're never alone. You need help because that's super heavy and some guys too. Perception and thinking are important factors as well*".

FR1: *"...you need to have a minimum physical ability. Absolutely. But you don't need to be elite athletic person…"*. This participant introduced another barrier related to the public opinion. FR1: *"If you see me, I don't look like a firefighter. Most people, if you understand what I mean, there's a difference in how the public sees the firefighter and how I look. This is a barrier as well".* MR3: "*You may have a super strong man. But sometimes there is a need to climb up for example and a small fitness and smarter person, it doesn't matter a woman or a man, can be more efficient*". Finally, participants agreed that counting on diversity leads to a more efficient performances.

Risk Propensity: Here the strategy was to show evidence produced during the project regarding risk propensity in First Responders to provoke the discussion (Figure 15). The fact that female First Responders must prove constantly that they are equal was reported as one of the main reasons why risk propensity did not differ between male and female First Responders and that female firefighters were more risk-takers than their gender counterparts. However, FR1 did not see herself as a risk seeker: "*sometimes I'm taken as a spontaneous leader in the group. Not because I'm the strongest one. Not because I'm the fastest one. Not because I'm the most experienced. Just because I'm the one that makes them safe. They like my ability to make them feel safe because my focus is 100% taking care of that. I don't know if that's because I'm a female or just me*".

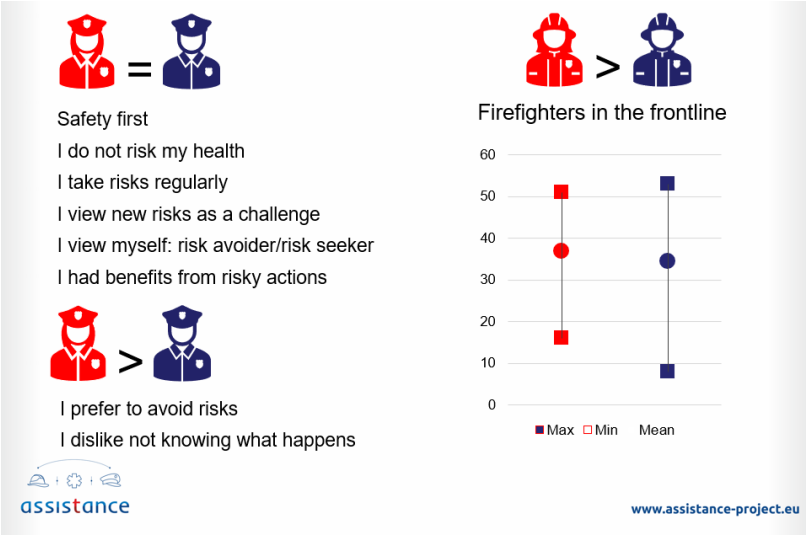

Figure 15: Information on gender vs risk propensity of First Responders to elicit discussion.

Coping/Resilience: Results from the study conducted during the project were presented to participants. Resilience (the ability to bounce back from stress*)* was higher in male First Responders than female First Responders whereas there were no differences in coping (trends to handle stress adaptively).

Overall, participants agreed with the results. For instance, FR1 stated that: *"women are more likely to feedback themselves asking questions such as What I did wrong? Did I do that wrong? Did I do that right? Is that person angry with me for taking that decision? Should I make another decision?... I know I tend to evaluate myself, I guess a little bit longer than the guys do, at least in my group".*

Block 3: This block aimed at getting feedback from end-users from a gender perspective on the ASSISTANCE project and its developments. Rather than prompting discussion, the formulated questions openly sought any comments, opinions, impressions, experiences etc. that participants may inform.

Has the ASSISTANCE project been gender sensitive? All participants agreed that the ASSISTANCE project has been gender sensitive and no further comments were given.

Can ASSISTANCE technologies help to address gender issues? Participants saw ASSISTANCE as a gender-focused project (but a gender-related project) thus they did not find specific benefits to one or another gender. They felt that the proposed technologies could protect First Responders, no matter the gender. FR4 said: "…the vital perimeter in today's exercise was for the security of everybody, woman and men".

Is there a need for further adaptation of the ASSISTANCE technologies? There were two main comments. The first comment was related to temperature sensors of one size (a size that fits most men). FR1: "*We tried the sensor in the Rotterdam, the one you wear in your ear, and I have really small ears. I don't know if that is why I female. I have to be sure that this wearable did not fall out*". The second comment was related to the heart rate sensors. This might be connected to gender differences in cardiovascular functions.
FR3 had to stop because of a heartrate warning, and she said: "*I have a lot higher posts. No matter what I do. I don't think that's gender specific*". Whereas this is not deemed to be a further adaptation the impact of this technology was considered as important aspect related to gender.

3.2.4. Assessment

End-users self-reporting, opinions and past experiences were collected during the focus group and analysed afterwards. The following conclusions can be drawn.

- Women (caregivers) and men (risk takers) were seen as equally vulnerable to disasters. Social structures and poverty were considered the most relevant factors contributing to women's vulnerability. Women's vulnerabilities in Europe were seen as dependent on culture/country.
- Stereotyping, citizens' expectations and mainstreaming were the issues that most worried women firefighters. They felt that they must prove constantly that they are equal.
- Female First Responders were seen as vulnerable as male First Responders. Physical strength was not considered the most essential quality. Other factors (physiological and psychological) and training were reported to be also important, rather than only gender. Gender diversity was seen as a positive way in first response performances.
- There was an agreement that the ASSISTANCE project has been gender sensitive and that the proposed technologies protect First Responders, no need to specifically focus on gender. However, two further adaptations were identified in relation to gender differences: 1) the size of temperature sensors wore in ears and 2) the gender consideration for setting up the thresholds for the hard rate sensors.

3.3. Ethics

Considering the varied nature of the technologies introduced in ASSISTANCE, the main characteristic of this project lies in the balance between team members and technological tools, vulnerability, and cooperation. Hence it becomes crucial to investigate ethical aspects of the impact of these technologies. Ethics is a discipline that is often used to analyse the effects of disruptive technologies, especially to protect the rights of individuals and to direct the development of these technologies in a socially desirable direction. Ethical philosophy generally has to do with that branch of knowledge that deals with critical reflection on human behaviour, both individual and collective. Ethics is concerned with analysing the sphere of good or bad actions, independently of whether they are legally permitted or prohibited or politically appropriate. Ethics concern certain value categories that define the individual, society, and the relationship between them.

In our case, the ethical approach was based on understanding ethical side effects of certain technologies in a work team in contexts of high vulnerability and crisis. Therefore, we chose to investigate how technology impacts on the relationship between: individual self-perception, the ability to represent the environment (Situational Awareness), the perception regarding human dignity and interaction with victims (Human Rights), and the ability to coordinate and respond to emergencies (Resilience). Each question during the focus-groups aimed at stimulating discussions on three conceptual areas, investigated from an ethical perspective (Situational Awareness, Human Rights, Resilience) to understand the possible ethical side effects by the adoption of these technologies. We decided to investigate the concept of Situational Awareness, in parallel with the investigation carried out by RISE and described in D7.6, from the subjective perception of the end user in relation not to the actual functioning of the technology (investigated in parallel by RISE) but from the point of view of evaluations of the ethical consequences of adopting such technology.

Literature distinguishes between metaethics, normative ethics and applied ethics[20]. The former has to do with an epistemological reflection on the ethical categories adopted by a society, the second has to do with the normatively oriented description of the good life within a society; applied ethics, on the other hand, has to do with the analysis of the consequences derived from the practical application of ethical theories. Such conceptual layering is useful to consider when dealing with ethics to be aware of the link between ethical and social evaluation. Indeed, ethical reflection makes it possible to consider how relations between humans and the world, and in this case between human beings, society and technology, are mutually constituted (Ihde 1990, 2009)[21]. As technologies mediate the relationship between the human and the world, and shape both during the mediation process, technologies also shape our ethical situation, as they mediate moral actions and decisions.

[20] See R. Attfield, Ethics. An overview, Continuum, London, 2012.
[21] Ihde, D. (1990). Technology and the lifeworld: From garden to earth. Indiana University Press., Ihde, D. (2009). Postphenomenology & Technoscience: The Peking University Lectures. New York: SUNY Press.

