THEMATIC SUB-CLUSTER 2.2
TOOLS ANALYSIS TO IMPROVE RISK PREVENTION AND INCREASE DISASTER RESILIENCE

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Contents

1. Introduction and methodology

In the framework of the Thematic Sub-cluster 2.2 “Risk prevention and disaster resilience” the three projects involved, namely ADRISEISMIC, MUHA and TransCPEarlyWarning, agreed to perform an analysis of the tools developed by each partnership with the objective to identify and highlight their potentialities if used at transnational level for improving risk prevention and increasing disaster resilience.

To achieve this outcome, it has been decided to take advantage of the final meeting of the sub-cluster that has been held in Rome on 30th September 2022 to reflect and discuss among the participants about the meaning of the capitalization activities and to identify the advantages of tackling the challenges of the ADRION area in a transnational way. The challenges have been identified in those topics and themes addressed by the projects participating in the cluster.

In the first part of the meeting the tools of the three projects were presented to the all partnership by each project representative. After the presentations, round-table discussions were organized to further explore how to address ADRION challenges focusing on useful approaches and tools and which are the strengths of facing the challenges in a transnational way. The topics of discussions, identified according to the subjects and the themes addressed by the three participating projects were the following:

1. Water management.
2. Earthquakes management.
3. Wildfires management.
4. Water supply management in emergency conditions.
5. Communication for resilience.

For each of the five themes, about 6-7 participants representing different institutions (research, local communities, universities, public institutions), and with different professional backgrounds and roles, had the possibility to brainstorm about: a) the challenges of the topic in the ADRION area, b) approaches, tools and technical support to adapt and mitigate the recognized challenges and c) how to do it at transboundary and transnational level.

Each team was coordinated by a facilitator, expert on the topic, who guided the discussion. The teams showed a great level of interaction and interest in sharing the ideas even when the topic of discussion was outside their expertise and comfort-zone. Following this introduction and methodology section, the present deliverable is structured into two main part: the first one is dedicated to the presentation of the results of the stand-alone brainstorming teams (Table 1) while the second one consists in the explanation of the features and potentialities of the most suitable tools identified among the results of each project that can be potentially integrated with considerations drafted at transnational level. Finally, a comparison analysis of the tools is carried out and a final chapter is dedicated to the conclusion of both the activity and the cluster experience.

	
Overview of the teams	Water management team

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Earthquakes management team</td><td>Wildfires management team</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Water supply management in emergency conditions team</td><td>Communication for resilience team</td></tr>
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Table 1. Pictures of the brainstorming teams at the meeting in Rome.

2. Results of the round-table discussion

2.1 Challenges and approaches in the water management

During the brainstorming session related to water management, all the participants recognized that water related challenges, which are all closely related to climate change and climate change adaptation process, are very actual in their countries and local environment. It was discussed initially what actually term “water management” means – recognizing that, in its core, it means management of the complex of water availability and water demand on different spatial levels and different time scales which includes also floods (excess of water). In the following paragraphs the recognized challenges are illustrated.

Flash floods and urban flooding. They are challenges recognized by all participants, also relative to the most recent tragic events of flash flooding in Macerata (Italy) and Rijeka (Croatia). With increased intensity of rainfall events and sealing phenomena, drought, urbanization, flash floods, their strategic perspective, action plans and measures should be addressed. They are not part of the EU floods directive and therefore commonly defined strategies and standards how to address them do not exist.

Drought. Especially 2022 drought, has affected all sectors and exposed critical issue, related also to climate change. All countries in the Adriatic-Ionian macro region were under severe stress. This exposed that there is limited strategic drought management (existing actually only for agricultural drought), lack of systematic water balances (combined river basin level, catchment level, water supply system level, water user level) with identified losses, potential water reuse, potential improved water storage and better water use efficiency. This is also because EU Water Framework Directive addresses almost only water quality issues, while the water quantity and water balances are left to be managed on a country level, following national or sometimes regional and local legislation and tools.

Improved management of water supply systems including water cycle as a part of circular economy. Drinking water is an absolute priority and central focus of water management. With the climate change, in some countries and realities the water supply is under extreme pressure as several water supply systems in the macro region had to issue strict restrictions on water use in order to avoid the complete breakdown of the water supply. The crisis management of the water supply systems has to be improved, but also actual management of water supply systems including measure for better water use efficiency, including water reuse to make the water supply more resilient and ready for similar droughts in the future.

Strategic challenge of sea level rise. Currently the mean sea level rise in the Adriatic-Ionian area is estimated to be around 5 mm/year with the accelerated rising anticipated to be soon around 10 mm/year. While the rise challenges are currently relatively limited, it is the dimension of the problem which puts this challenge on the list of priorities. The discussion on the strategies, action plans and measures applicable in different realities should start now, while there is probably still time to discuss them, provide common understanding and harmonized approaches and strategies to tackle it in the coming decades.

It was recognized that the tools and approaches that were developed in the projects MUHA, ADRISEISMIC, and TransCPEarlyWarning (chapters 3, 4 and 5) could be used and capitalized addressing the challenges described above. In the MUHA project advanced component – hazard – impact (vulnerability) – risk toolbox was developed supporting comprehensive risk assessment in water supply systems, aiming at support in the implementation of the new EU Drinking Water Directive. The tool is already multi-hazard and multi-objective, supporting both – risk-based management and crisis management; the tool could be upgraded to other water related risks (droughts, flash floods, water supply system measures and sea level rise). TransCPEarlyWarning project has developed a process-based model supporting planning of complex contingency procedures and their activation in the case response to emergencies (incidents). This could be capitalized, extended and upgraded to the applicability in the emergencies described above. While the outputs of the ADRISEISMIC project are less related to the challenges, the experiences in the development of learning materials would be valuable.

The water management challenges just described were recognized to be common in the Adriatic Ionian macro region, having also background in the strategic documents, especially as almost of them are related to the climate change adaptation process. Beside the similar challenges, they also address the relationships on the transnational catchments and water bodies (i.e. Soča-Isonzo, Neretva, Drim). Sometimes even regional challenges (within one EU country) occur in the management of the addressed challenges. New strategies, solutions, and tools are also necessary because of the complex cross-sectorial cooperation, required to resolve these challenges. Sectors are sometimes prone to the "silo" approach (*when certain sectors or people do not wish to share information with others in the same company*), and complex cross-sectorial cooperation should be addressed in order to provide necessary enabling environment.

2.2 Challenges and approaches in the earthquakes management

The group of participants to the brainstorming session about earthquake identified as one of the biggest challenges for the ADRION area the **absence of a strong culture of risk**. In this regard, raising awareness, especially of citizens, has been considered of great importance by the participants especially because strong earthquakes are not frequent events, and therefore there is the threat to forget the more appropriate behaviour in case of emergency and which measures should be followed in order to reduce the damages and the impact of the event.

Another challenge identified is the **(im)possibility to develop early warning systems**. Earthquakes are unpredictable events and therefore, at present, no possibility of early warning is available. However, some pieces of research are dedicated to improve the state of the art and it is considered a possible field of analysis in the next coming years.

Speaking about earthquakes in relation to disaster risk management, the **post-earthquake phase** still remains a challenge for the ADRION area. The urgency to face the lack of safe houses for citizens brings local, regional and national authorities to decide in short time where to place the temporary houses. However, their construction implies a change in the city configuration that, in some cases, is not temporary. The design of this kind of interventions is considered a very important phase, not only due to the impact on the existent and future configuration of the city and on citizens' lives, but also under the environmental perspective. The end-of-life concept should be taken into account since the design phase as well as new possible uses of those buildings can be conceived. If the new settlements will be demolished after their use, at least the recyclability of their components should be guaranteed. It is extremely important planning in advance how to face the emergency phase, so as to be prepared as much as possible after the disaster.

The last two challenges identified are related to the **urban planning discipline**. The first one concerns the regeneration projects of inner and rural areas. Planning for more accessible villages and towns can be of great importance to increase the resilience of these areas towards seismic risk. Clear and safe escape routes accessible by the most vulnerable groups of citizens allow a better management of the emergency and hopefully a decreased number of losses and deaths. In addition, the integration of seismic risk into urban planning laws and tools is still a challenge for ADRION area. At present, the seismic vulnerability of historic areas is mainly addressed at building level, but sectorial studies are often not able to address the interrelated consequences of earthquakes on complex socio-economic

systems like cities are. The diagnosis of seismic risk at large scales like the urban one is considered of great importance to bridge this gap being capable of orienting planning strategies for the regeneration of the entire city.

The second step of the round table discussion focused at the same time on the last two guiding questions. Sharing statistics among the relevant stakeholders to build a **common database of impact** is seen as a technical support in regard to earthquakes effects. Subsequently, a **common language** should be used to facilitate the process and be adopted at transnational level. Eventual models should be facilitated in their use and co-designed with the final users. Capacity building session can be organised to support the model use.

Another tool identified is a **good practices repository**, with the possibility to implement it at transnational level.

When it comes to earthquakes, great importance is given to the improvement of **Search and Rescue mission and related tools**, such as drones.

2.3 Challenges and approaches in the wildfires management

The group of participants to the brainstorming session about forest fire identified a number of challenges for the ADRION area. First and foremost is **increasing awareness** of citizens and stakeholders, and engaging into relevant **capacity building**, as accidents represent an important reason for wildfires in combination with increased temperatures attributed to climate change. Investing in **contingency plans** and **sharing knowledge** to common people is quite important. A second challenge is associated with **buildings** and the **urban environment** especially in communities that are in proximity to forests: appropriate materials and building techniques could delay spread of fire in houses and the urban tissue, while adequate urban planning is equally important for reducing casualties and property loss.

