D3.5 - Multi-level stakeholder engagement analysis, including impact analysis

WP3 - Requirement Analysis, Engagement of Professionals through Communities of Practice and Social Engagement

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ABSTRACT	Through the analysis of data gathered in ex-ante and ex-post surveys, interviews, participation statistics and content from CoP meetings, this deliverable evaluates the implementation and impact of the multi-level stakeholder engagement framework of the PathoCERT (Pathogen Contamination Emergency Response Technology) EU H2020 project, through the lens of an adapted Theory of Change framework.			

Document History

VERSION	ISSUE DATE	STAGE	DESCRIPTION	CONTRIBUTOR
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ABBREVIATIONS/ACRONYMS

FR	First responders
CoP/CoPs	Community of Practice/Communities of Practice
PathoCERT	Pathogen Contamination Emergency Response Technologies
SOP	Standard Operating Procedure
ToC	Theory of Change

Executive summary

PathoCERT (Pathogen Contamination Emergency Response Technologies) is an EU H2020 funded project focusing on enhancing the capabilities of first responders to prevent, mitigate, respond and recover from emergency situations, specifically, those that entail waterborne pathogen contaminations.

This report analyses the outcomes a series of qualitative research and engagement activities conducted with an array of key stakeholders in the PathoCERT pilot cities/regions with the aim of assessing the impacts that the project has had on awareness raising and knowledge sharing among those actors, with the ultimate objective of enhancing their preparedness and responsive capacities through innovative technological solutions and toolkits, during multiple and unexpected dangers.

Accordingly, the report starts by describing the PathoCERT multi-stakeholder engagement approach, providing an overview of the conceptual framework used in the project, including the implemented Community of Practice (CoP) structure in pilot city/region, as well as the engagement of additional key experts and citizens. Following, section 3 explores the analytical framework used for the impact assessment, namely the Theory of Change developed for this purpose, as well as setting out an overview of the data sources and collection methods. In section, 4 data collection and analyses are provided in detail, looking at each data source in turn, including country profiles for the first responders (FRs) surveys, as well as cross-country analysis. Then section 5 concludes with an overview of the main findings and learnings from the evaluation of the PathoCERT multi-stakeholder engagement approach and activities. The below provides an overview of the key results of the conducted analyses.

Research question	Key findings
Through opportunities to become more familiar with new technologies and their use in CoP meetings, to what extent are FR more prepared to deal with emergency situations?	**Positive attitude towards new and existing technologies** • A clear trend across all countries is the positive attitude towards existing and in-use technologies. • Respondents have indicated that new technologies are useful in their jobs and would use them if available. Most respondents also indicated that technologies provide a feeling of safety in the field. **Building and expanding trust** • Most respondents agree or strongly agree that new technologies are reliable in case of emergencies. Most respondent agree that they would trust the information generated by new technologies to keep them safe. • However, few respondents also indicated worries in terms of use of data especially regarding technologies that collect geo-spatial data that might be stored and used without authorisation.
Through CoP opportunities to explore potential emergency scenario responses, to what extent are FR more	**Implications of scenario exercises' frequency** • Across all countries, respondents agree and strongly agree that simulation exercises allow them to more easily start using new technologies **Perceived benefits of scenario exercises**

supported to tackle challenges?	• Across all countries simulation exercises are perceived as useful in preparing for emergency events and thus also pinpoint to the importance to increase their frequency. • Respondents from all countries believed that there is a need for more clarity regarding the roles and responsibilities of each organization during an emergency event.
Through the creation of new communication channels with other stakeholders, through the CoP, to what extent are first responders more connected?	Strengths and weaknesses of existing networks • A trend across all four countries in both surveys is that during emergency events there is little communication with inter-governmental and supranational organisations. The role of CoPs in opening up new communication channels • The CoPs have played a crucial role in opening up new communication channels as they brought together numerous stakeholders outside of the FR field. There are, however, striking differences in the composition of the CoPs by stakeholder type. The distribution of stakeholder types per CoP location not only reflects differences in the local emergency response approaches, but also indicates the priorities of the local hosting organisation as to which stakeholders' participation was perceived as relevant for the success of the CoP Strengthening of connections between different actors • The main actors involved in emergency management are similar across countries. Overall expectations voiced are clear communication and collaboration as well as instructions and adherence to established procedures.

Table 1: Overall findings

Through the analysis of the PathoCERT multi-stakeholder engagement processes, while it has been clear that there are specific learnings and opportunities related to the context of each local CoP, there are a number of interesting cross-cutting learnings and insights. Looking at the data through the lens of three key questions about the awareness, preparedness and connectedness of First Responders, one can identify some clear impacts of the PathoCERT CoP process on the key actors involved. While this report explores the findings in detail, highlights to take forward from this experience include the importance of integrating new technologies into existing processes for their effective uptake and regular use, the importance of holding regular scenario exercises with key stakeholders in the local emergency response network (including regular clarification of roles and responsibilities), the high impacts on the implementation of new technologies of introducing them through a CoP framework.

Overall, the conducted analyses have enabled to portray a CoP as an effective tool to bring together people, processes and technologies, especially in the development of new technologies or ways of working, with the advantage that it can also help to highlight areas for improvement or future development, improving the experience of First Responders and key stakeholders, as well as the effectiveness of the emergency response system as a whole. This report compiled a complete overview of the derived data and information across the various multi-stakeholder engagement processes which could serve as an inspiration for those developing the CoP methodology for use in future projects, settings and contexts at the European level and beyond.

1 Background

Catastrophic natural or human made events occur on a regular basis across the globe. In 2022, historic floods in Pakistan affected 30 million people in the Sindh and Balochistan provinces, with climate change being named as the main cause for the calamity.[1][2] In Europe, forest fires burned 659,541 hectares of land between January and mid-August 2022, the highest amount for this time of the year since recording began in 2006.[3] In February 2023, regions in southern Turkey and northern Syria were hit by a devastating 7,8 magnitude earthquake causing the death of 47.000 people.[4] On February 3rd 2023, a train containing hazardous chemicals such as vinyl chloride derailed in Ohio, USA, contaminating air, water and soil.[5] These are just a few examples from a long list of emergency events - ranging from droughts, earthquakes and severe storms to coastal floods and landslides - that pose risks to our ecosystems as well as to humans, due to possible water contamination, threatening the health of the civil population and that of first responders operating in the field during the emergency event.[6]

The EU H2020 funded PathoCERT project focuses specifically on water-borne pathogen contamination events, with the aim of increasing the capabilities and coordination of first responders during such emergencies. Throughout the project novel, cost-effective and easily usable technological solutions have been developed to support first responders in their work enhancing their situational awareness and ability to rapidly and safely respond to unknown threats. Stakeholder engagement and pilot activities have been conducted in the project six pilot cities/regions, namely: Granada (Spain); Amsterdam (The Netherlands); Limassol (Cyprus); Thessaloniki, (Greece); Sofia (Bulgaria); and Seoul (South Korea) to test and validate developed technological solutions, bring together key stakeholders and identify economic, environmental, societal and policy challenges that will need to be addressed.

2 The PathoCERT Multi-Stakeholder Engagement Approach

2.1 The mandate, purpose & scope

In the PathoCERT project, stakeholder engagement is understood as an ongoing, inclusive dialogue among all relevant actors that can contribute directly or indirectly to improving the protection of FRs against multiple and unexpected dangers as well as enhancing their response capacities. Furthermore, it is seen as a process for agenda-setting and collective implementation of activities that are shaped according to local needs, challenges and areas of opportunity.

The overall mandate of the stakeholder engagement approach is to ensure the design and deployment of better services, processes and/or governance mechanisms with a higher likelihood

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[1] https://reliefweb.int/disaster/fl-2022-000254-pak

[2] https://www.theguardian.com/commentisfree/2022/sep/08/pakistan-floods-climate-crisis

[3] https://www.theguardian.com/world/2022/aug/15/wildfires-europe-burn-area-equivalent-one-fifth-belgium

[4] https://www.theguardian.com/world/2023/feb/20/thousands-dead-millions-displaced-the-earthquake-fallout-in-turkey-and-syria

[5] https://www.theguardian.com/world/2023/feb/15/ohio-train-derailment-palestine-toxic-chemical-leak

[6] https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

of effectiveness for managing emergencies. Simultaneously, this enables the deployment of solutions that are being shaped and respond to the needs of all concerned parties throughout the various stages of emergency management. Accordingly, the stakeholder engagement approach is a layered process, including a series of key steps: feedback provision; system scoping; sharing of knowledge and experiences; testing and experimenting; and dissemination and outreach.

- **Feedback provision** and exchange with key project stakeholders on project outputs results in project partners being able to understand the needs and perspectives of these stakeholders/beneficiaries in a more comprehensive manner, leading to the design of higher quality products and services with increased usability.
- **System scoping** is used to discover the project outputs' potential in practice, showcasing the potential existing challenges, barriers and opportunities to their wider deployment.
- **Sharing of knowledge and experiences** enables the generation, exchange and sharing of interdisciplinary as well as cross-border/country learnings and experiences, with the goal of maximizing reciprocal learning effects.
- **Testing and experimenting** with the technologies allows the FRs and other operational actors to interact with the developed technologies and tools, and give further feedback and suggestions, as well as to use them under realistic simulated scenarios.
- **Dissemination and outreach** have the function of promoting and disseminating the project and its outputs to the project's key stakeholders and beyond.

2.2 The PathoCERT Communities of Practice

To practically implement the multi-stakeholder engagement approach and drive the development and uptake of novel processes and tools on the ground, the concept of Community of Practice (CoP) is applied in PathoCERT in combination with a series of pilot testing activities in the six project focused cities/regions.
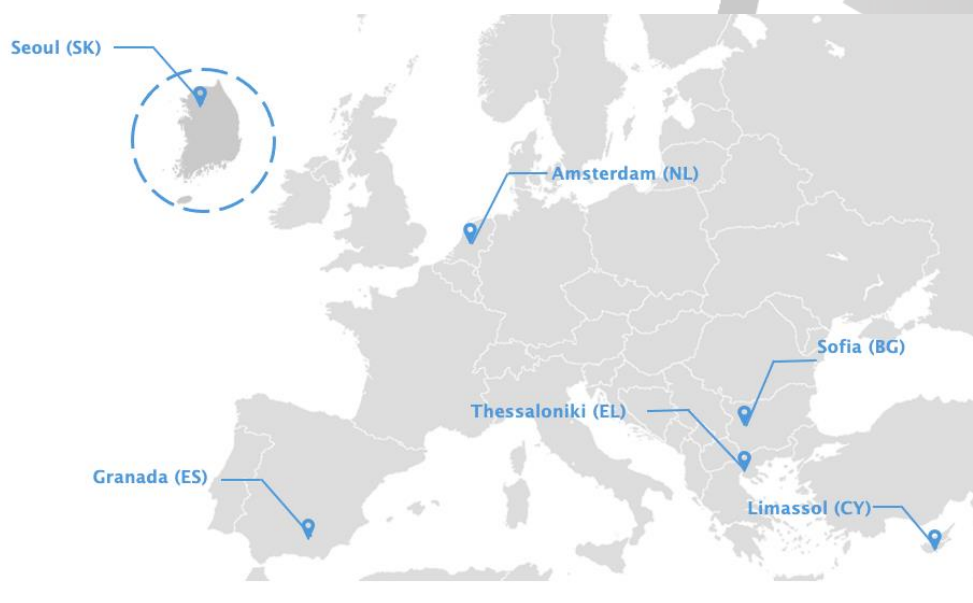

Figure 1: The PathoCERT Pilot Cities/Regions

A CoP can be defined as a structure that brings together a group of actors who share a common interest in a topic and come together to fulfil both individual and group goals. Accordingly, regular interaction is a crucial part of the methodology facilitated by regular face-to-face as well as online meetings of the key stakeholders of relevance to the PathoCERT project in each pilot area. Moreover, each pilot city/region focuses on specific pilot activities - defined via a baseline requirement analysis - which are also a central component of the PathoCERT stakeholder engagement process, since they evolve around pre-defined emergency events which could lead to water contamination and thus around a specific set of PathoCERT technologies.

Although common to each pilot city/region, the engagement approach and its components are applied in a flexible manner, with slight differences regarding the main stakeholders involved, the technologies considered most important given regional/national emergency management systems, existing technologies and processes in use.

In addition to these six local CoPs, in order to enhance the project and replication potential and further disseminate key experiences and learnings, a so-called pan-European CoP has been also set up within the PathoCERT project. This CoP in particular has been composed of selected representatives of the six regional CoPs and of other stakeholders that operate on a supranational level (e.g., Emergency Response Coordination Centre; Copernicus Emergency Management System; Health Emergency preparedness and Response Authority (HERA) and similar) including sister projects of PathoCERT, namely: **ULTIMATE Water**[7] and **Water Mining**[8].

The format and activities of the pan-European CoP are complementary to the overall setting and approach adopted for the local/regional ones with the difference that pan-European CoP meetings have been organised with the aim to enhance and best disseminate project´s knowledge, findings and key learnings and thus furthering the mainstreaming of PathoCERT outputs to actors operating in countries not directly addressed by the project pilot cities/regions.

2.3 Citizens & Local Champions Engagement

Furthermore, in PathoCERT, the multi-stakeholder engagement approach has been expanded in order to actively engage citizens. Due to their possible vulnerabilities and past direct and indirect experiences (e.g., living in certain prone-risk areas) citizens can be the repositories of precise knowledge with respect to water-borne contamination emergency situations and scenarios, and therefore, their cooperation is also a key for a successful handing of such emergency events.

Moreover, in many European countries, citizens directly support the management of an emergency event through volunteering and participating in responsive actions. This type of actor also represents a key stakeholder group that PathoCERT has engaged via the identification and commitment of so-called 'Local Champions`, defined in the project as "citizens known in the local communities as already knowledgeable and somehow active in the operating field of FR (e.g., fire-fighter volunteers)". These local champions have been acting not only as local ambassadors that facilitate the uptake of the project activities by a broader number of citizens, but they have been

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[7] It aims to create economic value and increase sustainability by valorising resources within the water cycle. Wastewater is not only a reusable resource but also a carrier for energy and components that can be extracted, treated, stored, and reused. Drawing on "Water Smart Industrial Symbiosis" (WSIS) we promote wastewater recycling in various industrial settings. The project focuses on the following industries: Agro-food processing; Heavy chemical/petro-chemical; Beverages& Biotech Industry.