3.3.1. Motivation

Due to their activity of information collection-sharing-control, technologies developed by the ASSISTANCE project and tested in pilot demonstrations play into some **fundamental dynamics that impact on human rights** issues and the **resilience of a team**, such as:

1. Self-perception
2. Sense of autonomy
3. Communication between team members and with victims
4. The ability to coordinate and organise team actions
5. The ability to promptly respond in a high-stress situation
6. The transmission of information

To provide an assessment of human factors of the ASSISTANCE technology in a condition of extreme vulnerability that considers the users' point of view on the above-described items, we carried out an investigation in which we applied three different monitoring techniques (see section 3.3.3). We first observed the behaviour of end users during the pilot demonstrations simulating disaster rescue operations. Then, mainly to engage them, we made a preliminary assessment of their role, profile and propensity to use the technology as well as their experience while using the ASSISTANCE technology, through a pre-interview monitoring technique. Finally, we conceptually divided the areas of investigation into three themes, addressed in three different focus groups following the pilot demonstrations:

A. ***The impact of ASSISTANCE technology on the ethical aspects of Situational Awareness***: Within the first pilot, we investigated the impact of the technologies with regard to the states, systems and processes[22] of the configuration of situational awareness, which we can refer to as "the comprehension that an individual or a team has of a situation".[23]
B. ***Impact of Assistance Technology on Human Rights***: The second focus group carried out during the second pilot explored the impact of technology on some fundamental aspects of human rights. We examined the issue of perceived human dignity in relation to teamwork and interaction with victims. The concept of human dignity, which is extremely stratified and rich[24], is considered the pivotal concept around which human rights legislation and theoretical elaboration are developed. To this extent, the central document defining human rights, that is the Universal Declaration of Human Rights (UDHR) drafted in 1948, bases its articulation on the concept of the dignity of the human being.
   Since the concept of dignity is vast and layered, we defined it in relation to the work done by First Responders and the impact of the technologies. Therefore, we sought to explore the following concepts:

[22] Lundberg, Jonas. (2015). Situation Awareness Systems, States and Processes: A holistic framework. *Theoretical Issues in Ergonomics Science*. 16. 10.1080/1463922X.2015.1008601.
[23] Toward a Theory of Situation Awareness in Dynamic Systems, *Hum. Factors J. Hum. Factors Ergon. Soc.*, vol. 37, no. 1, pp. 32–64, Mar. 1995, doi: 10.1518/001872095779049543.
[24] Düwell, M. (2014) 'Human dignity: concepts, discussions, philosophical perspectives', in *The Cambridge Handbook of Human Dignity*. Cambridge University Press. Available at: http://dx.doi.org/10.1017/CBO9780511979033.004., Claassen, R. (2014) 'Human Dignity in the Capability Approach', in *The Cambridge Handbook of Human Dignity*. Cambridge University Press., Claassen, R. (2014) 'Human Dignity in the Capability Approach', in The Cambridge Handbook of Human Dignity. Cambridge University Press.

I. Autonomy (freedom to act and freedom to decide)
II. Sense of Ability
III. Sense of professional value.

C. ***Impact of Assistance technology on team resilience***: within the third pilot, we investigated how the technologies introduced some impacts to improve the resilience of a teamwork on the following key aspects:
I. team collaboration and cooperation,
II. organisation of roles and coordination between team members.

3.3.2. Method

The target group was composed by First Responders classified according to their role in the ASSISTANCE project as well as their user profile (section 3.3.4).

The method used in our investigation followed the structure of the GELS framework, illustrated in Deliverable 8.6. In particular, given the diversified nature and peculiarities of each pilot demonstration, after the preliminary self-assessment stage (carried out with the relative SAT tool as reported in D8.6), we applied two different techniques in two different stages: a first stage by using Monitoring Tools (MTs) and a second stage by using the Analysis Tools (ATs). Preliminary ethics self-assessment was carried out by applying the relative tool during the three pilots. Table 21 reports the overall results.

Check	Result
Does the pilot need to recruit participants?	YES
Will participants be fully informed about: 1) the purpose of the pilot, 2) the rights of participants and 3) their benefits and risks coming from participating	YES
What type of participants are expected? Will the pilot involve potentially vulnerable individuals or groups?	Actors (role of victims) for the staging exercises
Is an Informed Consent Form required?	YES
Does the data collection need profiling?	NO
Will the pilot involve activities/interventions which may induce psychological stress, anxiety of humiliation of participants?	NO
Has the necessary training been given to the participants to arrive prepared for the pilot?	YES
What measures will you implement to safeguard the rights and freedoms of the participants?	Information Sheet, Privacy policy and informed consent
Are K-9 units involved? Have you considered direct and indirect effects on animal welfare?	YES, only during the first pilot. No effects on animals.

Table 21 Ethics Self-Assessment Results

The ethics self-assessment performed during the three pilots clearly highlight the importance of appropriately informing participants before their engagement. For this reason, in concert with the legal experts (see section 3.4), information sheets and consent forms were distributed to participants who participated in a free-of-charge and voluntary mode.

Moreover, participants were selected among a list of actors usually known by the First Responders in the region of the pilot, therefore they were aware of the activity and role (i.e. acting the role of victims). During the last pilot in Spain, the hosting partner MIR-PN had its own participants (personnel) playing the roles (i.e. police, terrorist) and other members from the ASSISTANCE project acting as victims.

The techniques used were designed with the objective of collecting data, both quantitative and qualitative, to investigate the following topics from an ethical perspective:

- The understandability and suitability of the ASSISTANCE technology.
- The impact of the technologies tested in the pilot demonstrations on relevant human factors such as situational awareness, human rights, and resilience.

The MTs were used during and after the three pilot demonstrations, as reported in Table 222. Nota that we have collected quantitative data from the pre-interview and the focus group as well.

Monitoring technique	Description	Collected information	
		Quantitative	Qualitative
Observation	Watching the procedures and participants during the pilot demonstrations through two main methods: 1) human observation, 2) automated observation (e.g., video cameras, recorders).	X	
Pre-interview	Conducting a pre-interview for participants after the first pilot demonstration, in order to have an initial assessment of their role/profile and their preliminary experience with the ASSISTANCE technology (e.g., understandability and suitability).	X	X
Focus group	Getting feedback from participants through semi-structured interviews.	X	

Table 22 Monitoring Tools (MTs) of the GELS framework

While the direct observation of pilot demonstrations helped the interviewers to better understand the technology users' needs and guided the interviews, the other two techniques were used to elicit the users' point of view and feedback.

In addition, the results of the monitoring stage were analysed using the Analysis Tools (ATs) of GELS framework, allowing us to carry out both a quantitative and a qualitative analysis as shown in Table 23 and Table 24.

Quantitative analysis
AT1 - Graphic representation of the pre-interview answers in terms of percentages
AT2 - Mentimeter[25]: Used to gather audience feedback and give percentage information about users' opinions on the impact of ASSISTANCE technologies

Table 23 Quantitative analysis

Qualitative analysis
AT3.- Content analysis: categorizing verbal or behavioural data
AT4.- Narrative analysis: reformulation of stories by users considering individual context and experiences

Table 24 Qualitative analysis

Having in mind these techniques, in the following sections we illustrate how the whole investigation was conducted and, subsequently, what results derived from this activity.

3.3.3. Observation and pre-interview

At this stage, first, the interviewers participated in the pilot demonstrations to observe the technology user's behaviour. Then, to identify and engage with the participants, immediately after the first exercise in the pilot demonstration, a simple questionnaire was distributed among users to classify them on the basis of their role and their propensity to use new technologies in general. As shown in Figure 16, the majority of the respondents (82.4 %) belonged to the firefighter category, the rest (11.8 %) were ambulance personnel, and the remainder (5.9 %) were police forces.

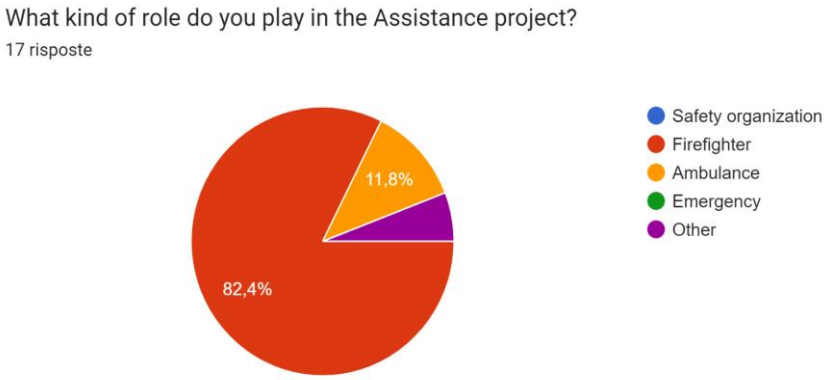

Figure 16 First question of the pre-interview: role in the project

As shown in Figure 17, many of the respondents showed a good degree of propensity to technology, divided between 47.1% who expressed a good degree of propensity to technology and only 11.8% who expressed a modest degree of liking for the use of technology.

[25] Mentimeter is a tool to interactively engage audience. www.menti.com

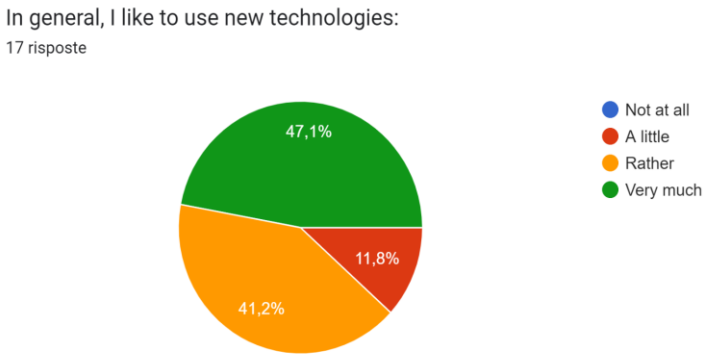

Figure 17 Second question of the pre-interview: propensity to adopt technology

The questionnaire also included some questions meant to analyse the Knowledge and suitability of the ASSISTANCE technology. Results of this questionnaire were then used as baseline for the focus groups investigation.

The questions asked at this stage were the following:

1) *What kind of role do you play in the Assistance project?*
2) *In general, I like to use new technologies*
3) *Have you used the technology developed by Assistance?*
4) *I understand the technology used in the Assistance project*
5) *The technologies developed by the Assistance project enhance my work*

3.3.4. Focus groups execution

After the above-described first stage, three focus groups were arranged with the project First Responders. The focus groups were moderated by ethics experts and conducted as followings: first of all, the participants had signed an informed consent for data processing. Then, they were asked to introduce themselves and to recount their experience during each pilot demonstration. After this, the objective of the activity was introduced by the ethics experts, followed by the exposition and explanation of the questions derived by the three themes described in section 3.3.1, to which participants were asked to answer on.

The following subsections detail how the three different focus groups were carried out.