Another important challenge is related to **better communication** between firefighting units and overall **better command system coordination**. Inadequate coordination at national/regional level in many ADRION countries has proven responsible for inefficient handling of fires. The situation is further deteriorating in the case of countries receiving international assistance when coordination of units must involve a **multinational dimension** to be supported by adequate systems and procedures. This is also especially true in case of **cross-border events** when administrative and firefighting structures of different countries must collaborate and coordinate efficiently to the end of achieving a common goal.

A further challenge is related to the **lack of materials, resources, financial capacities, and institutional collaboration** at individual country level, to address efficiently the needs of Civil Protection in the case of forest fires. **Data exchange** between institutions is critical for the different phases of Civil Protection starting from prevention and early warning and **digitalization** could play an important role to this end.

An additional challenge is related to **water versus fire** and the utilization of water resources to confront fires. Innovative solutions to guarantee access to water just in time at the spot of a fire, water scarcity, and draughts present different views of the same challenge. Similarly, there is a strong liaison of this problem with **climate change**.

The second step of the round table discussion focused on the technical support that could facilitate the provision of solutions to the aforementioned challenges. A first element that should be dealt with is related to **education, awareness raising, capacity building and training** developing adequate readiness of the population, sensitizing and engaging the different Quadruple Helix stakeholders from public administration and academia, to SMEs and citizens. Alerting the inhabitants of an area about the potential consequences of their behavior and driving behavior change, involving the entire Quadruple Helix, collecting feedback and ideas on how to more efficiently confront forest fire challenges, utilizing Living Lab methodology can help change the situation in ADRION and beyond.

Digitalization can offer solutions for monitoring and early warning alerting including remote sensing (drones & satellite data), guidelines for hazard mapping, Artificial Intelligence for alerting. Digital services facilitating firefighting coordination can make a difference increasing overall efficiency of a territory and utilizing **Open Data.** Exploitation of EC infrastructures like **Copernicus satellite data** is also a path to greater efficiency. **Simulation** can be also quite significant exploiting such technologies as Digital Twins and Virtual Reality for training. Regular **exercises (such as table top)** can increase the local stakeholder capacities in more efficiently dealing with forest fires and make them more capable of addressing them with fewer casualties and loss of property and natural resources.

Solutions empowering **urban planning** and **regulations for buildings** can have a significant impact, putting limits to planning for new urban areas, protection both cities and rural areas that are close to forests.

Finally, the brainstorming discussion focused on the need for transnational and cross-sectoral responses to increase efficiency in dealing with forest fires. First of all, forest fires present a **common** problem for all the area characterised in many cases as a **cross-border**

hazard, involving stakeholders from different branches of the Quadruple Helix and having a transnational character. **Coordination** and **support** of **multinational teams** is usually necessary, as well as **formalization** of cross-border reaction.

Building capacities at transnational level is also quite important involving stakeholders in **exercises (table top, field exercises, real events)** adopting digital tools and learning from other region best experiences. Comparison between different cases in different countries makes it possible to identify heterogeneities and similarities related to country hierarchy and responsibilities, allowing benchmarking between approaches and facilitating more efficient **decision making.**

2.4 Challenges and approaches in the drinking water supply in emergency

The brainstorming group on drinking water supply in emergency conditions identified several challenges for the ADRION area, mainly related to **water shortage conditions due to drought events**. It is well acknowledged, both in the scientific literature and in the practical management experience, that drought events are strongly increasing in frequency and duration all over the ADRION area, also in territories never impacted in the past. Such a decreasing of precipitation and related decreasing of water resource availability, and even high rainfall variability, due to climate change impacts, pose serious concerns both in ordinary and emergency conditions.

As far as emergency conditions concern, the group individuated issues on data availability regarding in particular: the **lack of structured databases on water availability**, allowing to estimate the space-time relationships between the climate variables monitoring (precipitations, both solid and liquid, temperature, soil moisture, etc.) and water resources availability. Such a lack prevents from developing robust early-warning systems; the **lack of structured and constantly updated databases on water needs and water uses**, necessary to estimate and quantify possible conditions of water shortage, defined as the impossibility or difficulty to meet all the water needs (especially when the water resources are shared among different kinds of water uses, such as drinking water, irrigation, hydropower production…)

During the emergency phase, the focus group recognized several challenges: a lack of coordination among the different stakeholders (water utilities, consortia for irrigation, power suppliers, etc.) and among stakeholders and institutions entrusted to manage emergency (primarily civil protections services) - this issue concerns also the ordinary

conditions, in particular the planning phase; a lack of citizen preparedness towards water scarcity issues; and a lack of an effective communication strategy during emergencies.

The focus group stressed the importance to **develop and adopt shared tools and good practices documents** (included structured checklists) to foster transnational and cross-regional water management, both in ordinary and emergency conditions). Some bottlenecks that limit the use of common tools were pointed out: 1) to develop tools and guidelines on a sound basis, extensive surveys to assess the most vulnerable water supply systems should be carried out to identify (also through quantitative approaches) the relationships between hazards (drought, earthquake, chemical / biological contamination, etc.) and impacts; 2) once developed and tested on a suitable number of test sites, the tools should be officially acknowledged by the institutions entrusted to evaluate and/or approve the contingency plans; 3) concerning the water utilities, the development of Water Safety Plans (WSP) should involve also all the institutions entrusted in different roles for water management. Within this framework, the use of guidelines and structured checklists is strongly suggested.
The focus group pointed out some main instruments to support the transnational and cross-regional challenged thereafter described.

Sharing knowledge and data. EU, through the program Copernicus, already provides data and knowledge useful to perform risk analysis in relation to drought. This kind of data gives information to frame the actual situation in terms of climate at regional scale. What is currently missing is shared knowledge and data in quasi-real time at the scale of the single interconnected water supply system, mainly on the impact of precipitation deficit on the actual capability of the system to meet the related water needs

Transnational legislation. As far as transnational legislation concerns, it is necessary to develop transnational agreement acts to set up common procedures in case of emergency. Such rules should be dynamics in relation to the actual conditions of the water resources.

Virtual Water Trade (VWT). Using Virtual Water Trade (VWT) to reduce water needs and alleviate stresses in several water stressed regions. Since VWT is the amount of water, either green (soil moisture) or blue (renewable and non-renewable), that is virtually mobilized though the import-export of agricultural goods, strategies for international or inter-basin trading of specific crop commodities (and food products in general) may be developed to reduce quantitative pressure of water resources in water-scarce regions. VWT should be considered among the effective tools for balancing the water budget when a proper planning of utilization and management of water resources is critically needed.

2.5 Challenges and approaches in the communication for resilience

The participants of the brainstorming session on communication for resilience agreed that a strong communication is key for effective risk management. In the view of the participants, effective internal and external communication plays an essential role in crisis management.

The first challenge to successful communication is to **raise awareness about the prevention and preparedness to natural hazards**. Then, the **target groups** must be identified. At first sight, citizens are the most relevant target group when it comes to risk prevention. Across the target "citizens" there are many nuances, i.e. children, youngsters or adults: each segment should be approached differently.

To be successful in this challenge, local and regional government must be well trained. That's why the **Training of Trainers (ToT)** model is envisaged. Raise **awareness campaigns** are considered one of the best tools to reach citizens, especially school children.

For example, the content of the campaigns should have the key messages which translate into plain language civil protections procedures work well.

Workshops, games, or some other popular and modern approach to the problem should give the best result. We are sure that application development of the monitoring locations for the main threats, or even an **educational app** that can be also turned into a children's video game, would make a positive long-term influence on the struggle with the problem.

As an added value, **transnational cooperation** help learn from other people's experiences, so all the institutions, local, national and regional should be closely connected and have well-developed cooperation and communication. Cooperation among sister institutions can improve exchange on Civil Protection procedures, develop joint tools and campaigns with harmonized material.

2.6 Take-home messages

As a summary of the brainstorming sessions, three key-points were recognized:

1. *Data sharing*. Knowledge of the dynamics of the hazardous events in terms of triggering and related impacts is of overall importance to identify sound strategies and actions for planning, early-warning, risk-assessment and mitigation measures. It is necessary to better coordinate the collection and homogenization of existing databases on both hazards and related impacts, fostering the inter-operability among

different platforms. Moreover, it is necessary to develop modelling tools to assess links between triggering events and the chain of consequences.

2. *Governance*. Management of emergencies (both natural and man-made) requires a strong coordination among several actors. It is necessary to improve the incident command system, distinguishing competences and specific roles, even more in the case of countries receiving international assistance when coordination of units must involve a multinational dimension to be supported by adequate systems and procedures.
3. *Capitalization*. In the framework of national and EU projects, several operational tools supporting the risk analysis and management have been developed. However, few of them are largely adopted on a wider scale, probably due to two main bottlenecks: a) very few tools are officially acknowledged by the institutions entrusted for planning and controls; b) not sufficient efforts have been devoted to capitalization activities. It is worth stressing that capitalization activities might effectively fostering education, awareness raising, capacity building and training to develop adequate readiness of the institutions and population.

3.Detailed analysis of the tools developed by the involved projects

3.1 ADRISEISMIC Moodle Platform

3.1.1 Description

ADRISEISMIC Moodle platform is a web-tool based on the MOODLE software, which is one of the most used and popular Learning Management Systems worldwide. The platform is hosted at the University of Crete data center and can be found at the address: https://adriseismic.nhmc.uoc.gr/ .

It has been conceived to host the training packages developed within ADRISEISMIC project in the different languages of the project partners countries. As a results, the home page of the platform allows the users to choose the language of their interest before entering the courses section. Six are the languages available namely Albanian, Croatian, English, Greek, Italian, Serbian and Slovenian (Figure 1).