[8] Water Mining focuses on the challenge of dwindling water supply and help ensure access to clean water and sanitation by exploring alternative water sources and developing innovative solutions for sustainable water management, including tapping into urban and industrial wastewater and seawater desalination.

also providing knowledge and expertise to project partners with respect to the on-the-ground testing of novel technologies as well as on societal issues concerning local communities' challenges and opportunities areas.

3 Impact Assessment: The Applied Analytical Framework

3.1 Building upon the Theory of Change

For the overarching structure of the impact analysis and evaluation process, the qualitative model of the `Theory of Change` (ToC) has been applied[9]. A theory of change is a framework that explains how a given intervention, or set of interventions, is expected to lead to specific development change, drawing on a causal analysis based on available evidence. Accordingly, the ToC can help to identify solutions to effectively address the causes of problems that might hinder progresses as well as reduce risks and thus guide decisions on which approach should be taken, considering comparative advantages, effectiveness, feasibility and uncertainties to ensure the approach will contribute to the desired change.

The ToC framework creates a journey through the breaking down of a project into different linked components:

- **Activities:** the practical activities which take place with stakeholders or within the team
- **Outputs:** the things that are generated or developed through implementation of activities
- **Outcomes:** the short-term changes which occur because of the outputs
- **Results:** the concrete change which is possible because of the outcomes
- **Impacts:** the long-term goals which can be reached through effective and sustainable results

To use a ToC approach in a project means that attention is paid to the different actions and layers of a project, especially in terms of understanding the logical flow of steps or pre-conditions to reach the ultimate desired impacts of the project.[10] One way of using a ToC approach is to start by setting out the desired impact of the project and then working backwards: e.g., which results would be needed to evidence the project contribution towards the impact? And to get those results, which outcomes would be needed? Which outputs will lead to those outcomes? And which activities will need to be implemented to generate those outputs? Additionally, inputs to activities can be considered as practical aspects needed to run activities.

Table 1 shows how a ToC framework has been applied to the PathoCERT multi-stakeholder engagement approach.

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[9] Source: https://www.theoryofchange.org/what-is-theory-of-change/how-does-theory-of-change-work/
[10] Source: *Ibid*

PathoCERT multi-stakeholder engagement approach – A Theory of Change			
Impact (2nd level)	The overall impact of emergencies is smaller in pilot locations		
Impact (1st level)	First responders are safer across pilot locations	FR across the pilot locations have the appropriate and effective tools, methods and capacities to use them	
Result	Ways of working and resources support the availability and use of PathoCERT tools and methods		
Outcome	FR are motivated to use tools, methods and are willing to engage in capacity building to use them effectively		
Outcomes (WP3 objectives)	Project activities have improved the protection of FR against multiple and unexpected dangers	PathoCERT activities have enhanced the operational capacities of FR through innovative technological solutions, toolkits and multi-stakeholder engagement methods	
Outputs	FR are more prepared – familiarity with scenarios (use of technologies according to emergency)	FR are more connected – sharing information and expertise more effectively within the local and international networks	FR are more supported – ability to work collectively to solve challenges (knowing, trusting, understanding who to contact in which situation, also for planning)
Activity (3rd level)	CoP meetings enable key stakeholders to come together in a locality		
Activities (2nd level)	FR have opportunities to become familiar with new technologies and reflect on how they could help them in their work	New communication channels between stakeholders – for information sharing and collective working	FR have the opportunity to explore potential emergency scenarios and the tools and methods they could use to overcome them, with other relevant stakeholders
Activities (1st level)	Tools and technologies	multi-stakeholder engagement/communication	Capacity building

Table 2: PathoCERT multi-stakeholder engagement approach – a theory of change

Within the PathoCERT impact analysis and evaluation process, the ToC has enabled project partners to gather key knowledge and learnings both within and between the development and testing phased of the PathoCERT novel technological solutions, thus allowing to validate various assumptions against available evidence and the perspectives of key stakeholders to ensure that the analysis is sound and that hose key assumptions are plausible, including aspects related to the role of key stakeholders. Hence, the ToC methodology has been applied to the PathoCERT impact analysis following four key steps[11]:

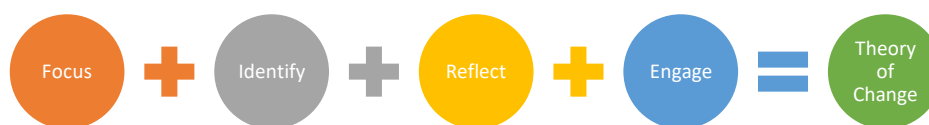[11] https://unsdg.un.org/sites/default/files/UNDG-UNDAF-Companion-Pieces-7-Theory-of-Change.pdf

Figure 2: Key steps of the PathoCERT theory of change

1. **Focus:** PathoCERT impacts on two layers, namely
   a. Impacts 1st level
   b. Impacts 2nd level
2. **Identify**: understand what is needed for the desired change to happen
3. **Reflect**: establish and make explicit the related key assumptions underpinning the theory of how change happens, and major risks that may affect it
4. **Engage**: identify partners and actors are most relevant for achieving each result, taking into account the related risks and assumptions

Building upon the ToC methodology, it was therefore possible to elaborate and focus on three central research aspects reflecting key outputs expected from the multi-stakeholder engagement activities and more specifically for the PathoCERT project from the activities directly involving and engaging first responders and:

- **Awareness** = familiarity with PathoCERT novel technological solutions
- **Preparedness** = practical knowledge on the use of the technologies
- **Connectedness** = interactions and communication channels

These three aspects cover the basis around which the reported impact analysis has been constructed answering the following key questions:

- *Through opportunities to become more familiar with* **new technologies and their use** *in CoP meetings, to what extent are FR more prepared to deal with emergency situations?*
- *Through CoP opportunities to explore* **potential emergency scenario responses***, to what extent are FR more supported to tackle challenges?*
- *Through the creation of* **new communication channels** *with other stakeholders, through the CoP, to what extent are first responders more connected?*

The insights derived from these questions have enabled the evaluation of the PathoCERT's impacts on the ground in broader terms of the role these new technologies can play in supporting first responders during their missions, and more specifically with respect to the emergency scenarios characterizing their respective city/region. Furthermore, the aspect of connectedness has been also considered as central, as being connected is central to a functioning and efficient emergency management system as it ensures seamless collaboration between different stakeholders involved such as first responders, government ministries, water authorities and civilians.

3.2   Data sources

Since multi-stakeholder engagement and co-creation activities are key to reach the mentioned PathoCERT's objectives and to provide answer to the mentioned three core research questions,

at the heart of this impact assessment, data have been derived from a number of qualitative and quantitative engagement methods, namely:

- Surveys conducted with First Responders
- Interviews with Local Champions
- Insights derived via the six PathoCERT Communities of Practice
- Exchanges and outcomes of the European Community of Practice

All these activities have been conducted accordingly to a specific timeline, enabling to assess project's impacts before and after the testing, and refinement of the PathoCERT technologies and processes.

The following table provides an overview of all qualitative research methods used and respective timeline applied.

Dataset	Data collection	Data analysis
First responder surveys (baseline and ex-ante) *Data collection: Jan 2022 – May 2023*	• For the baseline analysis a central survey was developed, translated into local languages of each pilot city /region • Disseminated via the SurveyMonkey application with the support of local partners' networks • Regular updates to local partners on how many responses, requests for further dissemination • The process was repeated for the ex-post survey, using the same structure/questions for comparative purposes • For the ex-post survey local partners disseminated the survey in a similar way, so broadly the same FR communities were targeted. We did include an extra question in the second survey in order to know the share of respondents which had also completed the baseline survey.	• Survey results downloaded • Descriptive analysis of results per question, per pilot city/region • Cross country analysis and data comparison
Interviews with Local Champions *Data collection: November 2022 – May 2023*	• Central interview guide and questions developed (including participant consent form) • Translated into local languages by local partners • Local CoP partners selected a number of Local Champions to be interviewed • Interview notes translated back into English and compiled into central database of responses	• Qualitative discourse analysis conducted
Insights derived via the six PathoCERT Communities of Practice	• Data collected from each CoP meeting via a common summary template prepared by CSCP • Data combined into central repositories of data • Previous deliverables D3.3 analysed the gathered data	• Relevant data from the CoPs compiled into central dataset • Descriptive data analysis of derived economic, societal and legal aspects

Exchanges and outcomes of the European Community of Practice *European CoP meetings: June 2022 and February 2023*	• European level CoP meetings held online for project partners from all countries and external stakeholders (including other water-related projects using CoP methodologies) • Discussion topics to explore and share best practice and learnings from different CoP experiences	• Notes from European CoP analysed in the context of overarching learnings from and potential of the CoP methodology

Table 3: Research methods and data sets

4 Overview: Data Collection & Analyses

4.1 First Responder Surveys: Structure & Data Collection

In order to gain knowledge and insights from the engaged first responders, two ad-hoc surveys (baseline & ex-post) were developed and launched in Sofia (Bulgaria); Limassol (Cyprus); Thessaloniki (Greece); and Granada (Spain) between January 2022 (launch of ex-ante baseline survey) and May 2023 (closing of ex-post survey) respectively to enable the assessment of possible changes in first respondents' awareness, knowledge, and communication as well as to better understand the possible impacts of the pilot-tested PathoCERT technologies and processes. Accordingly, the two surveys reported a similar structure with minor adjustments to the second version in order to best account for any extra differences. Due to differences in the local set-up and links to FR networks, we were unable to conduct the survey and analysis in the Netherlands and South Korea.

The surveys' questions have been developed on the basis of the outcomes and insights derived from baseline analyses conducted in each of the PathoCERT pilot city/region and initial CoP meetings outcomes aimed at identifying critical operational areas and key challenges. The design - closed-ended, multiple choice or checkbox questions – has been adopted in order to maximize participation and concurrently decreasing the risk of uncomplete answers. Participating in the surveys was always voluntary and no incentive for participation was offered.

The table below provides a summary of the key content of the two surveys divided by topic. The complete version of the surveys can be found in Appendix 1.

Survey topic	Inclusion in baseline and ex-post FR surveys
Demographic information	• Gender, age and highest education level (**both surveys**) • Did you fill in the previous FR survey? (**ex-post survey**, to identify how many respondents had filled in both)
Role/activities	• Which FR group are you working for, position/rank, duration of FR experience, paid/volunteer FR, territorial scale at which organization intervenes (**both surveys**)
Communication with other stakeholders	• Which main stakeholder groups do you communicate with during an emergency? (**both surveys**) • Do you find existing interactions with other key local and regional stakeholders efficient and sufficient? (**both surveys**)

	• What are the key communication channels currently in place to share information with other key local and regional stakeholders, including the public before, during and after an emergency event? (**both surveys**) • What are the main areas of improvements in the current information flow and communication with other stakeholder groups? (**both surveys**) • How does the communication within the organization and across involved organizations affect the FR's response in the emergency? (**both surveys**) • What do you need and expect from other stakeholder groups when dealing with a crisis? (**both surveys**)
Testing different scenarios	• Within your organization how often do simulation exercises (including tabletop exercises, drills, and orientation exercises) take place? (**both surveys**) • How well do simulation exercises help prepare you to face an emergency event? (**both surveys**) • Would you agree that simulation exercises allow you to easily start using new technologies? (**both surveys**) • What are in your opinion the most important benefits of these exercises (ranked by importance)? (**both surveys**)
Status quo of technologies available to FR and testing new technologies	• What are the technologies that are currently available to you and your organization during an emergency event and/or for pathogen detection? (e.g., field portable sensing devices) (**both surveys**) • Please use the scale to share your opinion on the following statements on technologies (difficult to use, outdated, effectiveness, feeling of safety on the field) (**both surveys**) • Complete the following questions thinking about using new technologies which can support emergency response (including, for example, PathoCERT technologies which are being developed to detect pathogens in water, provide geo-location data by drones, and collect and analyse relevant disaster-related data) (**both surveys**)

Table 4: Summary of key outcomes from the baseline and ex-post survey

The surveys were initially developed in English and then with the support of local partners translated into local languages (i.e., Spanish, Greek, Bulgarian) in order to reduce the risk of law participation on the basis of a language barrier. The survey was then administered via an online tool (Survey Monkey) to ease the access for the respondents while also enabling the derivation of graphs, tables and percentages.

4.2 First Responders Surveys: the cross-countries analysis

In order to account for the complexity of the answers received and to best analyse data, qualitative content analysis has been applied. It is a research method which examines textual data to single out patterns and structures to then derive categories and aggregate them into perceptible constructs. Text data might be in verbal, print, or electronic form and might have been obtained from narrative responses, open-ended survey questions, interviews, focus groups, observations, or print media such as articles, books, or manuals (Kondracki & Wellman, 2002).

Within this analytical approach an inductive content analysis was then applied to the PathoCERT first responders' surveys. This approach is generally used with a study design whose aim is to describe a phenomenon, in this case the level of knowledge, understanding and information of first responders with respect to emergency scenarios and novel technologies. Applied to our

specific analysis, it has enabled the identification of options that are most or least desirable and to discern first responders´ awareness, preparedness and connectedness levels.

Following, an initial overview was created with the main highlights and conclusions from the individual pilots, looking at each question separately. Through this process a basic understanding about the existing perspectives and opinions of each respondent was created. Nonetheless, given the objectives of the PathoCERT project, these analytical data where then combined through the conduction of a comparative analysis providing insights about the derived different results across pilot cities/regions helping to pinpoint the elements responsible for these differences and to underlie causal patterns and complexities. The below table provides an overview of the aspects that have been taken into account in the comparative analysis with respect to the baseline ex-ante survey.

Table of cross question analysis for the first survey

Needed communication improvements	Type of first responders Efficiency and sufficiency of stakeholder interactions Benefits of simulation exercises
Effect of communication on FRs response	Efficiency and sufficiency of stakeholder interactions
Simulation exercises to help face emergency events	Frequency of simulation exercises in organizations
General statements on technologies	New technologies to face emergency events
Frequency of simulation exercises in organizations	Benefits of simulation exercises Types of first responders
Simulation exercises and new technologies	New technologies to face emergency events

Table 5: Table of cross question analysis for the first survey

In the following sub-sections, first the results are summarized per pilot city/region and then cross-country analysis is reported.

4.2.1 Granada - Spain

Respondents of the Granada's baseline survey had an average age of 46, while in the ex-post survey 52 years with a completion rate of 65% and 59% respectively. In both surveys the majority of respondents worked as fire-fighters or in the civil defence department. In the baseline survey 70% of respondents have been in the job for more than 10 years, 24% between 1 to 5 years, and 6% between 5 to 10 years. While, in the ex-post survey, 91% and 9% of respondents have been in their jobs longer than 10 years and less than 1 year respectively. This socio-demographic data enabled a starting assumption that the majority of respondents have ample experience in their field and detailed knowledge of existing emergency processes and structures.