First Focus Group: Situational Awareness (SA): The objective of the first focus group was to understand and evaluate the impact of the project technologies on the ethical aspects of SA in a hybridised system, that is the ability of a team or individual to perceive, analyse and understand a given context or situation in which they are placed. Despite the complexity of the SA, the focus group attention was directed towards one specific aspect: the team awareness of the context and the environment, their consequent capacity to intervene actively in a coordinated manner and to respond proactively in an emergency or vulnerability situation. All those capacities are a delicate balance between the capacity to receive, understand and analyse information and concepts, the self-awareness - i.e., how one can perceive oneself as an active subject with respect to the environment -, the possibility of relying on a reliable and effective coordination system.

Therefore, as stated by Endsley: "Situation Awareness can be thought of as an internalized mental model of the current state of the operators' environment. All the incoming data from the many systems, the outside environment, fellow crew members and others must be all brought together into an integrated whole. This integrated picture forms the central organizing feature from which all decision making, and action takes place."[26]

Given the nature of the project and the nature of the exercises carried out, we focused our attention on the role and impact exerted by ASSISTANCE technologies in the configuration of the team of first responders. In fact, the project develops different types of technologies, some autonomous, such as robots and drones, and others that are embodied and wearable, such as sensors and cameras, and information transmission technologies such as the Situational Awareness Platform.

The questions asked in the first focus group were thus the following:

1) In this project there are two types of technologies, those embodied and wearable that increase human capacities and autonomous ones, such as drones and robots. Regarding the former, how do you think these affect your perception of yourself, your abilities and your limits?
2) Do you think that the introduction of robotic techniques into disaster risk modelling processes may reduce the ability of government, the public, and other important stakeholders to meaningfully participate in disaster recovery management (thus reducing the social acceptance of the news technologies)?
3) Regarding the second technologies, drones and robots, do you think these can increase your awareness of the situation? Does the autonomy of these technologies make you feel that you are no longer in control of the situation?

Second Focus Group: Human Rights: Human rights and their protection during rescue operations is a multi-layered topic. Among the different human rights, given the context of the exercises carried out and the teamwork interviewed, the focus was on the specific concept of **human dignity**, the cornerstone of human rights, and how this can be impacted, in an extremely vulnerable work environment, by the developed and tested technologies. Specifically, we applied the concept based on the capabilities approach developed by Nussbaum and Sen[27], so that the notion of human rights should be interpreted not in a merely formalistic sense, but in a substantive sense, with the aim of understanding the conditions that allow or disallow the exercise and development of certain capacities of human beings. Therefore, the focus group aimed to understand if and how the ASSISTANCE technology may impact on the capacities and abilities of the First Responders under extreme conditions, i.e., their own dignity perception.

[26] Endsley, M. R. (2001). Designing for situation awareness in complex systems. *Proceedings of the Second international workshop on symbiosis of humans, artifacts and environment*, Kyoto, Japan.

[27] Bendik-Keymer, J., 2014, "From Humans to all of Life: Nussbaum's transformation of human dignity" in Comim and Nussbaum (eds.), *Capabilities, Gender, Equality, Cambridge*: *Cambridge University Press.* Sen A., 2005, "Human Rights and Capabilities", *Journal of Human Development*, 6(2): 151–66., Nussbaum M., 2000, *Women and Human Development: The Capabilities Approach*, Cambridge: Cambridge University Press.

The first two questions were aimed at investigating the perceived impact of technologies on their sense of dignity in terms of autonomy - freedom to act and freedom to decide (human in the loop) - , sense of ability and professional enhancement. The last question examined the perception of technology dependency experienced with the use of the new technologies introduced.

The questions asked to first responders were:

1) During the pilot, how much do you feel the use of these technologies affects your sense of dignity in your work?
2) In which way do you think that these aspects of your sense of dignity are affected when working with these technologies? (Autonomy -freedom to act and freedom to decide, Sense of ability, Sense of professional value)
3) When using ASSISTANCE technologies during an emergency, do you feel more focused on…?

Third Focus Group: Resilience: The concept of resilience, derived from the physical sciences, primarily indicates the property of materials to withstand impact without breaking. In the transition of the term from the physical and material sciences to the psychological lexicon, the concept has taken on different facets. Resilience is considered not only as a predisposition or property that humans are endowed with, a property of matter, but as a competence that can be acquired or strengthened. Resilience therefore means, rather than the outcome, the process by which this capacity is built. The term therefore indicates those strategies and skills that are capable not only of facing and overcoming a crisis, but also of preventing it. When it comes to rescue operations, the concept of resilience is often taken into account as a key aspect to be improved for successful operations.[28] However, with a few significant exceptions[29], little emphasis is given to the point of view of first responders.

During the interaction with First Responders, we started from two definitions of the concept of resilience, one, elaborated by Egeland[30], which defines the concept from an individual point of view. For Egeland, resilience is "The capacity for successful adaptation, positive functioning, or despite high-risk status, chronic stress, or following prolonged or severe trauma". The other definition under consideration is instead elaborated from a team perspective, referring mainly to the community, and is elaborated by Pfefferbaum[31]: "The ability of community members to take meaningful, deliberate, collective action to remedy the impact of a problem, including the ability to interpret the environment, intervene, and move on".

[28] Pfefferbaum, B., Reissman, D., Pfefferbaum, R., Klomp, R., & Gurwitch, R. (2005). Building resilience to mass trauma events. In L. Doll, S. Bonzo, J. Mercy, & D. Sleet (Eds.), *Handbook on injury and violence prevention interventions.* New York: KluwerAcademic Publishers.

[29] Wyche, K. F., Pfefferbaum, R. L., Pfefferbaum, B., Norris, F. H., Wisnieski, D., & Younger, H. (2011). Exploring community resilience in workforce communities of first responders serving Katrina survivors. *American Journal of Orthopsychiatry*, *81*(1), 18-30.

[30] Egeland, B., Carlson, E., & Sroufe, L. (1993). Resilience as process. *Development and Psychopathology*, 5, 517–528.
Pfefferbaum, B., Reissman, D., Pfefferbaum, R., Klomp, R., & Gurwitch, R. (2005). Building resilience to mass trauma events. In L. Doll, S. Bonzo, J. Mercy, & D. Sleet (Eds.), *Handbook on injury and violence prevention interventions.* New York: Kluwer Academic Publishers.

[31] Pfefferbaum, B., Reissman, D., Pfefferbaum, R., Klomp, R., & Gurwitch, R. (2005). Building resilience to mass trauma events. In L. Doll, S. Bonzo, J. Mercy, & D. Sleet (Eds.), *Handbook on injury and violence prevention interventions.* New York: Kluwer Academic Publishers.

After discussing the above definitions of resilience with the first responders, we asked them some exploratory questions about the impact of the ASSISTANCE technology on the resilience, according to their perceptions gained by using all technologies during the training and the three pilot demonstrations. For the last focus group, we decided to use a tool, Mentimeter, to increase the engagement of First Responders[32]. Mentimeter is a tool that allows respondents to vote or comment on proposed questions simultaneously, allowing for greater participation. The questions were:

1. Keeping in mind the provided definition of resilience as the ability of the team to proactively respond to a disruptive event, in your experience and according to your perception:

   Which of the following technologies do you think to have the greatest impact on team resilience?

   a) Situational Awareness Platform
   b) Drones
   c) Robot
   d) AR/VR (Augmented Reality/ Virtual Reality)
   e) Wearable devices.
2. Use three words to describe in your perception, the aspects of team resilience that were most impacted by the used technologies.

3.3.5. Results and Assessment

Stage 1: observation and pre-interview: After a first observation during the pilot demonstrations, the pre-interview was done by using a google form to engage with the FR's and carry out an initial collection of data on opinions regarding the degree of understandability and suitability of the ASSISTANCE technology, useful to understand the context and the propensity of the technology users.

As the Figure 18 shows, while 64.7% of respondents claim to have used ASSISTANCE technology “a little” (it should be noted that this questionnaire was only submitted to the FRs after the first exercise), there is a good understanding of the technologies developed, exemplified by the answers to the question "I understand the technology used in ASSISTANCE project" (see Figure 19), with 47.1% of respondents claiming to have understood it a lot, and 41.2% of respondents claiming to have had a sufficient understanding of the technologies. The remaining 11.8% stated that they did not have a complete understanding of the technologies developed, but none selected the answer 'Not at all'.

With regard to the suitability rating of ASSISTANCE technologies (see Figure 20), following the first pilot demonstrations, 64.7% of the respondents said that they consider ASSISTANCE technologies useful "sometimes" to improve their work, 17.6% said that they are "always" useful in carrying out their work, while 11.8% answered "rarely" and 5.9% answered negatively.

[32] Hill, L. (2020). Mentimeter: A tool for actively engaging large lecture cohorts. *Academy of Management Learning & Education*, *19*(2), 256-258.