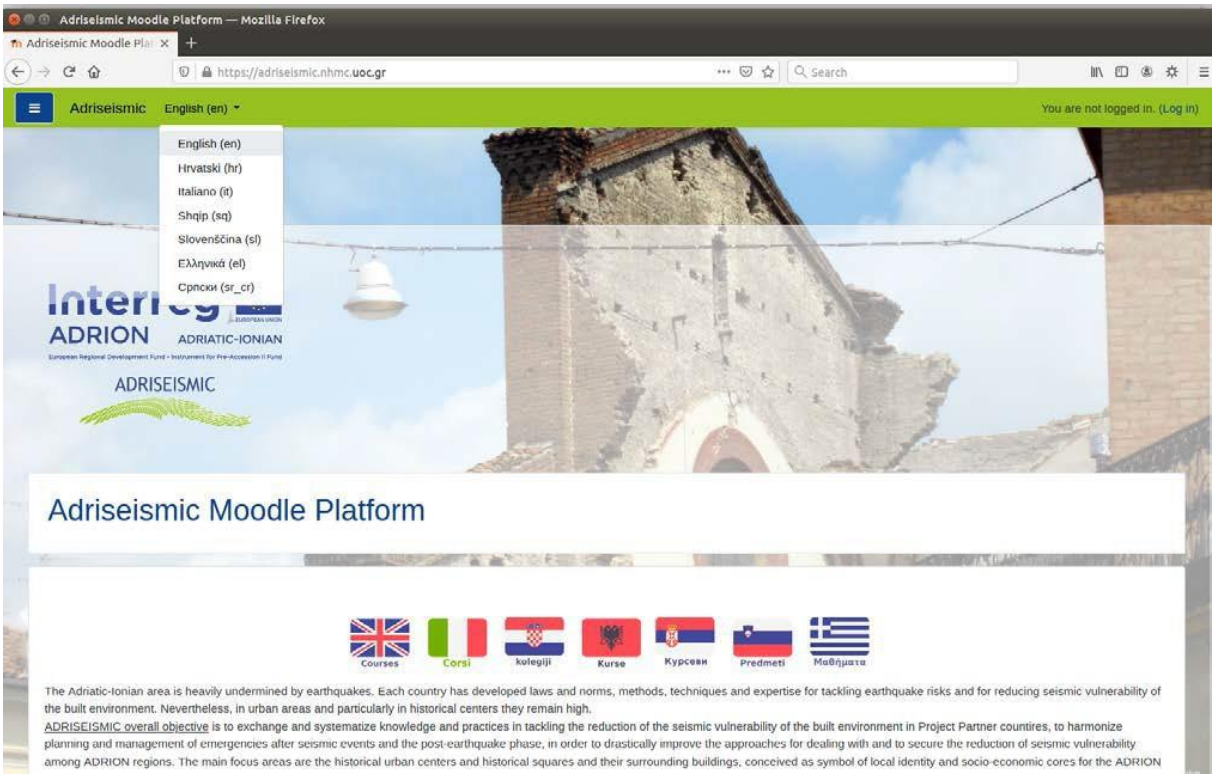

Figure 1. ADRISEISMIC Moodle platform homepage.

In the project framework four training courses have been developed:

- Training packages for practitioners
- Training packages for building workers
- Training packages for civil servants
- Training toolkit for volunteers

The structure of the courses into the platform follows the syllabus configuration that has been drafted per each target group and it has been translated in all the language. The complete training packages have been developed in Italian language only, in order to test the training materials at local level and therefore, video-lessons are available for each module of the courses.

However, some topics have been considered of great importance for the project scope and not dependent to the local specificities. For those, video-lessons have been produced in all the languages.

In addition, one more section has been set up under the English courses called “International Summer School on new integrated approaches for seismic improvements of Adriatic and Ionian historic urban centres". This part of the Moodle has been used to carry on an

international summer school coordinated by the University of Bologna about the topics addressed by the project. All the students enrolled to the course using a keyword and had the opportunity to follow the lectures already available in the platform under the training package for practitioners. Some examples have been provided in the figures below (Figure 2, 3, 4).

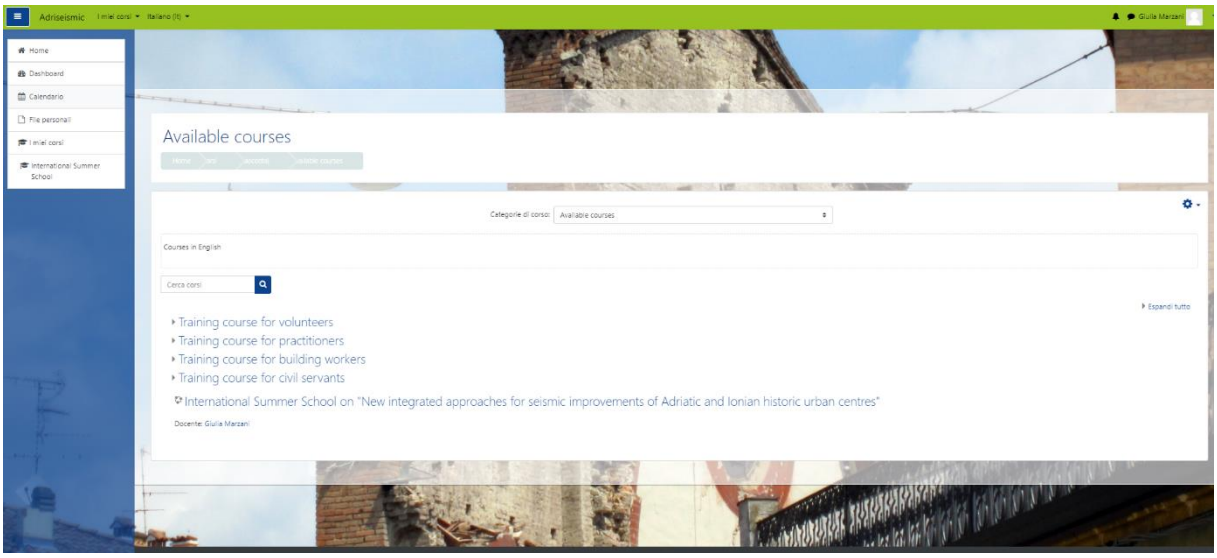

Figure 2. The four training packages in English language and international summer school section.

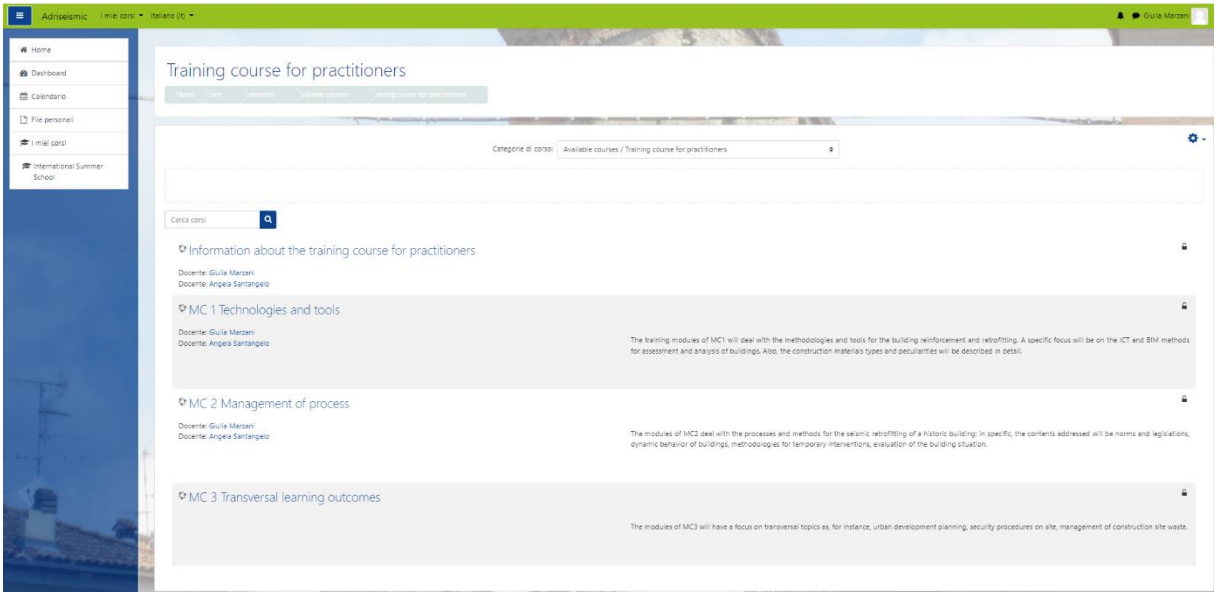

Figure 3. Example of the training package. The practitioners case.

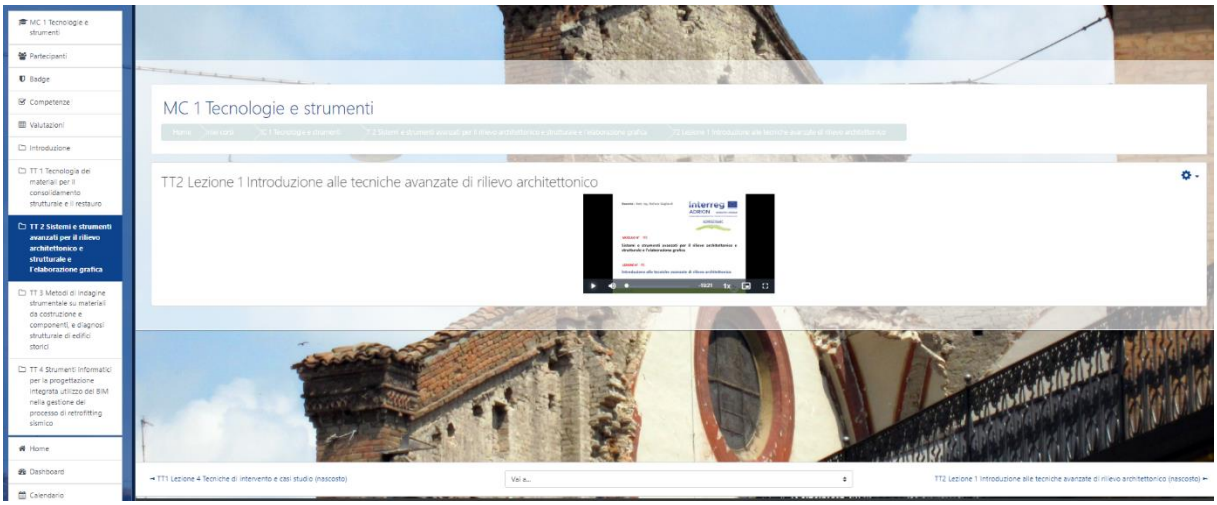

Figure 4. Video lesson of the Italian training package for practitioners.