During an emergency event, first responders need to communicate with different stakeholders depending on the type of emergency. Via the baseline and ex-post surveys, it has been possible to identify that in Granada, governmental representatives, civil society, and media are central to be in contact with, during the type of possible emergency scenarios they might face. When asking whether the type and level of communication among and with those actors was perceived as sufficient, negative answers were provided in the baseline ex-ante survey, while some improvements have been identified on the same aspect in the answers provided in ex-post survey, as shown by the graphic below ().
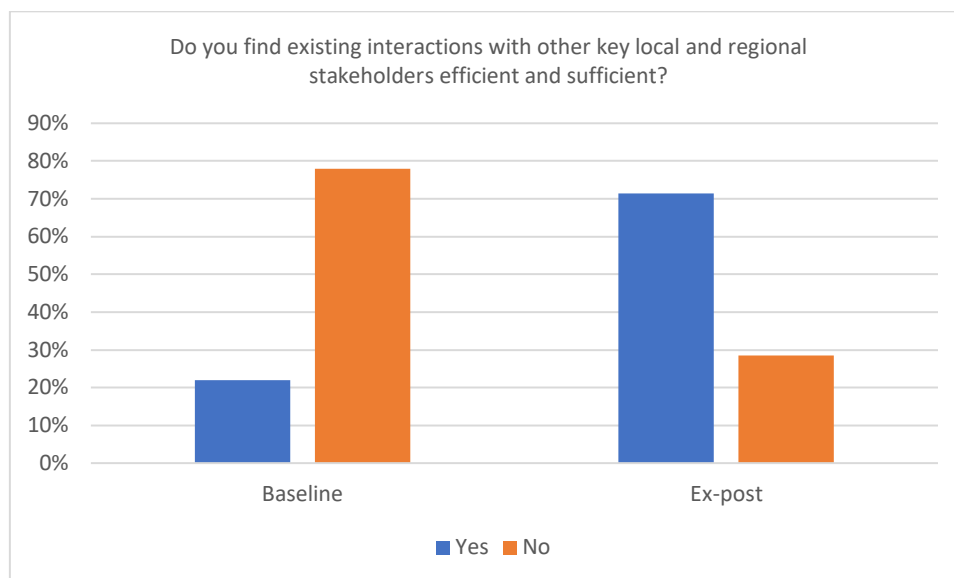
Figure 3: Granada, Spain: Do you find existing interactions with other key local and regional stakeholders efficient and sufficient?

Respondents in the baseline survey have identified: 1) *'bridging difference in organisational culture'* as the main area of improvement, followed by *'having more clarity on the roles and responsibility`; `improving interoperability`;* and *`having access to state-of-the-art technologies`* (). In the ex-post survey, the response distribution was more distinct, with *'improving interoperability'* and *'having access to state-of-the-art technologies'* identified as the crucial areas of improvement. *'Increasing transparency'* has been also mentioned as an area requiring changes thanks to the implementation of the PathoCERT activities.
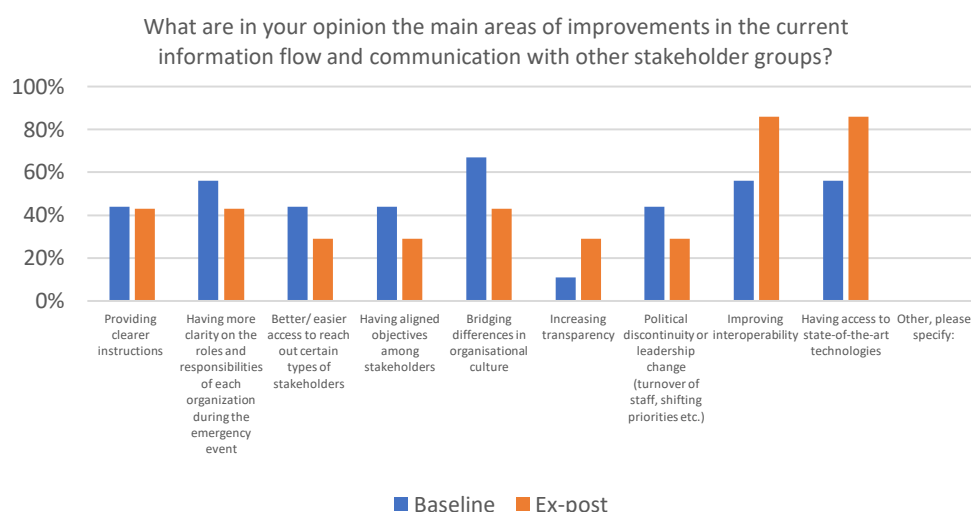
Figure 4: Granada, Spain: What are in your opinion the main areas of improvements in the current information flow and communication with other stakeholder groups?

It is also interesting to note that first responders from Granada indicated that they feel more connected to other actors in the defence mechanism now than at the beginning of the project activities, as it can been seen in Figure 5. This is an indicator that the PathoCERT multi-stakeholder engagement activities, such as the CoP meetings have contributed to narrow a communication

gap providing local actors with the opportunity to gather and exchange more often about common challenges, barriers as well as ex opportunity areas.

I feel sufficiently connected to the other actors supporting the defence mechanism
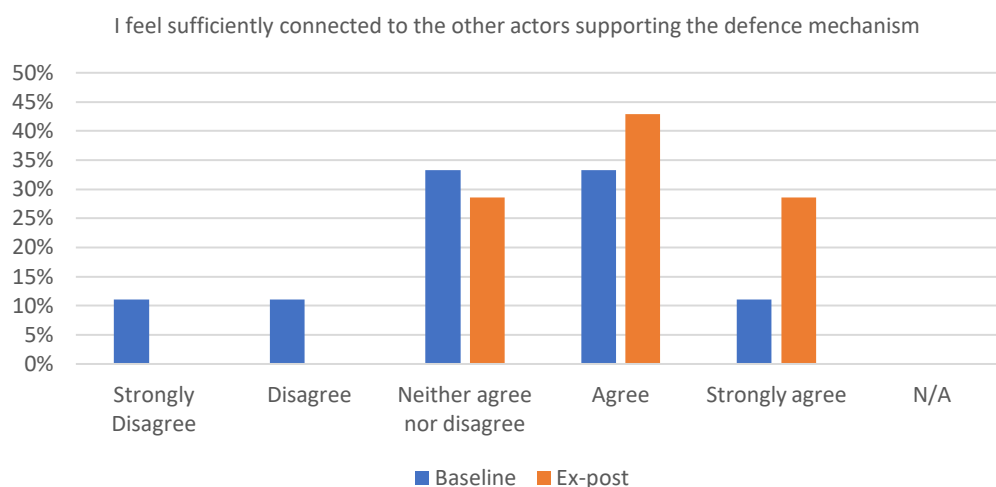
Figure 5: Granada, Spain: I feel sufficiently connected to the other actors supporting the defence mechanism

When looking at the importance first responders indicated with respect to pilot exercises, it is worth notice that in both the baseline ex-ante and the ex-post survey, they have indicated pilot exercises as a very useful tool to be better prepared for an emergency event as well as to the deployment of new technologies.

Moreover, the cross analysis when looking at the frequency that scenario exercises and how useful respondents find these exercises showed that regardless of how often they are performed, respondents find them "useful" or even "very useful". Even respondents who only have the opportunity to conduct pilot exercises once every year or once every several years have indicated reported them as "useful", and concurrently also indicate their preference for more frequent exercises in Granada.

Specifically, three main benefits were mentioned, in both surveys, with respect to pilot exercises, namely:

- Evaluation and validation of response plans
- Facilitation of additional training
- Evaluation of tools and technologies available to FRs

When asked about existing technologies and their usage, overall, first responders indicated that existing technologies are not difficult to use, and also that they do not consider them outdated or ineffective but still adequate to guarantee safe operations on the field. Nonetheless, from the surveys, it also emerged that respondents seem to have gained trust in new technologies: in the baseline survey 22% strongly agreed and in the ex-post survey this share increased to 71%. Respondents of the baseline survey had concerns about data privacy issues as can be seen in *Figure 6* and EF_Ref138Figure 7. These seem to have been alleviated to some extent, but should be kept in mind for the further development of the PathoCERT technologies.

For technologies which use location data: I would be worried that someone would track my location for other purposes than rescue
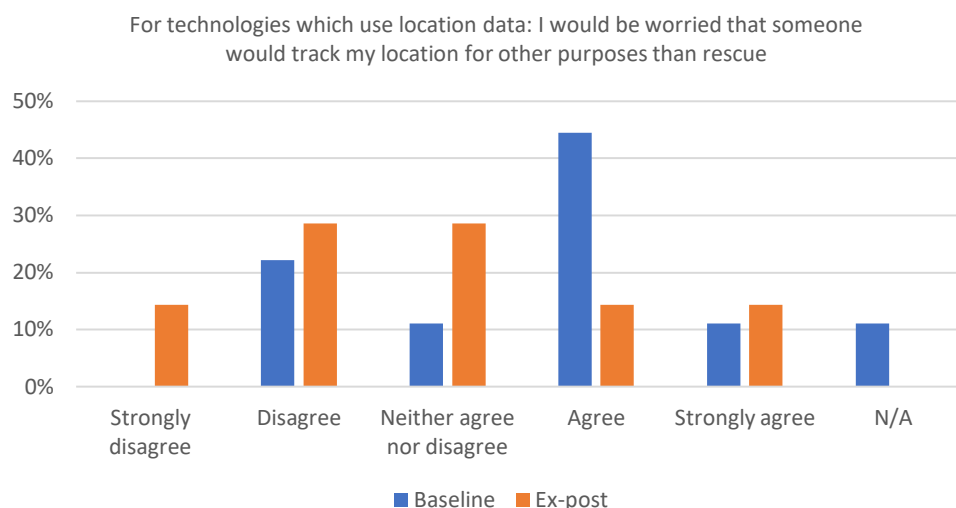
Figure 6: Granada, Spain: For technologies which use location data: I would be worried that someone would track my location for other purposes than rescue

For technologies which use location data: I would be worried that someone would use my location data without authorisation
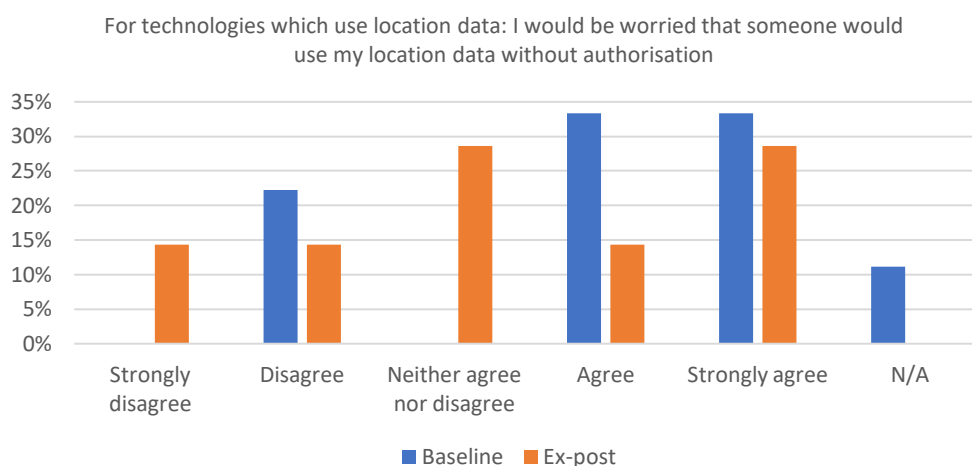
Figure 7: Granada, Spain: For technologies which use location data: I would be worried that someone would use my location data without authorisation.

4.2.2   Thessaloniki - Greece

The average age of respondents in Thessaloniki was 41.5 years in the baseline survey and 43 years in the ex-post survey. In total 120 respondents filled out the baseline survey with a completion rate of 62%, and 166 respondents filled out the ex-post survey with a completion rate of 69%. In both surveys the majority of respondents worked for the civil defence and have mainly worked in their positions for 1-5 years, 39% of respondents in the baseline and 41% in the ex-post survey, respectively. In the baseline survey 18%, 16% and 27% have been in their positions less than 1 year, while in the ex-post survey 19%, 19% and 21% have been 5-10 years and more than 10 years, respectively.

Most of the respondents in both surveys has intervened at a national/federal scale followed by regional/provincial and communicated the most with governmental representatives. As it can be seen in Figure 8, there has been a slight improvement on whether stakeholders find the interactions with local and regional stakeholders sufficient and efficient.

Figure 8: Thessaloniki, Greece: Do you find existing interactions with other key local and regional stakeholders efficient and sufficient?

