



RiskPACC

INTEGRATING RISK PERCEPTION AND ACTION TO ENHANCE CIVIL
PROTECTION-CITIZEN INTERACTION

COMMUNITY CONSULTATION REPORT

Deliverable 2.2

Dissemination Level: PU



RiskPACC

Integrating Risk Perception and Action to enhance Civil Protection-Citizen interaction

D2.2 Community Consultation Report

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|-----------------------------|---|
| Deliverable number: | 2.2 |
| Version: | V5 |
| Delivery date: | 28/2/2022 |
| Dissemination level: | Public |
| Nature: | Report |
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Document control

| Version | Date | Author(s) | Change(s) |
|---------|-----------|--|-----------------------|
| 1.0 | 10/2/2022 | Selby Knudsen | First draft |
| 2.0 | 12/2/2022 | Su Anson, Vangelis Piditis, Jon Coaffee | Edits to document |
| 3.0 | 15/2/2022 | Selby Knudsen, Su Anson | Addressing all edits |
| 4.0 | 18/2/2022 | Deborah Huron, Giacomo Bianchi, Vangelis Piditis | Internal review edits |
| 5.0 | 23/2/2022 | Selby Knudsen | Edits addressed |

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ABOUT RISKPACC

Increasingly complex and interconnected risks globally highlight the need to enhance individual and collective disaster resilience. While there are initiatives to encourage citizen participation in creating a resilient society, these are typically fragmented, do not reach the most vulnerable members of the communities, and can result in unclear responsibilities for building disaster resilience.

New technologies can also support preparedness and response to disasters, however, there is limited understanding on how to implement them effectively. Awareness of risks and levels of preparedness across Europe remain low, with gaps between the risk perceptions and actions of citizens and between the risk perceptions of citizens and Civil Protection Authorities (CPAs).

The RiskPACC project seeks to further understand and close this Risk Perception Action Gap (RPAG). Through its dedicated co-creation approach, RiskPACC will facilitate interaction between citizens and CPAs to jointly identify their needs and develop potential procedural and technical solutions to build enhanced disaster resilience. RiskPACC will provide an understanding of disaster resilience from the perspective of citizens and CPAs, identifying resilience building initiatives and good practices led by both citizens (bottom-up) and CPAs (top-down). Based on this understanding, RiskPACC will facilitate collaboration between citizens, CPAs, Civil Society Organisations, researchers and developers through its seven (7) case studies, to jointly design and prototype novel solutions.

The “RiskPack” toolbox/package of solutions will include a framework and methodology to understand and close the RPAG; a repository of international best practice; and toolled solutions based on new forms of digital and community-centred data and associated training guidance. RiskPACC consortium comprised of CPAs, NGOs, associated organisations, researchers and technical experts will facilitate knowledge sharing and peer-learning to close the RPAG and build disaster resilience.

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Executive Summary

This deliverable provides an overview of the practices undertaken by citizens groups to increase community resilience in their areas. It pulls information from interviews conducted with different types of citizen groups in six of the seven case study areas involved in RiskPACC: Israel, Italy, Czech Republic, Belgium, the UK, and Greece. Their resilience activities are discussed, as well as additional needs they have, ideas for the future, communication with CPAs, and their thoughts on risk perception. Additionally, current tech used in disasters preparation and response is detailed, along with ideas for future use. These sections are then used for a SWOT analysis. Finally, a discussion on what these interviews highlighted in terms of closing the RPAG and the implication for RiskPACC is undertaken.

Chapter 3 provides a summary of the information obtained during the interviews. This summary is divided into sub-sections, each addressing a different aspect of the interviews. The first focuses on the meaning of resilience in communities. Most of the groups interviewed did not use the word resilience in their daily work, either because the citizens did not understand the word, or because other terms such as emergency management are used in its place. Following this section, the next lays out the activities that citizen groups use to increase resilience. These activities fell into four broad categories:

- Risk communication
- Trainings (both for the community and for the members of groups)
- Preparedness/prevention
- Disaster response

In terms of risk communication, many of the citizen groups tried to spread information about the risks faced in their communities. These activities ranged from providing brochures to spreading information through schools. The trainings that are conducted typically fell into two categories, trainings for the community and trainings for the members of these citizen groups. The trainings for the community aim to provide information on how to prepare and respond to hazards, while the trainings for members focused more on familiarizing volunteers with disaster management practices in the area, to better integrate into the ongoing DRM work.

This chapter then discusses communication between the CPAs and citizen groups. The different groups had varying levels of communication, from none at all to being well integrated into the CPA structure and having good levels of communication. This chapter also discussed risk perception of the community. Most citizen groups agreed that risk perception was very low, although it typically increased after disasters.

Chapter 4 highlights the different technologies that are used in prevention and response activities. The first section of this chapter provides an overview of the types of technologies available, from VGI to different social media and crowdsourcing technologies. Following this overview, the report provides more

detailed information on specific technologies that have either been used in a preparation or response capacity, or have the ability to be adapted to do so. These technologies include many of the platforms that will be used or adapted by RiskPACC partners, including the STAM platform. Other tools discussed include the Belgian communication tool, BE-Alert. Finally, opportunities for future use as well as some of the vulnerabilities and factors that many limit the uptake of these tools are addressed. Vulnerabilities included a discussion on the digital divide, where the elderly and low income may not have access to these tools and therefore fall further behind.

Chapter 5 discusses the strengths, weaknesses, opportunities, and threats of both the traditional practices discussed by the citizen groups, and the new tools that were highlighted in Chapter 4. For the traditional tools, some of the strengths included the strong sense of community fostered by the groups, the resources available to conduct activities, the good communication with CPAs that some groups have, and the ability to be involved in resilience planning activities. Some of the weaknesses were the lack of communication that some of the groups have with CPAs, the lack of a sense of community encountered by some groups, and a lack of resources to be able to conduct all of the activities they want. Opportunities include the new engagement seen by many citizen groups following the Covid-19 crisis and the desire of communities to receive more information. Threats included the lack of preparedness for a large scale crisis, as well as damaging political influences over crisis management.

For the new technological tools, strengths include the more direct involvement of citizens in DRM practices and increased communication between citizens and CPAs. Weaknesses include issues with user retention in many of these tools, as well as the potential to increase the digital divide. Besides these weaknesses, there are also some real threats that these new tools exhibit. First, there is the potential for these apps to be spreading misinformation. There is also the threat that citizens will be used as censors for CPAs, limiting the actual engagement in the process. Despite these threats there are also opportunities in using these tools, including the ability of CPAs to better understand the opinions, beliefs, and perceptions of communities and the ability of these tools to better increase citizen knowledge.

Finally, the report ends with discussing ways that this information can be used to address the RPAG. This section highlighted many things that came up in the interviews, including the better engagement of citizens following disasters. This could be the best time to engage citizens to increase awareness and participation in prevention activities. Additionally, almost all of the interviews discussed the need for better ways to interact with CPAs. Most believe that this will increase risk perception among citizens. Finally, the use of new tools to reduce the RPAG was detailed, including the ability to use these tools to increase communication.

Glossary and Acronyms

| Term | Definition/Description |
|--------------|---|
| AI | Artificial Intelligence |
| CPA | Civil Protection Agency |
| DRM | Disaster Risk Management |
| EU | European Union |
| GA | Grant Agreement |
| GPS | Global Positioning System |
| GSCP | General Secretariat for Civil Protection |
| IoT | Internet of Things |
| LC | Land Coverage |
| LU | Land Usage |
| MCS | Mobile CrowdSensing |
| NGO | Non-Governmental Organization |
| PoI | Points of Interest |
| RPAG | Risk Perception Action Gap |
| SCENT | Smart Toolbox for Engaging Citizens in a People-Centric Observation Web |
| SWOT | Strengths, Weaknesses, Opportunities, Threats |
| VGI | Volunteer Geographic Information |
| WP | Work Package |

TABLE 1: GLOSSARY AND ACRONYMS

1 INTRODUCTION

1.1 Overview of Community Resilience

As illuminated in D2.1, in recent years, resilience as a concept has become more civic, urban, domestic and personal and is having significant implications for the way in which disaster management is conducted in communities (Coaffee & Lee, 2016). However, current governance processes still mostly exclude ordinary citizens from feeding into such discussions regarding new forms of urban and community resilience (Coaffee et al., 2021). The public, until relatively recently, has been considered passive recipients within an increasingly controlled and regulated disaster response where the knowledge of stakeholders with higher levels of expertise appeared to be overly privileged (Coaffee & Rogers, 2008). That being said, increased attention is now being paid to how individuals and a broad range of local citizen groups might become more responsible for developing their own community resilience, although a number of scholars criticise such an approach. (McEntire & Myers, 2004; Welsh, 2014).

Community resilience is a central concept for RiskPACC. Ideas of active citizenship and horizontal and vertical communication between CPAs and citizen groups that challenge conventional top-down modes of disaster risk governance and one-way communication processes (such as brochures to inform citizens about existing risks and preparedness measures) constitute the main goals of the project. Community and societal participation are moving to the core of new approaches to resilience governance in the push for more holistic disaster risk management practices. Therefore, overall disaster resilience is seen as a co-creation process involving a shared dialogue between different stakeholders, *including local communities*. The building of such resilience is about new forms of collaborative governance which will be 'most effective when it involve[s] a mutual and accountable network of civic institutions, agencies and individual citizens working in partnership towards common goals within a common strategy' (Coaffee et al., 2008). Involving citizens in the resilience building process is an endeavour capable of not only increasing overall disaster resilience but also has the potential to enhance the quality of disaster response. This includes potentially allowing for the empowerment and consideration of marginalised groups in the development of assessments and measures, therefore producing more soci-spatially just outcomes (Ziervogel et al, 2017). This deliverable supplements D2.1 and focuses on these new forms of collaborative governance by examining the tactics and practices of local communities in enhancing community resilience across six of the case studies involved in the RiskPACC project.

1.2 Overview of Deliverable 2.2

This deliverable (D2.2), "Community Consultation Report to identify how community resilience and risk perception operates in local settings" is the output of Task 2.2 "Understanding local practices." It seeks a better understanding of community practices in the case study areas. The task brings together citizen groups in the case study areas and gathers information on how they understand community resilience, what their needs are, the methods they are currently using to enhance and support

disaster and community resilience and what they would like to use in the future. This work will highlight strengths and weaknesses of current practices, as well as opportunities for future use. In addition to community resilience practices, community understandings of risk perception (including citizen group ideas as to how to improve risk perception) and the use of technology and mobile tools for risk preparedness and response will be discussed, including the strengths and weakness of specific digital tools and general concepts. Finally, information from the citizen group interviews will be used to develop ideas for closing the risk perception action gap (RPAG). Detailed information on the RPAG, its meaning and how it relates to the concepts of community resilience and risk perception can be found in D2.1. This deliverable will specifically identify the activities that are currently being undertaken by citizen groups in the case study areas to better understand how communities are conceptualising, practicing and developing resilience as well as technologies that can assist in citizen group activities.

Moreover, this deliverable, along with D1.2, “CPA consultation report and repository of best practices,” will provide the knowledge basis of what is happening on the ground in the project’s case study areas. These outputs will increase the understanding of current practices, both from the perspectives of CPAs and citizen groups. The outputs from D1.2 and D2.2 will feed into both the baseline information required for WP3, “Co-creation lab and stakeholder integration,” and the development of the RiskPACC framework in WP4, while they will also inform understandings of resilience, vulnerability, and risk perception that will be used throughout the project.

The main objective of this report is to gather information on local practices of citizen groups, their attempts to increase resilience, the understanding and actions around risk perception, and ideas to close the RPAG.

1.3 Structure of the deliverable

Following the introduction, this document includes:

- Chapter 2: This chapter provides an overview of the case study areas and the methodology used to interview citizen groups and analyze the data. It includes a brief overview of the disaster risk management (DRM) governance structure in the case study areas and how citizen groups and volunteers are currently involved in DRM activities, an overview of the case studies, and information on the methods used.
- Chapter 3: This chapter summarizes information from the citizen group interviews. It highlights their understanding of resilience, details the current resilience activities that the groups are conducting in their communities, discusses the relationship these groups and the communities in general have with CPAs, and explores the importance of risk perception in citizen group activities.
- Chapter 4: This chapter examines current technologies that are being used in preparedness response activities, and how citizens in particular are contributing

to these activities. It outlines several thorough examples of citizens using technological tools in DRM activities and discusses opportunities for future use of these technologies. It concludes with a brief examination of vulnerabilities that arise when using these tools.