3.1.2 Objectives

The MOODLE platform allows to make the knowledge and results generated by the project more accessible and ensures to have such material available for other interested parties beyond the partnership and after the project end. Thanks to its properties, the MOODLE platform is able to spread all the training packages and toolkit to a wider audience making them immediately available.

3.1.3 Strengths and weaknesses

The platform is open source, with the possibility to support the participation of a large and active community.

Among its many advantages is the fact that it is extremely customizable and flexible while many plugins are available to satisfy any kind of need. Also, it should be stressed that there is the possibility to find great support and documentation about the software use.

The main component of a MOODLE platform is the e-course. An e-course:

- Supports multiple pedagogical (Classes can be instructor-led, self-paced, blended or entirely online);
- Encourages collaboration and team work;
- Integrates external resources and learning tools;
- Can include multimedia content;
- Possess customizable grade management;
- Can include peer and self-assessment;

• Disposes high levels of security and privacy.

The main learning tools utilized by an e-course are:

• Resources and activities: files, pages, videos, quizzes, assignments, fora, etc.;

• Communication tools;

• Team work;

• Assessment management;

• E-Course management and monitoring.

When it comes to weaknesses, the platform requires to sign in to have full access to the contents, and this may discourage participants to access it.

3.1.4 Users

The ADRISEISMIC Moodle platform is conceived to be accessed to the project partners to use the materials available and replicate the trainings in their local context.

Students can also enrol directly to one or more courses without the rights of content modifications.

3.1.5 Accessibility

The Moodle platform is open source and therefore anyone is free to register using a username and choosing a password. The enrolment to the courses as student is managed by the platform administrators.

3.1.6 Future/capitalization

Moodle is an open-source learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalised learning environments. It will be managed also beyond the project lifetime by linking it through the project website. All project partners will have the possibility to access the platform and use the materials necessary to perform and to replicate trainings. Moodle's multilingual capabilities ensure there are no linguistic limitations to learning online for everyone. The tool is used to establish the network of organisations which are interested in transnationally tackling environmental vulnerability. Thanks to its flexibility, the platform can be structured to host a dedicated session related to "risk prevention and disaster resilience" with the possibility to upload different types of materials focused on the sub-cluster topics and developed by the participants.

3.2. MUHA Water Safety Planning Procedures Decision Support System (WASSP-DSS)

3.2.1 Description

The revised water Directive (EU 2020/2184) “on the quality of water intended for human consumption”, who’s legal framework is set by the Directive 98/83/EC, explicitly mentions the “water safety plans” (WSP) as the correct tool for water utilities to provide safe drinkable water, together with standard EN 15975-2 concerning security of drinking water supply. WSPs, according to the approach suggested by the World Health Organization, are based upon a comprehensive risk-assessment and risk-management approach, which addresses all steps in water supply – from catchment to consumer. In order to support and harmonize WSPs drafting and implementation, WHO provided specific guidelines (WHO, 2009) that drive the risk analysis through 11 detailed modules (Figure 1). In particular, the “system assessment” is based on four modules: “Describe the water supply system” (module 2), “Identify the hazards and assess the risks” (module 3), “Determine and validate control measures, reassess and prioritize the risks” (module 4), “Develop, implement and maintain an improvement / upgrade plan” (module 5).

The concept of the MUHA project (MultiHazard Framework for Water Related Risks Management): 1) a correct approach to risk analysis on drinkable water supply systems needs a multi-hazard perspective encompassing all the components of the system and possible superposition of different hazards; 2) risk analysis on drinkable water supply systems needs the involvement not only of the water utility, the body entrusted of its development, but also of several institutions to harmonize monitoring and response procedures. Based on these premises, the main goal of the MUHA project is to connect hazards and risks related to the integrated water cycle with the existing and improved coping capacity developed by civil protection mechanisms on a national, international and EU level. Four water related risks are mainly addressed within the project framework: accidental pollution, flooding, drought and failure of critical infrastructure due to earthquakes.

The detailed analysis of the current status of implementation of WSPs in the ADRI-ON area performed in the first period of the MUHA project highlighted the necessity to firstly characterize the water supply system under consideration by structuring the analy-sis in a shared scheme able to represent all the components of the WSP, crossing each components with possible hazardous events and impacts in a multi-hazard approach.

Such an analysis led to an informative tool, accessible via web at the address http://muha.apps.vokas.si/home

The tool, called WASSP-DSS (WAter Safety Planning Procedures Decision Support System), basically supports the development of the modules 2 and 3 of the guidelines provided by the WHO (Figure 5).

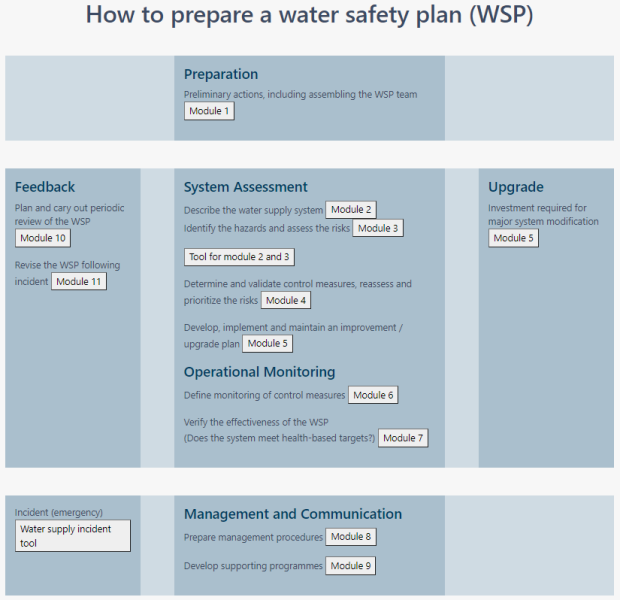

Figure 5. Main page of the MUHA WASSP-DSS tool giving an overview of the modules driving the development of water safety plans according to the WHO guidelines (2009).

The WASSP-DSS has been extensively tested on the six pilot sites of the MUHA project, as shown in Figure 6. The testing phase focused in particular on four hazards: drought, flooding, earthquake, and accidental pollution, all potentially impacting the pilots.

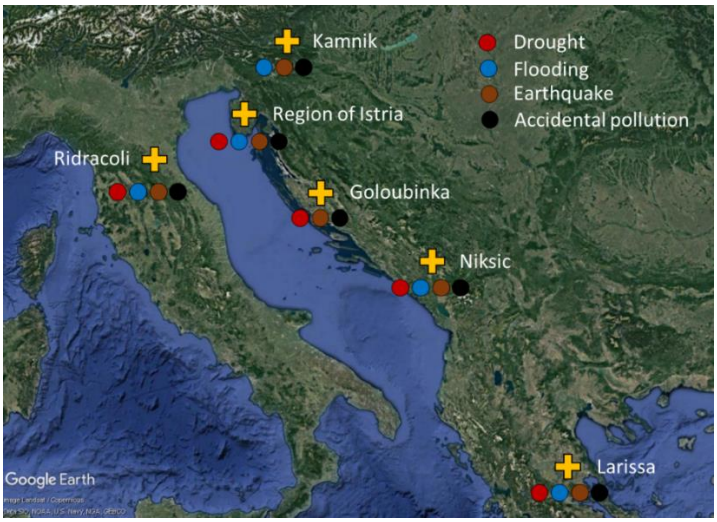

Figure 6. Pilot sites of the MUHA project.

3.2.2 Objectives

The WASSP-DSS tool is constituted by a catalogue of possible hazardous events associated with different components of the water supply system chain. Its main goal is to support the Water Utilities in identifying possible hazardous events impacting the system and which part may be more affected to assess risk matrices in relation to each hazard and component. The tool will be further developed also after the end of the project through the constituting "UNAS" network, the network of the users of WASSP-DSS and will lead to drawing up a strategic guidance document for a sound implementation of Water Safety Plans (WSP).

Selection of the WSS components

WASSP-DSS is constituted by a catalogue of possible hazardous events associated with different components of the water supply system chain: 1) surface water resources; 2) groundwater resources; 3) artificial recharge; 4) raw water intake; 5) raw water storage and transport; 6) treatment; 7) reservoir and pumps; 8) transport and distribution; 9) internal piping; 10) organization and information; 11) governance and future hazards). Some of them, as shown in Figure 7, are in turn split in sub-components.

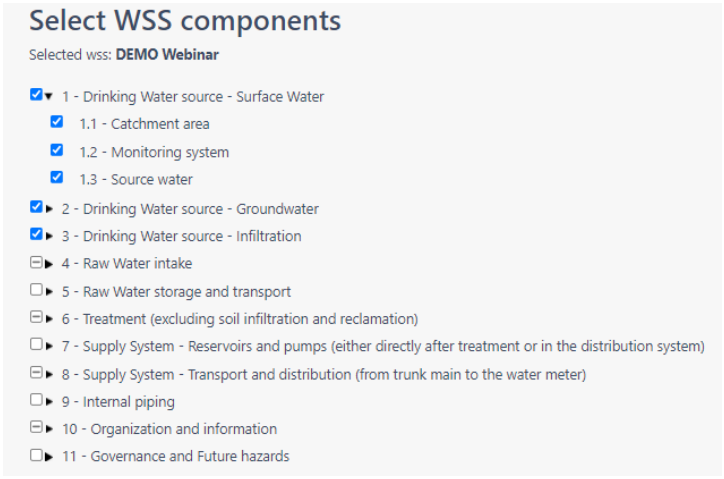

Figure 7. Components of a generic water supply system to support the risk analysis through the WASSP-DSS.