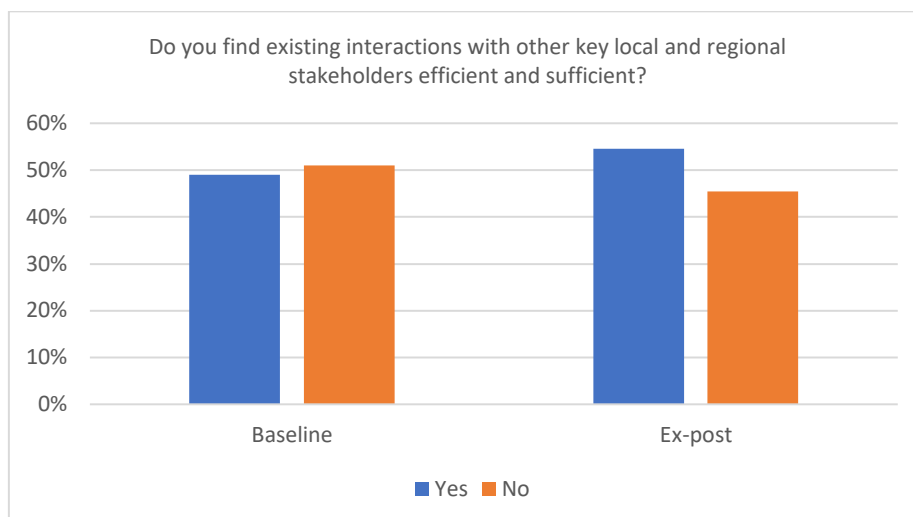There are differences between the baseline and ex-post survey when it comes to the perception of main improvement areas in the current flow and communication with other stakeholders, see Figure 9. Across both surveys, most respondents have identified that *'having more clarity on the roles and responsibilities of each organization during the emergency event'* is a key area of improvement. The increase in respondents who chose '*bridging cultural differences'* could be due to the CoP activities which brought together a broader number of different stakeholders (Figure 23) and the subsequent realization of how the organisation operate in differing manners, which is also applicable for the statement in the previous sentence. Similarly, the decrease in the number of respondents who chose *'better/easier access to reach out to certain types of stakeholders'* is an indication that PathoCERT technological developments and CoPs activities have eased communication among emergency management stakeholders as well as interoperability. The graph below also shows that in the ex-post survey respondents have focused more on certain areas of improvement while in the baseline survey many respondents saw a higher number of improvements needed.
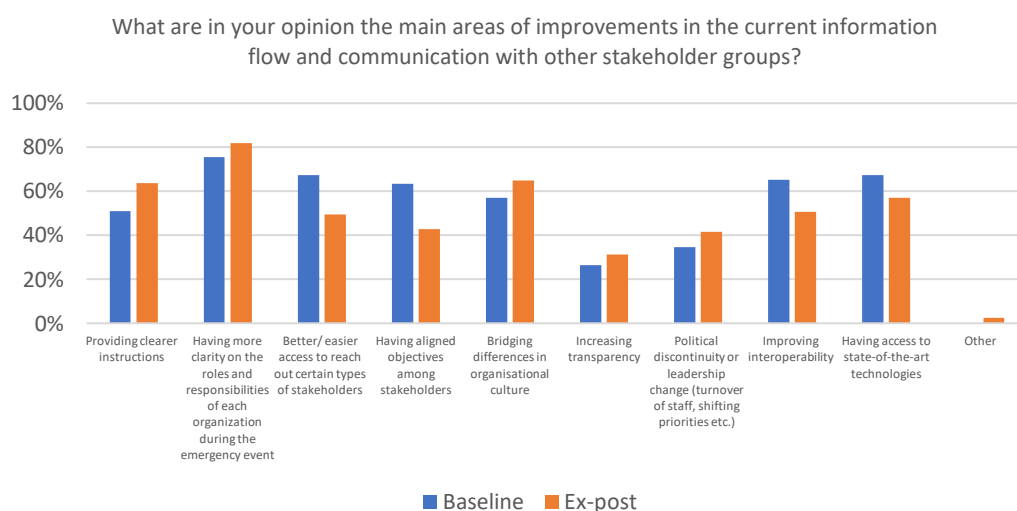

Figure 9: Thessaloniki, Greece: What are in your opinion the main areas of improvements in the current information flow and communication with other stakeholder groups?

Thus, the cross analysis was conducted focusing on the main areas of improvement connected to the length respondents have been in their positions. This is because, in the baseline survey, individuals who had been in their job, 1-5 and more than 10 years saw the need for the most improvement. In the ex-post survey those that had been in the job less time, respectively less than 1 year and 1-5 years indicated a higher more need for improvements than those who had been in the job longer.

The surveys also highlighted how the CoP activities have increased respondents' perceptions in terms of being connected to other actors in the defence mechanism (Figure 10).
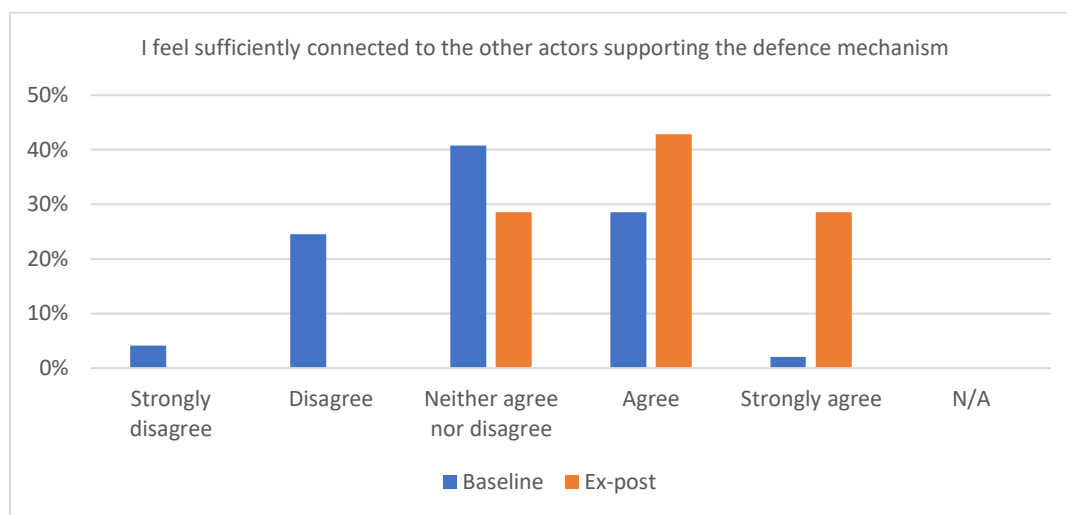
Figure 10: Thessaloniki, Greece: I feel sufficiently connected to the other actors supporting the defence mechanism.

Additionally, it is importance to notice that as for Granada, also in Thessaloniki, throughout both surveys, the majority of respondents indicated that they find simulation exercises `very useful` and they agree that simulation exercise allow them to more easily start using new technologies.

The cross analysis conducted on how often these exercises should be held and the perceived usefulness of them, clearly showed that those who are only able to participate in exercise once every few years, find the exercises "less useful" than those who have been participating in exercises more regularly. The perception of the benefits of the simulation exercises has shifted slightly between the two surveys as can be seen in Figure 11. In the ex-post survey, the most important benefits were "the evaluation and validation of response plans" and "the evaluation of tools and technologies" available to FRs, while in the baseline survey, respondents indicated "team work".

What are in your opinion the most important benefits of these exercises (please rank by importance, 1 = most important, 2 = next most important etc.)?

Figure 11:Thessaloniki, Greece: What are in your opinion the most important benefits of these exercises (please rank by importance, 1 = most important, 2 = next most important etc.)?

In general respondents, in both surveys, disagreed or strongly disagreed that current technologies are difficult to use; completely outdated; not effective at all or do not provide a feeling of safety in the field. This indicate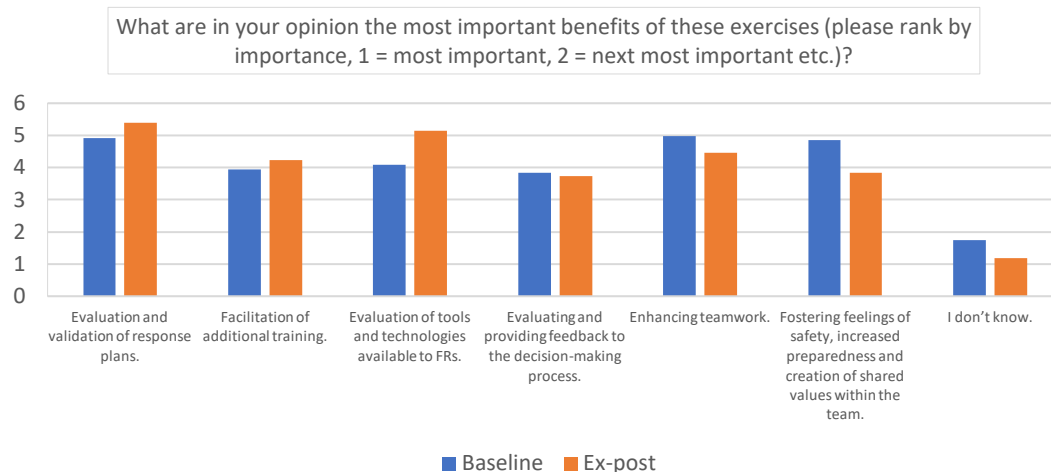s that throughout the project and despite the presentation of the new PathoCERT technologies, confidence in existing technologies remains, indicating that the most effective approach would be to seek higher integration of newly developed technologies into exiting operational framework and tools.

A similar conclusion can be derived when looking at the answers indicating whether respondents find new technologies useful in the job, responses have shifted slightly between the two surveys. In the baseline most (55%) respondents strongly agreed with the statement that new technologies are useful in the job and 39% agreed, while in the ex-post survey 52% respondents "only" agreed with the statement and only 36% strongly agreed. Similar trends can be seen with respect to the issue of '*where new technologies are available, I intend to use it'* and `*I like working with new technologies*`: respondents moved from "strongly agreeing" with the statements to "only agreeing". Nonetheless, in general respondents in both surveys trust new technologies' reliability and perceived them as positive.

Respondents also indicated no worries with respect to aspects, such as: trust in information or data provided by new technologies; illicit tracking concerns when using location data; usage of data for activities other than rescue missions. Finally, it is important to highlight that both the baseline and ex-post survey indicated the validation of new technologies on the field as a fundamental prerequisite to increase the likelihood of first responders using them.

4.2.3 Sofia - Bulgaria

The average age of respondents in the baseline and the ex-post survey was 45 years. The baseline survey was filled out by 46 individuals with a completion rate of 62%, while the ex-post survey was filled out by 13 individuals with a completion rate of 60%. In the baseline survey, the majority of respondents worked for the Sofia Regional Health Inspectorate, in the fire brigade and as public officials. In the ex-post survey, there were almost an equal number of fire-fighters, civil protection and Sofia Regional Health Inspectorate employees. The two surveys highlighted that three main stakeholders are those with whom first responders need to communicate during an emergency event, namely governments, civil society, and water institutions. Moreover, as it can be seen in

Error! Reference source not found. below, there has not been any change in the perceived efficiency and sufficiency of stakeholder interactions.
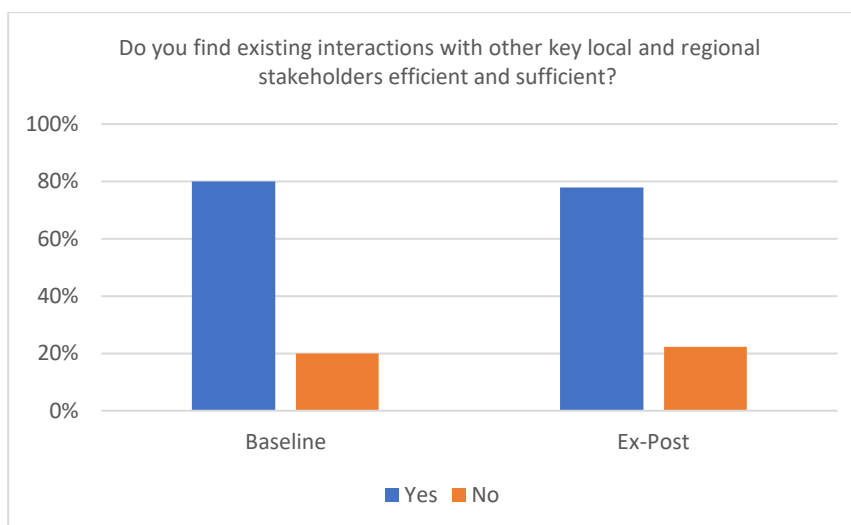

Figure 12: Sofia, Bulgaria: Do you find existing interactions with other key local and regional stakeholders efficient and sufficient?

As for the other pilot cities/regions, also for Sofia, an analysis has been conducted with respect to the time spent in the role: in the ex-post survey, 58% of respondents have been in their job longer than 10 years, and 25% between 5-10 years. Only 8% had been in their job less than 1 year and between 1-5 years respectively. In comparison, respondents from the baseline survey had been in their positions for less time, with 33% being in their job less than 1 year, 25% between 1-5 years, and only 33% more than 10 years. In the ex-post survey 58% of respondents indicated that they operate at a national level, 25% at a regional and 17% at municipal level. While, in the baseline survey, the percentage were respectively, 66% operate at the regional level, 30% at a national and 3% at a municipal level. This is an important indicator when analysing indicated areas of improvements which for Sofia were the following in the baseline survey:

1. Having more clarity on the roles and responsibilities of each organization during the emergency event
2. Having aligned objectives among stakeholders
3. Having access to state-of-the-art technologies

While, in the ex-post survey, respondents provided slightly different ones, namely:

1. Having access to state-of-the-art technologies
2. Having more clarity on the roles and responsibilities of each organization during the emergency event
3. Better/easier access to reach out to certain types of stakeholders

In the baseline survey, those respondents who had been working less, saw the need for more improvements compared to those who have been working longer. The ex-post survey, however, showed slightly different results, with those working more than 10 years reporting a perceived higher need for improvements across the provided improvement areas.

Based on both surveys, respondents from Sofia indicated that the current communication plan makes them feel safe and that they also feel sufficiently connected to other actors. Moreover, they also indicated a positive attitude towards simulation exercises, and how those can help them

to be better prepared for an emergency event: with an increasing number of respondents finding exercises very useful, respectively, 19% in the baseline and 37% in the ex-post survey. The cross-cutting analysis between the frequency and the perceived usefulness of the exercises showed that with increasing frequency the perceive usefulness also improves. In general, respondents in Sofia also clearly indicated that that simulation exercises can help them to apply novel technologies more easily in the field. Interestingly, the number of respondents who strongly perceives this as a benefit has significantly increased in the ex-post survey as can be seen in Figure 13 indicating the contribution of the CoP activities towards awareness raising with respect to the project's technologies and tools among first responders
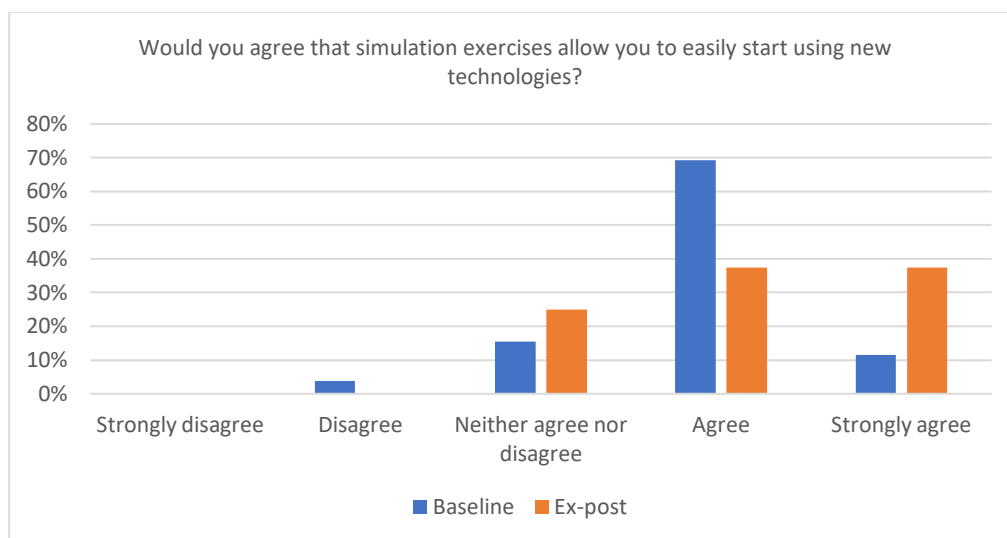
Figure 13: Sofia, Bulgaria: Would you agree that simulation exercises allow you to easily start using new technologies?