- Chapter 5: This chapter analyses the interview data, highlighting strengths, weaknesses, opportunities, and threats of current citizen group practices. It also provides information on the strengths and weaknesses of integrating new tools and technologies into local community resilience practices.
- Chapter 6: The main body of the report concludes with a discussion of the citizen groups activities and ideas for closing the RPAG.
- Chapter 7: The conclusion summarizes the information presented in the main body of the report and discusses the next steps, both for WP2 and for how this deliverable will be built on by other WPs

2 METHODOLOGICAL APPROACH AND IMPLEMENTATION

This chapter will introduce characteristics of the case study areas, information on the citizen groups that were interviewed, as well as highlight the methodology for the interviews and analysis.

2.1 Case Study Description

The overall objective of this deliverable is to describe the activities of citizen groups that are active in the RiskPACC case study areas. There are seven different case studies involved in RiskPACC:

- Lancashire Police Constabulary, UK
- Municipality of Padova, Italy
- Municipality of Rafina-Pikermi, Greece
- Municipality of Eilat; Magen David Adom, Israel
- National Crisis Center Federal Public Service Interior, Belgium
- Czech Association of Fire Officers, Czech Republic
- IZAR, Germany

These seven case study areas are run by local or regional CPAs. For more information on their practices and resilience activities, see D1.2.

Each case study partner is focused on different hazards as a part of RiskPACC, from natural to anthropogenic. The partners helped identify different citizen groups working in their area to be interviewed for this deliverable. While many of the citizen groups that were interviewed focused on similar hazards to those being addressed by the case studies, there were several with different focuses, which are described in Table 2 below.

| Case Study Country | Case Study Hazard | Citizen Group Hazard |
|--------------------|---|--------------------------|
| Greece | Wildfires and Floods | Wildfires |
| Italy | Multi-hazard: floods, heatwaves, extreme rainfall | General civil protection |
| Israel | Earthquakes | Earthquakes, oil spills |
| Belgium | Multi-hazard, including terrorism | Flooding |
| UK | Terrorism and flooding | Flooding |
| Czech Republic | CRBN | Pandemic |
| Germany | Pandemic | <i>Not interviewed</i> |

TABLE 2: HAZARDS ADDRESSED (SOURCE: RISKPACC GA AND INTERVIEWS)

The pandemic case study did not identify a citizen group for the interviews, due to the fact that it does not focus on a local area, instead tackling the global response to the pandemic.

Every country, and therefore every case study area, has a slightly different DRM and governance structure, thus interacting with citizens in different ways. These structures and interactions are detailed below across the different case studies of RiskPACC.

2.1.1 GREECE

In Greece, the General Secretariat for Civil Protection (GSCP) is responsible for directing and coordinating all activities related to the prevention, control, and management of crises. The GSCP issues national plans for each disaster and hazard. These national plans are adopted after extensive and sophisticated cooperation among all relevant agencies involved in disaster risk reduction and emergency management, and become binding on all stakeholders upon their adoption (Mülayim, 2014). Additionally, the GSCP is charged with maintaining the volunteer system for disaster response, which includes all registered volunteer organizations and volunteer experts and makes an important contribution to the resilience activities. Moreover, the Hellenic Red Cross establishes disaster response units on a voluntary basis (Mülayim, 2014). This volunteer system allows volunteer organizations and citizen groups to become integrated into the DRM structure.

2.1.2 ISRAEL

The Israeli approach to emergency management is based primarily on the need to prepare for and respond to attacks on the country. The major threat Israel faces is war-related, resulting in an emergency management system with strong military influences (Rozdilsky, 2009). For non-war crises, the Ministry of Public Security is responsible for the operational preparedness and readiness of all the agencies under it, including the Israel Police, the Israel Prison Service, and the Fire and Rescue Service (Vollmer & French, 2014). Volunteers are active in emergency management at the Israel Police, Fire and Rescue Services, and MDA (Vollmer & French, 2014). While volunteers are active in these emergency management services, there is limited information on how volunteer groups outside of these services are organized and utilized in emergency situations.

2.1.3 UNITED KINGDOM (UK)

Crisis management in the United Kingdom is based on the theory that a bottom-up approach should be used, with management and decision-making occurring at the lowest appropriate level (Hayes, 2014). Most emergencies in the United Kingdom are managed at the local level, but if necessary, the government's central response framework can be utilized. Voluntary organizations play an important role in strengthening capacity and are involved in the DRM and resilience activities. There are many different volunteer groups operating in the United Kingdom, including the British Red Cross, Salvation Army, St. Johns Ambulance, British Cave Rescue Council, International Rescue Corp, and the Royal National Lifeboat Institute, to name a few (Cabinet Office, 2011). In addition to these established volunteer groups, many local areas have created their own citizen groups to work with CPAs to address hazards in their area.

2.1.4 ITALY

In Italy, risk forecasting and prevention, assistance to affected populations, management of emergencies, and risk mitigation are all considered civil defense activities established in Law No. 225/92, which created the National Service. The protection of the population and the protection of the territory are the main objectives of the National Service, which the central Ministry addresses in collaboration with regional and local governments (Larossi et al., 2014). By law, citizens are an integral part of disaster management. All citizens are called upon to protect themselves and support the disaster response by following the recommended behaviours of the disaster response authorities. Citizens are informed and trained through risk awareness programs at the national and local levels and information campaigns in schools (Larossi et al., 2014).

2.1.5 BELGIUM

In Belgium, the Minister of Internal Affairs is authorized to deploy the police, rescue services and civil defence corps during a crisis. In addition, the Minister of the Interior, the governor of a province, and the mayor are authorized to draw on all civilian resources in times of crisis (Birkman & De Stewart, 2014). Communication is structured through a second crisis centre "coordination committee" that provides transparent information to the mayor, governor, and/or minister (Civil Protection, 2014; IBZ, 2014). Its role is to focus information for the general public. The committee provides support in crisis situations with GIS tools, video conferencing, power generators, sirens, etc. to provide support. Some of these are supplied by volunteers. In addition, there are 450 operational staff and 650 volunteers working in the civil protection force (Birkman & De Stewart, 2014).

2.1.6 CZECH REPUBLIC

In the Czech Republic, civil emergency planning (CEP) includes "planning, coordination, and management arrangements to ensure that the state is prepared to prevent and manage emergencies and crisis situations that threaten the population, administrative operations, and the economy, to meet international security obligations, and to support the armed forces during state emergencies" (UNISDR Europe, 2013). As an important part of the security system, crisis management in the Czech Republic includes both the political sphere and the strategy for protecting the population, finances, and the economy (Swedish Civil Contingencies Agency, 2009). Volunteers are involved in the dissemination of emergency warnings, with members of volunteer rescue teams personally notifying citizens (Eicher & Jager, 2014). Besides this function of the volunteer rescue teams, there is limited information in how citizens are included and how in the DRM structure.

2.1.7 GERMANY

While the pandemic case study is considered a global study, the organization is based in Germany and therefore the German organisational structure will be discussed. In Germany, the entity first responsible for a disaster is the county, municipality or district where the disaster first occurs. If a disaster exceeds the capacity of a municipality or if several counties are affected, the state authority provides coordination. At the federal level, the Federal Ministry of the Interior (BMI), supported by the Federal Office of Civil

Protection and Disaster Assistance (BBK) and the Federal Agency for Technical Relief (THW) are initially the central institutions for crisis management. The German civil security system relies heavily on non-profit relief organisations and their volunteer staff. Their main task is emergency and crisis response through medical, rescue and ambulance services on behalf of public agencies. Most management tasks and everyday emergency services are carried out by professional staff, but volunteers remain essential for membership fees, training, public outreach, and more impactful crisis management situations.

Some of the citizen groups interviewed for this report fit into the formal volunteer sector of the DRM activities of the state, while others are less integrated with CPAs and have been established to address problems that have arisen in their communities.

2.2 Questionnaires

One of the central objectives of this deliverable is the documentation and analysis of community knowledge related to multiple natural or human-induced risks in different contexts and realities. This tacit knowledge strongly relates to the concepts of disaster and community resilience, both of which have been extensively explored in D1.1 and D2.1 respectively, but is most explicitly contextualised in this project through the concept of community risk perception, a concept that has been granted the following working definition for RiskPACC, in D2.1:

“Risk perception involves people’s beliefs, attitudes, judgements and feelings, as well as the wider social or cultural values that people adopt towards hazards and their benefits. The way in which people perceive risk is vital in the process of assessing and managing risk. Risk perception will be a major determinant in whether a risk is deemed to be “acceptable” and whether the risk management measures imposed are seen to resolve the problem.”

In this context, the focus of the methodological approach has been turned towards understanding and deciphering how citizen groups and local communities across the six case studies understand disaster resilience and risk perception as well as how these concepts relate to them and wider communities, what their needs are, and the kind of resilience methods they are currently using and what they would like to use in the future. In order to obtain this information, the principal methodological approach utilised was semi-structured interviews.

Semi-structured interviews are defined by Dunn (2005, p. 80) as ‘a form of interview that has some degree of predetermined order but still ensures flexibility in the way issues are addressed by the informant’. The semi-structured interviews were employed targeting at acquiring what Kvale (1996, p. 5) defined as ‘descriptions of the life world of the interviewee with respect to interpreting the meaning of the described phenomena’. The semi-structured interview approach has some significant advantages for the present. First, it provides a framework for a discussion between researchers and interviewees, without however creating barriers or limitations to the information that can be obtained. Moreover, interviewing can be a unique method for obtaining original empirical data, while concurrently motivating the interviewees to critically reflect on their approach to dealing with disaster and community resilience issues in practice. Finally, given the restrictions in travelling posed by the ongoing

pandemic, the process of conducting the interviews was not bound by physical proximity limitations and could be performed (in some cases) remotely, thus creating more favourable dynamics for the interviewers.

The designing of interviews required careful planning and coordination in advance. Designing a questionnaire for community groups in particular is a significantly challenging process, particularly as it was addressed towards individuals with various experience in disaster risk management coordination. To achieve higher integrity in terms of style, contents and consistency in the use of terminology and wording and in an attempt to soften the process of interviewing for the interviewers, a common questionnaire was developed in collaboration with WP1 partners targeting CPAs and community groups interchangeable (ANNEX 1). The questionnaire consisted of four parts as follows:

1. **Part 1** General questions targeted both CPAs and Community Groups
2. **Part 2** Questions for the CPAs
3. **Part 3** Questions for the Citizens/Community Groups
4. **Part 4** Summary which regards questions about the effects of the pandemic targeted both CPAs and Community Groups

Both Deliverable D1.2 and D2.2 followed the researcher-administered questionnaires method. Such a method practically involves the answering of questionnaires without the existence of pre-determined responses were available to the interviewees. Questions were used to solicit unrestricted answers and the respondents were free to express themselves in any way they have chosen. This allowed interviewees to manifest their emotions and opinions. More explicit information about the researcher questionnaire method followed in this project are presented in D1.2

For this deliverable, interviewees were selected based on connections with the case study partners. Many were volunteer organizations or community groups that work closely with CPAs. Case study members selected and interviewed the community group members. Following the conducting of the interviews in all case study areas but the global pandemic case study based in Germany, Parts 1, 3 and 4 were analysed by project researchers from WP1 and WP2 so as to reflect the different risks and contextual particularities of the case studies, while a categorisation of respondents and their respective responses also took place.

Specifically, the questions targeted at the citizens and community groups included the following where based around the following themes:

- *Nature of risks the different areas faced.*
- *Existing needs in terms of addressing the impact of such risks.*
- *Personal view on the content of resilience (disaster or community).*
- *Outline of community action in their areas.*
- *Existing communication channels between community groups and CPAs.*
- *Existing tools and methods in place (if there are) for community engagement in disaster risk management.*

2.3 SWOT Analysis

Following the conducting and analysis of the interviews, the approach that has been adopted was a SWOT (Strength, Weaknesses, Opportunities, Threats) analysis. SWOT analysis (also addressed as situational assessment or situational analysis), is a method used mostly in organisational studies such as strategic planning and management, to identify existing strengths and weaknesses but also potential opportunities and threats on a given task. Here, strengths and weaknesses most commonly refer to existing and internal attributes and needs of a system/strategy, including processes and methods currently in place, while opportunities and threats are more external factors that could become aspirational goals or pose extrinsic pressures to the intended activities.

The SWOT analysis technique is mostly performed as an assessment and evaluation tool in the preliminary stages of the decision-making processes and aiming at supporting the identification of the favourable or unfavourable internal and external factors related to a strategic plan. Although it has been used widely as a decision-making support tool, SWOT analysis has intrinsic limitations, mostly related to its inability to account for unexpected opportunities and threats, predominantly in rapidly evolving or changing conditions.