Specific Risk assessment

A catalogue of hazardous events possibly occurring in the selected component (or sub-component) is given. Each hazardous event (in Figure 8 an example of the hazard "shortage of water" due to drought) is described in a specific box summarizing the related trigger, consequences and possible measures. For each hazardous event, the user is requested to evaluate the probability of occurrence by selecting estimated return period among some pre-defined categories (from weekly to 30 years or more) and the severity of occurrence. It is worth stressing that the first one needs a quantitative estimate, while the second one Is qualitative. The two components are combined to compute a risk estimation, in turn categorized as very low, low, medium, high and very high.

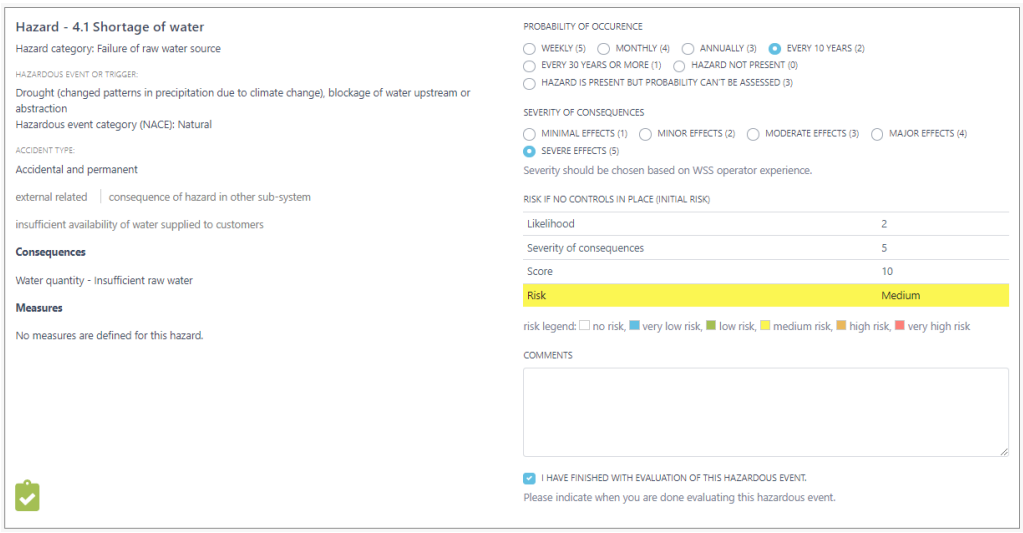

Figure 8. Example of hazardous event box in the WASSP-DSS tool.

Overall Risk assessment

Once completed the "catalogue of events" going through all the components and possible related hazards, the overall risk assessment is dynamically represented through a multidimensional approach where outcomes are given in terms of number of hazardous events per component and hazard category, severity of consequences by component and by hazard and the risk category by component and by hazard (Figure 9).

Figure 9. Overall representation of the risk analysis performed on a generic water supply system through the WASSP-DSS tool.

The complete report can be finally exported in docx or xlsx format.

3.2.3 Strengths and weaknesses

The MUHA WASSP-DSS is open source, with the possibility to support the participation of a large and active community. It is primarily addressed to water utilities that are developing water safety plans.

The tool drives the user through a first and complete risk assessment of Drinking Water Supply System components, resulting in a rough but overall overview of the actual DWSS vulnerability.

It is worth stressing that the new methodology adopted in the WASSP-DSS allows for performing a risk analysis addressed to the WSPs implementation based on a matrix approach that crosses a comprehensive catalogue of hazardous events with the structure of the entire DWSS, described component by component. Such an approach somehow completes the general guidelines on WSP provided by the WHO.

Some strengths points can be pointed out:

1. WASSP-DSS appears a very useful tool to support the initial screening for developing robust water safety plans, ranking the riskiest hazardous events. Such an initial phase is fundamental, although for the medium to large water utilities it is not sufficient.
2. The tool itself by proposing a common scheme of analysis to all the water utilities at national and transnational scale is an added value to foster exchanges of information among water utilities and toward Institutions entrusted for controls.

Some weakness points can also be identified:

1. For medium and large water supply systems it is necessary to develop different water safety plans related to different subsystems. In this regard, the choice of the correct space scale is fundamental: the “subsystems” should consider the chain of impact of hazardous events considering the propagation of impacts. However, for the WUs this could imply developing tens of water safety plans, requiring large efforts in terms of necessary time and personnel. The tool does not allow to take the spatial connections of WSS infrastructures into consideration, implying that spatial relations and related impacts among components (as well as the direction of such impacts) are not explicitly considered. In general, adding spatial data (e.g. maps with the location of infrastructures and assets, flood hazard maps, historical events flooded maps) would

provide more detailed and distributed information on risk level over a complex infrastructural system, and help directly identifying suitable mitigation measures.

2. Some of the WSP risk analyses are based on information that should be provided by other institutions than the water utility and that are not available (or because are not produced, or because are not made available by the Institution that provided them). This is why a strong collaboration among different actors is absolutely necessary.
3. Some of the information necessary for risk analysis are not simply based on direct monitoring, but rely on models able to simulate physical processes. Models are not usually adopted, especially by the small and medium water utilities. It would be advisable that at least for some hazards, a "modelling team" to be shared among several water utilities is constituted to support development of water safety plans.

3.2.4 Users

The MUHA WASSP-DSS is conceived to be accessed and used primarily by water utilities, in particular during the first phases of development of water safety plans. It can also be shared by all the institutions involved in different roles in water management, particularly those ones in charge of evaluate and eventually approve WSPs.

3.2.5 Accessibility

The MUHA WASSP-DSS is accessible via web at the following address:
http://muha.apps.vokas.si/home
after registration through a valid email.

3.2.6 Future/capitalization

UNAS, the User Network of Adrion water Safety plan, is a supported transnational cooperation network and has been first presented during the transnational pilot management workshop held on July 15th, 2021. The network is constituted by the users of the WASSP-DSS (WAter Safety Planning Procedures Decision Support System tool) and fosters interactions among the many actors involved in water resources management, mostly during the Water Safety Plan (WSP) preparatory phase.

UNAS takes the form of a community forum (Figure 10) hosted by the MUHA toolboxes server with the aim of giving the users an easy, efficient and safe transnational platform for sharing knowledge and experiences on MUHA toolboxes and the WSP elaboration. Moreover, UNAS is

making the MUHA toolbox alive by giving the users the possibility to provide structured feedback during the MUHA project.

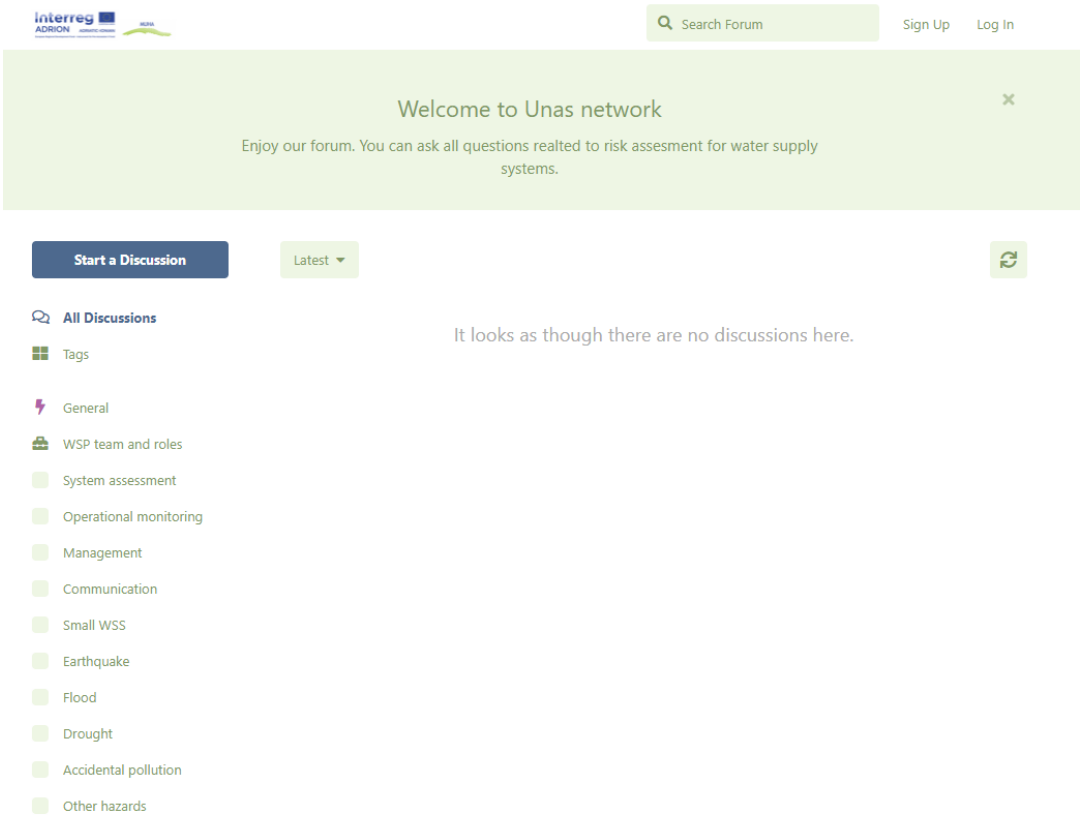

Figure 10 – UNAS main page with tags displayed on the left side.

