Interreg

Co-funded by the European Union

Italy – Croatia

Digital Plan

Iot DSS Platform

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Specific objective Title	Promoting climate change adaptation and disaster risk prevention, resilience, taking into account eco-system based approaches.
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Work Package Title	Digitalization model of civil protection plans and IoT EDSS Platform Development
Activity Number	1.5
Activity Title	Development of Internet of Things Decision Support System Platform
Partner in Charge	LP
Partners involved	All partners
Status	FINAL
Distribution	public

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About Digital Plan Project

The main objective of the project is the digitalization of civil protection plans, already operatives in the territorial areas of competence of the PPs, to improve the capacity of local authorities to investigate the risks present, to define common operational methods of action in the event of a disaster and in particular to share all the emergency planning with other bodies and agencies in charge of rescue, for compress intervention times, and with the population.

Project Relevance

The selected theme of digitalization of CP Plans represents a common interest for Italian and Croatian territories that present similar problems and demand common transnational solutions. Fragmentation of the area and different status of civil protection systems create heterogeneity in hazard handling. Yet, risks and disasters, sure enough, do not recognize state borders and other boundaries imposed by human conventions and treaties. Common risks affect the whole area and the need for a homogeneous, interoperable, and EU-integrated approach is a necessity. This means both homogenizing plans and procedures in the area and presenting common tools for civil protection plan digitalization.

Further to homogenization, such a plan, its accompanying capacity building and training, and its adoption by partners will strengthen the administrative and technical capacities of local authorities in managing hazardous and emergencies. Moreover, partners will benefit from the transnational process of exchange of know-how and from a common basis of knowledge and experience, which will help individual solutions for enhancing resilience in uniformly dealing with natural and man-made hazards within the involved territories. By empowering territorial resilience, the project reduces overall Italian and Croatian programme area vulnerability through extensive information interchange in both vertical and horizontal directions.

The Digital Plan project will contribute to disaster risk reduction, and management efficiency both in the planning phase and in emergencies, collaborating in the building of resilience in the Adriatic region, through the strengthening of cross-border territorial cooperation with the help of innovative technologies both through DSS (Decision Support System) and through the integration of IoT (Internet of Things) sensors.

A poor sharing of emergency planning and management tools and the effects of forecast and ongoing climate change such as extreme weather events, floods, droughts, increased temperatures, and major snow events are a "powder keg" in the world of risk management and the emergency.

The cooperation between the territories of Italy and Croatia, with this project, supports the strengthening of resilience in all sectors of activity in the field of civil protection; then the focus risks of the project, chosen by the PPs, identify innovative technological tools and to support decisions, also with climate adaptation actions.

The territories of the PPs, given the short distances, also share the impacts of multiple extreme phenomena with meteorological or seismic forcing, for which it is essential to share knowledge, skills, and equipment in the event of disaster response, but also during the other phases of the resilience-building and contingency planning cycle.

Until now, the world of extreme events and climate change has been seen as two separate entities, but this is not correct. The main challenge derives from the assumption that good emergency response planning also makes it possible to identify and apply tools and climate adaptation actions.

This cross-border initiative is particularly needed while the entire Adriatic region is preparing to manage events related to climate change and the management of any emergency crises. Climate change mitigation and adaptation can only be achieved through an integrated approach of territorial cooperation and resilience building by endorsing the entire resilience cycle: planning and preparedness, prevention, response, mitigation, recovery, and adaptation towards a new equilibrium. The Deming cycle, the reference point of emergency planning (planning, execution, control, and adjustment), can be perfectly integrated into this cycle.

Finally, in the Sendai Framework for Disaster Risk Reduction (2015-2030), the project's actions support the ultimate goal of achieving results.

The 2015 Sendai Document and the United Nations International Strategy for Disaster Reduction emphasized the need to address disaster risk reduction and climate change adaptation in setting sustainable development goals.

The project with its actions goes precisely in this direction and specifically aims to improve the understanding of disaster risk, improve disaster preparedness for effective response and rebuild better in the recovery phase by setting some overall objectives in the project actions such as increasing entities with their disaster risk reduction strategies and increasing the availability of and access to multi-hazard early warning systems and disaster risk information and assessments.