In the context of this project, SWOT analysis will be used to examine a range of processes and methods traditionally used by local communities to increase their resilience, particularly focusing on the potential of digital technologies, such as crowd-sourcing and VGI, to support disaster risk preparedness, management and response. Finally, the SWOT analysis here will also attempt to identify how specific human factors, including vulnerabilities, facilitate or limit the use of respective digital technologies with the ultimate goal of exploring different community practices and approaches to close the RPAG

3 INCREASING RESILIENCE IN COMMUNITIES: TRADITIONAL METHODS AND PRACTICES

This chapter draws on the interview findings to detail how resilience and risk perception fit into citizen group practices. It outlines the meaning of resilience from a community perspective, current practices in building community resilience undertaken by these groups, their needs and potential future activities. It also addresses community risk perception, including communication between CPAs and community members. Table 3 below highlights the activities that are undertaken by each community group. This information will then be expanded upon in the following sections.

| | Greece1 | Greece2 | Greece3 | Greece4 | Israel1 | Israel2 | Italy | Belgium | UK | Czech |
|--|---------|---------|---------|---------|---------|---------|-------|---------|----|-------|
| Understanding Resilience | | | | | | | | | | |
| Does the groups use the term resilience? | √ | | | √ | N/A | √ | | N/A | | |
| Are other words used to capture resilience activities? | | √ | √ | | N/A | | √ | N/A | √ | √ |
| Is resilience about prevention/preparation? | √ | √ | √ | √ | √ | | √ | | √ | N/A |
| Is resilience about response? | | √ | | √ | | √ | √ | √ | | N/A |
| Resilience Practices | | | | | | | | | | |
| Communication (with CPAs and/or citizens) | | √ | | | | √ | | √ | √ | √ |
| Training (of the citizens group and citizens) | √ | √ | | √ | √ | √ | | | √ | √ |
| Prevention or preparation measures | √ | | | | | | | | √ | |
| Disaster response activities | √ | | √ | √ | | √ | | √ | √ | √ |
| Additional Needs | | | | | | | | | | |
| Funding | √ | √ | √ | √ | √ | | | | √ | √ |
| Increased communication | √ | | √ | √ | √ | √ | | | | |
| Different focus of activities | | | | | √ | | | | | |
| More personnel | | √ | √ | √ | | | | | | |
| Communication | | | | | | | | | | |
| Good integration with CPAs | √ | √ | | √ | | | √ | √ | √ | √ |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lack of information sharing | √ | | √ | √ | √ | √ | | | | |
| Communication via email and SMS | | √ | | | | | √ | √ | | √ |
| Increased communication after disasters | √ | | √ | | | √ | | | √ | |
| More information or training needed | √ | √ | √ | √ | √ | | | | | √ |

N/A: question was not asked

TABLE 3: OVERVIEW OF CITIZEN GROUPS ACTIVITIES (SOURCE: INTERVIEWS)

3.1 The Meaning of Resilience in Communities

As discussed in D2.1, the term 'community resilience' was developed to reflect the role of society, and communities in particular, in reducing their own vulnerability and managing disasters (Davoudi et al., 2012). This idea has come from both the recognition that communities have a role to play in DRM activities, and the need to reframe resilience from a top-down to a bottom-up approach, taking into account local knowledge and understanding (Aldrich, 2012; Wagner, et al; 2014). While the term community resilience has been thoroughly examined in the research, less is known about its uptake in practice. The working definition of community resilience for RiskPACC established in D2.1 is:

"The capacity of communities and individuals to interact with their surrounding physical and built environment, comprehend risk and actively mobilise activities to enhance societal connectedness including the use of digital technologies, to co-produce knowledge and build two-way communication channels with the CPAs and other local stakeholders to cope with, adapt to, prepare for and recover from external perturbations or inherent stresses."

This section will examine the use of the term community resilience by citizen groups and their understanding of the concept in practice.

Interviewees were asked what resilience means in their countries and whether or not it is a term used in their work at the community level. Additionally, they were asked what type of resilience activities were taking place. As there was a large variety of citizen groups interviewed, with different levels of knowledge of overall crisis and disaster management, a variety of responses were received. Those that were more familiar with the term were either more closely affiliated with the CPA structures of local or national CPAs, or associated with a larger NGO that has developed and used the terminology previously. Most citizen groups that have been set up by community members, or were volunteer groups, did not have any knowledge of the word resilience. Which is an interesting observation, given the fact that the term has concentrated great attention in the last years. Yet, these results show that without the formal structure and language of CPAs, resilience is a term not often used in the community. One interviewee mentioned that:

"Prior to Covid, the word resilience was not used by citizens at all when thinking about resilience. Now that Covid has led to people learning more about emergency management, terms like resilience and vulnerability are becoming better understood."

For citizen groups that do not use the word resilience, the terms emergency management or risk management are more commonly used. The groups that used these alternative terms were more commonly involved in risk communication and disaster response, with less focus on preparation and preparedness. In contrast, one interviewee from the UK said that **preparation** was the word used to indicate resilience, because most of the resilience activities that were done by the citizen group involved preparing for flood events.

For the groups that do use resilience as a term, some, such as a very well-established NGO in Greece, were very familiar with the term and its more academic and practical definitions. While the group understood and used resilience, they argued that the more appropriate term to use in communities is cohesion and continuity. They argued that:

“Clearly, the organisation with all the experience that it has in any project we develop the issue of resilience, cohesion and continuity as one of the key parameters. For example, we always work with local staff, we develop relationships with the local community to make our actions “accepted”, we prioritize our actions based on local realities and constraints and respecting local customs and habits. Our aim is, alongside our humanitarian action, to pass on know-how, practices and solutions for the sustainability of our programmes after our departure.”

So, while they understand the concept of resilience well, they did not believe that is it the most appropriate term to use for their activities in the local areas.

Many citizen groups do not use the term resilience, but they do work on disaster management activities to do with both preparedness and response, therefore attempting to increase resilience without using the term. Risk management or disaster management are more commonly used, as many believe that these resilience activities are most associated with preparing for, responding to or recovering from disasters. Therefore, it can be argued that based on our analysis most citizen groups believe that both response and preparedness are important aspects of resilience activities, with groups usually focusing on one or the other, and only a smaller number among them focusing on both.

3.2 Current Resilience Practices by Citizen Groups

All citizen group members interviewed were in some way involved in disaster management and resilience activities in their communities. Depending on the organization, there are different community resilience practices that they participate in. Such practices range from risk communication to disaster response, and will be detailed below along with additional needs and planned future resilience activities.

3.2.1 OVERVIEW OF CURRENT PRACTICES

The different citizen groups represented have varying levels of involvement in disaster management. Many work in the fields of risk communication and preparedness, while others work in the disaster response and recovery phase. Different practices in the different areas of DRM in the communities are highlighted in Figure 1 below and then expanded on in sections 3.2.1.1 to 3.2.1.4.

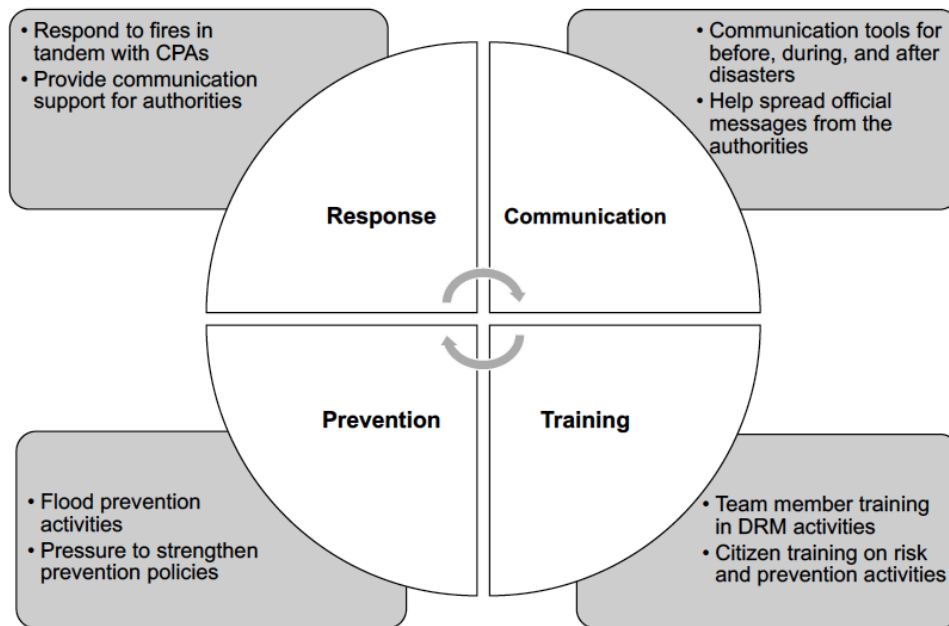


FIGURE 1: CITIZEN GROUP RESILIENCE PRACTICES

3.2.1.1 Risk communication

Risk communication is a very important aspect of the activities that many of the citizen groups conduct. Many of the interviewees expressed that citizens did not understand their risks and did not know how to act if a disaster occurred. The aim of these groups communication activities is to increase knowledge of risk and promote potential prevention and response activities. For instance, one group in Greece has organized a communication and action network, with seminars to communicate different risks and actions that citizens can take. Similarly, in Italy, a citizen group mentioned that they gave a lot of “instruction to citizens” on the risks they face. In Israel, one of the major initiatives being undertaken by a citizen group is “developing communication tools to be used [by the community] before, during, and after the disaster.” All interviewees believe that better risk communication would increase risk perception, and therefore lead to better preparation and response. This is the reason that so many of their activities focused on this area.

In Belgium, communication is also prioritized, but the focus is less on prevention activities and more on communication during the response phase. For example, a group of volunteers in the community monitor social media during a hazard event, and then assist in spreading official messages and information from the authorities to citizens. In past hazard events, these volunteers have been faster at spreading information to citizens than the authorities. Additionally, amateur radio operators have developed disaster response teams that help maintain communications during power outages.

3.2.1.2 Trainings

Many of the interviewees discussed trainings as one of the main activities that they undertake. These trainings usually take on two forms: training citizens on disaster risk,

preparation, and response or training volunteers to work with their organizations. In Greece, all interviewees, regardless of the organization they work for, provide training for their volunteer members. For instance, one organization provides training so that their volunteers can “deal with crises in a specialized way.” Another group in Greece trains its members, and then recruits volunteers and provides each volunteer group with a trained leader. Yet another group in Greece also trains all of its members on municipal emergency management practices so that they can be effective in disaster response. In Italy, the citizen group member interviewed pointed to training as one of the key activities for the group. They train volunteers to work in civil protection, and this training helps them work with municipal and regional emergency management authorities.

The other form of training mentioned in the interviews was training performed by citizen groups to better inform citizens of risks and actions that can be taken. In the UK, many of the community flood risk management groups provide trainings to citizens on how to best prepare their properties for flood events. In Israel, “schools do many trainings” to help children better understand the risks in their communities. One citizen group in Greece created a game for school children, to provide trainings on risk prevention activities and to “awaken the [idea of] prevention” in children, echoing gamification approaches which are planned to be developed in later stages of RiskPACC.

3.2.1.3 Preparedness/Prevention activities

Many of the communication and training activities mentioned above are designed to increase prevention activities among citizens, but many citizen groups also work on additional prevention and preparedness activities. For example, one citizen group in Greece organized a workshop with the fire services that walked citizens through different civil protection issues, including prevention activities that citizens can take. Additionally, another citizen group in Greece is using their influence to pressure local and regional governments to strengthen their policies related to disaster prevention. As this Greek interviewee described:

“Prevention enhances both the preparedness and the stability of a social protection system, raising the level beyond which a disaster can have disproportionate impacts.”

The citizen group in the UK focuses heavily on flood prevention. They educate citizens on their risk, actions that they can take, and ways to prevent losses in the event of a flood. To do this, they have created a history of floods in the area and the different responses, and passed it out the community and CPAs. They have also placed sand bins and pumps in flooding hot spots in the community and instructed citizen on their use. They also, with assistance from local CPAs, find funding for additional resources to conduct activities such as purchasing flood defences and using local knowledge to find the most flood prone areas. The group is working to prepare for flooding events and aims to be able to have the community act independently to address flood risk. In recent years they procured funding to build their own flood barriers, and that paired with the education activities discussed above, resulted in no major flood damages by major storms in 2019. Several interviewees mentioned that there was not enough attention paid to prevention activities, which will be addressed further in section 3.2.2.

3.2.1.4 Disaster response

While some citizen groups are focused on prevention activities, others have focused primarily on disaster response activities. These activities are varied depending on the focus of the organization and what hazards are most prevalent in the area. The Belgian interviewee discussed several different disaster response activities. A NGO that focuses on tech support is often called upon by CPAs to help establish Operational Command Centers, especially during power outages. During the Belgian Covid response, this group helped set up triage areas outside of hospitals. Additionally, an amateur group of meteorologists monitor weather during extreme weather events and provide that information to authorities, so that CPAs can get a better picture of weather in areas where they do not have monitoring systems.