UNAS network can be accessed directly from the toolbox:
http://muha.apps.vokas.si/home
or by the following link:
http://muha-unas.apps.vokas.si/
During the MUHA project duration, the UNAS main functionality is the ability to share structured feedback on the use of the WASPP toolbox, as missing component, unconsidered innovative measures, or comments. After the duration of the project, the UNAS main functionality is expected to be the ability to share experiences, knowledge, and information among the stakeholders through the UNAS forum.

3.3 TransCPEarlyWarning Platform

3.3.1 Description

The TransCPEarlyWarning Civil Protection Early Warning Platform (TransCPEW platform) aims to unify and automate the various Civil Protection (CP) processes regarding the prevention of natural and man-made disasters. It serves the purpose of offering a focal point of reference for the Civil Protection stakeholders in ADRION territories enabling the integration of different information sources and systems and will make it possible for CP stakeholders to perform the relevant experimentation through pilot implementations.

The creation of the Platform involved several preceding steps that resulted in gathering the necessary information and extracting the correct user requirements from it. The first step was a thorough analysis of the Civil Protection Early Warning frameworks in Italy, Greece, Bosnia-Herzegovina, Croatia, Slovenia, Albania and Montenegro, which resulted in a firm understanding of the current regulatory status of Early Warning (EW) mechanisms in each participating country. Existing procedures related to Early Warning were extracted and broken down into basic modules that appeared to be repeatable in each country. Finally, consultation with Civil Protection officers provided the necessary expert knowledge regarding requirements that needed to be included in the Platform's design.

The TransCPEarlyWarning Civil Protection Early Warning Platform provides a number of functionalities that comprise:

(i) the design, execution and monitoring of Civil Protection Early Warning procedures;

(ii) the provision of access to different tools/sources of information related to Civil Protection for facilitating everyday routine of Civil Protection stakeholders;

(iii) the experimentation with open datasets and open source code algorithms for the wildfire and flood risks addressed by the project;

(iv) the provision of an appropriate web enabled multilingual secure user interface to enhance Civil Protection stakeholder experience in the ADRION macro-region.

The platform attempts to provide a unified solution that includes functionality for designing, executing and monitoring the stages of an early warning procedure. The system consists of three discrete subsystems that are interconnected through APIs over the HTTP protocol. Those subsystems are in turn divided into smaller components that perform specific tasks. This modular design makes the system flexible and upgradable, two qualities absolutely necessary when dealing with complex, dynamic, and diverse processes. The platform three

main subsystems, are the Early Warning Processes Designer, the Execution Engine and the Early Warning Dashboard.

The platform is hosted at ATHENA Research Center – Industrial Systems Institute at URL: http://transcpearlywarning.isi.gr/login

User authentication is necessary to access the platform functionalities. Platform supports multilinguality and is available both as a desktop – web application and as a smart phone app (Figures 11, 12, 13).

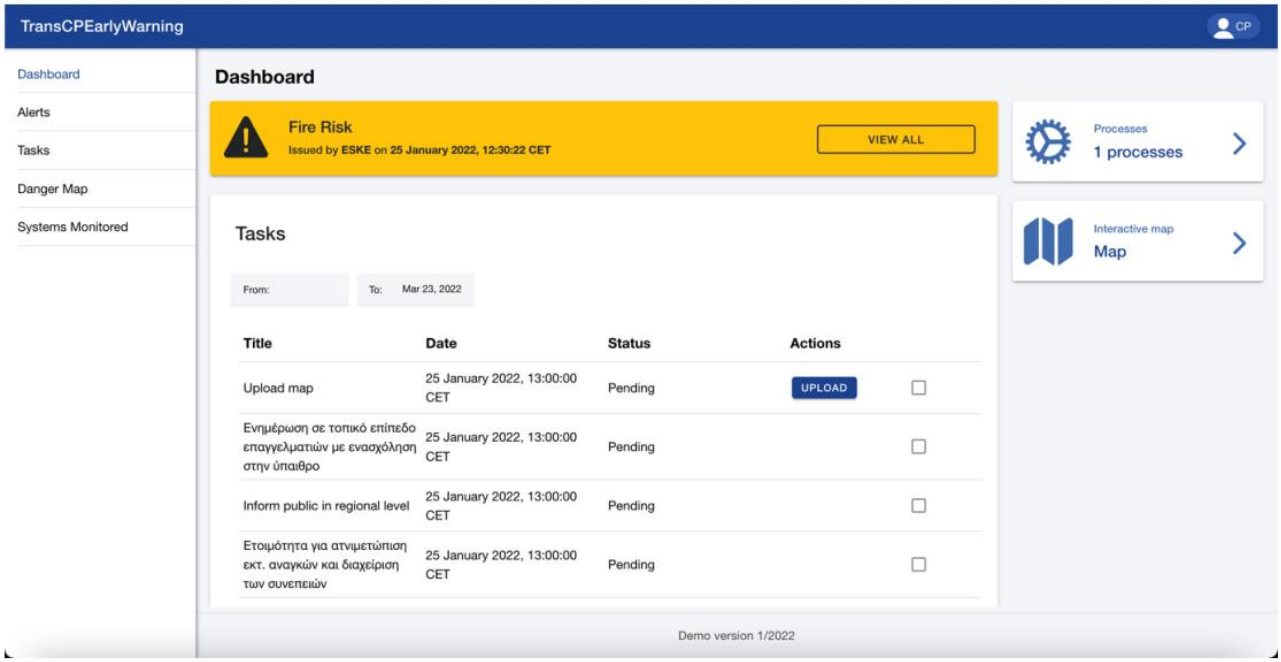

Figure 11. Dashboard of the TransCPEarlyWarning Civil Protection Early Warning Platform.

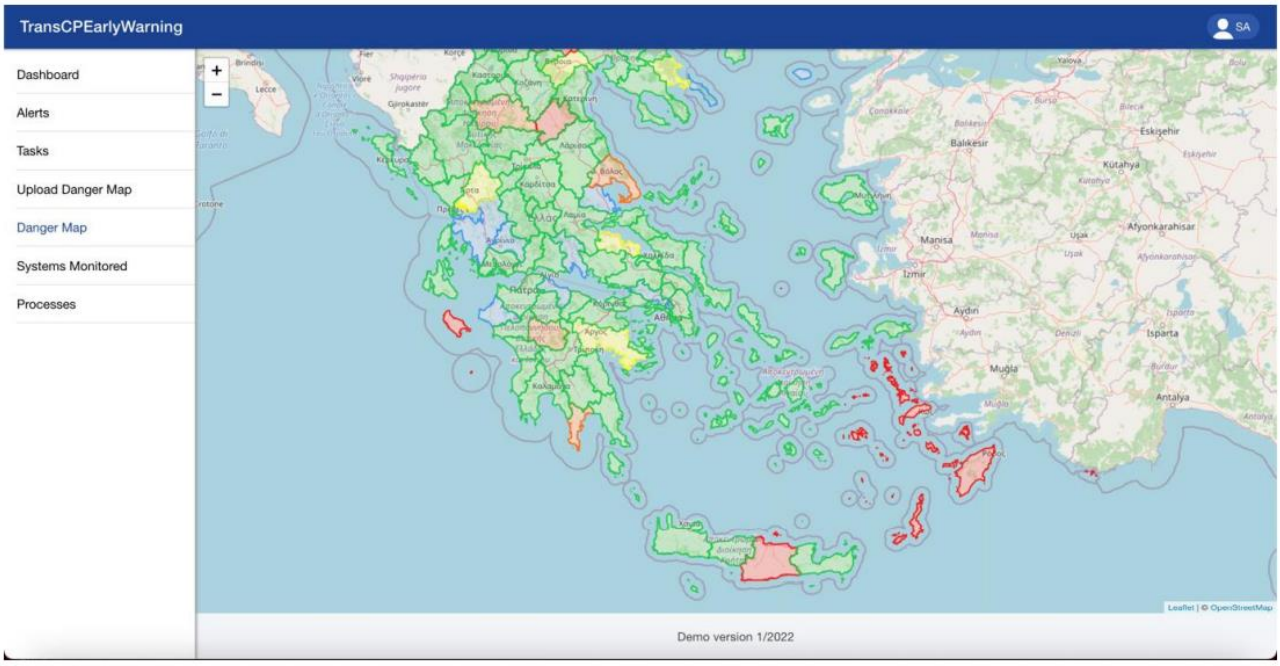

Figure 12. Danger Maps usually represent a starting point for Early Warning processes.