WP1: Digitalization model of civil protection plans and IoT EDSS Platform Development

WP1 aims to develop a cross border model for civil protection plan digitalization. It will be based on a set of activities, starting from collection of data from civil protection plans, selecting the risks affecting the plans, the emergency flow charts, open data sources like public and private platforms, websites and webcams, to carry out at preliminary analysis of the needs of each individual PPs and to study the local civil protection plans. Furthermore, WP1 also focuses on the development of a scalable and capitalizable IT platform that can achieve several goals: (i) digitization of civil protection plans; (ii) access to geolocated open data sources and IoT sensors; (iii) manage synthetic georeferenced environmental data. Given the ongoing impact of climate change and its potential to increase the frequency and severity of extreme weather events, a key component of the platform will involve conducting multivariate statistical analyses.

Activity 1.5 Development of Internet of Things Decision Support System Platform:

Starting Period: Period 1, 01.03.2024 – 31.08.2024

Ending period: Period 5, 01.03.2026 – 31.08.2026

LP1 will coordinate activity relates to develop a series of software modules, which firstly will be developed and tested individually then integrated into a single web enabled platform based on functional and technical specifications (WP2). The platform will be also tested applying pilot actions with IoT sensors. Subcontracted by public procurement managed by LP1, software houses will carry out the entire process of development and testing. The platform will include modules such platform willator, cartographic representation of risk scenarios & hazardous event, elements of emergency planning included in DB plan of activity 1.1, 1.2 and 1.2, user graphic interfaces. The web interface will have layered components that will be accessible by different users with different roles (public and private); the access privileges will define the components that each user can see and eventually modify.

The software architecture of the DSS will be based on a cloud micro-services approach. LP will produce the technical and user manuals of the platform. PP7 will make a training set (training contents and tutorials) to staff of local authorities that will use the platform to manage civil protection plans digitalized.

Layers and IoT DSS Platform:

The main objective of the web platform is to provide a back-office interface that simplifies data entry for partners. It enables both partners and experts to input the parameters required for the proper functioning of Decision Support Systems (DSS).

Platform architecture

The platform is organized into three main layers:

1. **Presentation Layer**
   This is the user interaction layer. It includes the front-end interface with maps, as well as the back-office area for managing data.
2. **Application Layer**
   This layer contains the business logic. It handles all operations related to data management, performs calculations, and integrates with the IoT system.
3. **Data Layer**
   This is the data storage layer. It consists of databases and object storage systems used to store both structured data and binary files.

Carthographic data: Vector and raster

When working with cartographic data, it's important to distinguish between vector data and raster data:

- **Raster data** is made up of a grid of cells or pixels, where each cell contains a value (e.g., temperature).

- **Vector data** represents geographic features using geometries such as points, lines, or polygons, and is generally more accurate since it's not limited by grid size.

Data analysis from questionnaires

Based on the questionnaires completed by partners during activity and 1.3, two main geographical categories were identified:

- **Area of Interest**
  These are the pilot areas defined by each partner (e.g., municipalities, river basins), including points of interest, reference data, and other relevant information.
- **Risk Areas**
  These refer to specific areas that must be monitored for each identified risk, including relevant points of interest and reference data.

All the data collected through the questionnaires are associated with vector geometries (points, lines, polygons).

This means the data must be stored in a database using a shared standard, with uniform table structures (e.g., same column names and formats). To ensure proper functionality of the web platform and allow for consistent data filtering and map visualization, the database structure requires standardization across all partners. This includes defining common fields and formats for both the area of interest and for each identified risk and its associated resources.

Compilation Guidelines and Thematic layer questionnaire for digitalization of civil protection plans:

To gather and determine the data necessary for the digitisation of the Civil Protection Plan available within the civil protection/emergency plan to be digitalized in each partner territory LP GAL Molise administered to the partners a questionnaire containing guidelines and questions relevant to fulfil and gather the necessary geographical layers and data.

Geographical Information overview

The partnes have to determine geographical information that refers to data that include geographic coordinates. These data can be represented in various forms, including:

- **Point**
- **Line**
- **Polygon**
- **Raster**

Common file formats for geographic data include: .shp, .kml, .kmz, .dwg, .geojson, .geotiff, among others.