In Israel, citizen groups have worked with CPAs during their Covid-19 response. They have worked with citizens to provide assistance during quarantine periods and have assisted the elderly that were most at risk. Similarly, all of the citizen groups that were interviewed in Greece had assisted CPAs in response to the fires in 2018 to varying degrees. One of the groups led local volunteers to protect property during the first and provide information to citizens on how to react to fires. Another was established to provide official volunteer aid to local fire departments, and provide local knowledge and assistance to any official fire department response. Other citizen group responses in Greece included organized civil protection groups that are activated to assist in any sort of hazard response by the municipality. Italy has a similar citizen group structure, where volunteers follow emergency management regulations that have been established by the municipality and assist the municipality in their disaster response activities. While the UK group focuses mainly on prevention activities, they also play a small, but meaningful role in the response to flooding. While it is primarily the job of local CPAs to erect flood barriers, local citizen groups assist with this activity, especially in widespread flooding events where other areas may be of more concern. Many local groups have temporary flood barriers that can be erected, including deploying these barriers to areas in the community that they know are prone to flooding.

The activities that are undertaken by citizen groups in terms of disaster response tend to either take place in tandem with local CPAs, or fill a void that CPAs cannot cover during a disaster. The interviewees highlighted the current practices of community groups, showing that there are a variety of different community resilience practices currently taking place, highlighting the diversity of actions that can be taken to increase resilience.

3.2.2 ADDITIONAL COMMUNITY NEEDS

One of the needs identified by a majority of interviewees was an increase in communication and training from CPAs, and better organization between the citizen groups and CPAs. This will be discussed more in-depth in section 3.3.

Additionally, many of the interviewees discussed the need for more resources. These resources included funds, equipment, and personnel. In Greece, all interviewees said there was a very limited budget for civil protection activities. As volunteer groups, most of the funding came from citizen donations, and therefore there was not enough

funding. These groups also suggested that they needed equipment such as “fire safety, tents, and signage on the premises so that they are safe and ready to be used in case of emergencies.” Another interviewee in Greece plainly specified their needs in addressing disaster risk, when stating they had “not enough budget, not enough equipment, and we would like more volunteers.” This shows the challenges that many of the citizen groups face when trying to participate in DRM activities. In contrast, in countries such as Italy, the volunteer organization are funded by the local municipalities, and therefore feel that they have the resources that they need.

In Israel, an interviewee determined that what they needed most was more of a focus on prevention activities. They believed that there was an overall lack of understanding of the risks and how to act when they occur, and would like to focus on prevention activities to increase that knowledge and spread it to the community.

3.2.3 FUTURE RESILIENCE ACTIVITIES

There was limited discussion in the interviews about what citizen groups would like to do in the future. As with the needs of the community, much of the discussion of future activities centred around better communication and collaboration with CPAs in the area, to both better understand the roles of the citizen groups and better incorporate those groups into the local CPA structures. Many interviewees also believed that they could work to capitalize on disasters that have occurred to both increase the participation and understanding of the citizens.

This feeds back to the core aims of RiskPACC, to better facilitate two-way interaction between CPAs and citizens to reduce the RPAG. As citizen groups lacked a vision for future resilience activities, this is an opportunity for RiskPACC to provide ideas for future activities that can improve communication and close the RPAG, using the newly developed tools from RiskPACC technical partners.

3.3 Communication and Collaboration with CPAs

The building of disaster and community resilience is about new forms of joined-up governance which should involve a network of civic institutions, agencies, and individual citizen working together towards common goals (Coaffee et al., 2008). Involving citizens, if done appropriately, can enhance capacities and capabilities of disaster resilience, potentially allowing for the empowerment and consideration of marginalised groups in the development and implementation of disaster resilience. As the interviews showed, there is a strong desire by citizen groups to be involved in community resilience activities and to increase collaboration and communication with CPAs. This section will discuss communication in more detail.

As mentioned in section 3.2.2, many of the needs of the citizen groups revolve around the lack of communication between CPAs and citizen groups. The level of communication depends drastically on the country and the type of group that the interviewees come from. For example, in Belgium, CPAs select and train different NGOs and citizen groups to work with the government during disasters. Because of this process, citizen groups have particularly effective communication levels with CPAs. They also receive training, so that they understand how CPAs work and have a better idea of disaster management initiatives in their area.

In contrast, Israel does not seem to have significant communication channels between CPAs and the community. According to one interviewee, there are some opportunities to discuss issues with the Mayor at townhall meetings, but rarely does this include discussions of disaster management activities. There is an overall lack of information shared between CPAs and communities, which leads to a lack of knowledge of risks and how to prepare for them. The interviewee suggested “more public hearings to better inform the public.”

Similar issues with communication were discussed with an interviewee from Greece. They described difficulties in the communication between CPAs and the community during a disaster event. According to the interviewee:

“CPAs did not know how to inform citizens [during] the 2018 fires. Citizens should be informed over the phone, during the development of an event.”

This lack of communication led to challenges in coordinating the community response with what the CPAs wanted. While this was found during one interview in Greece, other interviewees from Greece described the communication with CPAs as “as good as it could be with the municipality,” and “very effective.” These differences in perception of communication could be due to the different collaborations that the citizen group have with CPAs. Some are more established NGOs that have closer ties to the local authorities, while others were groups of volunteers with less official connections. Even the citizen groups in Greece that were satisfied with their communication with CPAs expressed a desire for “better training at a regular interval.”

For those interviewees that described the types of communication that took place, most mentioned email, phone, and SMS messages. In Italy, there are multiple means of communication between CPAs and citizens, including the internet, SMS messages, megaphones, and door-to-door communication. According to the interviewee, this communication has been very effective and has led to effective risk management.

While there have been various levels of satisfaction with the communication detailed by the interviewees, all, even those that described communication as effective, have commented on the need for better collaboration and training. Interviewees from Greece and Italy have both suggested the need for “better organization” between the CPAs and different citizen groups/volunteers, while in Belgium and the UK trainings are occurring to better align understanding and cooperation between the two groups, mostly with the aim of better assisting CPAs during emergencies and helping communities prepare for various hazards.

Finally, although there have been communication issues (see above) between CPAs and citizen groups, many interviewees expressed optimism about positive changes in communication. Most of these changes have occurred following disasters. The group in Greece that had struggled with communication during a fire event commented that “communication had improved after the fire,” and that it continued to improve. Similarly, communities in the UK also experienced better communication after CPAs realized that citizen groups were effective during flood events. One interviewee in Greece offered a suggestion for a better model of communication:

“Communication can be made easier and more effective by inviting actors in the form of external assistance who will offer specialized help based on their subject matter... And external assistance includes institutional bodies and services, voluntary organizations, society itself. For this to happen there must be coordination, a crisis management model, immediate establishment of a crisis management team for immediate response, identification of immediate needs and mobilization of all stakeholders based on these needs. To achieve this, the preparation, training, contact and local knowledge of all those involved in coordinating the response should be in place.”

This nicely sums up the views of citizen groups. They have local knowledge that can be used in disaster management activities, and through coordination and collaboration with CPAs and trainings, the two way knowledge transfer can improve the crisis management model.

3.4 Risk Perception in Communities

As shown in D2.1, as well as discussed on Chapter 2, Risk perception among citizens is vital in the process of assessing and managing risk, and influences the understanding and acceptance of DRM measures being taken. Therefore, understanding risk perception in the case study areas is an important step in closing the RPAG, as it will better explain citizens understanding of the risks they face.

All interviewees mentioned risk perception in the community, either directly or indirectly. A major concern among the citizen groups interviewed was the lack of risk perception in their communities. Interviewees from Israel, the UK, and Italy all mentioned the fact that citizens did not have a high level of risk knowledge, although each interviewee gave slightly different reasons that they thought this was a case. In Italy, for instance, the interviewee claimed that there were “issues [with resilience] because there is only a superficial knowledge of risk, as many have not experienced major disasters.” The UK has a similar view on risk perception, mentioning that “in areas that have been flooded before, the perception is higher, but it is generally quite low.” Both interviewees believe that exposure to a hazard is one of the major drivers of risk perception. Alternatively, in Israel, the interviewee emphasized the lack of information available about risks from the CPAs as a reason for low risk perception. They believe that “risk perception is low among community members because they do not know what the risks are or how to ask,” and this lack of information is due to poor communication with the CPAs. While the views on what accounts for the lack of risk perception differ between the interviewees, they all agree that risk perception needs to improve in their communities to improve DRM and resilience. One interviewee highlighted the importance of risk perception in DRM and resilience, saying:

“risk perception is incredibly important, as increased risk perception means a more informed and prepared population that responds more readily and effectively.”

Similarly, another interviewee states that “risk perception will impact planning and response since it will help citizens act to prevent risk or minimize it.” In Greece, one of the interviewees believed that the communities had a “good mutual understanding of risk between CPAs and the community.” They believe this is due to the recent wildfire-related tragic incidents in Greece, where communities have become more aware of

disasters, which has led to better cooperation amongst all organizations. This has increased the overall risk perception.

While all interviewees agreed that increasing risk perception among citizens is important to the overall success of preparedness and response, they had different views on the best ways to increase that risk perception in communities. Most of these ideas involve increasing the information available to citizens, as they currently only have a superficial level of knowledge. One interviewee highlighted the need for “better and more widespread information available to the public” so that the public could become more involved in the DRM process. Similar views were discussed by another interviewee, who described a process where:

“municipalities organized a workshop in cooperation with the fire services that informed different groups on civil protection issues, which increased risk perception.”

Such responses highlight the importance of bringing citizens into the DRM process, in order to render them more involved. These more participatory methods have been hypothesized by both researchers and the interviewees to increase risk perception as well as increase actions by the community to improve resilience (Wachinger et al., 2013).

4 COMMUNITIES AND TECHNOLOGY: NEW TOOLS TO INCREASE RESILIENCE

This chapter will highlight different technologies that are currently being used in DRM activities, discuss opportunities for future uses, and briefly touch on vulnerabilities that may limit use. Findings in this section are based on literature and the expertise of RiskPACC technology partners. This is an expansion of the work done in D2.1 to show the academic work done on VGI and other technologies used in community resilience.

4.1 Current Technologies used in Preparedness and Response

Apart from traditional CPA and community practices, technologies are revolutionising the ways relevant stakeholders prepare for and respond to disasters. Developments in technologies such as robotics, drone technology, machine learning (ML), big data analytics, artificial intelligence (AI), social media and blockchain are increasingly utilised for anticipatory and response actions pre-and post-disaster, facilitated by the innovative surge of supporting infrastructure and devices, cloud computing, smartphones and wireless broadband technologies (Adid et al., 2021). Such developments strengthen information dissemination, risk communication and knowledge sharing, improve understanding of disaster drivers, enhance data-driven models and decision making, evaluate impact through novel methods and widen the knowledge base of social and economic impacts of disasters (Abid et al., 2021). Table 4 outlines the appropriate technologies and innovative approaches utilised for the five (5) action pillars of DRM listed by the Global Facility for Disaster Risk Reduction (GFDRR, 2015; Meira & Bello, 2020).

TABLE 4: EXAMPLES OF TECHNOLOGY AND INNOVATIVE APPROACHES FOR ADDRESSING THE FIVE (5) PILLARS OF ACTION FOR DRM.

| | Pillar of action | Description | Examples of technology usage and innovative approaches |
|----------|---------------------|---|---|
| Pillar 1 | Risk identification | Better identification and understanding of disaster risk through capacity building for assessment and analysis | Exposure identification and mapping; Models; Databases: Participatory Risk Mapping (crowdsourcing), Big data. |
| Pillar 2 | Risk Reduction | Avoiding the creation of new risks and seeking the reduction of existing risks by considering and accounting for disasters risk in the public policies and investments | Community-based ecosystem and DRM; Hybrid solutions; Integrated water resources and coastal zone management; Earthquake-resistant constructions; Communication-network; Network analysis applications and software and system; |

| | | | |
|----------|----------------------|---|---|
| Pillar 3 | Preparation | Improved capacity to manage crises by developing disaster management and forecasting capabilities | Resource databases; coordination and resource allocation tools; Knowledge networks; Weather forecast: real-time tracking of storms; Mobile Response; Awareness-raising technologies and tools; Social Media Technologies; UAVs and other search and rescue robotics tools; Sensors. |
| Pillar 4 | Financial Protection | Increased financial resilience of governments, the private sector and households through financial protection strategies | Blockchain, Crowdfunding New insurance models Microinsurance schemes. |
| Pillar 5 | Resilient Recovery | Faster and more resilient recovery through support for planning reconstruction processes | Unmanned aerial vehicle (UAVs); Coordination and resource allocation tools and technologies; "Build back better" technologies; Livelihood and disaster assessments; Improved sanitation technologies; Water access and purification technologies; Medical technologies |

Source: This table was adapted from the UN Economic Commission for Latin America and the Caribbean (ECLAC) report, L. Fontes de Meira and O. Bello, "The use of technology and innovative approaches in disaster and risk management: a characterization of Caribbean countries' experiences", Studies and Perspectives series-ECLAC Subregional Headquarters for the Caribbean, No. 93 (LC/TS.2020/106-LC/CAR/TS.2020/3), Santiago, Economic Commission for, Latin America and the Caribbean (ECLAC), 2020.