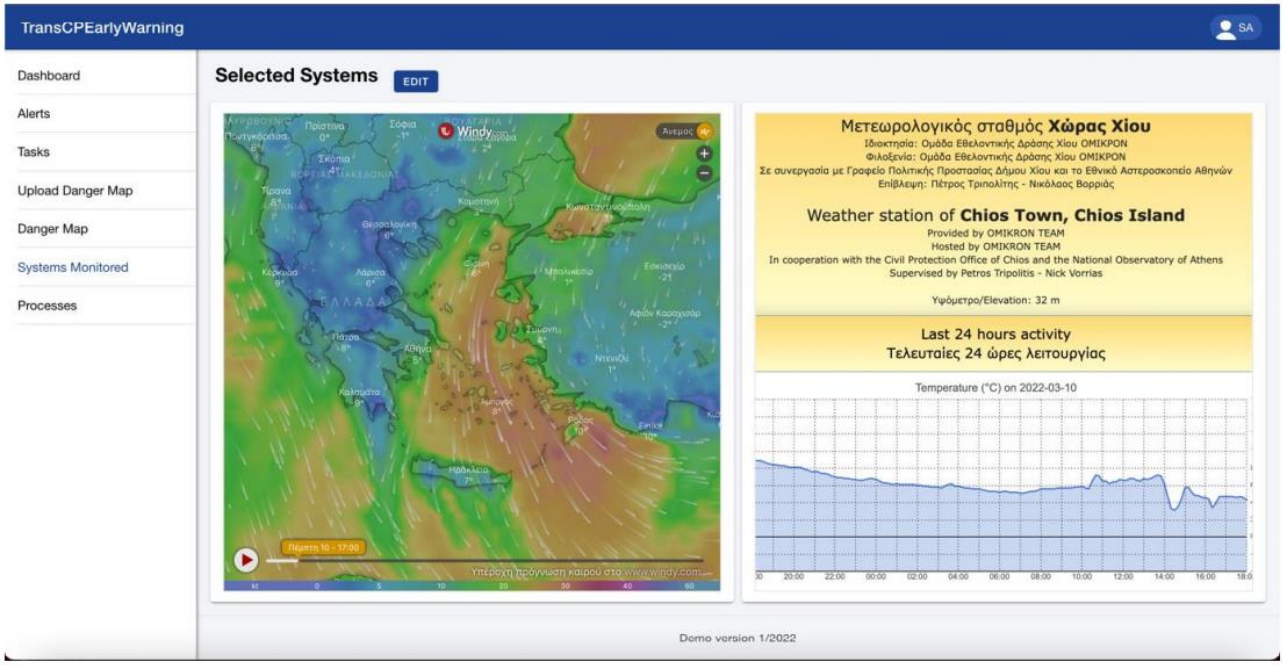

Figure 13. Integrating existing systems used in CP routine is considered essential.

The platform is accompanied by adequate training material available on Moodle platform hosted at ATHENA Research Center – Industrial Systems Institute under URL: https://training.transcpew.isi.gr/

The material is freely available and is structured according to the different types of users that need to use it and comprises both manuals and videos with multilingual subtitles detailing the platform usage.

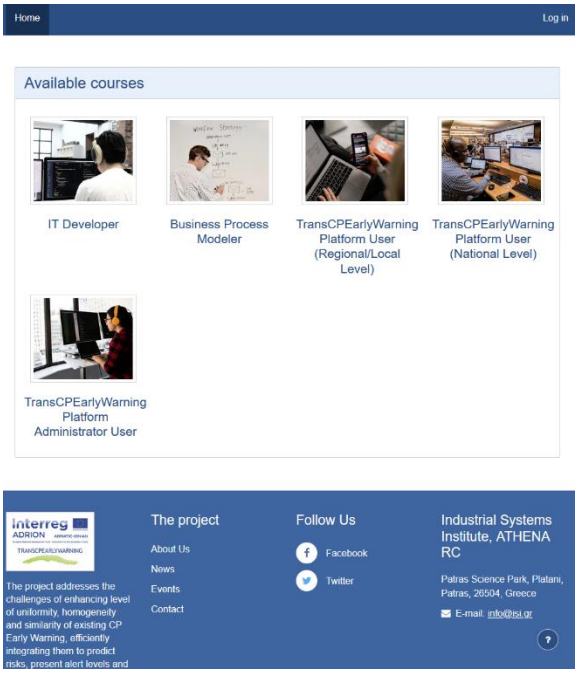

Figure 14. Screenshot of TransCPEarlyWarning Moodle platform

3.3.2 Objectives

The Platform allows Civil Protection officers to perform all of their duties from a single unified and easily accessible point all. These include:

- access to the different information sources and systems utilized in their everyday routine with reference to forest fires and floods
- monitoring and management of the early warning process within their area of responsibility
- communication and message forwarding to other stakeholders based on the procedure defined from the existing framework in each country
- process design and modification, according to the needs of the Civil Protection organization that a user represents.

All the above are presented through a Graphical User Interface that is designed specifically to aid users in their work by highlighting the most important information and actions that need to be taken. The Platform has been designed to follow accessibility and security by design principles. It also offers multilingual support to enhance user interaction with platform modules and services.

The Pilot Testing Experimentation component provides some additional capabilities to the platform as regards recent experimental advancements in the early warning field. More specifically, it will provide a repository of existing implementations and datasets for AI-based early warning system implementations, as well as some basic experimentation capabilities, in order for the project's community to familiarize itself with such aspects, as well as understanding current needs in the field in order to be applied to the ADRION area.

3.3.3 Strengths and weaknesses

The main features and characteristics of the platform are the following:

- It has been designed and developed so that it conforms with the Web Content Accessibility Standard (WCAG), version 2.1, level AA. To this end special measures have been taken in order to be perceivable, operable, understandable, and robust.
- It supports multilinguality and is available in 8 languages (partner native languages + English).
- It has been designed so as to guarantee interoperability of its web and mobile versions.
- It is supported by a complete installation package so that it may be deployed at a stakeholder's premises quite easily.
- It offers a Dashboard as a central focal point, easing navigation throughout its features and enabling an efficient user interface.
- It aims at providing a focal point of reference for all actions of a Civil Protection stakeholders.
- It supports user authentication.
- It allows Civil Protection process modelling and design following a common information model drafted out of examination of existing plans in the ADRION partner countries.
- It offers AI experimentation capabilities targeting mainly early stage alerting for forest fires.

- It has integrated security by design principles.

When it comes to weaknesses, the platform requires an elementary level of digital literacy and is only accessed through authentication as it is not targeting general audience but civil protection stakeholders.

3.3.4 Users

The TransCPEarlyWarning platform is targeting a number of users

- Civil Protection Quadruple Helix including CP stakeholders at regional, local and national level as well as related bodies
- Platform IT Developer, Civil Protection Business Modeller, and Administrator to offer support to the overall platform operation

3.3.5 Accessibility

The platform has been designed and developed so that it conforms with the Web Content Accessibility Standard (WCAG), version 2.1, level AA.

3.3.6 Future/capitalization

The platform will be showcased during the pilot testing in the partner areas in the period until the end of the project. Out of the pilot testing experience and the lessons learnt and feedback collected an action plan for its wider applicability will be drafted specifying measures and recommendations so that it can be officially adopted.

Future steps associated with the platform is its extension to include other phases of the Civil Protection lifecycle further to the Early Warning phase that it is currently addressing. This could enable a unification of the entire lifecycle under a single digital tool and increase overall efficiency. This approach is also in line with the common project proposal of the Cluster.

3.4 Analysis of the tools

Based on the descriptions provided by the projects' leaders, the three tools have been analysed searching for similarities and connections.

3.4.1 Geneal features

In general, the description of the tools developed during the projects have in common the characteristics of being freely available for any interested user on the net, the hands-on structure can be understood by the different types of stakeholders and a multilinguals approach has been adopted for both written manuals and videos.

ADRISEISMIC Moodle platform is a web-tool based on the popular Learning Management Systems, the MOODLE software. The main component of a MOODLE platform is the e-course which the featured learning tools utilized are resources and activities (files, pages, videos, quizzes, assignments, fora, etc.), communication tools, team work, assessment management, e-Course management and monitoring. The platform hosts the four training packages developed within ADRISEISMIC project, in the different languages of the project partners countries, divided on the following groups: practitioners, building workers, civil servants, and volunteers.

WASSP-DSS (WAter Safety Planning Procedures Decision Support System) is the informative tool, accessible via web, developed during the MUHA project, which supports the development of the modules 2 and 3 of the Water Safety Plans (WSP) guidelines provided by the WHO (2009). A video-tutorial in English with the subtitles in all the six languages of the partnership has been developed to help the new users. The WASSP-DSS has been extensively tested on the six pilot sites of the MUHA project; each pilot site focused on one or several of the four hazards: drought, flooding, earthquake, and accidental pollution.

The TransCPEarlyWarning Civil Protection Early Warning Platform (TransCPEW platform) aims to unify and automate the various Civil Protection (CP) processes regarding the prevention of natural and man-made disasters. It serves the purpose of offering a focal point of reference for the Civil Protection stakeholders in ADRION territories enabling the integration of different information sources and systems and will make it possible for CP stakeholders to perform the relevant experimentation through pilot implementations. The platform attempts to provide a unified solution that includes functionality for designing, executing and monitoring the stages of an early warning procedure. The platform and the training material available on Moodle platform, are both hosted at ATHENA Research Center

- Industrial Systems, partner of the project. During the pilot testing the platform will be installed by the 7 partners coordinating pilot testing in the ADRION partner countries.

3.4.2 Objectives and users

The objectives of the tools strictly depend on the needs of the main stakeholders of the projects. The MOODLE platform of ADRISEISMIC allows to make the knowledge and the results generated by the project more accessible, and the training packages and toolkit available for other interested parties beyond the partnership and after the end of the project. The WASSP-DSS tool of MUHA project has the main goal of supporting the Water Utilities in identifying possible hazardous events impacting the water system to assess the consequent risks; the tool will be further developed also after the end of the project through the already constituted UNAS, the network of the users of WASSP-DSS. The TransCPEarlyWarning Platform allows Civil Protection officers to perform all of their duties, with reference to forest fires and flood, from a single unified and easily accessible point.

About the users, the ADRISEISMIC Moodle platform is conceived to be accessed to the project partners and students. The MUHA WASSP-DSS is regarded to be accessed and used primarily by Water Utilities; then also by all the institutions involved in different roles in water management, particularly those ones in charge of evaluate and eventually approve WSPs. The TransCPEarlyWarning platform is targeting Civil Protection Quadruple Helix including CP stakeholders at regional, local and national level as well as related bodies; also Platform IT Developer, Civil Protection Business Modeller, and Administrator to offer support to the overall platform operation.