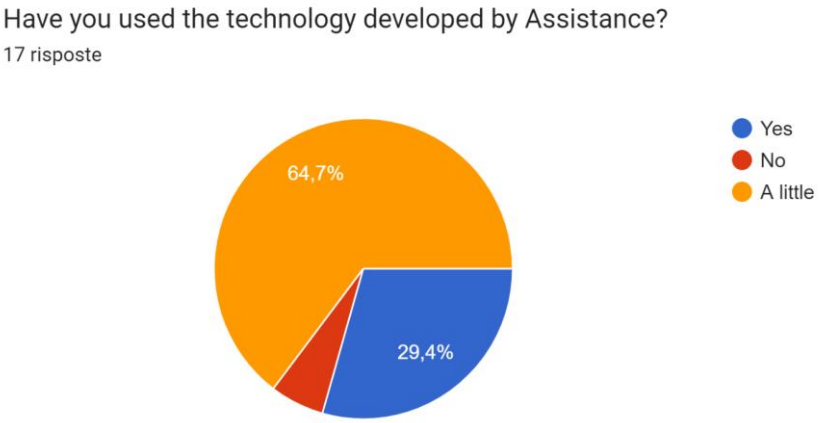

Figure 18 Third question of the pre-interview: usage of technology in the project

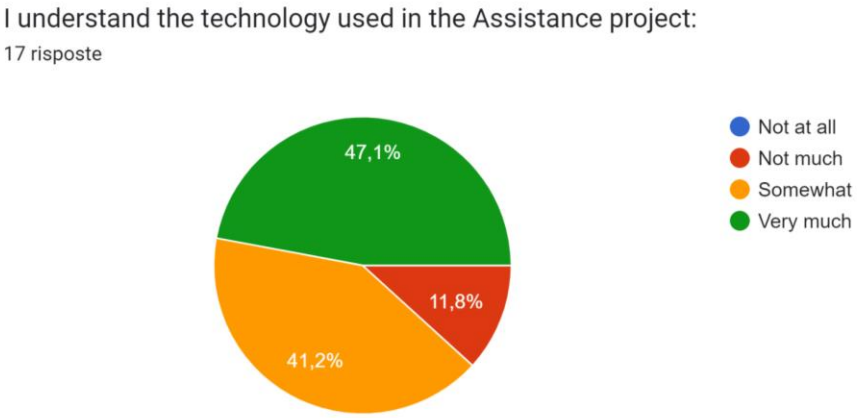

Figure 19 Fourth question of the pre-interview: understandability of the technology

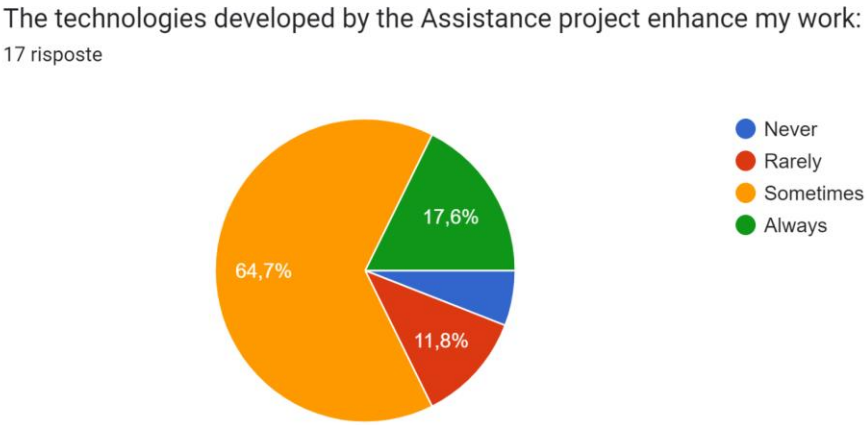

Figure 20 Fifth question of the pre-interview: suitability of technology

Stage 2: the focus groups: Table 25 reports strengths and weaknesses emerged from the first focus group held in Izmir (Turkey) and Table 26 illustrates the results of the second focus group, held in Rotterdam (Netherlands).

First Focus Group	Strengths	Weakness
First Question	All participants appreciated the underlying goal of the technologies, namely to make more information available to the team and to enhance their senses (particularly their ability to visualise space) during rescue operations. Furthermore, all first responders stated that they feel **empowered** by these technologies.	Concerning wearable technologies, some participants felt uncomfortable with the use of the video camera during rescue operations. In particular, the discomfort noted was not a technical factor or a physical impediment, but rather the feeling of being too **observed** while carrying out their work. This feeling could have a negative impact on the performance of operations as many first responders stated that they felt evaluated and judged, thus leading to a distraction from the emergency context.
Second question	Regarding perceptions of autonomous technologies such as the use of robots and drones, their impact on risk modelling processes was rated positively. First responders noted a good integration between autonomous technologies and team members as they did not feel that their empathic, communicative and purely human functions were replaced by the technology employed. Robots and drones were therefore rated **positively** as a means of help and support.	No critical issues were found with respect to the use of ASSISTANCE technologies with respect to risk modelling processes.
Third Question	With regard to the third question, concerning both situational awareness and the concept of human in the loop impacted by the use of autonomous technologies, it was found that these types of technologies do not negatively impact the feeling of always being in control of the situation and the management of autonomous technologies, thus the feeling of human in the loop and human in command is **respected**.	However, a critical issue that has been noted in this regard is that of sometimes being **overwhelmed** by too much information received from technological devices, resulting in the feeling of not being able to adequately manage the flow of information and therefore not being in control of the situation.

Table 25 Strengths and weaknesses emerged from the first focus group (Turkey)

Second Focus Group	Strengths	Weakness
First question (impact on autonomy, sense of professional value, sense of ability)	The impact of wearable and autonomous technologies was rated positively on the factors asked, because they were evaluated as technologies that improve work ability and complement communication and coordination tasks, resulting in a feeling of **empowerment** for the sense of ability, sense of professional value. Regarding the value of autonomy, many valued autonomous technologies (robots, situational awareness platforms, drones) because they did not interfere with the decision-making ability of first responders.	Criticalities were found in the use of wearable technologies (cameras and sensors) because they can generate a sense of **control and evaluation**, thus diminishing the sense of professional value. With regard to the sensors for measuring the pressure and heart rate, on the basis of which it can be determined whether they should be replaced or not, criticalities were found on the impact of the sense of ability and sense of professional value.
Second question	Regarding perceptions of autonomous technologies such as the use of robots and drones, their impact on risk modelling processes was rated **positively**. First responders noted a good integration between autonomous technologies and team members as they did not feel that their empathic, communicative and purely human functions were replaced by the technology employed. Robots and drones were therefore rated positively as a means of help and support.	**No critical issues** were found with respect to the use of ASSISTANCE technologies with respect to risk modelling processes.
Third Question	If properly trained in the use of these technologies, they could become an **excellent aid** in managing high information flows and coordinating operations because they can help focus more attention on other factors to be considered during an emergency, thus delegating information gathering to the technologies. Reliability is a key indicator to be considered for these technologies.	Some note that there is sometimes a feeling of being **overwhelmed** by technology-derived information, leading to stress. The use of cameras and tablets during rescue operations could lead to **less empathic communication** with victims.

Table 26 Strengths and weaknesses emerged from the second focus group (Netherlands)

As reported in section 3.3.2, during the third focus group held in Linares (Spain), it was introduced the mentimeter tool, to have a more interactive session with all the FRs. By using this tool, two questions were submitted and Figure 21 and Figure 22 report the results.

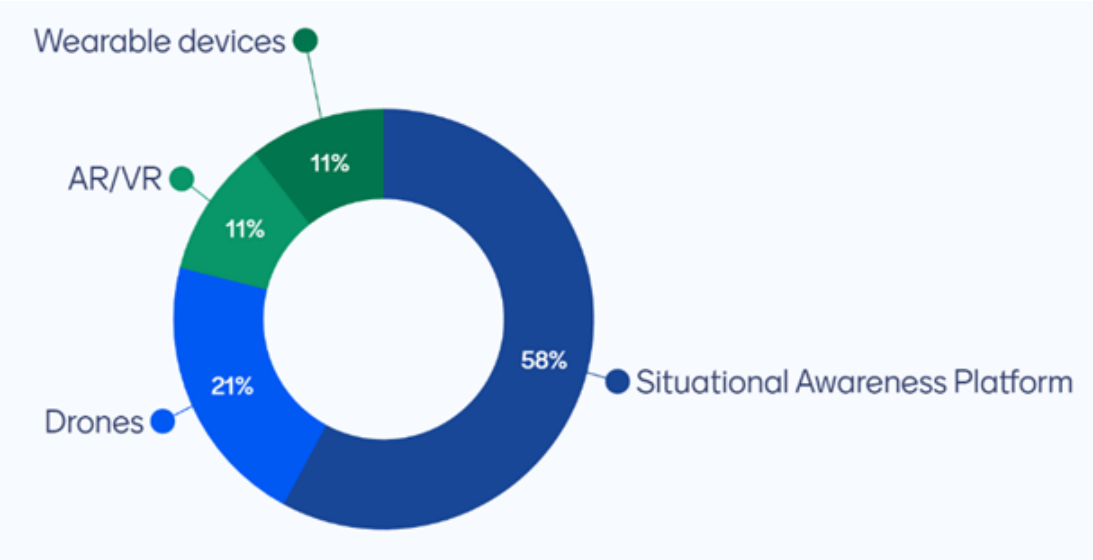

Figure 21 ASSISTANCE technologies with major impact on team resilience

Figure 22 Team Resilience: Most Important Impacted Aspects

Table 27 reports the summary of the results of the third focus group held in Linares (Spain).

Third Focus Group	Strengths	Weakness
First question (see Figure 21)	Regarding the assessment of the technologies that most impact a team's resilience, the largest percentage was represented by the **Situational Awareness Platform** (58%), followed by Drones (21%) and, with the same percentage, Wearable devices and Augmented Reality/Virtual Reality (11%).	The first question had an exploratory purpose and did not ask for a positive or negative assessment of the impact of technologies.
Second question (see Figure 22)	The aspects most highlighted as important to first responders in defining resilience capacity were situational awareness, communication, transparency, among others. In the discussion following the results of the Mentimeter vote, the impacts of the situational awareness platform and drones on team resilience were **positively** evaluated as being able to provide more information and faster communication between team members.	Potential issues related to these technologies, applied in critical activities, might arise in case of lack of **reliability and transparency**. Related to transparency and trustworthiness, these are characteristics highlighted as fundamental to building team work resilience. Therefore, transparency and trustworthiness have to be considered as key factors of technologies, especially when decisions have to be taken (by humans based on data from automatic systems).