Numerous technologies contribute to the generation of risk-related information for the creation of spatially explicit risk maps, by gathering and analysing information about **exposure, vulnerability and hazards** at the community scale. Participatory citizen mapping of exposed critical infrastructure and private buildings enables the estimation of the impacts of hazards and disasters (Klonner et al., 2016). Web and mobile crowdsourcing efforts, drones, machine learning, and big data analytics have been instrumental in many exposure-mapping efforts. The use of web- and mobile-based vulnerability surveys platforms to map socio-economic vulnerability indicators, such as

open-source Open Data Kit (ODK)¹, Geographical ODK (GeoODK)² and KoboToolBox³, has been employed by numerous national CPAs to survey and gather inputs on the resilience of communities (Nguyen & Akerkar, 2020). For example, in preparation for a flood event, Indonesia's SIBAT, a volunteer community disaster preparedness agency surveyed households from 21 communities with ODK to collect information on various vulnerability indicators, such as local living conditions, the number of persons per household, health status, environment, education levels, gender, income, and nutrition (McCallum et al., 2016). To map hazards impacts, the American Red Cross employed spatial Video technology for rapid damage assessments via volunteered videos acquired with GPS-enabled cameras attached to citizens cars as they drive through neighbourhoods impacted by a disaster (Lue et al., 2014).

The advent of smart mobile phones and web platforms has facilitated real-time, citizen generated, data collection on hazards events, providing information about which regions are most severely impacted by the hazard. Such information can be further used for the speedy validation of the outputs of hazard models and complement and validate hazard mapping undertaken by other, more traditional methods (Pastor-Escuredo et al., 2014). The United States Geological Survey (USGS) "Did You Feel It?" (DYFI) project aptly exemplifies this by automatically creating macroseismic intensity maps with data generated by asking internet users about the seismic shocks and ensuing damages they experienced (Wald et al., 2011).

The increased use of social media also provides opportunities across all disaster phases, including for community resilience. Social media may be used before a disaster to build partnerships, trust and community resilience by enabling community members to establish communication networks (Anson et al., 2017). In the response phase, the vast amount of social media data generated by the public provides insights to support responders decision making. For instance, RiskPACC partner Crowd Sense, collected and analysed 120,000 messages about Storm Darcy from social media users in the Netherlands during one week in 2021 (Ruseva, n.d.). The analysis resulted in 9,000 messages covering potential incidents such as road accidents, abandoned trash, heavily snowed streets and iced roofs. Recent research is also highlighting the potential value of private messaging apps such as WhatsApp to respond to disasters. A study examining the use of social media in response to the 2018 Kerala floods in India found that WhatsApp, as well as open social media applications, was used to communicate different types of information such as the location status of friends and family (Varghese and Yadukrishnan, 2019). However, "digital inequalities in society" can result in social media communication not reaching certain segments of society such as older citizens, those with lower levels of education, minority groups, and rural communities (Deeker et al., 2020).

¹ <https://opendatakit.org>

² <http://geoodk.com>

³ <https://www.kobotoolbox.org>

In addition, Internet of Things (IoT) compensate for sparse infrastructure, particularly in developing countries, and contribute to real-time bi-directional communication between CPAs and citizens. Developments in cloud computing, data analytics and software and hardware engineering sensors have led to the emergence of real-time, connected sensors referred to as IoT. IoT sensors are used to monitor hazards levels and alert CPAs and citizens alike about potentially hazardous situations, thereby facilitating information dissemination. IoT allows CPAs to probe citizens about hazard levels in their respective locations, and to disseminate relief measures for those already impacted and mitigation strategies for the yet to be impacted citizens (ITU, 2019). The Rio Operations Centre – built in response to the vicious storms and devastating landslides in 2010 – monitors the weather, traffic, police and medical services in real-time to prepare for potential hazards like landslides and floods, prioritising low-income settlement areas. Aided by collaboration, alignment and data and knowledge sharing across 30 city divisions, the Centre implements defences to mitigate the threats of imminent disasters (Urban Sustainability Exchange, n.d.)⁴.

Mobile Crowdsensing (MCS) applications can be applied to many fields, such as environmental, infrastructure or social applications according to Ganti et al. (2011)⁵. The environmental applications leverage from measurements of the pollution levels in a city, water levels in creeks, and monitoring wildlife habitats and enable the mapping of various large-scale environmental phenomena by involving citizens and other end-users. The infrastructure applications involve the measurement of large-scale phenomena related to public infrastructure, such as traffic congestion, road conditions, parking availability, outages of public works (e.g., malfunctioning fire hydrants, broken traffic lights), and real-time transit tracking. Another emerging field, often used interchangeably with MCS, is crowdsourcing which according to Estelles-Arolas et al. (2012)⁶, is the participative online activity that benefits from the knowledge and/or experience of the crowd (i.e., end-user or participant). In both crowdsensing and crowdsourcing, data are collected collaboratively through Internet-connected geolocated devices enabling the collection of vast amounts of data and the opportunity of analysing them to perform more advanced processes and applications.

Although many developments have been made vis-à-vis the use of disruptive technologies for analysis of volunteered data, many uses of AI, Big Data, blockchain and robots are still largely experimental (ITU, 2019). While promising, facilitating large-scale impacts for community resilience requires additional research of the ways that these technologies can be leveraged across the entire disaster continuum.

4.2 Examples of Technologies

This section will provide a closer look at several different technologies that are currently being used in different sectors of DRM. There was very limited discussion of tools used by citizen groups in the interviews, therefore these examples are tools

⁴ <https://use.metropolis.org/case-studies/rio-operations-center>

⁵ Ganti, R.K., Ye, F. and Lei, H. (2011) Mobile crowdsensing: current state and future challenges. IEEE communications Magazine, 49(11), pp.32-39.

⁶ Estellés-Arolas, E. and González-Ladrón-de-Guevara, F. (2012) Towards an integrated crowdsourcing definition. Journal of Information science, 38(2), pp.189-200.

that have been developed by RiskPACC technology partners that will be adapted for use in RiskPACC.

4.2.1 CROWDSOURCING FOR ENVIRONMENTAL ASSESSMENT

The aim of crowdsourcing information in a disaster is to provide more timely and accurate information to improve emergency response and save more lives. Table 5 shows a selection of existing crowdsourcing applications that are used for environmental and climactic assessment (adapted from Muller et al., 2015).⁷

| Project | Type | Data | Summary |
|--|---|--|---|
| UKSnowMap | Web 2.0, citizen science | Snow rating, location | UK citizens tweet a snow rating (out of 10) which are shown on map |
| CoCoRaHS | Web 2.0, citizen science, amateur weather stations | Rainfall amount, location | US citizens upload information about precipitation amount as measured by manual gauges |
| Global Learning and Observations to Benefit the Environment (GLOBE) | Citizen science, amateur weather stations and other environmental sensors | A range of environmental data, inc. weather data | The GLOBE Programme is an established, international science and education project whereby students and teachers can take scientifically valid environmental measurements and report them to a publicly available database. |
| City temperatures from smart phone battery temperatures | Smart device, mobile app | Mobile phone battery temperature; Air temperature proxy, location | Temperature data derived from smart phone batteries sensors (not specifically designed for crowdsourcing the weather) are fed into a heat transfer model to produce daily air temperatures averaged over a city. |
| European Severe Weather Database | Citizen Science | Tornados, severe wind, large hail, heavy rain, funnel cloud, gustnado, dust devil, heavy snowfall/snowstorm, ice accumulation, avalanche, damaging lightning | Eye-witness reports and mapping of severe weather across Europe |
| Air Quality Egg | Citizen science, amateur weather stations | NO ₂ , CO, temperature, humidity | Low-cost, WiFi-enabled air quality sensor |
| UK Met Office 'Weather Observation Website' (WOW) | Amateur weather stations | Range of weather data and metadata | Amateur weather observers website for visualizing data (including metadata and quality flags) |
| Weather Bike | Bicycle platform, Amateur weather stations | Location, temperature, wind | Low-cost sensors attached to a bicycle |

TABLE 5: EXISTING CROWDSOURCING APPLICATIONS FOR ENVIRONMENTAL ASSESSMENT (SOURCE: MULLER ET AL., 2015)

4.2.2 SCENT PROJECT

The Smart Toolbox for Engaging Citizens into a People-Centric Observation Web (SCENT) project funded under the H2020 programme, focused on enabling citizens to become the 'eyes' of the authorities and policy makers by monitoring land-cover/use

⁷ Muller, C. L., Chapman, L., Johnston, S., Kidd, C., Illingworth, S., Foody, G., Overeem, A., & Leigh, R. R. (2015) Crowdsourcing for climate and atmospheric sciences: Current status and future potential. International Journal of Climatology, 35(11), 3185–3203.

(LC/LU) changes, particularly focusing on flooding events. SCENT offered a crowdsourcing platform that provides a series of tools and applications that allow the flow of information between the components of the toolbox as well as the creation of information from policy makers and contributions from the volunteers. It includes an Authoring tool for policy makers that allows them to identify areas of interest, create campaigns and Points of Interest (Pol)s and access the collected and extracted information in a user-friendly way as map overlays. Part of the crowdsourcing platform is also a series of gaming applications that aim to engage volunteers to collect images and sensor measurements as defined in the Authoring tool and to contribute to environmental monitoring by providing, qualifying and interpreting information about LC/LU (see Figure 2).

The Crowdsourcing platform included four main modules of the Scent Toolbox:

- The Crowdsourcing backend, which handles communication and interaction of crowdsourced content among the platform components.
- The Authoring tool, which represents the entry point for local authorities to (i) define and customise citizen engagement campaigns on LC/LU data collection (ii) access crowdsourced images and citizen notifications (iii) view and explore the extracted information from the crowdsourced data.
- The Open Image tool, which crawls open image repository for relevant content, in order to augment the crowdsourced data with already available information.
- The gamification applications that aim to engage citizens into contributing data.

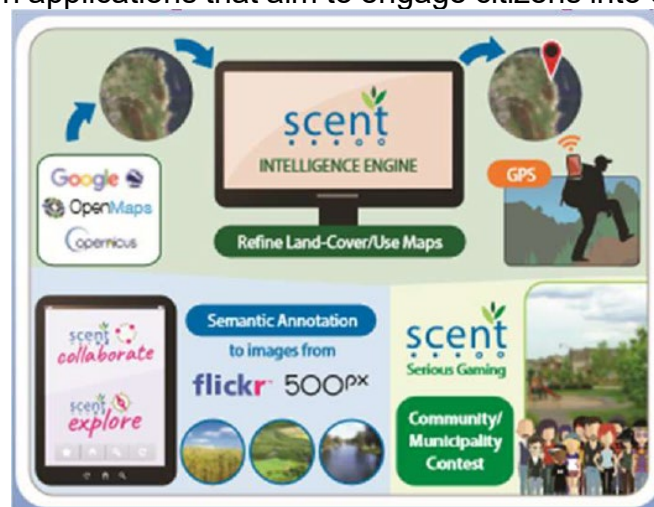


FIGURE 2: SCENT HIGH LEVEL DIAGRAM

Furthermore, SCENT deployed serious gaming applications in order to further engage citizens and create a sense of purpose. The game invites citizens to discover their environment in an exciting way. Little Scent Explore characters are hidden around the place of interest. Citizens collect points when they find them. Their phone pings when a character is approaching, and users can then “capture” the character on their phone. The camera takes a photo of the location and uploads it to the platform. Two large scale pilots were conducted (i.e. in the Greek region of Attica and in the Danube Delta region of Romania) to highlight the important role that citizen-generated data plays in environmental monitoring. This involved over 500 citizens setting out with their SCENT

smartphone applications and sensors to obtain environmental data and provide key information derived from photos and measurements along the Kifissos River basin⁸.