3.4.3 Strenghts and weaknesses for transnational cooperation

About the strengths and weaknesses, it is interesting to notice that in general the tools have in common the following characteristics:

- open source, with the possibility to support the participation of a large and active community;
- prolonged lifespan, as they will be managed also beyond the project lifetime through each project website or dedicated link;
- strong collaboration among all the involved stakeholders;
- customizable and flexible;
- possibility to find great support and documentation about the software use;

- use of English as common language, but in all the projects also the possibility to vision one or more material in the national languages of the partnership;
- common scheme of analysis, that can be used at national and transnational scale;
- sign in requirement to have full access to the contents.

3.4.4 Capitalization

The capitalization of the projects lies on the life duration of the tools which are expected to be fully functional and alive after the projects official closure.

ADRISEISMIC Moodle platform is a flexible platform used to establish the network of organisations which are interested in transnationally tackling environmental vulnerability and it will be managed also beyond the project lifetime by linking it through the project website. It hosts a dedicated session related to “risk prevention and disaster resilience” with the possibility to upload different types of materials focused on the sub-cluster topics and developed by the participants. In addition to the courses, an international summer school named “International Summer School on new integrated approaches for seismic improvements of Adriatic and Ionian historic urban centres", can be carried on about the topics addressed by the project.

UNAS, the User Network of Adrion water Safety plan, is a supported transnational cooperation network. The network is constituted by the users of the WASSP-DSS tool and it expected to foster interactions among the many stakeholders involved in water resources management through sharing knowledge and experiences on MUHA toolboxes and the WSP elaboration. After the duration of the project, the UNAS will remain alive through a dedicated website managed by one of the MUHA’s partners.

The TransCPEarlyWarning platform will be showcased during the pilot testing in the partner areas in the period until the end of the project. Throughout the project a Transnational Network for Civil Protection Early Warning is engaged in the project first through focus groups contributing to the platform requirements, then participating in pilot testing and finally remaining active after the end of the project, supporting through a signed MoU its sustainability. After the end of the project, the platform could be extended to include other phases of the Civil Protection lifecycle further to the Early Warning phase that it is currently addressing. This could enable a unification of the entire lifecycle under a single digital tool and increase overall efficiency.

4. Conclusions

The experience of the thematic sub-cluster gave the opportunity to explore how to build the “capital” of the ADRION Programme on the theme of “risk prevention and disaster resilience” (Figure 14). The three Interreg ADRION projects, ADRISEISMIC, MUHA and TransCPEarlyWarning, learned from one another and shared the tools, outputs and best practices developed to tackle common natural disasters in the ADRION area. Based on the technical meetings that were held during the duration of the cluster, the discussions went around three topics of attention: risk management cycle, data, communication. Climate change and transnational cooperation were the issues that on one side moved, on the other side glued, the discussions. Looking at the big picture, the projects’ final goal was to give the technical information requested to promote strong EU policies, legislations, and guidelines for the European citizens, "*United in diversity*". In the following paragraphs, the conclusions of the thematic cluster experience are collected and summarized.

In the project management, the risk management cycle is commonly divided into four steps which entangle the risk identification, analysis, response, and monitoring and review. The risk management cycle applied to natural disasters, in the ADRION area faces deep challenges for what is considered the early-warning phase and the post-disaster phase. Moreover, planning in advance how to tackle the emergency, to be prepared as much possible after the disaster occurs, is still an unmet priority. For the planning strategy, stakeholders should be involved in regular exercises (table top, field exercises, real events) as they can increase the local capacities in dealing efficiently with natural or man-made disaster and to prevent casualties and loss of property and natural resources. Mechanisms and models of exercises should be facilitated in their use and co-designed professionally with the final users. Exercises should be organized even at transnational level, using a common language, to share and learn from other region best experiences. Comparison between different cases in different countries makes it possible to identify heterogeneities and similarities related to country hierarchy and responsibilities, allowing benchmarking between approaches and facilitating more efficient decision making. Transnational and cross-sectoral responses are clearly recognized pivotal to increase efficiency in dealing with the management of disasters. Coordination and support of multinational teams is usually necessary, as well as formalization of cross-border reaction.

Related to the risks management cycle, an adequate urban planning is important for reducing casualties and property loss: solutions empowering urban and environment planning and regulations for buildings can have a significant impact by protecting both cities and rural areas that are prone to natural disasters.

Data exchange among institutions is critical for the prevention, early warning and post-event management. Sharing statistics among the relevant stakeholders to build a common database of impacts is seen as a technical support in regard to the disaster effects.

The lack of structured databases on different resources and disasters prevents, for example, from developing robust early-warning systems; for the same reason, also the lack of constantly updated databases necessary to estimate and quantify possible natural conditions, limit enormously the plans and mechanisms to adaptation and mitigation.
Digitalization can offer solutions for monitoring and early warning alerting including remote sensing (drones and satellite data), guidelines for hazard mapping, AI for alerting, Open Data. Digital services can facilitate, for example, the firefighting coordination. The exploitation of EC infrastructures like Copernicus satellite data is also a path to greater efficiency. Simulation can be also quite significant exploiting such technologies as Digital Twins and Virtual Reality for training.

The development and adoption of shared tools, good practices and a practices repository should also foster transnational and cross-regional disaster management, both in ordinary and emergency conditions.

We are currently living in a society with absence of a strong culture of risk. The power underlying by communication is still under exploration and the use of its potential is just at its beginning. A strong communication strategy is the key factor that in the coming future will support effective risk and crisis management.

The first and foremost challenge to successful communication is to raise awareness of citizens about the prevention and preparedness to natural hazards. It is commonly recognized that there is both a lack of citizen preparedness towards natural disasters issues and a lack of an effective communication strategy during emergencies. The community of people that are living in a territory prone to natural disaster are the relevant target group when it comes to risk prevention and preparedness; across the target there are many categories such as children, adults, elderly people, people with disabilities and each of them

should be approached differently. Raise awareness campaigns are considered one of the best tools to reach citizens, especially school children. Alerting the inhabitants of an area about the potential consequences of their behaviour and driving behaviour change, collecting feedback and ideas on how to more efficiently confront natural disasters challenges, can help change the situation in ADRION and beyond.

To be successful in this challenge, local and regional professionals dedicated to communication must be well trained: that's why the Training of Trainers (ToT) model is envisaged.

Workshops, games, video-games, educational app and other popular contemporary approaches could help in engaging the people with the occurrence of natural disasters and how to deal with them.

The communication among relevant stakeholders that are responsible to mitigate or adapt in the crisis event should also be improved. Inadequate coordination at national and regional level in many ADRION countries has proven responsible for inefficient handling of natural disasters as wildfires, droughts and earthquakes. One of the elements that should be dealt with is related to education, and training developing adequate readiness, raising awareness and engaging from public administration and academia, to SMEs and research.

The Living Lab methodology has been proposed as user-centred and open-innovation mechanism to integrate research within people.

With the respect of the unique culture of each community, the transnational cooperation also in the field of communication helps to learn from other people's experiences; the institutions, local, national and regional should be closely connected and have well-developed cooperation in communicating strong and direct messages for risk prevention and disaster resilience.

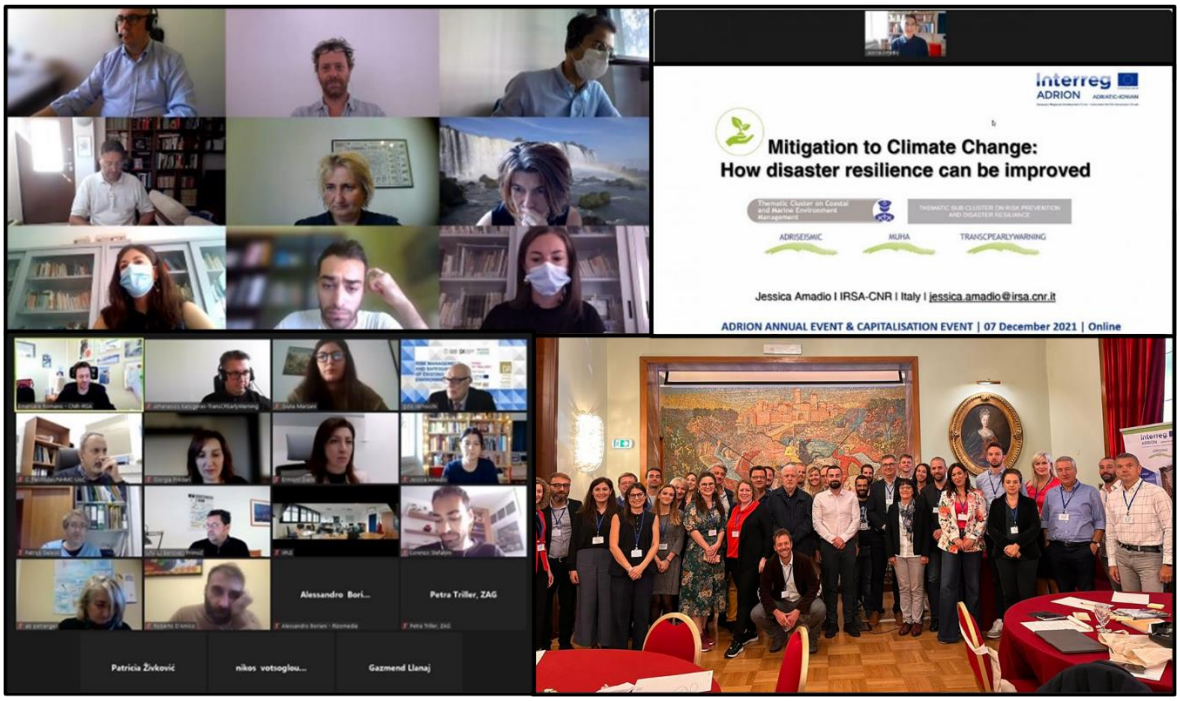

Figure 14. Screenshots of the thematic sub-cluster meetings and events.