It is worth notice, in this regard, that following the CoP and pilot activities, the perceived benefits of the exercises have shifted. The top three benefits in the baseline survey were:

1. Evaluation and validation of response plans
2. Evaluation of tools and technologies available to FRs
3. Evaluating and providing feedback to the decision-making process.

While, in the ex-post survey, the following top three benefits have been identified:
1. Evaluation and validation of response plans
2. Enhancing team work
3. Facilitation of additional training.

Additionally, in both surveys, respondents showed high-level of confidence in the existing technologies, finding them easy to use, effective, and providing a feeling of safety in the field. Nonetheless, the gathered answers also showed that respondents were positively inclined towards new technologies, however, showing some concerns regarding the use of geo-spatial data, as it can be seen in Figure 14.

Figure 14: Sofia, Bulgaria: For technologies which use location data: I would be worried that someone would use my location data without authorisation?

4.2.4 Limassol - Cyprus

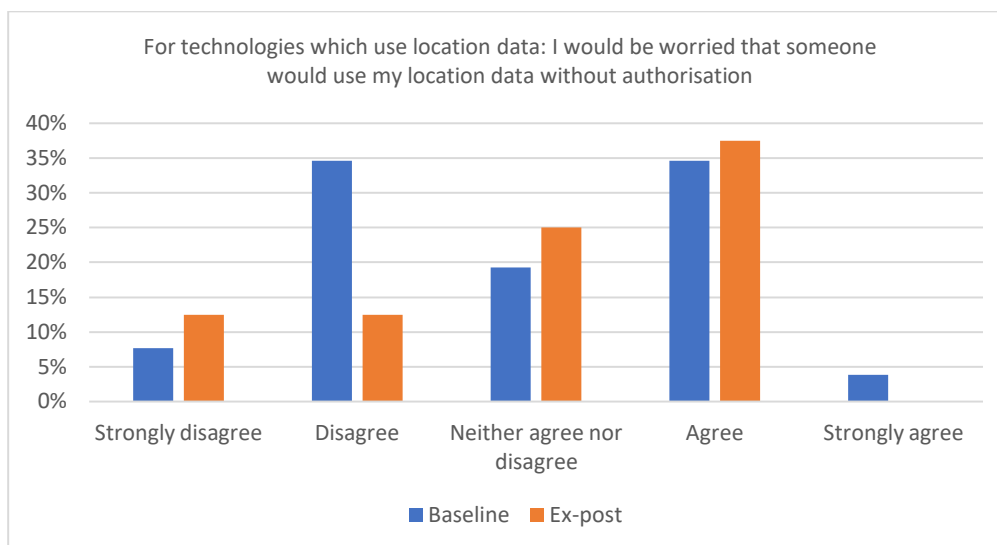The average age of respondents in the baseline survey was 45 and 47, in the ex-post survey. The baseline survey was filled out by 57 individuals with a completion rate of 59% while the ex-post survey was filled out by 19 respondents with a completion rate of 68%. In both surveys, the majority of respondents worked for civil defence, they have been in their job longer than 10 years and mainly operate at a national level. Both surveys, indicated three key stakeholders' groups for the communication activities during an emergency event in Cyprus, namely, governments, service providers and water institutions. With respect to this, as shown in **Error! Reference source not found.**, a higher percentage of respondents retained the interaction between stakeholders not to be sufficient as well as efficient (ex-post survey). This could be the results of the CoP meeting which have provided the stage for more frequent opportunities for exchanges and discussions thus bringing to the forefront the rather limited occasion for interactions occurring before the implementation of the PathoCERT multi-stakeholder engagement activities.
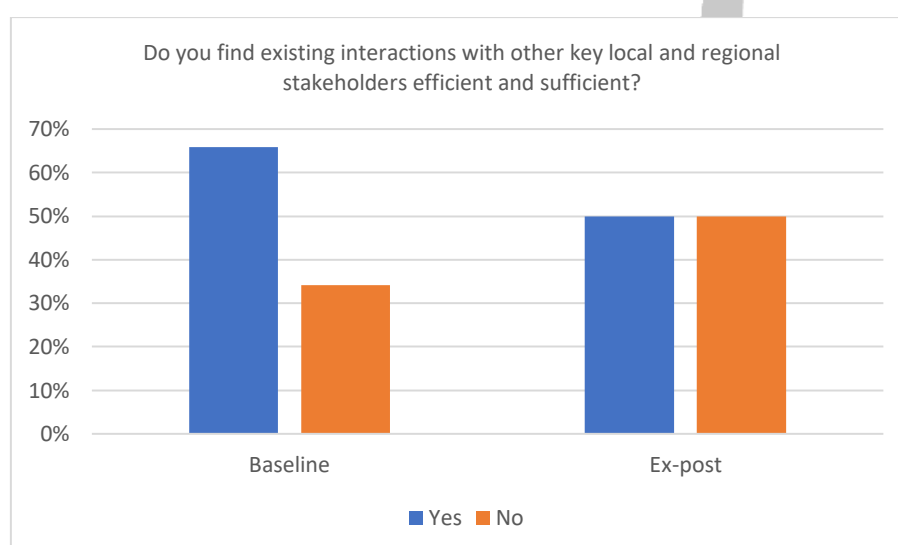

Figure 15: Limassol, Cyprus: Do you find existing interactions with other key local and regional stakeholders efficient and sufficient?

In both surveys, main areas of improvement referred to *'having clarity on roles and responsibilities'* followed by *'providing clear instructions'* and *'having access to state-of-the-art technologies'*. In the baseline survey almost 60% of respondents indicated that *'better/easier access to reach out to certain stakeholders'* needs to be improved. This percentage decreased to around 20% in the ex-post survey, indicating that the CoPs have fulfilled their purpose of bringing together different stakeholders groups enabling multi-level exchanges.

In the ex-post survey, around 40% of Cypriot respondents considered the current communication plan efficient, while in the baseline the percentage was around 55%. This could be explained by a high number of respondents who neither agreed or disagreed with the statement in the ex-post (35%) and in the baseline (20%) surveys.

In the baseline survey, respondents - around 55% - indicated that simulation exercises take place every few months, while in the ex-post survey only 31% indicated that while 38% reported that they never take place. This can be explained by the fact that not exactly the same respondents participated in two survey exercises and that depending on their role (e.g., governmental representatives, fire-fighters, volunteers etc.) they might undertake simulation exercises differently. Nonetheless, throughout both survey respondents clearly indicated that simulation exercises are very useful in the preparation for an emergency event and agree that those exercises are helpful when starting to use of new technologies.

A cross cutting analysis between the frequency of the simulation exercises and the perceived usefulness was conducted. In both survey's, it is interesting to notice that both respondents who never participated in exercises or did only once every few years, and those respondents who partake in exercises more frequently (e.g., every few months) have indicated that they find them very useful, although stressing an interest for more exercises. The top two benefits reported with respect to simulation exercises - in both surveys - were 'evaluation and validation of response plans' and 'evaluation of tools and technologies available to FRs'. The third most chosen option in the baseline survey was 'enhancing team work' while in the ex-post survey 'evaluating and providing feedback to the decision-making process'.

Both surveys showed that respondents from Limassol, have 'confidence in the existing technologies', believing them to be effective, able to provide a feeling of safety in the field, easy to use and to be up-to-dated. Even-though they are happy with existing technologies respondents from both surveys indicated that new technologies would be useful in their job and believe that those presented by PathoCERT are reliable. As can be seen in Figure 16 respondents from Limassol seem to have gained more confidence in new technologies throughout the pilot-testing phase of the project.
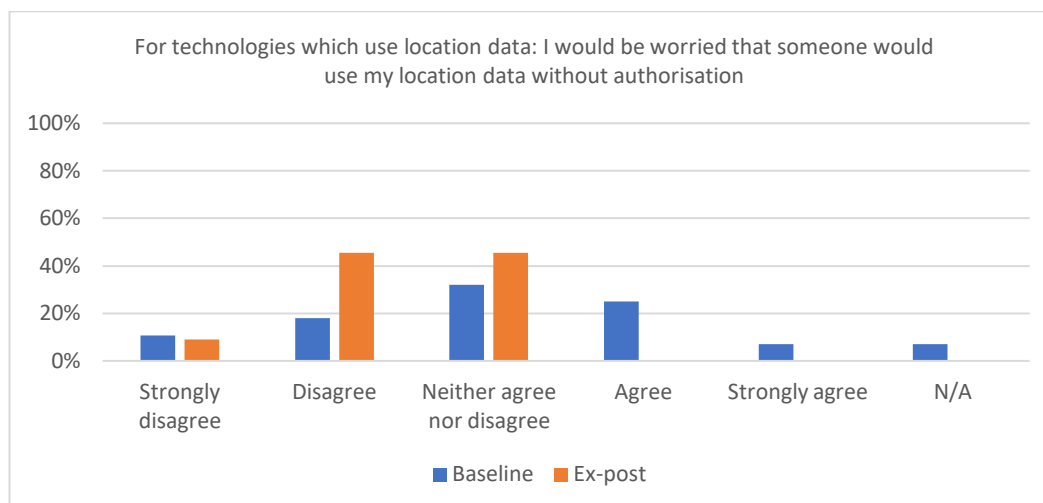
Figure 16: Limassol, Cyprus: For technologies which use location data: I would be worried that someone would use my location data without authorisation.

Respondents have also gained more confidence in data protection of the new technologies, as can be seen in Figure 17.
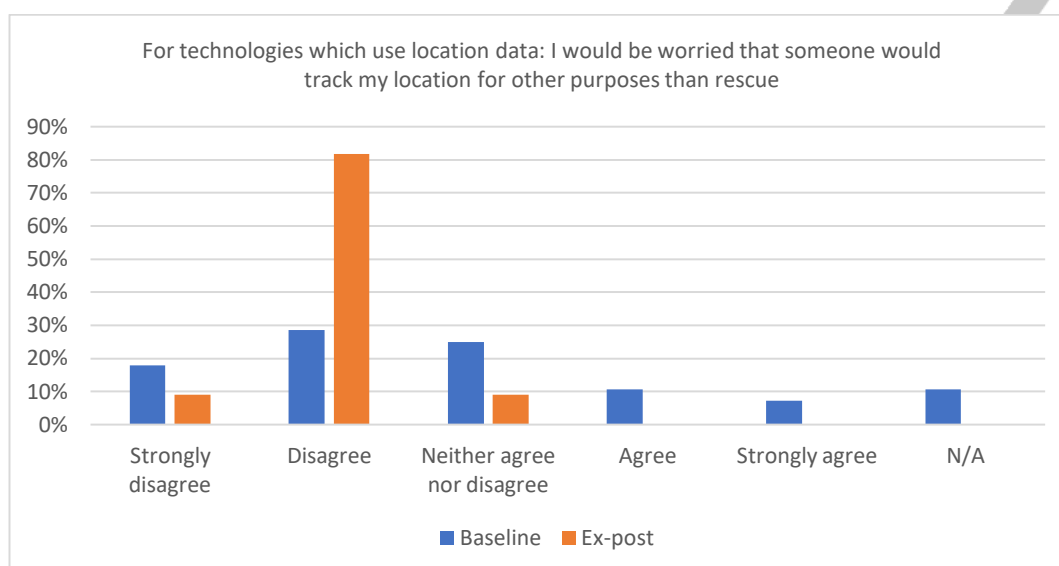
Figure 17: Limassol, Cyprus: For technologies which use location data: I would be worried that someone would track my location for other purposes than rescue.

4.3 The Local champions

As described in the initial sections of this report, in the PathoCERT project, six Communities of Practice have been established to enable the successful promotion, development, testing, and adoption of new processes and solutions linked to water-borne emergency situations. The CoPs while targeting key stakeholders have also provided an opportunity to reach out to citizens, directly or indirectly can also be affected by such events. Therefore, in many instances, their cooperation is also a cornerstone for the successful handing of emergency events. Thus, in PathoCERT, citizens have been considered as a key stakeholder group to be engaged. Specifically, the project has addressed citizens in the local communities already knowledgeable and somehow active in the operating field of first responders (e.g., fire-fighter volunteers) directly supporting

during emergency event through engagement in responsive actions. Those actors have been defined as "local champions". They have been identified and engaged via the support of local partners' networks and engaged with the final aim of further facilitating the uptake of the project activities by a larger number of citizens as well as of first responders in the six PathoCERT pilot cities/regions.

Once identified, they have been engaged not only via the CoPs meetings and pilot activities, but also consulted via ad-hoc interviews in order to:

- Further explore how local champions interact/are involved in local emergency responses
- Better understand the type of collaboration(s) with other key stakeholders central to the PathoCERT project
- Gather their feedback on the PathoCERT technologies and how those could possible impact the local champions' activities
- Probe their interests in terms of future involvement including their participation into the pilot-testing activities organised under the umbrella of WP8

Exchanges with local champions took place in Sofia (Bulgaria), Limassol (Cyprus), Thessaloniki (Greece), Granada (Spain), and Seoul (South Korea) in early 2023.[12] The background documents including the guideline on how to run the interviews have been prepared in a centralised manner by the CSCP to ensure consistency in data gathering and analysis (see Annex 2). Accordingly, the documents have been first developed in English, and only at a later stage translated in the local languages with the support of the PathoCERT partners to avoid communication challenges and/or low participation due to the language barriers.

The interviews have enabled to derive key insights on how local communities – directly involved in emergency water-borne situations – perceived and would react to the deployment of novel technologies and processes, both from a technical and societal perspective. Indeed, these insights combined with the CoP meetings have further contributed to validate the derived assumptions made throughout the data gathered via the baseline and ex-post surveys leading to the refinement of the PathoCERT technologies and tools to enhance their short and long-term successful application on the ground as well as to better understand knowledge gaps and opportunities areas regarding local communities affected by water-borne emergency events.

The interviewed local champions represented a pool of mainly male actors, with a high education level, university degree or higher (PhD). The typology of organizations they represented are quite diversified depending on the pilot city/region: e.g., in Greece and Spain the majority were first responders operating on the field, for Bulgaria one could identified a mixed representation between first responders and municipality representatives; Limassol' and Seoul's local champions also constituted mix of different actors ranging from first responders to technical operators.

The majority have been operating in the sector for longer than 5 years with only a minor number have worked in the sector between 1 and 5 years. When interviewed, the majority of local champions were also aware of the PathoCERT project and related activities in their city /region thanks to their direct engagement into CoP meetings or via awareness raising activities conducted locally by the project partners (WP8).