4.2.3 CITI-SENSE PROJECT

CITI-SENSE (Development of sensor-based citizens' observatory community for improving quality of life in cities) project aimed to develop "citizens' observatories" to empower citizens to contribute to and participate in environmental governance, to enable them to support and influence community priorities and associated decision making. CITI-SENSE developed, tested, demonstrated and validated a community-based environmental monitoring and information system using innovative and novel Earth Observation applications. The main elements included sensors and linking technologies, as well as information products derived from the data and services. This included atmospheric information derived from satellite data, creating a network with 400 volunteers actively providing datasets through the monitoring devices in nine European cities⁹.



FIGURE 3: OBSERVATION KIT USED DURING CITI-SENSE PROJECT(SOURCE: ASPURU ET AL., 2016)

The project established the world's largest air quality sensor network. The network consisted of 324 units, deployed all over Europe. Community participation included over 400 volunteers, who tested the monitoring devices, in 9 European cities. During the project 24 individual Citizen Observatories were established with main aim to monitor outdoor and indoor air quality. Over 1200 people downloaded and used the project's air perception app. More than 9.4 million observations were collected during the final project year¹⁰.

4.2.4 COVID TRACKING APPS

Many of the case study countries have designed apps to track Covid infections. Italy, Israel, and Germany all have app developed that assist in contact tracing and

⁸ <https://cordis.europa.eu/article/id/421804-scent-citizen-observatories-help-citizens-actively-engage-in-flood-monitoring>

⁹ <https://cordis.europa.eu/article/id/175088-citizenbased-air-quality-monitoring>

¹⁰ <https://cordis.europa.eu/article/id/175088-citizenbased-air-quality-monitoring>

informing citizens. The Israeli app, HaMagen 2, was developed for contact tracing. It cross-references GPS history of mobile phones with geographical data of a diagnosed Covid-19 patients. The user is able to accept or reject notifications, and if they are accepted then the user is directed to the Ministry of Health website for recommendations and further information¹¹¹². This allows citizens to understand their risk and act on that information. Italy and Germany have similar contact tracing apps, where people that have been in close contact with Covid patient are notified via the app. When enough people download and use these newly developed apps, they can be beneficial in stopping the spread of Covid. Similar apps have been created in other countries, including the UK. This is an example of technology being used to respond to a newly emerged hazard.

4.2.5 STAM PLATFORM

STAM, one of the partners in the RiskPACC project, has developed a platform to assist in the communication between CPAs and citizens for disasters, and assist in hazard and risk awareness. The goal of the STAM application is to connect different users by creating a community. Particular attention will be paid to the elderly, creating a user experience that is accessible to them. Based on information provided while creating a profile, tailored alerts will be sent to individuals. Additionally, this app will provide a CPA volunteer to be able to answer any questions and provide solutions to different alerts that are sent. Aside for building a community and providing an opportunity to interface with CPAs, this platform will also provide valuable weather alerts from CPAs, to help citizens become more aware of their risk of natural hazards (RiskPACC GA, 2020).

4.2.6 BE-ALERT

As part of D1.2, CPAs were interviewed in case study areas. One of these interviewees discussed a platform that is used for risk communication in Belgium, named BE-Alert. BE-Alert is an alert system through which the government notifies community members in an emergency situation and gives the necessary instructions on actions to take by text message, voice message or e-mail. Residents must subscribe to the platform to receive these messages. BE-Alert messages can be received in two different ways.

1. A Mayor, Governor or the Minister of the Interior (National Crisis Centre) can send an alert based on registered addresses. Based on the address, individuals can be informed of a (possible) emergency situation near their home / workplace.
2. In the event of a major emergency, a message can also be sent out based on location. Everyone who is physically present in that area will then receive a text message.

This system is unique to Belgium, and is assisting CPAs in increasing the outreach of their risk communication efforts.

¹¹ <https://govextra.gov.il/ministry-of-health/hamagen-app/download-en/>

¹² https://www.scss.tcd.ie/Doug.Leith/pubs/contact_tracing_nongaen_app_traffic_techreport.pdf

4.3 Opportunities for Future Use

These types of crowdsourcing applications could play a vital role in the future, especially in areas that are densely populated, locations where data are difficult to be obtained, or where traditional meteorological and other climatic monitoring networks are in decline. At the same time, computing power increases the amount of accessible data. Therefore, with extreme weather events expected to increase in frequency, duration and intensity in many regions in the future, crowdsourcing has the potential to offer dense and high-resolution observations. Such data allows for the observation of atmospheric conditions and weather phenomena occurring in more populous regions and can work towards the mitigation of future risks. With the knowledge of changing patterns provided by these applications, both CPAs and communities can assess which areas will be most at risk in the future.

Additionally, several of the technology solutions discussed in the RiskPACC Grant Agreement illustrate more opportunities for technologies in the DRM sphere going forward. One of these solutions is the STAM platform, which will create a communication hub where CPAs and citizens can collaborate and communicate (RiskPACC GA, 2020). This will hopefully assist in bridging the communication gap that has been discussed above. Furthermore, it has been shown that gamification of educational material can increase engagement (Backland & Hendrix, 2013). The SCENT platform listed above also have the potential to be adapted for RiskPACC to focus on different disasters, and can provide an additional form of communication from CPAs to citizens. This will include a gamification element. RiskPACC proposed to use technology and gamification to create interactive learning environments to attempt to maintain and even increase citizen interaction in managing disaster risk. Recruiting and retaining mechanisms for citizens and other interested end-users that provide relevant feedback need to be studied, along with techniques to motivate and encourage them when they perform or complete a task. Citizen engagement practices should be incorporated to any future proposed technical solution. Finally, social media can also be harnessed to gather information during a disaster, as well as facilitate communication between CPAs and communities.

Based on information provided during the interviews with citizen groups, there is an opportunity to use new technology going forward. When the interviewees mentioned what they used in their communications with CPAs, none of them detailed any of the emerging technologies discussed above. Most used email and SMS messages to communicate. Adopting some of the new applications and technologies mentioned above provides an opportunity for citizen groups to increase their communication with CPAs. Additionally, one group in Israel mentioned the desire to create tools that can assist in communication, in which case there is the opportunity to work with these community groups to create tools that will address their needs. The BE-Alert system in Belgium may be a tool that can increase communication, although the system is described as a top-down approach. There is little interaction with the communities, therefore it may need to be adapted to increase bottom-up, community centric communication.

4.3.1 VULNERABILITIES THAT MAY LIMIT TECHNOLOGY USE

Although communities could benefit from the use of technology in DRM, as proved by the number of use cases presented above there are still some open issues that need to be addressed. The use of personal data coming from personal devices introduces security and privacy issues, particularly with reference to the citizens' and end-users' location, therefore, personal information should be secured and data breaches should be prevented. These privacy concerns may be a limiting factor in engaging citizens, and the ethics of these tools needs to be considered as they are developed (Anson et al., 2017).

The need for energy consumption and availability of such battery-enabled devices should also be discussed when looking at limitations to this technology use. This can be a limiting factor in several ways. First, there may be some lower income individuals that do not have phones that have the capabilities needed to run these applications. This would limit the perspective gained, as information may not be collected from the most vulnerable. Second, during hazard events that involve a loss of power or the loss of cellular towers, these apps and tools may not be accessible. Additionally, attention must be paid to those that are not digitally or technologically literate. Many people, especially older adults, those that live in rural areas, and those with lower socio-economic status may not have the same access to these tools or understand their use (Lechowska et al., 2018; Deeker et al., 2020). They should not be left behind due to this lack of access or understanding.

4.4 Technology and the Case Studies

As mentioned above, there was a lack of discussion of technological tools during the interviews with citizen groups. There was no mention of these tools when discussing current practices or communication with CPAs. In terms of communication, most groups still use emails and SMS messages to communication with CPAs and each other. This lack of discussion is most likely due to the fact that technologies like these are not used, and are not a priority for future use. Additionally, there was no discussion of using data, especially citizen generated data, as a typical practice of these citizen groups. This is in contrast to some of the interviews done with CPAs for D1.2, where they were collecting data from citizens, as well as developing their own internal communication systems and tools for communication with citizens (see D1.2 for more detail). This illustrates that while there may be an emphasis on top-down data collection and communication with CPAs in many of the case study areas, there is a lack of bottom-up, more citizen generated data and communication tools. This discrepancy will be explored as RiskPACC progresses and will be addressed in forthcoming deliverables.

5 SWOT ANALYSIS OF COMMUNITY PRACTICES

As mentioned in the methodology, a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was done to look at the different approaches taken by the different citizen groups represented by the interviewees. An overview of the SWOT analysis can be seen in Figure 4, with more details in sections 5.1.1 and 5.2.1.

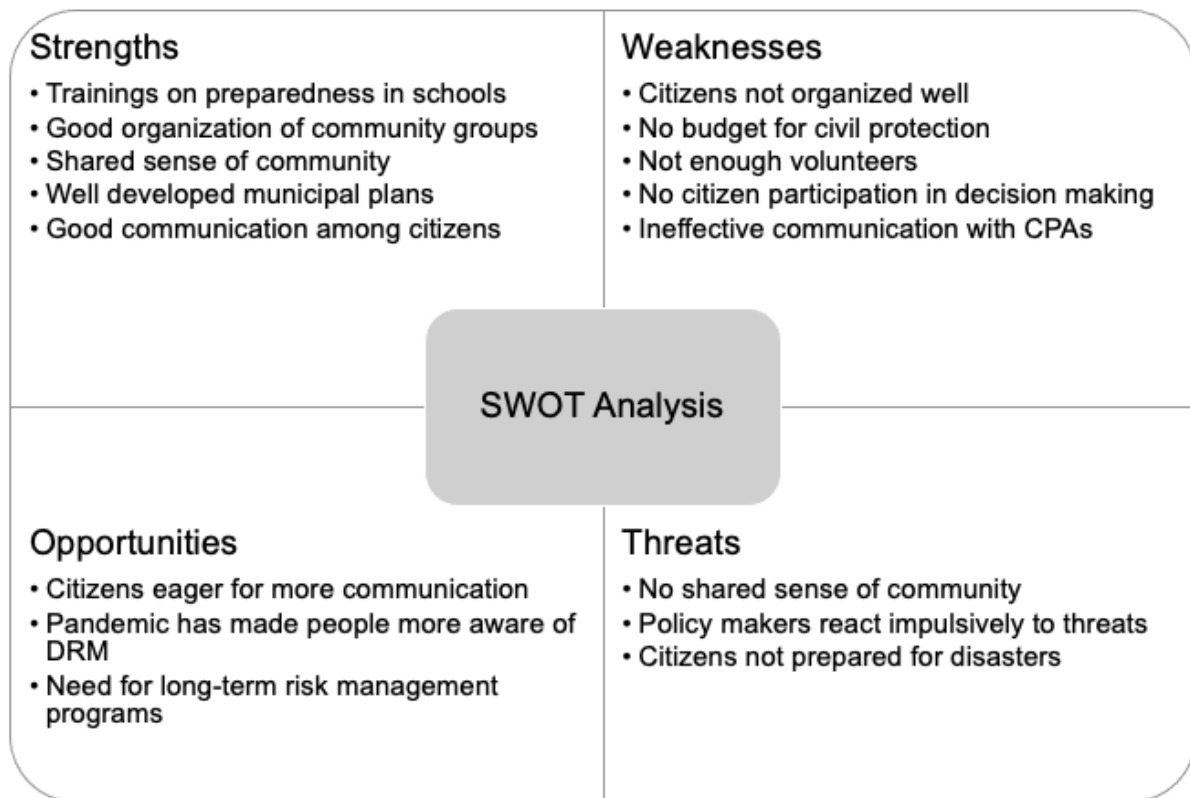


FIGURE 4: SWOT ANALYSIS RESULTS

An analysis was also done on the innovative technologies mentioned in Chapter 4, as well as the limited information on technology from the interviews. A SWOT analysis was conducted looking at these technologies. Details on this analysis can be seen in sections 5.1.2 and 5.2.2.

5.1 Strengths and Opportunities

5.1.1 TRADITIONAL PRACTICES

5.1.1.1 Strengths

The strengths in traditional practices done by community organizations to increase resilience vary slightly by country, but fall into similar categories: the benefits to the community resilience practices gained from providing trainings, the resources available to conduct different resilience activities, the strength of community organization, resilience planning activities, and communication with CPAs.

As mentioned above, **trainings** are a large focus of the activities of these citizen groups, and are considered by all who conducted them to be a strength of their organization. These trainings include things such as trainings for children in schools in Israel and training of both the community and volunteers in civil protection activities in Italy and Greece. One group in Greece has also trained managers in every district and region. All groups that conduct these trainings believe that they increase **communication** between CPAs and the community, which helps in increasing risk perception in the communities and therefore improve community resilience. Similarly, communication in general is another strength that most of these citizen groups share. Some of the groups have established communication with the CPAs in the area, which makes prevention and response activities more streamlined and effective. These groups also have effective communication with citizens. An interviewee from Greece specifically mentioned “inclusive and good communication among citizens” as something that was working well in their work. This communication builds trust, as well as increasing risk perception.