Table 27 Strengths and weaknesses emerged from the third focus group (Spain)

3.4. Legal

3.4.1. Motivation

The ASSISTANCE Project involves human beings in dealing with rescue operations. During such operations the proposed technologies could process personal data and impact on human rights. As anticipated in the D8.1 and D8.5, the main aim of a final assessment is whether the ASSISTANCE technologies are compliant or not with the data protection and privacy regulation, in particular, with the General Data Protection Regulation (Regulation (EU) 2016/679 of the European Parliament and of the Council, hereinafter: “GDPR”), the European Data Protection Board (“EDPB”) decisions and to outline the possible risks on the rights and freedoms of data subject.

In order to assess the compliance with privacy, data protection and human rights aspects, the results collected during the pilots provide a good starting point, combined with the studies on the technology, to finalize the evaluation of the whole project. Indeed, the pilots and the related activities allowed us to assess the compliance to the privacy and data protection regulation, as well as the human rights protection, and to analyse the measures to be taken to reduce the risk of the impact on data protection and human rights. For this reason, the assessment was conducted in the final phase of ASSISTANCE project, after the carrying out of the pilots, necessary in order to collect the relevant information related to the application and functioning of the technologies.

3.4.2. Method

In order to conduct the Assessment on privacy, data protection and human rights, the methodology followed has consisted in the submission of a questionnaire to the technical partners involved in the pilots' scenarios ("Questionnaire"), created by E-LEX.

The aim of the Questionnaire is to collect all the information concerning the processing of personal data by the ASSISTANCE technologies used during the Pilots, as rescue operations simulation. The Questionnaire is structured as follows:

- Section I – The role of the Partner and the rescue operations activities
- Section II – General part on data protection and ethics
- Section III – Results of the rescue operations

PART A – The performance of the Pilots
PART B – Preliminary results and final output

Section I aims at acquiring information regarding the role played by the partner in the project and its role in the pilots.

Section II asks the Partners to provide information about:

- the processing of personal data;
- the role of the Partner in performing the processing activities;
- the methodology used to collect personal data;
- the categories of personal data collected including the special ones;
- the supporting assets used by the Partner;
- the storage of the personal data;
- the security measures adopted by the Partner;
- the data anonymisation and encryption process.

Section III concerns the results of the pilots and is divided in two parts:

- PART A - the performance of the Pilot. In particular, the Partners have to provide the critical aspects detected during the Laboratory environment; the Outdoor controlled environment; the Realist environment.
- PART B – preliminary results and final outputs. The Partners have to provide preliminary results, the necessity of personal data for a successful output, the possible risks, the other security measures to guarantee a higher level of data protection.

The Questionnaire results are also combined with the content of other deliverables. In particular, the Assessment considers the outcomes reported in the following deliverables: D6.4 on training network and Pilot evaluation; D7.3 on First Pilot Summary Report and System Development; D7.4 on Second Pilot Summary Report and System Development; D7.5 on Third Pilot summary report and System developing. Also, the Deliverables D1.3, D1.4 and D1.5 on Risk & Opportunities are analysed in the context of the Assessment.

3.4.3. Results

Participants: Technical partners were asked after testing the ASSISTANCE technology in the three pilots. The following partners filled in the Questionnaire: UC; CATEC; CNBOP-BIB; VIASAT; UPV; ETRA. Their role was: WP leaders, End User and Platform Provider, UAV developer and integrator, wearable sensors developer and Project manager coordinator.

Technologies used and evaluated in the Assessment: UGV with sensor and autonomy capability; VR platforms; Wearable sensors; UAV-based video streaming and swarming for extended wireless coverage, UAV capture, Situation Awareness Platform (SAP), Mobile SAP.

Processing and categories of personal data: The most executed operations of processing personal data were collection, recording, storage and use (Figure 23).

Personal data were collected by Partners though wearable cameras, videos from drones integrated in the SAP and shown though the HMI. Not all the Partners collect personal data during the pilots and in using the ASSISTANCE technologies. It is worth to be mentioned that the other personal data, such as name, surname, organisation and contact details, are only collected to ensure the participation in the pilot. During the pilots, special categories of data are not collected.

In any case, the technologies used by ASSISTANCE can collect relevant information about human beings involved in rescue operation. As the pilots showed though, the platforms implemented by the technical Partners, the drones and cameras can detect injured people and, therefore, collect data concerning health. Moreover, the technologies mainly captured images, video, sound recording. However, these were not linked to the identity of individuals (Figure 24) and are used only to get an overview of the rescue operation and, in some cases, were not even stored, but just live streaming on the platforms.

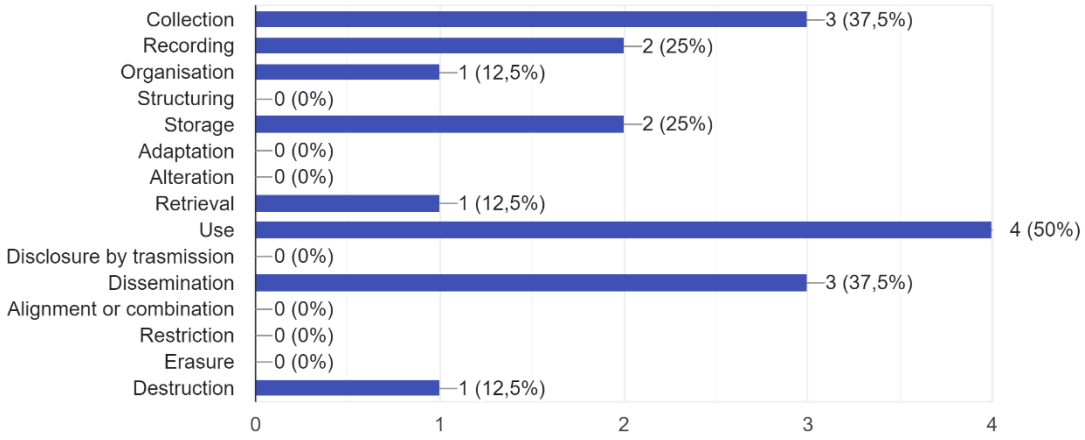

Figure 23: What operations of processing of personal data are performed by partner?

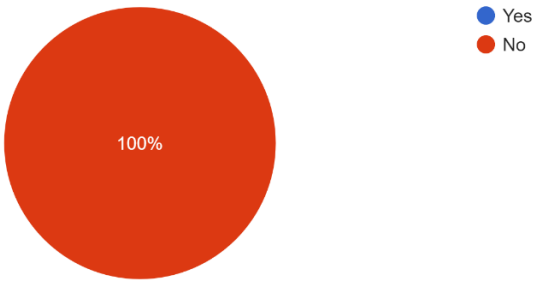

Figure 24: Does the Partner allow to link the face acquired from photographs and videos to the identity of person?

Focus on storage and transfer of data: A particular attention should be paid on the retention period and transfer of collected data by technologies. Regarding retention, it has been clarified that some technologies - such as platforms - do not to store data, but only collect data. Other technologies, on the other hand, collect and store information, including images, and use it to achieve a general view of the rescue operation. Note that the retention period for personal data must comply with the requirements of the GDPR and only for as long as necessary for the purposes informed to the data subject. Retention period must also comply with European security regulation, such as the Law Enforcement Directive ("LED"). Considering the above, while using ASSISTANCE technologies in the future and possible rescue operations, data retention provisions must necessarily be complied with, taking into consideration the issues related to safeguarding the vital interests of human beings involved.

With regard to the transfer of data, according to the information gathered during the Project, ASSISTANCE technology enables communication between all operators whose intervention is required to support the rescue operation. If during a rescue operation, personal data (pursuant to the Article 4, n. 1, of GDPR) are collected and transferred between the operators, the appropriate security measures must be applied, in order to ensure that there is no unlawful dissemination of data, and possible consequent risks to the rights and freedoms of individuals involved. Moreover, the transfer of data must be carried out exclusively to comply with the purpose of protecting vital interests threatened or affected during the rescue operation.

Legal basis for processing personal data: All the activities carried out during the pilots involving human participants were performed, considering the application of data protection regulation. Before the participation in the pilot, an Information Sheet and a Consent form, created by E-LEX, were released to all the participants/volunteers. Precisely, the Information Sheet provided detailed information about:

- the ASSISTANCE project, such as a description of the Project and its purposes;
- the pilot to which the volunteer participates, such as a description of the Pilot, including, the scenario, the place and the date in which the pilot takes place;
- the information and the contact details of the data controller. Pursuant to the Article 4 of GDPR and the privacy structure of ASSISTANCE Project, the data controller is the partner leading the pilot, which is interested in collecting and processing the personal data of the volunteer;

- the processing of personal data. In all the pilots, name, surname, contact information of the volunteer are collected, in order to ensure the participation in the pilot. Other data, such as geolocation, data concerning health and body temperature are collected anonymously. For these data, the partner cannot link the information to the identity of the volunteer;
- the images, videos and sound recordings are anonymized and therefore, not linked to identity the individual;
- the transfer and the storage of personal data, specifying that the data can be transferred only to comply to legal obligation and are stored for the length of the project;
- the exercise of the rights, provided in the articles 15-20 of GDPR, such as the access to personal data, the alteration, the erasure etc.

On the other hand, the Consent Form provided evidence of participant's agreement, including:

- a statement of declaration to have read the Information Sheet and to have had the opportunity to ask questions;
- a statement of agreement in participation;
- an authorisation to take and use images, videos and sound recordings during the Pilot and for the purposes of the ASSISTANCE project.