The gathered data enabled to dig deeper and substantiate a high level of satisfaction with respect to existing communication channels and plans deployed during water-borne emergency events. Concurrently, it was also possible to identify that actors involved throughout all stages of an emergency events are those usually reporting a higher level of satisfaction with respect to current

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[12] The Dutch CoP team was unable to conduct interviews **due to the local operational setting and procedures.**

communication plans and processes compared to those who only cover a specific role. This is an important indicator to be considered, as it suggests a possible individual correlation between level of satisfaction of existing communication procedures and role covered during emergency events.

The local champions interviews also provided a deeper understanding between the feedback and perception provided with respect to the PathoCERT and their potential application. The local champions who operate through the different phases of an emergency response have also reported higher expectations regarding the potential contribution of the project's technologies during a water-borne pathogen emergency event. This again it is a signal to be considered when assessing the overall project's objectives and final impacts, as the actual contribution perceived by local actors seems to be highly connected to their direct roles and level of expertise.

It is also worth mentioning that the local champions have positively evaluated the future adoption of PathoCERT novel technologies and tools, while, however, highlighting central aspects which already emerged during several CoP meetings:

- Training and simulation exercises are crucial in order to effectively and efficiently deploy new technologies;
- Integration with existing tools and procedures is a central step for the adoption of any novel technology;
- Areas of deployment need to be carefully considered, as often first responders are operating in remote areas limiting or lacking access to cellular and internet signals;
- Integration among different tools is important as accessing different e.g., databases, platforms etc. during an emergency event decrease the efficiency of the operation and in the majority of cases is not possible;
- The development of any novel technologies needs to consider local legislations, as in some instances, they might be regulations limiting or even forbidding the use of certain tools.

4.4 Insights from the European and Local Communities of Practice

The following sections focuses on key insights derived from the European CoP meetings and local/regional CoP meetings. The outcomes of the latter are not fully elaborated in this report, as an ad-hoc one reporting in details the outcomes and key insights from the CoPs D3.3 'Communities of Practice – best practices and key learnings' has been developed. In general, about the approach the following aspects emerged: while remote videoconferencing was necessary due to COVID-19, in-person meetings are preferred by stakeholders for more profound discussions and outcomes. Regarding the number of participants, it was unveiled that even in smaller meeting were valuable in providing insightful input, emphasizing the significance of initial stakeholder mapping and analysis. An advantage of the CoP format is its flexibility to be adapted to diverse topics and stakeholder formations. However, adherence to core features is highly recommended to ensure effective and uniform engagement. These insights are crucial for successful CoPs in various domains.

The first European CoP meeting took place online and focused on facilitating exchange between the six PathoCERT CoPs. The overarching goal was to identify common challenges and solutions with a particular focus upon the first responders' knowledge and experiences.

Key insights provided information about the status quo, including key challenged and opportunity areas regarding the adoption of new technologies and processes for first responders on the ground. This first meeting emphasized the significance of conducting training with and providing user manuals for technologies before their application in pilots. First responders and key stakeholders who participated highlighted the challenges they might face due to the co-existence of multiple older and new technologies within the pilot cities/regions, which could result in complex communication and interoperability layers. Common standards were seen as an opportunity to improve interoperability and communication among first responders, across pilots as currently the language barrier and differences in protocols, training, and technologies posed hurdles for cross-country collaboration, highlighting the need for common protocols in such emergency scenarios. CoPs' structures were acknowledged as platforms for improved communication with key stakeholders, though challenges in sustaining members' motivation were noted. Successful CoPs with higher member engagement were urged to present their case in detail for others to learn from. More broadly, best practices from different the pilot cities/regions were recognized as valuable resources to be shared and learned from in future European CoPs. Additionally, the meeting emphasized the importance of communicating detailed descriptions of challenges and needs to technical partners, enabling focused follow-ups in upcoming CoP meetings.

The second European CoP facilitated the exchange with two other water-centred Horizon Europe projects that also applied a CoP approach, ULTIMATE and Water Mining, in an effort to identify synergies and divergences in regards of the role of the CoP methodology. The meeting highlighted significant insights into the benefits and challenges of CoPs. Among the notable advantages, it was mentioned that CoPs are a substantial contributor to engineering projects. When properly implemented, they add substantial value to technical endeavours. Moreover, local integration of CoPs proves advantageous, fostering synergies among stakeholders, even when their interests may occasionally conflict. The versatility of CoPs was also emphasized, serving multiple roles simultaneously - as instruments to increase acceptance, conduits for disseminating knowledge, and platforms for normative social learning. As the sustainability of CoPs beyond the project's horizons proved to be another concern, the meeting highlighted the necessity of local ownership and bottom-up elements. These elements play a crucial role in sustaining high motivation among stakeholders, ensuring the longevity of CoPs beyond the project's timeframe. In addition, integrating the CoPs into national disaster response frameworks can be an option to facilitate constructive and immediate communication channels between decision makers and responders on the ground. This would allow to constantly harness the experiences and knowledge of first responders for the constant improvement and optimisation of the disaster response mechanisms.

Some of the notable challenges of CoPs were also addressed. Resource limitations for stakeholder engagement were identified as a prevalent issue, especially in projects where partners often lack the necessary experience and skills for effective multi-stakeholder engagement. Early in the PathoCERT project's lifecycle, the CoP approach demands considerable time and effort to identify and engage the correct stakeholders effectively, presenting an initial hurdle that requires careful navigation. Additionally, mismatches in interests between the overarching project objectives and

those of local participants could potentially hinder progress. Therefore, it was recommended to have open reflections about the common objectives early on. Despite these challenges, the meeting participants acknowledged that the benefits of CoPs, when harnessed and addressed appropriately, can significantly contribute to successful project outcomes and stakeholder satisfaction.

The third and final European CoP meeting will take place in the first quarter of 2024 and will focus on leveraging the valuable insights from previous discussions to facilitate the uptake of the innovative PathoCERT technologies in an effort to optimise the experience for first responders.

5 Key Take-aways

This section of the report sets out the analysis of the data collected from the four different channels. Here we bring together this multi-level analysis to share the cross-cutting and overarching themes and key findings take-aways which emerged from the PathoCERT's multi-stakeholder engagement processes. Where relevant, we also share cross-country comparisons where the findings differed across the different six pilot cities/regions.

Throughout all CoP meetings, the participation was tracked alongside some information about the participants. The subsequent participation data analysis aimed at providing insights into what kind of stakeholders participated and how participation patterns changed over time. As a result, changes and similarities between different CoPs were identified. As the data analysis took place before all of the CoP meetings were run, the data on the more recent iterations of CoP meetings are partial. Still, it was possible to identify notable patterns, such as that the different roles and understandings in the CoP locations also correlated with differences in the CoP participation.
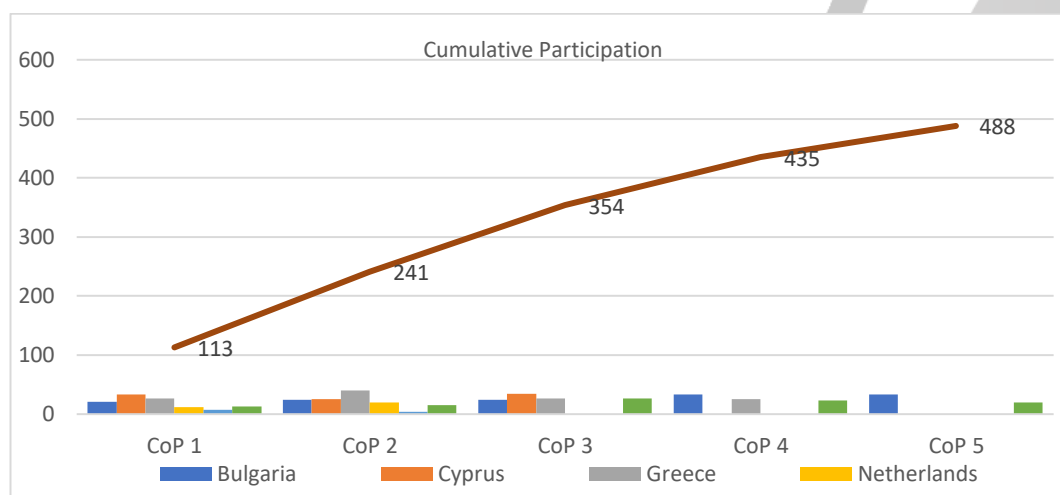

Figure 18: Cumulative participation by CoP iteration

Furthermore, the participation data allowed to derive, how many participants were external, meaning not formally part of the project's consortium. These external participants were usually local stakeholders that were involved in or responsible for the design of the response mechanisms. In almost all instances, the majority of participants of the meetings were not formally part of the consortium which represented an added value in terms of knowledge sharing and data gathering.
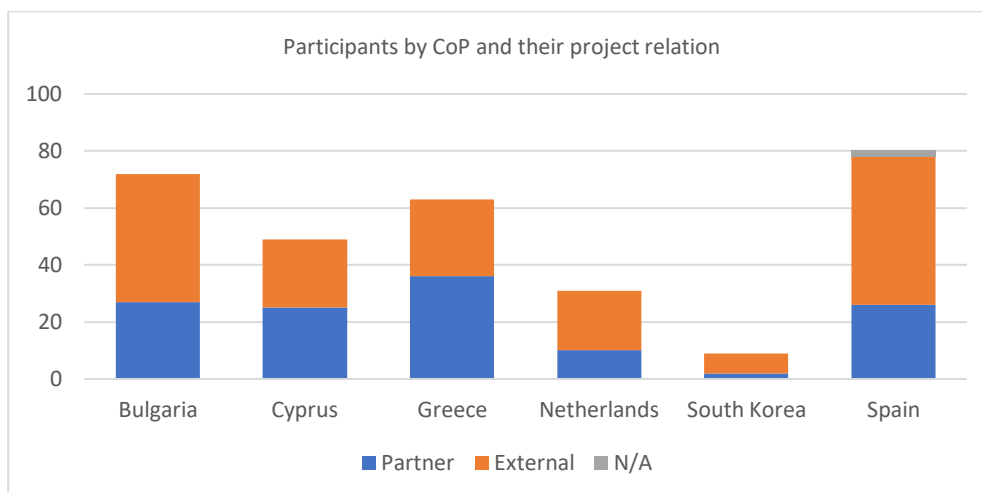
Figure 19: Participants by CoP and project relation

The gender distribution throughout the CoPs was monitored as well. The overall distribution over all CoP meetings per location is illustrated in Figure 20. For the CoPs in Europe, the percentage of female participants can somewhat be associated with the number of FRs present at the meetings. The more FRs join a meeting, the likelier it is that the share of females present tends to be lower. This shows that the FR sector is still attracting more people that identify themselves with the male gender.

In the case of the CoP in Seoul (South Korea), the CoP meetings were usually limited to selected representatives of participating organisations and usually consisted of less than five people per meeting. In this case, based on the small sample, no far-reaching conclusions should be drawn about the local first responder sector.
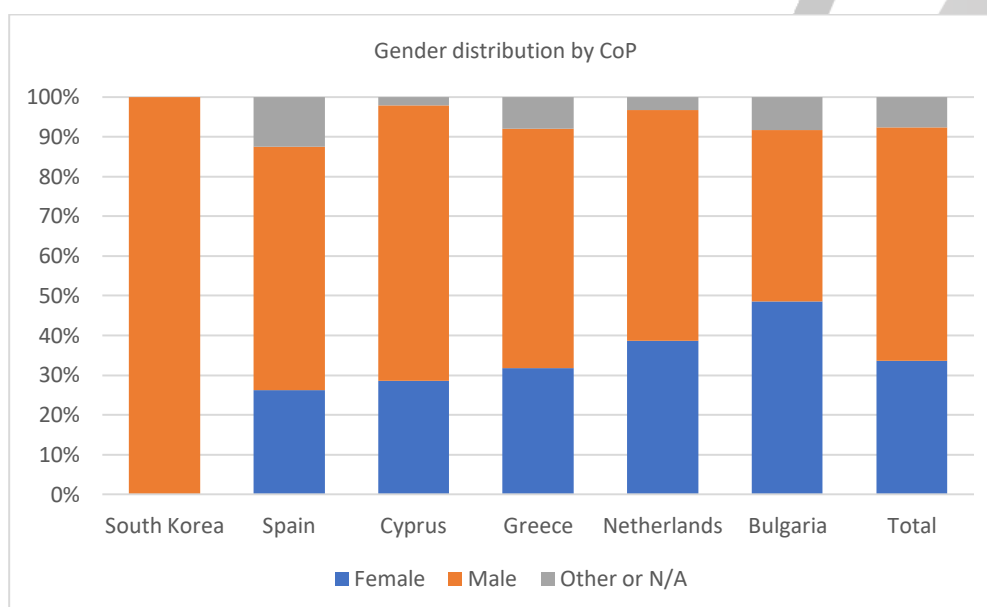

Figure 20: Gender distribution by CoP.

Similar to the gender distribution in the CoPs, individuals who filled out the baseline and the ex-post survey were predominately male as can be seen in *Figure 21*, except for the case of Sofia (Bulgaria) with respect to the baseline survey.
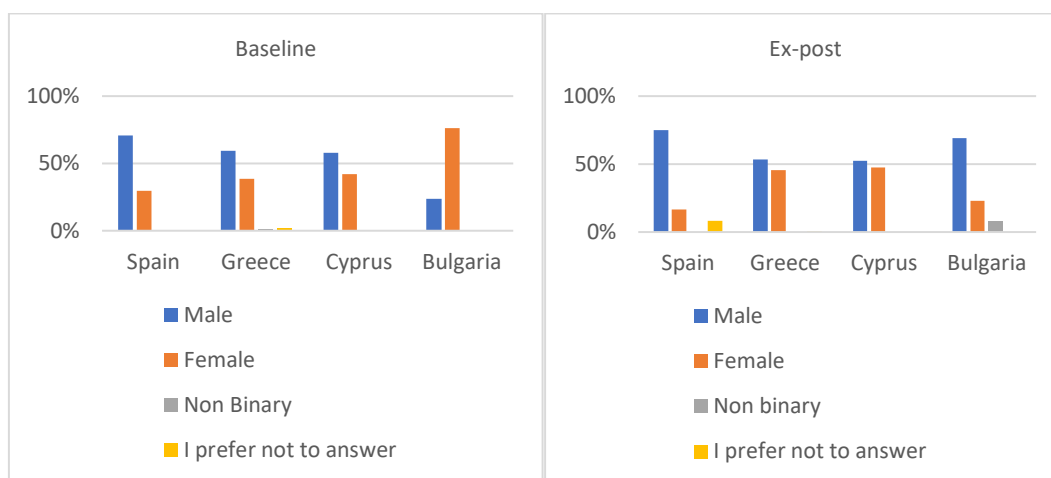

Figure 21: Gender of survey respondents

The dominance of individuals identifying with the male gender seems to be prevalent in the emergency management sector and measures should be taken to ensure females received the same access to jobs in this sector.