One of the most important strengths mentioned by most of the citizen groups is the **sense of community** and the way the community has been organized in each of the areas where its work is performed. Interviewees from Greece, Italy, and Israel all mentioned that there is a strong sense of community in their areas. This leads to a mentality of co-production and working together, therefore strengthening their social bonds. Apart from the sense of community, many of the interviewees also mentioned that the communities they work in are well organized in terms of volunteers. In Israel, there are “organized citizen groups that help each other,” while in Italy and Greece groups of volunteers are organized to support the community. These activities also build the sense of a shared community in the area and help these citizen groups gain a better understanding of community needs.

Additionally, many of the citizen groups have well **developed civil protection plans** to work with and municipal resilience plans available, which is another strength of many of these groups. In Italy, where the citizen group interviewed works closely with the municipality, they have access to all of the municipal plans for civil protection and resilience. This helps in many of the activities that they do, as they better understand what the city will be doing in response to risks. The group in Italy also works on developing resilience plans and learns from the effects of hazards to better prepare for the next hazard. Groups in Greece mentioned similar activities in terms of resilience plans. This is a strength, as they are adapting to the past response and working with the communities to increase resilience going forward.

Another strength in current community practices is the **resources** that some citizen groups have available. This does not apply to all groups, as there are a few that have funding issues, but several of the groups believed they had had the fiscal resources that they needed to do the work they were doing. In Israel, specific sources of funding are set aside for responding to hazardous events, so funds are available for disaster response. The community organization in Italy also believes they have enough resources and equipment for their purposes.

5.1.1.2 Opportunities

Based on the information provided from the interviewees, several opportunities have emerged for improving and expanding upon programs going forward. One of the biggest opportunities for the groups interviewed is that citizens are eager for more communication. This provides an opportunity to better engage with citizens and therefore increase risk perception and resilience. Interviewees from both Israel and Italy mentioned that “improvement of communication would be welcome by citizens.” If groups can seize this opportunity and increase communication with citizens, it will lead to a more informed general population, which is beneficial for DRM activities and should increase overall community resilience.

Additionally, while being a hardship for many people, the Covid-19 pandemic has provided opportunities for citizen groups to become more involved in their areas. Groups in Italy and Greece have commented that the pandemic has increased citizens risk awareness, made people more responsible and cooperative, increased protective measures, and has reinforced the importance of communication. The same has been seen in Belgium, where “more and more people registered as helpers” during the pandemic. This provides an opportunity for groups to harness this increased awareness and responsibility, and expand it to other hazards. This could help citizen groups spread information about natural hazards and prevention measures they can take, and people may be more responsive than they were previously. It was also commented that the role of volunteers became stronger, which is another opportunity brought by the pandemic.

Finally, several groups mentioned a need for “long-term risk management programmes.” This provides an opportunity for citizen groups to create these programs. If the need has been identified, and the resources are available, these groups could step into the void and create programs that are most appropriate for the communities that they are based in. Designing community appropriate long-term risk management programs provides an opportunity to increase community resilience.

5.1.2 NEW TECHNOLOGIES

5.1.2.1 Strengths and Opportunities

The innovative technologies mentioned in Chapter 4 have several strengths and opportunities, specifically the ability to improve communication between CPAs and citizens, involve citizens in the DRM process, and capture more data than previously possible. In terms of capturing data, the CITI-SENSE app was downloaded by 1200 people and 9.4 million observations were added to the system to capture air quality. This is data that would not have been collected otherwise. If this type of participation can occur with tools that are oriented towards preparation or disaster response, this can both provide valuable information to CPAs and involve vastly more citizens in DRM activities.

Another strength in many of the new tools developed for community participation is the direct involvement of citizens in the DRM process, which can increase citizen knowledge and therefore increase community resilience. For example, participatory mapping initiatives have involved citizens inputting data on exposure, vulnerability,

and hazards in their community. This process involves citizens actively exploring their neighbourhoods and developing an understanding of their local exposures and vulnerabilities, aspects that may have gone unnoticed prior to mapping.

Additionally, there is the opportunity for these innovative technologies to increase communication between CPAs and communities. For example, Internet of Things (IoT) has the potential to contribute to better communication between CPAs and citizens. IoT sensors are used to monitor hazards levels and alert CPAs and citizens alike about hazards in areas with limited infrastructure, which then prompts CPAs to communicate with citizens about the hazards faced and either provide a response or potential mitigation measures (ITU, 2019). See D2.1 for more information on the use of the IoT in community resilience practices.

These new technologies also provide an opportunity for CPAs to better understand the opinions, beliefs, and perceptions of citizens and citizen groups. This provides a platform for CPAs to better understand communities, therefore increasing two-way communication, which can ultimately increase community resilience. For example, the SCENT project described above has a feature where citizens can mark hazards. This helps both the citizens express what they are most concerned about and helps CPAs understand community perspectives. If citizen groups can promote the usage of these tools and technologies they may be better placed to influence CPAs actions with better two-way communication.

Aside from communication, there are other opportunities that these new apps and tools provide. These include opportunities to increase citizens knowledge of risks and hazards. Many of these applications provide opportunities for knowledge as well as communications. For example, part of the STAM platform will be built to share interesting information on different risks and hazards, where if used, will lead to better understanding of risk. There is an opportunity to use these apps and tools to create a more bottom-up approach, therefore enhancing community resilience.

With new technologies increasing in usability and presence, this creates an opportunity for citizen groups to utilize these tools in their efforts to increase community resilience. With many of the community groups looking for better communication with CPAs, and one even suggesting a tool to increase communication, this is a great opportunity to advance their usage. If such tools can be adapted for disaster scenarios and used by CPAs, then there is the potential for use by citizen groups to enhance communication and provide a bottom-up approach. Many of these technologies are still in their infancy and have yet to be adopted by the mainstream of DRM activities, but they have many potential strengths and opportunities related to their future use. With the ability of many of these tools to connect CPAs and citizens, as well as to connect citizens with different views and understandings, these strengths can lead to better overall collaboration, with the potential to close the RPAG.

5.2 Weaknesses and Threats

5.2.1 TRADITIONAL PRACTICES

5.2.1.1 *Weaknesses*

While many of the citizen group representatives mentioned communication, organization, resources, and trainings as their activity strengths, other groups struggled in these areas and considered them weaknesses in their practices. In terms of communication, while some groups had effective communication with the communities and CPAs, others struggled in these areas. Communication was a major weakness among Israeli groups, with interviewees commenting that there was both ineffective communication between CPAs and the citizen groups, and also that there was no guidelines or instruction on how to react in the face of crises. This problematic and partial communication led to insufficient preparation for hazards. Additionally, this lack of communication meant that there was limited citizen participation in decision-making. Research has noted that community participation in DRM activities can increase risk perception and resilience, so the lack of participation in this case can reduce resilience in the area, constituting a significant weakness (Twigg, 2004; Wachinger et al., 2013; Bubeck et al., 2012).

The availability of resources was also a weakness identified by several different interviewees. Interviewees from both Israel and Greece mentioned that more resources were needed, including both budget and equipment. One group in Greece has their budget dependent on sponsorships and donations, therefore funding is limited. Another group in Greece commented that there was no budget for civil protection. This is a weakness, as limited funding means that the actions that they can take are reduced.

While in some places there was good organization of the community and volunteers, other places did not have this same structure. Interviewees from Italy and Israel both commented that “citizens are not organized into groups, teams or organizations.” The Italian group has also noted that there are insufficient ties between public structures and volunteers, and one group in Greece commented that there are not enough volunteers. This is a weakness, as it means that citizens do not feel as engaged in the DRM processes in these areas. In areas with limited citizen participation, there is the potential for lower risk perception, less preventive actions, and a more challenging response to hazards. This can reduce the resilience in an area.

Additionally, while training was done by many groups, one group in Greece considered that to be a weakness in their activities. They believed that there was insufficient training of the local fire brigades, as well as a lack of joint trainings between the fire brigade and the group. This led to a disconnect between the CPAs and the citizen groups, a major weakness when addressing disaster response and community resilience.

5.2.1.2 *Threats*

While threats were different in different areas and among different groups, there were some that were shared across multiple groups. First, there was consensus between several groups that citizens were not prepared for highly impactful hazards. They did

not have the knowledge they needed to understand their risks and did not know what to do when hazards hit. This is a major threat to the work being done, as uninformed citizens will be less likely to participate in activities and will not be prepared. Similarly, communication from CPAs to citizens during hazard events was lacking in some areas. There were complaints of technology failing during disasters, as well as CPAs not being well trained in communication in properly responding emergency calls to fire brigades. If citizens are unaware of the risk and how to act, and the communication from CPAs during an event is subpar, this could lead to many issues in the disaster response process.

Additionally, several groups commented that policy makers and CPAs reacted impulsively to threats. One interviewee even commented that several response and recovery activities were not completed because of political pressure in the area. While the actions of policy makers and CPAs are not under the control of citizen groups, these actions are threats to community activities. If there is no plan to follow, or the plan is disregarded and impulsive action is taken instead due to political pressure, this can lead to a lack of trust among the community. This lack of trust can hamper citizen group actions as well, threatening resilience in the area. Previous research discussed in D1.1 showed that trust was one of the most important factors in increasing risk perception in an area, so this is a major threat to the work that citizen groups are doing (see RiskPACC Deliverable 1.1).

While some interviewees commented that there is a strong sense of community, there are some areas that do not have this shared sense. Without this shared sense of community, it is more difficult to get individuals to act and may decrease community resilience. Research has shown that without a shared sense of community, there may be a lack of consensus on ideas to create a common vision for community resilience (Pitidis & Coaffee, 2020). This is a threat to citizen group actions because the fewer people that are involved in the community the fewer people will understand their risks and know how to act. Without the shared sense of community there is less incentive to volunteer in DRM activities.

5.2.2 NEW TECHNOLOGIES

5.2.2.1 Weaknesses and Threats

Due to the relatively recent development of these tools, there are several weaknesses and threats that should be considered when adopting these approaches. First, research has indicated that although many of these tools have seen an uptake in use by citizens, there are issues with the retention of users (Park et al., 2017). This phenomenon is not exclusive to technological tools, it has also been seen in physical disaster response activities as well, but has been particularly noted in relation to digital tools such as VGI. This is a major potential weakness, as lack of continued engagement may limit the impact of these tools.

Secondly, these tools can increase vulnerability if they are not carefully implemented. Those with lower income may be less likely to have a smart phone, which is necessary to access and use many of these tools. Without access to the tools, those with lower income may not be able to access the same information or have the same ability to communicate with CPAs. This could further increase their vulnerability. Additionally,

the elderly or those with disabilities may have a harder time accessing these tools than others. There are several reasons for the potential lack of access. First, the elderly are, in general, not as digitally literate as other groups. They may struggle to download and use various smartphone applications. For those with disabilities, there are different struggles in accessing applications and tools. For those who are blind or deaf, unless these apps have special features that increase accessibility, they will struggle to access the information. Most of these tools have the potential to increase the digital divide, where the use of these tools will marginalize those users without the money, access, and time to utilize the technology (See et al., 2019).

Additionally, the proliferation of misinformation that is occurring on online platforms is a concern to the proper use of these tools. As the point of many of these tools in to increase accessible information, if they become another place to spread misinformation, it will not only dilute the usefulness of tools, but has the potential to provide inaccurate information that can be distractive during a hazard event. This can be a potential threat to both the application or tool, as well as citizens that are using them.

Finally, there is the threat that these tools may not increase the involvement of citizens. Many of the tools discussed above are created to gather data from citizens to enhance data that has been collected by CPAs. In this regard, there is the potential for citizens to be used as sensors to collect data through software, without truly engaging them in the process of DRM. Bottom-up engagement of citizens can increase community resilience, but there is the threat that these activities will not truly increase engagement. Finally, there is the potential that CPAs will not trust the quality of the data, as data accuracy is a concern with using citizen generated data (Haklay *et al.*, 2010). This lack of accuracy, or the perception of lack of accuracy among CPAs, may lead to a hesitation in the use of these tools. This is a threat to the usage of these tools, as well as a potential threat to the trust between the CPAs and citizens.

While technologies and the tools being developed have the potential to increase the participation of citizens in DRM activities and improve communication with CPAs, there are several concerns that need to be considered before these technologies can be widely adopted.