The Information Sheet adequately informed all the volunteers about the processing of their personal data, pursuant to Article 13 of GDPR and the Consent form adequately provided evidence of the consent to the participation and to the collection of images, videos and sound recording, pursuant to Articles 6 and 7 of GDPR. Indeed, the participants were informed about the voluntary nature of their participation, the degree of risk and burden involved in the participation, the procedures that will be implemented during the pilot scenarios. The participants were also informed of the possibility to ask questions and receive understandable answers before deciding to participate in the pilot.

However, the processing of personal data, including the special categories, though the ASSISTANCE technology, during a real rescue operation, will not take place through the provision of a previous consent by individuals. Indeed, the legal basis to cover all the processing of data should be the protection of vital interests and the purposes of public order and public security. Pursuant to the Article 6, par. 1, lett. d), processing is lawful when it is necessary to protect the vital interests of the data subject or of another natural person. Specifically concerning the vital interests, Recital 46 of the GDPR states "*the processing of personal data should also be regarded to be lawful where it is necessary to protect an interest which is essential for the life of the data subject or that of another natural person. Processing of personal data based on the vital interest of another natural person should in principle take place only where the processing cannot be manifestly based on another legal basis. Some types of processing may serve both important grounds of public interest and the vital interests of the data subject as for instance when processing is necessary for humanitarian purposes, including for monitoring epidemics and their spread or in situations of humanitarian emergencies, in particular in situations of natural and man-made disasters*".

In its Opinion 06/2014, the Article 29 Data Protection Working Party had already examined this case, as the legal ground was limited to cases in which the processing of personal data is necessary to protect the vital interests of the data subject. The application of such legal basis should be limited to life-or-death situations, or, at least, to cases where there is a risk of injury or other damage to the health of the data subject.

Additionally, concerning the special categories of data, Article 9, lett. c) GDPR provides that "*processing is necessary to protect the vital interests of the data subject or of another natural person where the data subject is physically or legally incapable of giving consent*". Considering the rescue operations, human beings' data are going to be processed under the legal basis of vital interest, thus the life and/or the physical integrity of human beings are threatened. Therefore, technologies were adequately compliant with the data protection regulation and can be used to collect information and data about human beings involved in rescue operations to protect their vital interests.

GDPR principles: All the data were processed only and exclusively for the purposes and within the limits of the project, in compliance with Article 5 of GDPR. In particular:

- the lawfulness, fairness and transparency. The data are collected to allow the participation in the pilot and the participants express their consent and authorisation to participate;
- purpose limitation. As stated, the data are only processed for the Assistance purposes and allow the partner to collect relevant information about the functionality of the technologies;
- data minimisation. Partners collect only data that are necessary for the processing purposes;
- accuracy. The volunteers receive the information related to the exercise of their rights, included the right to erase or rectify data that are not accurate or complete;
- storage limitation. The data are stored only for the necessary period to comply the purposes and for the length of Assistance Project. Some information, particularly images depicting groups of people, may be used for dissemination purposes after the project is completed.

Therefore, in a rescue operation scenario, the ASSISTANCE technologies implemented may collect data in compliance with the principles of GDPR. Indeed, regarding the lawfulness, fairness and transparency principles, all the data may be collected in order to save lives and/or to protect vital interest of human being. The technologies are able to collect only the minimised and relevant information to manage the rescue operation. In most cases, moreover, the images and videos are exclusively needed to have an overview of the rescue operation and to communicate with the health services.

Security measures: Technical partners implemented appropriate technical and organisational measures and ensure adequately a level of security appropriate to the risk (Figure 25). In particular, pursuant to Article 32 GDPR and the Article 5, par. 1, lett. f), the technical and organisational measures adopted by Partners are: anonymisation, data breach procedure, minimisation, operating security, backups, physical access control, hardware security.

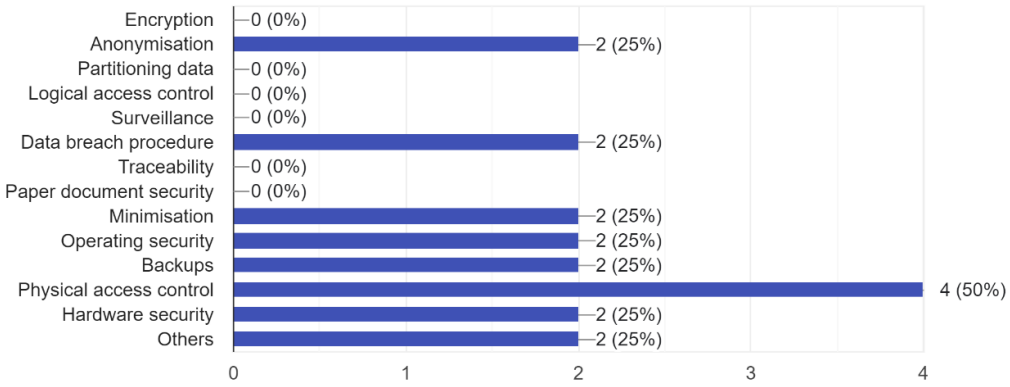

Figure 25: What are the security measures implemented by the Partner?

Specifically, in compliance with the principle of integrity and confidentiality, during the pilots, the data concerning the individuals, as well as the images, videos and sound recording are anonymised, in order to ensure appropriately security of personal data, against unauthorised, unlawful processing and loss, destruction or damage.

The anonymisation, therefore, consists in an appropriate security measure. The GDPR distinguishes the anonymisation from the pseudonymisation. According to Recital 26 of the GDPR:

"*the principles of data protection should apply to any information concerning an identified or identifiable natural person. Personal data which have undergone pseudonymisation, which could be attributed to a natural person by the use of additional information should be considered to be information on an identifiable natural person. To determine whether a natural person is identifiable, account should be taken of all the means reasonably likely to be used, such as singling out, either by the controller or by another person to identify the natural person directly or indirectly. To ascertain whether means are reasonably likely to be used to identify the natural person, account should be taken of all objective factors, such as the costs of and the amount of time required for identification, taking into consideration the available technology at the time of the processing and technological developments. The principles of data protection should therefore not apply to anonymous information, namely information which does not relate to an identified or identifiable natural person or to personal data rendered anonymous in such a manner that the data subject is not or no longer identifiable. This Regulation does not therefore concern the processing of such anonymous information, including for statistical or research purposes*".

Therefore, the measures implemented in the context of the ASSISTANCE technologies are compliant with the Article 32 of GDPR and ensure a level of security appropriate to the risk. Presently, the technical measures have been identified taking into account the risks presented by processing and with respect to the standards established by the guidelines and regulations on drones. In any case, it is recommended that the ASSISTANCE partners update the technical measures, based on the digital and technological evolution and in light of the drone industry standards-

3.4.4. Final assessment and mapping of the risk

Considering the above outcomes, ASSISTANCE and the related technologies should be assessed as compliant with the data protection regulation the Regulation EU 679/2016 ("GDPR"), the Directive EU 2016/680, European Data protection Board decisions.

The impact of technologies on the rights of the data subject was anticipated in Deliverable D8.5 based on macro categories of ethics risk considering the characteristics of the processing carried out by the use of technologies (Table 28).

GDPR	Ethics risk	Risk*
Right to be informed		
Article 12	No transparency of Information	***Low***
Article 13 (1) and (2) and Article 14 (1) and (2)	No content of Information	***Low***
Article 13 (1) and Article 14 (3)	Insufficient time of providing Information	***Low***
Article 12 (1), (5) and (7)	Poor means of providing Information	***Low***
Article 13 (2) (d) and Article 14 (2) (e), Articles 77, 78 and 79	No satisfaction of right to lodge a complaint	***Low***
Right of access		
Article 15 (1)	No satisfaction of right of access to one's own data	***Low***
Right to rectification		
Article 16	No rectification of inaccurate personal data	***Low***
Right to erasure		
Article 17 (1)	No erasure of personal data	***Low***
Right to restriction of processing		
Article 18 (1)	No satisfaction of right to restrict use of personal data	***Low***
Article 19	No notification	***Low***
Right to object		
Article 21 (1)	No satisfaction of right to object due to the data subject's particular situation	***Low***
Article 21 (2)	No satisfaction of right to object to use of data for marketing purposes	***Low***
Article 21 (5)	No satisfaction of right to object by automated means	***Low***
Rights related to automated decision-making and profiling		
Article 22	No satisfaction of right related to automated decision-making and profiling	***Low***
Article 21	No satisfaction of right to object automated decision-making	***Low***
Article 13 (2) (f)	No satisfaction of right to a meaningful Explanation	***Low***
Compliant organizational and technical measure		
All	Failure in implementing the measures foreseen in D10.7 of ASSISTANCE	***Low***
All	Unauthorized access, exfiltration or destruction of personal data	***Low***
* ***High; Medium; Low***		

Table 28 Ethics risks map.

3.5. Societal

3.5.1. Motivation

The application of technologies and solutions required the assessment and evaluation from a societal perspective. The process described here is a scenario build technique to recognise practical and future effects of the project developments. It consisted of collecting the reactions, perceptions and opinions of end users after facing/using the ASSISTANCE Technologies during the pilot demonstrations. The main aim was to examine whether the project developments had the potential to positively change the way and conditions in which First Responders are doing their job.

3.5.2. Method

An online survey was created by RISE and UC for the evaluation of the tested technologies for the pilot demonstrations (Pilot 1 in Izmir, Turkey; Pilot 2 in Rotterdam, Netherlands and Pilot 3 in Linares, Spain). The questionnaire has three main sections: Usability, Usefulness and Societal Impacts. Note that that usability and usefulness are evaluated in D7.6. Here we report on the Societal Impact section. Three constructs were defined. The first construct was the change perceived by end-users after using the tested technology, the second construct was the perceived benefits of the technology and the third construct reflect the intention of using the tested technology. Table 29 shows the survey questions and the related available answers. A 5-point Likert scale was used to measure the statements of Items Q1-Q8 (1=strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree) whereas a rating scale from 1 to 10 was available for questions Q9-11.