5.1 Through the creation of new communication channels with other stakeholders, through the CoP, to what extent are First Responders more connected?

Strengths and weaknesses of existing networks: based on the baseline and ex-post surveys, it has been possible to get an indication in which country more collaboration is necessary and where stakeholders fell connected sufficiently. Figure 22 shows that in all four pilot cities/regions key local stakeholders indicated that interactions is efficient and sufficient, in particular after the conduction of the ex-post survey. The CoPs in Cyprus and Bulgaria show a decrease in percentages believing this, indicating that the CoPs have shown how much potential there is in connecting with different stakeholders' groups.
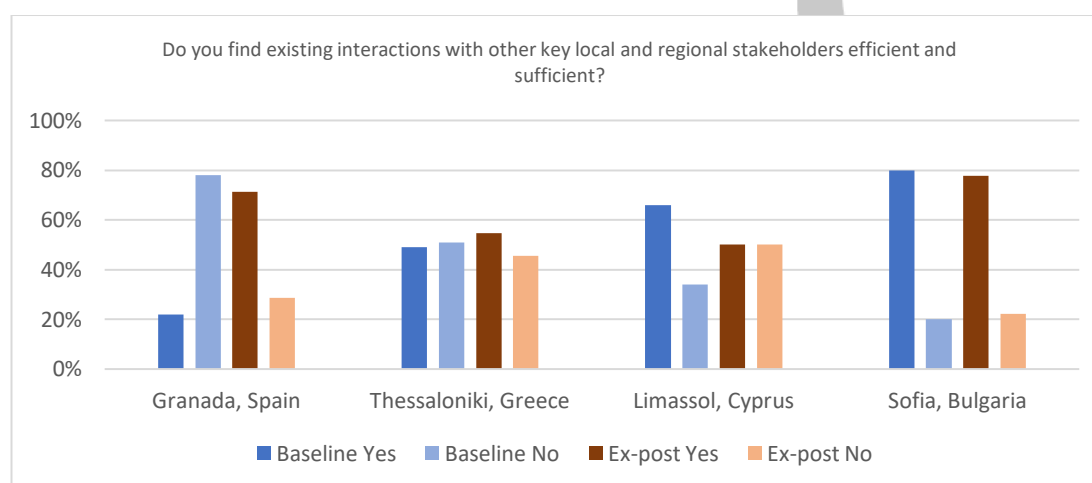

Figure 22: Do you find existing interactions with other key local and regional stakeholders efficient and sufficient?

The perceived main areas of improvement across the four pilot cities/regions differ not only between all four pilots but also between the two surveys. The former indicates that each of the pilots has a unique emergency management system and structure, starkly highlighting the need for individualized improvement approaches. A solution that might address the correct short comings in one pilot city/region might result in the disregard of more prominent improvement needs in another one. Across all pilots the improvement needs seem to have become clearer throughout the project. Additionally, increasing transparency and the need for reducing political discontinuity do not seem to be areas where pilots across the two surveys require immediate action. This latter aspect was also reported not to be crucial in EU CoPs meetings, as the relatively strict hierarchies and the Standard Operating Procedures (SoP) are not disrupted by political discontinuity. There is, however, the problem on a local level that municipalities are somewhat less involved in the development of the SoPs and, therefore, could lack an understanding of the entire system.

Most action should be directed based on the clustered results derived from the ex-post survey, in the following areas:

1. Having more clarity on the roles and responsibilities of each organization during the emergency event
2. Providing clearer instructions and common protocols during an emergency event
3. Having access to state-of-the-art technologies

The EU CoPs have also uncovered the thorny issue that often FRs within and between regions lack common software and protocols, presenting a key opportunity area for improving interoperability though common standards and communication channels as well as possible via common novel technologies and processes. Although, not diffused, best practices partly exist on national and regional levels. For cross-border emergency situations, a language barrier has to be bridged. Especially European CoP meetings allow to reflect upon possible cross-countries solutions. Additionally, as communication with inter-governmental and supranational organisations during emergency events seems to be limited and/or difficult, the improvement of exchanges and protocols could concurrently aim to resolve the issue on both sides. As it might not be possible to initiate contact while an emergency situation is unfolding, it is important to have the communication channels in place prior to the event. An exchange of practices the pilots could foster mutual learning. For example, Bulgarian respondents indicated most frequently that they use social media during emergency situations in both surveys, potentially indicating why they communicate with civil society more than the other pilots. All four pilots however, mostly communicate with governments during emergencies according to the ex-post survey highlighting the central role those institutions play in the emergency management system and the need to effectively engage with them.

The role of CoPs in opening up new communication channels: the CoPs have played a crucial role in opening up new communication channels as they brought together a diversified array of stakeholders (see Figure 23). Before digging deeper into the composition of those CoPs, it is worth noting, that local project partners were responsible to recruit relevant stakeholders and the recruitment process might have been slightly biased as previous connections and network opportunities were, naturally, employed. This means that the data compiled below mirroring the distribution of stakeholder types per CoP location not only reflects differences in the local emergency response approaches, but also indicates the priorities of the local hosting organisation

as to which stakeholders' participation was perceived as relevant for the success of the CoP's approach.

When looking at graphic strikingly are the differences in the composition of the CoPs: in Sofia, governmental agencies were the main participant of the CoPs with heads of FR associations representing the entire sector of the region. The participation data of the Amsterdam CoP clearly shows the different understanding of FR in the country. In Granada, FRs had a crucial role throughout all CoP meetings and accordingly their representation is significant.
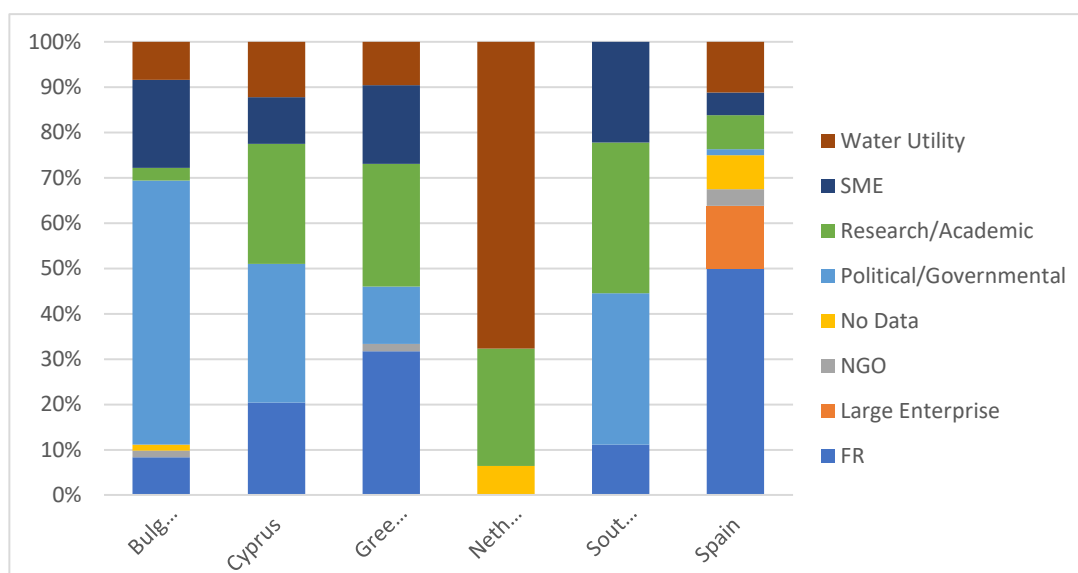

Figure 23: Type of participants by CoP location.

Strengthening of connections between different actors: requires knowledge of the needs and expectations those have with respect to the management of water-borne emergency events. The table listed under Annex 3, outlines the responses provided by respondents in the baseline and ex-post survey. The main actors involved in emergency management are similar across the pilots. Overall expectations voiced by actors are clear communication and collaboration as well as clear instructions and adherence to established procedures. The outcomes also highlight where there are opportunities for improving the interaction with and across specific stakeholders' groups. This is, for example, the case with educational institutions and media.

5.2 Through CoP opportunities to explore potential emergency scenario responses, to what extent are First Responders more supported to tackle challenges?

Implications of scenario exercises' frequency: the frequency of the simulation exercises differs across the PathoCERT pilots, but most respondents in both surveys have indicated that simulation exercises occur every few months. A cross-comparison between frequency of exercises and profession of respondents showed across all pilots that there is no clear trend as to which types of first responders participate in exercises more or less frequently. Moreover, there seems to be another factor influencing the frequency linked to the role the actor has within the organizations. This for example would explain the different answers identified between the baseline and ex-post surveys with respect to the frequency of simulation exercises by the same local organisations. Notwithstanding, across all pilots and in both surveys, respondents agree and strongly agree that simulation exercises allow them to more easily start using new technologies.

Perceived benefits of scenario exercises: across all pilots, simulation exercises are perceived as useful in preparing for emergency events. On average, in the ex-post and the baseline survey, the evaluation and validation of response plans was chosen the most by all pilots as can be seen in Figure 24.
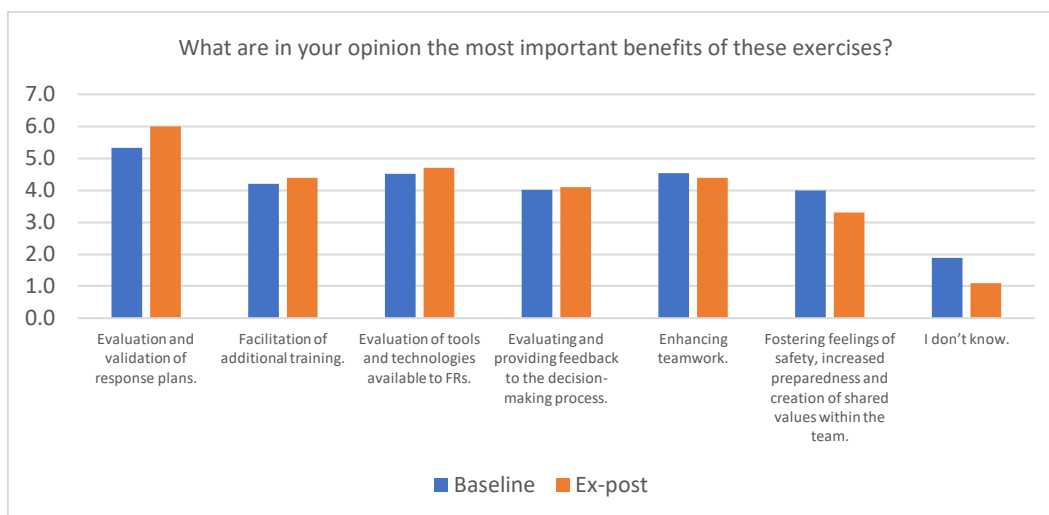

Figure 24: What are in your opinion the most important benefits of these exercises? (Ranked by importance, 1 = most important, 2 = next most important etc.)?

5.3 Through opportunities to become more familiar with new technologies and their use in CoP meetings, to what extent are FR more prepared to deal with emergency situations?

Positive attitude towards new and existing technologies: a clear trend across all pilots is the positive attitude towards existing and in-use technologies, as only in one pilot respondents indicated that technologies are outdated. Despite this positive opinion on existing technologies respondents are remarkably open towards new technologies across all pilots[13]. A possible explanation for this positive attitude towards new technologies – even though existing ones are considered up-to-date and effective - could be that respondents across all pilots indicated that via the implementation of novel technologies and tools they could then concurrently contribute to the decision-making process.

All pilots indicated that they 'strongly agree' or just 'agree' with the statement that if new technologies are available, they intend to use them. Also, for the other statements made about new technologies and their usefulness and "fun-ness" respondents tended to 'strongly agree' or 'agree'. Considering these positive perceptions, it is also not surprising the outcomes of including training of these novel technologies into simulation exercises and to increase the frequency of the latter.

Building and expanding trust: trust, as one could have expected, is crucial for the successful implementation of novel technologies and processes. Only if the users trust that new technologies their employment in the field and the integration into existing procedures can be successful. Throughout the PathoCERT multi-stakeholder engagement processes has emerged

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[13] For the first 9 statements in question 21, responses only exist from Greek, Cypriot and Bulgarian respondents. The statements were not included in the Granada's questionnaire

that most respondents 'agree' or 'strongly agree' about the reliability of new technologies and that they feel confident and safe about the generated information and the use of generated data. Nonetheless, some differences between the latter two points have been identified across the pilots. The major concern is related to the inappropriate use of generated information, as the geo-spatial ones. Even though the data concerns seem to have decreased throughout the project, monitoring measures should be implemented to ensure that all used data is kept private and falls under data protection policies.

Through the analysis of the PathoCERT multi-stakeholder engagement process, while it has been clear that there are specific learnings and opportunities related to the context of each local CoP, there are a number of cross-cutting learnings. Looking at the data through the lens of three key questions of the awareness, preparedness and connectedness of first responders, we can see some clear impacts of the PathoCERT CoP process on the key actors involved. While this report explores the findings in detail, highlights to take forward from this experience include the importance of integrating new technologies into existing processes for their effective uptake and regular use, the importance of holding regular scenario exercises with key stakeholders in the local emergency response network (including regular clarification of roles and responsibilities), the high impacts on the implementation of new technologies of introducing them through a CoP framework. In general, we have seen that the CoP is an effective tool to bring together people, processes and technologies, especially in the development of new technologies or ways of working, with the advantage that is can also help to highlight areas for improvement or future development, improving the experience of first responders and key stakeholders, as well as the effectiveness of the emergency response system as a whole.

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Appendix 1 - First Responder survey (English version)

X local implementor and Y local implementor has partnered in an international, 3-years EU-funded project called PathoCERT (Pathogen Contamination Emergency Response Technologies). The goal of the project is to strengthen the coordination of the First Responders (FR) in responding to waterborne pathogen contamination events. This will increase the FR capabilities, allowing the rapid and accurate detection of pathogens, improving their situational awareness, and improving their ability to control and mitigate emergency situations involving waterborne pathogens. To achieve this objective, PathoCERT will research and demonstrate a collection of novel, cost-effective and easy-to-use and acceptable technologies, tools and guidelines which will be field-validated by the FR.