6 COMMUNITY PRACTICES AND CLOSING THE RPAG

The chapters above have outlined the community resilience practices that are currently being undertaken by the citizen groups that were interviewed from the project, as well as the strengths, weaknesses, opportunities, and threats of these approaches. The following chapter will use the information gained from the current practices and relate them to the overall aim of RiskPACC, namely closing the RPAG.

Many citizen group members have mentioned the lack of risk perception among citizens in their area, and the need to increase that perception. Additionally, many brought up the fact that increasing risk perception should increase the willingness to take actions that can help increase community resilience. In this regard, many citizen groups are already thinking in terms of the RPAG. As mentioned in section 3.4, most of the citizen groups are already concerned with increasing risk perception in their areas. There were several actions that interviewees mentioned to increase risk perception, namely taking advantage of the increased awareness post disaster and finding ways to better educate citizens on risks and actions. The main goal of citizen groups in increasing risk perception is to ultimately increase citizen action in DRM and therefore community resilience.

The interviewees that mentioned taking advantage of disasters to increase awareness observed that many community members were more aware of their risk after they had been impacted, and that this was a suitable time to engage with citizens and increase resilience for future hazard events. This is in line with what has been previously written about resilience, that it was linked to how individuals and communities can organize themselves to learn from past disasters to reduce their risks to future shocks (National Academy, 2012; Mythen & Walklate, 2006). Additionally, most of the research on risk perception shows that this time period is when risk perception increases (Cui & Han, 2018; Rana et al., 2020). As this has been observed in both research and among citizen groups, it should be harnessed to close the RPAG. Citizen groups, as well as CPAs, should focus on this time frame as a good opportunity to implement new initiatives and increase communication with citizens. With citizens more willing to act in the time following disasters, it may be the best opportunity to increase action in line with risk perception. This was shown by some of the community groups responses to questions about the Covid-19 pandemic. Many have detailed that the pandemic catalyzed community action and led to citizens better understanding different risks.

In addition to focusing on the post-disaster period to increase perception and action, citizen groups highlighted the need for better communication with CPAs as a key to increase risk perception. Most citizen groups do not want to wait for disasters to urge people to action, as they are trying to focus more on prevention activities. One major barrier to these prevention activities noted in the interviews was a lack of information and a lack of interaction with CPAs. It has been noted that resilience in society is heavily dependent on how interactions between risk management processes of CPAs

and citizens is organized (Le Roux & Van Niekerk, 2019). The interviews matched this research, commenting that a major weakness in their response is a lack of interaction. Some of the interviewees suggested ways to combat this lack of interactions, including trainings and workshops with CPAs to enhance knowledge and exchange ideas. Others suggested that the one-way communication that is typical of CPA interaction was not effective and that citizens needed to be involved in the planning process. This was seen in the research done for D1.1, where many of the typical CPA communication techniques did little to increase risk perception (Van Mamen, 2014; Sattar & Cheung, 2019; Jóhannesdóttir & Gísladóttir, 2010). This recommendation of better two-way communication with citizen groups is consistent with RiskPACC's WP3, as the WP is designing co-creation workshops that will be an opportunity for CPAs and citizens to exchange ideas and for citizens to become more involved in the DRM process (RiskPACC Grant Agreement, 2020). Citizen groups insist that these interactions will increase risk perception and actions, hopefully closing the RPAG. In addition to these workshops, some of the platforms and tools being developed by the RiskPACC consortium may also assist in enhancing the two-way communication between CPAs and citizens. These include the gamification ideas and the STAM platform that are discussed in section 4.2 and 4.3.

Currently, there is limited discussion of use of technology tools by the citizen groups that were interviewed. Therefore, there is currently very limited impact of these emerging technologies on the community resilience activities undertaken. This is an area that can be focused on to close the RPAG, as many of these tools could be introduced to the case study areas. Providing these tools may enhance communication and increase risk knowledge among the community, as well as improving communication channels between CPAs and the community groups, all of which community groups agreed would increase risk perception. While technology can provide opportunities to increase communication and interaction between CPAs and citizens, it cannot be the only solution. Solely relying on technology will exclude some groups, and therefore complementary solutions that are less technologically focused need to be considered.

7 CONCLUSION

This report has detailed the activities of different citizen groups in the case studies areas in terms of DRM and resilience activities. It highlighted the type of the work that is being done on the local level to increase resilience and prepare and respond to disasters. It has also highlighted the strengths and opportunities involved in the citizen group approaches and analysed the weaknesses in the present system. In addition to the local practices, this report provided a thorough overview of the types of technological tools that are being developed to assist both CPAs and citizen groups in preparedness and response activities, as well as ways that these tools are helping individual citizens become more engaged in the DRM process. All of this led to a discussion of the RPAG and local practices that may help address the existing gaps.

In Chapter 3, we have highlighted the current local practices, needs of the citizens groups, the understanding of resilience in the community, as well as communication with CPAs and risk perception. We found that while the term resilience was used by some of the groups with close ties to international NGOs or CPAs, most groups did not use it. Those that did not use the word resilience tend to use the word disaster/risk management in its place. In terms of current local practices, most of the activities could be broken down into the following categories: communication, training, preparedness and prevention, and disaster response. In terms of additional needs, the most pressing were better communication and additional resources. Risk perception was highlighted as a major issue by all interviewees, as they all deemed citizens unprepared for disasters.

In Chapter 4, innovative technologies and tools used in preparedness and response were discussed. These tools included approaches such as participatory mapping, citizen upload of environmental data, crowdsourcing, and new video technology. Most of these new tools require citizen action, therefore increasing exposure to and knowledge of hazards and risk education for individual citizens. Ideas such as gamification of hazard education were introduced as additional ways to increase citizen participation. In addition, issues with these new tools, such as privacy and disparity between access to mobile devices, were discussed.

Chapter 5 brought this information together, analysing both the technology tools and the traditional practices for strengths, weaknesses, opportunities, and threats. There was divergence between the groups on strengths and weaknesses, with many of the strengths of some groups being the weaknesses of others. The opportunities going forward included the fact that citizens wanted to further their knowledge of risk, potentially opening the door for these citizen groups and CPAs to better inform the public. Additionally, the opportunities for new technologies tools were available, especially to enhance communication between CPAs and citizens, with the opportunity to increase two-way communication in the case study areas.

Finally, in Chapter 6, we discussed the RPAG in terms of the information that was gathered on local practices. We identified that many of the groups found that the post-

disaster period was the best time to get citizens engaged in DRM activities as it increased risk perception. Most importantly, a theme that was explored across this report emerged as essential in closing the RPAG. Better communication with CPAs was deemed vital in increasing risk perception and closing the RPAG. CPAs need to provide more and better information to citizens and think of engaging ways to do so. The traditional approaches of communication have led to an uninformed public. This is an opportunity for RiskPACC to step in and facilitate ways to increase this communication.

7.1 Future work and next steps

This work, along with D1.2, examines the practices that are currently ongoing by both citizen groups and CPAs in case study areas. These two reports will provide information on ongoing activities in the case studies to inform the consortium and provide insights. This deliverable is a continuation of D2.1, providing the first look at empirical research on community resilience practices.

This work will be used for the gap analysis that will be completed for D2.3. This gap analysis will draw together findings from this deliverable and deliverable 2.1 in WP2 to identify best practices, community perspectives, requirements, vulnerabilities, and gaps in the current operationalisation of resilience concepts in local areas. A similar gap analysis will be done in WP1 through D1.3. In addition to WP2, this report will provide evidence for WP4 and will be used to develop the RiskPACC framework. This framework will assist in understanding risk perceptions, communications between CPAs and communities, and other factors that may be behind the RPAG in different settings. The framework will then lead into the work that is done with communities and CPAs in WP3, including the co-creation labs. Along with WP1, this work contributes to establishing the conceptual foundations of the RiskPACC project.

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9 ANNEXES

9.1 WP1 and WP2 Questionnaires



PART 1: General questions

- 1. Is there a register of the hazards and risks (natural or humanmade) for the area (municipality/county/state/other) that you work in?**
 - a. if yes, are these categorized and in which categories?
 - b. if not, are you aware about the risks in your area area/community/municipality? Which are these risks?
 - c. Do you believe that the perception of risk between CPAs and local citizens/citizen groups coincide? Please explain.
 - d. What types of other stresses does your area/community/municipality (beyond the abovementioned risks) concern you?
 - e. What kind of actions are you currently taking to address these hazards/risks?
- 2. What are your current needs in terms of resources for managing the hazards and addressing the impacts of these hazards/risks?**
 - a. Do you have enough budget, equipment, personnel?
 - b. Do you think that existing budget, means or personnel could be distributed and used more efficiently?
 - c. What would you like to do differently?
- 3. Is the word “resilience” used in any policy report/paper or doctrine in your area of work?**
 - a. If used, what does it practically mean for your area of work?
 - b. If resilience isn't a term commonly used in your area, what are the terms used to describe the process by which hazards are



managed (this might for example be risk management, emergency management, etc.)

- c. Are there any dedicated policies to increase disaster or community resilience? Please specify.
- d. Are resilience actions based on prevention or response actions?
- e. Can you think of any ways that disasters can result in positive outcomes for your area, such as opportunities for improvement? If yes, can you give examples?

PART 2: Questions for the CPAs

1. Is there a doctrine to support communities to prepare for, confront and recover from natural hazards in your area?

- a. What are the policies in place that you follow to support such actions? Please list relevant policies at national, regional/provincial and city/municipal levels.
- b. What are your current activities being undertaken in your area?
- c. Do you plan on introducing any specific activities in the near future?
- d. What kind of activities? (Preparation or procurement, training, raising awareness...)
- e. Longer-term, what would you like to see your area doing to increase resilience?
- f. on your current approaches what are your strengths and weaknesses?



2. In your opinion are all community group members conceptualising risk in the same way or not? Please elaborate.

- a. What methods, including digital technology, do you use to communicate with community members?
- b. Do you believe that new technological tools & social media are effective for risk awareness and risk communication?
- c. Do you believe that the existing communication actions in your area are effective?
- d. What are the challenges with such communication?

3. How would you describe your relationship with the community that you work with?

- a. Are there any community groups that you work closely with?
- b. Is there any specific consideration for the sensitive groups of citizens (e.g. children, people with special needs)?
- c. Are there any cultural, environmental and other associations and volunteer groups that could contribute to your mission?

4. How would you describe your collaboration with the other CPAs that you work with?

- a. Which CPAs collaborate with you for risk management? (specify for prevention, response, recovery phases)
- b. Do you use any methods/ tools or communication protocol for acquiring a common operational picture and coordinating your actions? Please specify
- c. What would you improve in your communication and coordination with the other CPAs



Part 3: Community group questions

1. How would you describe community action in your area with regard to the risks faced?
 - a. Are there recent hazard events that the community has responded to?
 - b. Are community members organised in groups/teams/organisations etc?
 - c. Is there more than one community organisation in your area working on issues of risk reduction?
 - i. If yes, do they communicate with each other?
 - ii. Are there any specific policies or plans from the municipality that encourage the formation of such groups, or is this the result of communities self-organizing? Please elaborate
 - d. In your opinion, is there a shared sense of community in your area or are there divisions?
2. Is there any communication between local authorities and community groups/individuals in your area with regard to the risks faced?
 - a. How is communication done?
 - b. How effective is the communication?
 - c. How could communication be made better?
3. What are your opinions on the existing approaches to managing the risks in your area?
 - a. What are the strengths and weaknesses of existing risk management policies and mechanisms in place?



- b. As a community group, how are your views on risk currently addressed by existing risk management approaches?
 - c. What opportunities are there for citizens/community groups to influence policy and decision making in your area?
 - d. If not, what more would you like to see occurring?
1. Related to the risks you mentioned above, for which kind of events
 - a. do you feel well prepared? Why?
 - b. do you feel not well prepared? Why?
2. As a community member, what are the needs of your community during a potential disaster?
 - a. Are you leading or are you aware of any community-led mechanisms in place in case of for disaster risk response?
 - b. What kind of support would you expect from CPAs in such situations?
 - c. In an ideal situation, what kind of methods/mechanisms would you like to see activated for disaster risk response?
6. Is citizens' perception of risk important for effective risk planning and response, in your opinion? Please elaborate.
 - a. How is citizens' perception of risk incorporated in existing risk management plans and policies in your location?
 - b. What would you like to see changing in the existing context?
 - c. Can you think of any possible ways that risk perception could be registered and incorporated in future risk management plans and policies?
 - d. Are there any potential barriers in the participation of communities to disaster risk activities? Please elaborate.

Part 4: Summary



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1. How has the COVID-19 global crisis changed the way you think about risks?
 2. How has the COVID-19 global crisis changed the way you plan for managing future risks

The RiskPACC Consortium



FIGURE 5: RISKPACC CONSORTIUM