Construct	Item
	For each of the following statements mark the alternative that best describes your overall experience of the ASSISTANCE platform today.
Change	Q1.-It is likely to modify our usual ways of doing the job
	Q2.-It helps us to learn new ways to deal with disasters
	Q3.-It provides new information to make decisions
Benefit	Q4.-It makes our job easier
	Q5.-It reduces the workforce needed while improves efficiency
	Q6.-It increases the protection of First Responders
	Q7.-It reduces stress and prevents risk taking behaviours
	Q8.-It is safer and more effective than human interactions
	On a scale of 1 (low) to 10 (high) rate...
Use intent	Q9.- the importance of this technology for your job
	Q10.-to what extend you are willing to use this technology
	Q11.-to what extend you are willing to recommend this technology

Table 29 Items used for the Societal Impact assessment during the pilot demonstrations.

We conducted a Confirmatory Factor Analysis (CFA) to check the relationship and consistence between observed variables (Q1-11) and their underlying latent constructs (Change, Benefit and Use intent).

Internal consistency between the items was measured as well using Cronbach's alpha indicating a good reliability (Change α=0.78; Benefit α=0.87; Use intent α=0.86).

Figure 26 shows the model relationships as well as factor loadings. The adequacy of the model was assessed using a number of fit measures (Table 30). The chi-square is insignificant so the observed data can be closely patterned by the hypothesized model. Other measures (TLI and CFI >0.90; RMSEA and SRMR ≤0.05) indicate a good fit of the model.

In relation to the positive changes of the ASSISTANCE technology, the ability of this technology to provide new information for decision making is the more important indicator (β=0.91, SE=0.11, *p*<.001) followed by the possibility to learn new ways to deal with disasters (β=0.87, SE=0.11, *p*<.001). Job conditions (β=0.89, SE=0.11, *p*<.001), protection (β=0.87, SE=0.11, *p*<.001) and preventing stress and risk-taking behaviours (β=0.81, SE=0.11, *p*<.001) are the main perceived benefits of the ASSISTANCE technologies. Use intent is mainly driven by recommending the technology (β=0.93, SE=0.11, *p*<.001). These factor loadings are large, suggesting a clear relationship between the items and constructs. The readers may take this model into account when checking the presented results.

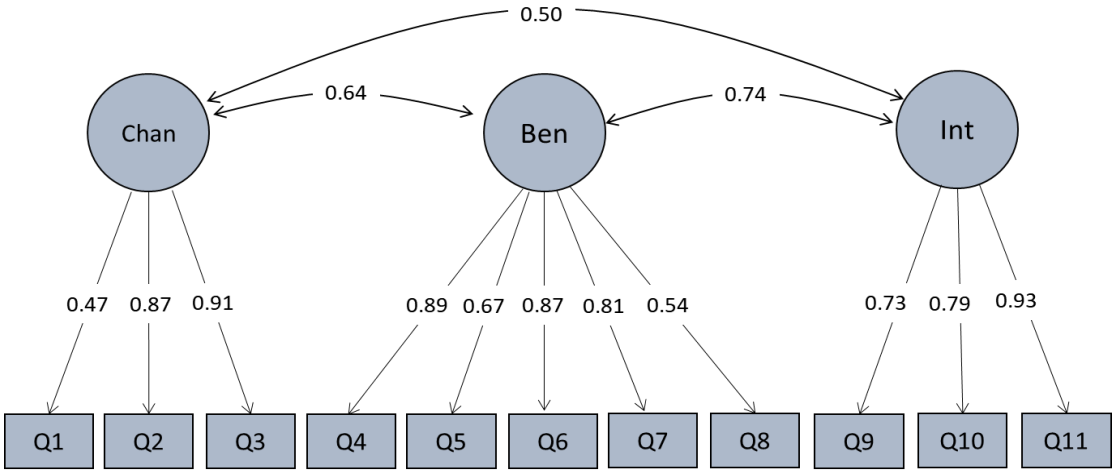

Figure 26: Path diagram for the societal impact assessment of the ASSISTANCE technologies. Chan= Perceived positive changes; Ben= Perceived benefits; Int=Use intent.

Fit measures	
Chi-square	47.42
p-value	.22
df	41
Tucker-Lewis Index (TLI)	0.97
Comparative Fit Index (CFI)	0.98
Root mean square error of approximation (RMSEA)	0.05
Standardized root mean square residual (SRMR)	0.05

Table 30 Fit measures of the model for the societal impact assessment of the ASSISTANCE technologies.

3.5.3. Results

Participants: In total 51 end-users (male=36; female=15) responded to the questionnaire after facing/using the ASSISTANCE technology during the three pilots. Table 31 displays the characteristics of respondents. Most were firefighters (68.63%), with > 16 years of experience (62.74%) and worked in the frontline (60.78%).

Variables	Data
Country n (%)	
Turkey	11(21.57)
Sweden	13(25.49)
Poland	5(9.80)
Netherlands	14(27.45)
Spain	7(13.73)
Type of service *n* (%)	
Firefighters	35(68.63)
EMS	12(23.53)
Police	3(5.88)
Other	1(1-96)
Years of experience in service *n* (%)	
<2year	5(9.80)
2-5 years	6(11.76)
6-10 years	4(7.84)
11-15 years	4(7.84)
16-20 years	13(25.49)
>20 years	19(37.25)
Current position n (%)	
Commander	8(15.69)
Team leader	12(23.53)
First Responder	19(37.25)
Trainer	3(5.88)
Manager	4(7.84)
Other	5(9.80)
Years of experience in the current position *n* (%)	
<2year	4(7.84)
2-5 years	11(21.57)
6-10 years	12(23.53)
11-15 years	7(13.73)
16-20 years	9(17.65)
>20 years	8(15.69)

Table 31 Characteristics of the ned-users who participated in the survey.

Change: The first set of questions was related to the perceived changes and new insights generated by the proposed technology:

- Q1.-It is likely to modify our usual ways of doing the job.
- Q2.-It helps us to learn new ways to deal with disasters.
- Q3.-It provides new information to make decisions.

Frequencies of responses are shown in Figure 27. The idea that the technology will change the usual ways of doing the job was supported by 56.86% of end-users whereas 35.29% remained neutral in relation to this question. Note that this question simply expressed a change rather than a positive change. Interestingly, most practitioners (84.31%) confirmed that the proposed technology improves learning (Q2) and decision making (Q3) for disaster response.

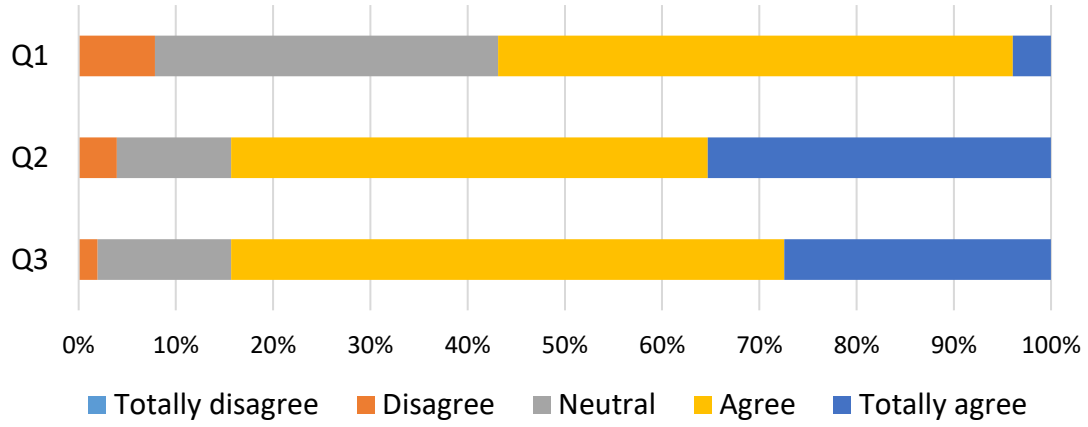

Figure 27: Practitioners assessment of the ASSISTANCE technologies: Positive changes in job (Q1), learning (Q2) and decision making (Q3).

Benefit: The next set of questions was oriented to the direct benefits perceived by the end-users after having contact with technology. This construct has five key questions:

- Q4.-It makes our job easier
- Q5.-It reduces the workforce needed while improves efficiency
- Q6.-It increases the protection of First Responders
- Q7.-It reduces stress and prevents risk taking behaviours
- Q8.-It is safer and more effective than human interactions

Frequencies of responses are shown in Figure 28. The most important finding is that 71% of end-users considered that the ASSISTANCE technology will protect them during their operations because this is one of the main objectives of the project. Also 61% agreed that the tested technology will make their job easier and therefore their working conditions. Around half of the end-users agreed that the proposed technology will decrease stress and risk-taking behaviours (51%) and reduce the workforce while improving the efficiency (51%). This is a very good finding as most First Responders are conservative in relation to the potentials of technology to change their behaviour and performances. That is why only 39% perceive this technology as safer and more effective than human interactions. These results are in line with previous findings reported in this deliverable concerning the trust and confidence on technology (see Section 2.1.2).