You, as a key stakeholder in the emergency response mechanism, can give your contribution by filling out the following this survey.

[Paragraph only in ex-post survey] We previously conducted a very similar survey in early 2022 in order to understand the situation in the early stages of the PathoCERT project. This survey follows up over a year later, in order to provide a point of comparison, to understand if and how things have changed. Everyone can fill in this survey, whether you completed the first or not. Please answer the questions based on your current experience as a First Responder.

Agreement & key Information

Participating in this survey is voluntary. You can stop the survey at any point in time. In case of a termination, you don't have to state any reason whatsoever for doing so.

By participating in this survey, you consent to the use of the gathered answers only for the research activities of the PathoCERT project. We would like to highlight that all answers will be completely anonymous and in no way will be published or can be linked to you personally. In case you choose to participate you agree on the following points:

- That you have read and understood the objective and scope of the survey

- That your consent is voluntary

- You are 18 years or older

- We can use your answers for the PathoCERT activities

Survey Instructions

Please note: Filling out the survey should not take longer than 15 minutes!

IMPORTANT: Please fill out this survey only once!

Please read every question and answer thoroughly before advancing to the next page. In case you filled out something wrong, there is an option for you to move back to the previous page(s). When

moving backwards, we would like to ask you to not change your answers based on new realizations or knowledge from the next questions. In addition, we want to highlight that there are no right or wrong answers and assure that there will always be an option to answer the question. This can be done through a "I don't know" answer or similar options. In case you have not answered any of the questions will you get a reminder to answer every question before advancing to the next page

Demographic information

1. [Question only in ex-post survey] Did you fill in the previous PathoCERT First Responder survey (in early 2022)? Yes/No/I can't remember

2. Gender: ☐Male ☐Female ☐non-binary ☐I prefer not to answer

3. Age: _____

4. Highest Education Level completed:

    ☐ Primary school

    ☐ High school (Technical school)

    ☐ Higher education degree (University, College)

    ☐ post-graduate studies (Master's, PhD)

    ☐ Other (please specify): _____

Role / activities

5. Which FR group are you working for:

    Police

    Fire fighter

    Civil defence

    Ambulance driver

    Paramedic/emergency medical staff

    Other, specify: _____

6. What is your position/ rank in this FR body?_____

7. How long have you been a first responder?

    ☐ less than 1 year

    ☐ 1-5 years

    ☐ 5-10 years

    ☐ more than 10 years

8. Are you a paid or volunteer first responder?

    ☐Paid-Full time ☐Paid-Part time   ☐ Volunteer (not paid)

9. At which territorial scale does your organisation primarily intervene?

☐ National/Federal level

☐ Regional / provincial / state level

☐Municipal level

☐Community / neighbourhood level

☐Other, specify

Communication with other stakeholders

10. Which are the main stakeholder groups that you communicate with during an emergency? (Multiple answers)

☐ Inter-governmental / supranational organisations

☐ Governments (national, regional, local)

☐ Service providers

☐ Water institutions (river basin organisations, regional water authorities or boards)

☐ Regulators (economic, environmental)

☐ Civil society

☐ Science, academia and research centres

☐ Media

☐ Other (please specify):

11. Do you find existing interactions with other key local and regional stakeholders efficient and sufficient?

☐ Yes

☐ No

12. What are the key communication channels currently in place to share information with other key local and regional stakeholders, including the public before, during and after an emergency event?

Communication channel	When is its use prioritized		
	Before the emergency event	During the emergency event	After the emergency event
Radio communications			
Sirens			
Audio Public Address systems			
Smartphones			
Satellite phones			

Social Media - Syndicated Emergency Communications			
Emergency-oriented instant messengers and computer screen pop-ups			
AI-enabled chatbots			

13. What are in your opinion the main areas of improvements in the current information flow and communication with other stakeholder groups

☐ Providing clearer instructions

☐ Having more clarity on the roles and responsibilities of each organization during the emergency event

☐ Better/ easier access to reach out certain types of stakeholders

☐ Having aligned objectives among stakeholders

☐ Bridging differences in organisational culture

☐ Increasing transparency

☐ Political discontinuity or leadership change (turnover of staff, shifting priorities etc.)

☐ Improving interoperability

☐ Having access to state-of-the-art technologies

☐ Other, please specify:

14. How does the communication within the organization and across involved organizations affect the FR's response in the emergency?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	N/A
The current communication plan makes me feel safe when performing my professional duties	☐	☐	☐	☐	☐	☐
I feel sufficiently connected to the other actors supporting the	☐	☐	☐	☐	☐	☐

defence mechanism							

15. What do you need and expect from other stakeholder groups when dealing with a crisis?

Stakeholder Group	Needs & Expectations
1.	
2.	
3.	

Testing different scenarios

16. Within your organization how often do simulation exercises (including tabletop exercises, drills, and orientation exercises) take place?

☐ At least once a month

☐ Every few months

☐ Once a year

☐ Once every few years

☐ Never

17. How well do simulation exercises help prepare you to face an emergency event?

☐ Not useful at all. They don't help me to feel prepared.

☐ Somewhat useful.

☐ I don't know.

☐ Useful. They help me to feel prepared.

☐ Very useful. They help me to feel very prepared.

18. Would you agree that simulation exercises allow you to easily start using new technologies?

☐ Strongly disagree

☐ Disagree

☐ Neither agree nor disagree

☐ Agree

☐ Strongly agree

19. What are in your opinion the most important benefits of these exercises (please rank by importance, 1 = most important, 2 = next most important etc.)?

Ranking	Exercises
	Evaluation and validation of response plans.
	Facilitation of additional training.
	Evaluation of tools and technologies available to FRs.
	Evaluating and providing feedback to the decision-making process.
	Enhancing teamwork.
	Fostering feelings of safety, increased preparedness and creation of shared values within the team.
	I don't know.

Testing new technologies & status quo of technologies available to First Responders

20. What are the technologies that are currently available to you and your organization during an emergency event and/or for pathogen detection? (e.g., field portable sensing devices)

    1.

    2.

    3.

21. Please use the scale to share your opinion on the following statements on technologies.

    The available technologies:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	N/A
Are very difficult to use	☐	☐	☐	☐	☐	☐
Are completely Outdated	☐	☐	☐	☐	☐	☐
Are not effective at all	☐	☐	☐	☐	☐	☐
Don't provide a feeling of safety on the field at all	☐	☐	☐	☐	☐	☐

22. Complete the following questions thinking about using new technologies which can support emergency response (including, for example, PathoCERT technologies which are being developed to detect pathogens in water, provide geo-location data by drones, and collect and analyse relevant disaster-related data).

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	N/A

I generally find new technologies useful in my job	☐	☐	☐	☐	☐	☐
Where new technologies are available, I normally intend to use it	☐	☐	☐	☐	☐	☐
I like working with new technologies	☐	☐	☐	☐	☐	☐
Working with new technologies is fun	☐	☐	☐	☐	☐	☐
Other members of my team would consider using these technologies as positive	☐	☐	☐	☐	☐	☐
People from my family and/or my friends would want me to use these technologies	☐	☐	☐	☐	☐	☐
I believe new technologies to be generally reliable in case of emergency	☐	☐	☐	☐	☐	☐
I hesitate to use new technologies for fear of making mistakes I cannot correct	☐	☐	☐	☐	☐	☐
New technologies are somewhat intimidating to me	☐	☐	☐	☐	☐	☐
For technologies with collect or generate data: I would trust any information or data provided by new technologies to keep me safe	☐	☐	☐	☐	☐	☐
For technologies which use location data: I would be worried that someone would track my location for other purposes than rescue	☐	☐	☐	☐	☐	☐

For technologies which use location data: I would be worried that someone would use my location data without authorisation	☐	☐	☐	☐	☐	☐
I feel I am able to input into decisions about which new technologies we use and how we use them	☐	☐	☐	☐	☐	☐
I would be more likely to use new technologies if I was able to validate them on the field during the development phase	☐	☐	☐	☐	☐	☐

Appendix 1 - Local Champion interview template (English version)

Section 1: background information
1. Please state your gender: () female () male () other () don't want to answer
2. Please state your level of education () Primary school () Middle school () High school () Higher Education Degree (University, College) () Post-graduate studies (Master's, PhD) () Other (please specify)
3. Which local organisation(s) are you part of/do you collaborate with?
4. How long have you been part of the organisation?
5. What motivated you to join this organisation?
6. Please tell us about your role and responsibilities: what do you do?
7. Had you heard about the PathoCERT project and its technologies before this interview?   a. If yes, how:
8. Have you had previous regular communication with members of the PathoCERT project?   a. If yes, whom? (please, include the name of the organisation)
Section 2: local champions as part of the local emergency response eco-system
9. What is your experience with, or prior involvement in, the emergency response eco-system?
10. In which stage of the emergency response do you contribute (if applicable)? () mitigation/ prevention () preparedness () response () recover
11. How do you evaluate the current communication between your organization and other agencies/ actors involved in the emergency management system?   a. Please answer on a scale from 1 (very poor) to 10 (excellent)
12. What do think is the contribution of your organization in the implementation of emergency response actions at the local and regional level?
13.
Section 3: Feedback on the PathoCERT activities, technologies and impact
14. What is the most challenging thing you have encountered during an emergency situation?   a. From what you have seen, do you think that the PathoCERT project has the potential to ease this /these challenge(s)?

15. To what extent do you use technological means to perform your tasks in your organization?
a. Are the means you have access to sufficient to perform your tasks efficiently?
b. From what you have seen, do you think that the PathoCERT technologies would help you to be effective and efficient in your role?
Section 4: Previous & Future involvement
16. Have you participated in a PathoCERT CoP meeting?
a. If so, what was your impression of the CoP as a way of bringing key actors in local emergency response together?
17. Given the opportunity, would you like to participate further in the PathoCERT CoPs and/or other PathoCERT activities?
a. If yes, which activities in particular?

At the end of the interview make sure to thank the Local Champion and share with them opportunities to contribute to the local CoP/other opportunities to be involved.

Appendix 3 - Needs and expectations of different stakeholders

What is needed and expected from the different stakeholders?				
	Granada, Spain	Thessaloniki, Greece	Limassol, Cyprus	Sofia, Bulgaria
112-line operators	Better coordination, should listen more and allow participation of local/provincial emergency response organizations in the design of framework legislation;	/	/	To give us clear information and coordinates of the event if possible
Civil Protection	Greater involvement and knowledge of national/local police and civil guard functions within the Civil Protection planning, Control and command in the emergency, continuation of current coordination	Co-training, utilizing our capabilities, utilization of equipment, provision of fuel, Contribution to actions and coordination with stakeholders, Early activation, clear instructions, logistics, clear information, activation of voluntary organisations, technical and logistical support, common operational protocols, cooperation, elimination of politically driven behaviour, harmonised objectives, policy consistency, transparency, provision of materials, training of volunteers	Immediate assistance, Methods and equipment for communication if the GSM system goes down	Better and timely communication with them, making requests according to the SOPs, rapid response
Civil Society	Excellent collaboration	Cooperation, clear information, compliance with directives, support	/	Strict compliance with the orders of the authorities during

				the event, assistance and provision of resources
Coast Guard	Better and clearer first information about the event, More involvement in operations, more immediate information, search for missing persons	Co-training, utilisation of capabilities, provision of fuel by the Port authority	/	/
Educational institutions	/	/	/	Training and response to types of accidents and disasters
Emergency Medical Services	Initial victim care	Rapid provision of aid and removal from remote parks, Joint trainings - exercises	/	Assistance to those in need, response time
Firefighters	Real-time connected in-vehicle VR cameras, Exchange of files with planimetry, connection with images captured by Drones in real time, Communication needs	(better) Cooperation, joint trainings, acceptance, co-training, use of out capabilities and equipment, provision of fuel, Involvement of volunteers in the operations involved, Involvement of rescue teams, professionalism, elimination of politically driven behaviour, harmonised objectives, impartiality, reduction of egoism	Information, High levels of cooperation, upgrading the level of communication, better coordination, working as a team,	make your requests according to the SOPs, response instructions

Media	/	/	/	To be trained on how to react to help the public to overcome the crisis (what information to disseminate to help people to avoid casualties and damage, guidance for action and reaction from the public for the specific case, etc.), then to look for culprits/causes (if any) for the crisis. Be more proactive in positive examples of preventive action taken on specific threats and encourage education/training of the population to respond and take preventive measures, awareness
National government	Political class: Greater investment in citizen training, from schools and institutes children should be trained from an early age in the culture of resilience and self-protection.	Assessment & activation of urban protection	Coordination/preparation exercises; clarify my mission, define my responsibilities and tasks (central gov.)	strict execution of responsibilities, To know their duties in a crisis, which people to include in the "headquarters" for the management of the specific crisis, what are the first measures to be taken, the order and manner of interaction, the order and manner of requesting assistance (outside the area of action, international), to annotate the actions after the crisis has been overcome, to request a plan for preventive measures and preparation of

				their team, Coordination, planning, preparation and training for disaster response, Precise and clear national guidance, Act in accordance with established Standard Operating Procedures (SOPs)
Police	Collaboration and coordination, Mobile tools for audio-visual contact, Assistance and attention in the coordination of the incident, Access, appropriate first actions	Cooperation where required, Site security, evacuation of citizens, road opening, knowledge and training	Direct information, alignment of objectives and infrastructure, better information and coordination	/
Regional/local authorities	Greater recognition of budgetary needs, especially in the field of new technologies (management software and specific allocations for infrequent risks).	Contribution of the Civil Protection Department of the Region to actions and stakeholder coordination Central coordination and cooperation, communication with other actors, contact, better preparation, solidarity The water directorate of the decentralized administration of Macedonia-Thrace to take responsibility for controlling and monitoring the quality of surface water used for water supply	Cooperation- mutual information, help with stff and machinery by the Provincial administrations	Provision of the water sample results as soon as possible according to the SOPs by the inspectors of the Regional Inspectorates (MOEW and MH), implementation of prevention programmes, recovery measures, the employees in charge of defence and mobilisation should Make a username and password for access to the Aerospace Observation Center-MIA geoportal. From it they can be informed about the current situation in case of emergencies,

		Direct logistical support, financial support,		timely activation of volunteer resources.
Utility	Improve coordination of sanitation	Direct notification to the official e-mail address of the Agency, not to personal official e-mails (EYATH)	/	/
Volunteers	Volunteers should provide logistical support to first responders.	Alliances, Harmonisation of responsibilities and knowledge, better cooperation	Clarification of mission, delineation of their responsibilities and tasks	Active involvement in the accident response process, better coordination and communication in case of accidents