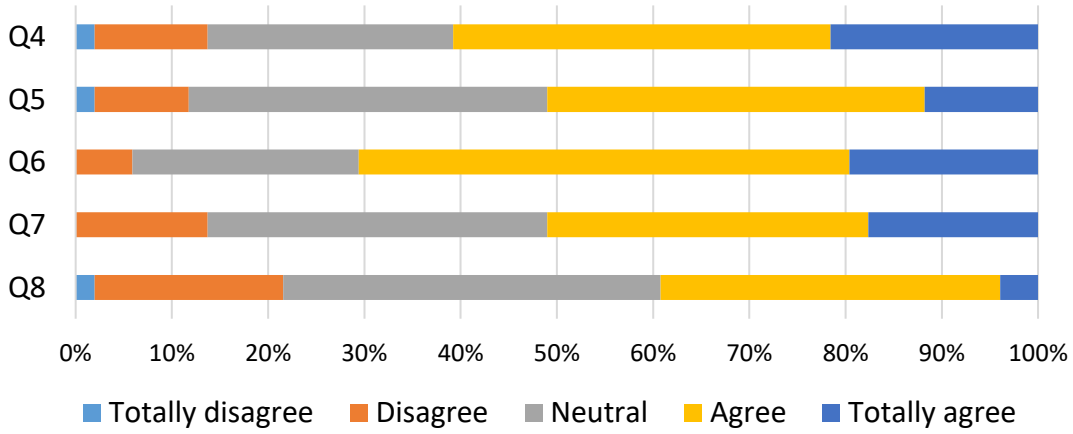

Figure 28: Practitioners assessment of the ASSISTANCE technologies: job easier (Q4), workforce and efficiency (Q5), protection (Q6), stress and risk-taking (Q7) and better than humans (Q8).

Use intent: The last set of questions tried to capture the practitioner's impressions about the overall importance of the ASSISTANCE system and their willingness to use it. The end-users were asked to provide a personal rate from 1 to 10 for the following questions:

- Q9.- the importance of this technology for your job
- Q10.-to what extend you are willing to use this technology
- Q11.-to what extend you are willing to recommend this technology

Figure 29 shows the proportion of end-users and the scores they assigned that were used to measure the intent use of the ASSISTANCE Technology. Results showed that on average the technology was rated quite high (Q9: Mean=7.57; SD=1.72; Q10: Mean= 7.61; SD= 2.07; Q11: Mean=6.90; SD=2.5972) suggesting that overall end-users were motivated to use it.

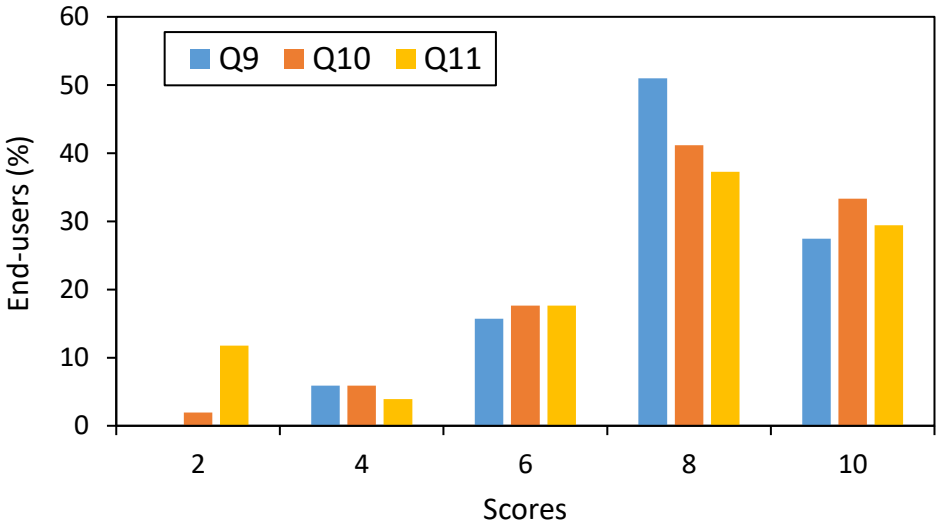

Figure 29: Practitioners assessment of the ASSISTANCE technologies: Importance for the job (Q9), intention to use (Q10) and intention to recommend (Q11).

Additional results: During the second pilot in Rotterdam, we conducted two questionnaires. The first questionnaire focused on the reported experiences of the end users (n=22) with the technologies they currently used. The second questionnaire focused on the reported experience of end users (n=15) with the ASSSTANCE Technology. The items of the questionnaires are displayed in Table 32. This allowed us to compare/contrast the results of both questionnaires to examine whether the ASSISTANCE technologies produced an actual change in end-user responses. In this analysis the alternative hypothesis is that scores from the 2nd questionnaire (ASSISTANCE technologies) are higher than those collected from the 1st questionnaire (current technologies).

Results suggest that, according to the end-users, the ASSISTANCE technology has improvements on the knowledge to deal with disasters (Q2 and Q3) and the safeguard of First Responders (Q6 and Q7) when compared with the current technologies (Table 33). These societal impacts are perfectly aligned with the purposes of the project.

1st questionnaire: The technology I current use… 2nd questionnaire: The ASSISTANCE technology…		Available options
Q0	…is compatible with our practices and routines.	*1=strongly disagree* *2=disagree* *3=neutral* *4=agree* *5=strongly agree*
Q2	…helps us to learn new ways to deal with disasters.	
Q3	…provides new information to make decisions.	
Q4	…makes our job easier	
Q5	…reduces the workforce needed while improving efficiency	
Q6	…increases the protection of First Responders.	
Q7	…reduces stress and prevents risk taking behaviours	
Q8	I prefer this technology rather than human interactions	

Table 32 Items to compare attitudes of end users towards technology they used and the ASSISTANCE technology.

Item	1st Questionnaire Mdn(IQR)	2nd Questionnaire Mdn(IQR)	Statistic (W)	*p*-value
Q0	4(0.75)	3(1)	129.5	.89
Q2	3(1.75)	4(0.5)	283.5	**<.001**
Q3	3(2)	4(0)	248.5	**<.001**
Q4	4(1)	4(1)	2.517	.40
Q5	3(1)	4(1)	207.5	.08
Q6	3.5(1.75)	4(0.5)	221.5	**.03**
Q7	3(2)	4(1.5)	235.5	**.01**
Q8	3(0)	3(1)	182.5	.27

Table 33 Median and IQR (Interquartile range) of responses for the 1st and 2nd Questionnaire and Mann-Whitney U test results (one tailed). Significant *p*-values in bold (α=0.05).

3.5.4. Assessment

This study represented the core of societal impact assessment of the ASSISTANCE technologies and solutions. End-users provided their impressions from a societal perspective (perceived positive changes, perceived benefits and use intents) after directly interacting with the technologies during the pilots.

A first general insight, based on the results of this study is that end-users perceived that ASSISTANCE technologies will improve several aspects of their current situation as First Responders i.e. working conditions, health & safety and well-being. The most striking improvements were found to be associated with learning, decision-making and protection. Nevertheless, the proposed technologies did not produce a clear change in the overall attitudes towards technologies in terms of trust and confidence. It is argued here that this societal change is cultural in nature and needs a long-term vision based on further experiences with more technologies.

4. Conclusions

WP8 aimed at considering the need for tackling non-technological issues of the ASSISTANCE project. Rather than focusing on side effects of instrumental (technological and legal) safety and security measures, we concentrated on a societal impact from the very beginning of the project, using a multidisciplinary approach from different perspectives, including active participation of end-users or First Responders (decision-makers and ground level staff), and citizens in the research process.

A Societal Impact Assessment (SIA) methodology was proposed and used. The SIA perspective contributed also to find new solutions and adjust and focus research targets. We advanced the potential effects of the overall project on society. A list of likely impacts was defined and used as a benchmark for further research within the project. The most likely impacts involved changes in health and safety, protection, decision making, training and working conditions. Past experiences of First Responders were also investigated to get valuable information about the needs and expectations of end-users and also their attitudes towards technologies for the subsequent technology assessment. An important focus was the study of EU citizens to check how they perceive disasters and what are their attitudes toward preparedness. Although not directly related to the project outcomes, this study allowed us to understand the importance of citizens participation in disasters response, thus improving First Responders capabilities.

Rather than a gender focus project ASSISTANCE is a gender related project. Gender Dimension was introduced and applied at two levels: the First Responders and the citizens. Gender differences and similarities were found allowing us to provide new insights of this societal issue. The gender analysis allowed us to assess differences in vulnerabilities, perception of threats and risks, resilience and coping strategies as well as checking that the ASSISTANCE solutions fit to gender perspectives.

The final assessment of the ASSISTANCE project and its proposed technologies and solutions was conducted through a proposed methodology (the GELS Toolkit) allowing us to evaluate non-technical impacts from gender, ethics, legal and societal perspectives.

A focus group centred on gender aspects of the project and the developed technologies was conducted. We identified that there still exists gender stereotypes in the context of disasters response and we confirmed that the project and its outcomes are compliant with gender expectations.

Ethical implications of the project and its technologies were analysed by conducting three focus groups i.e. relationship between individuals, communities, and teamwork. fundamental dynamics that impact on human rights were investigated (i.e. self-perception, sense of autonomy, communication between team members and with victims, the ability to coordinate and organise team actions, the ability to promptly respond in a high-stress situation and the transmission of information). We identified strengths and weaknesses that emerged from this analysis.

Legal monitoring and evaluation were conducted thus confirming that the project complies with regulations and has low risks considering the characteristics of the processing carried out using technologies.

Societal impacts of the ASSISTANCE technologies were assessed by the end-users who reported potential improvements and benefits of such solutions on their well-being, sense of protection and working operations. However, despite the willingness to use the technology there is still a lack of confidence in the efficiency of technologies for disaster response (e.g. technology replacing humans in certain tasks and decision making).