Each question in the thematic layer section offers the following answer choices:

- **The data is available**
  The information is already included in the civil protection/emergency plan and stored in the partner's database.
- **The data does not exist / is not applicable**
  The risk or resource is irrelevant in the area (e.g., avalanche risk in a non-mountainous municipality).
- **The data exists but is unavailable or not yet identified**
  The risk is present but lacks formal identification or accessible datasets (e.g., a known hazard not yet officially mapped or certified).
- **The data cannot be retrieved**
  The information is currently inaccessible due to lack of knowledge, expertise, or resources within the responsible authority.

Thematic Data Categories (Reference to Questionnaire Topics):

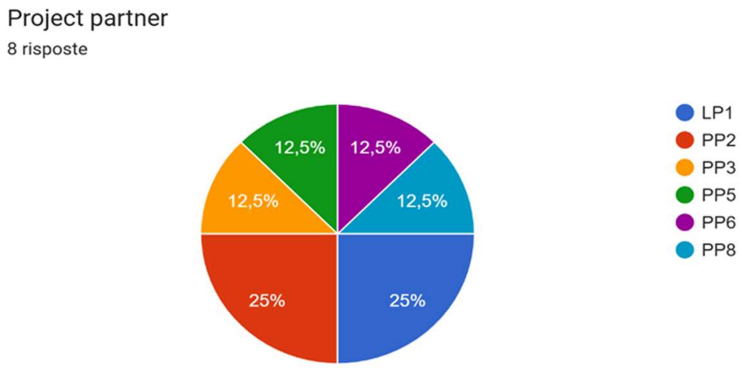
The questionnaire focuses on identifying the availability of key geographic data layers needed for civil protection planning, including:

- **Strategic and Operational Facilities**: Hospitals, emergency operation rooms, civil protection offices, police/fire stations, voluntary organization headquarters.
- **Critical Infrastructure**: Roads, access routes, essential service networks (electricity, water, gas, telecom), mobility hubs (ports, airports).
- **Risk Zones**: Seismic, flood, hydraulic, hydrogeological, forest fire, wildfire-urban interface, avalanche, volcanic, and tsunami risk areas.

- **Environmental and Protected Areas**: Green zones, wooded areas, conservation areas.
- **Emergency Management Sites**: Assembly areas, arrival and assistance zones, semi-permanent settlements, helicopter landing zones.
- **Monitoring and Support Systems**: Sensor systems, radio and telecommunications infrastructure, observation points.
- **Resources and Supplies**: Fire hydrants, first aid supplies, material and equipment storage facilities.
- **Other Relevant Locations**: Livestock and agricultural facilities, production sites, emergency waste management areas, closure points, and critical locations highlighted in local CP plans.

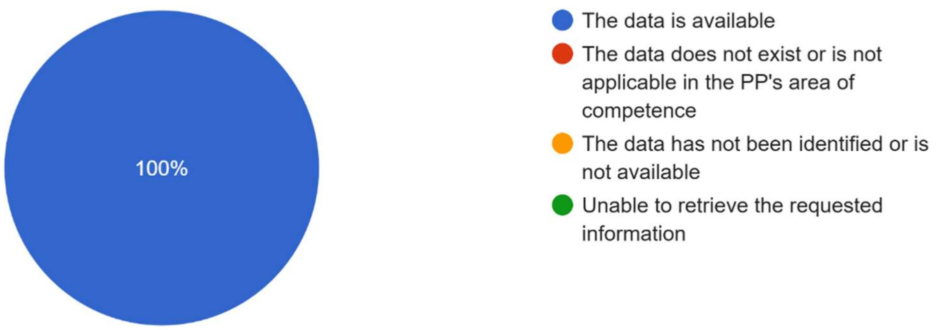
Partners involved and questionnaire results:

The project partners involved and that answered the questionnaire are: LP1- GAL Molise, PP2 – AGRRA, PP3 - Parco Maiella, PP5 - Municipality of Dubrovnik , PP6 – RERA, PP8-Municipality of Fermo.

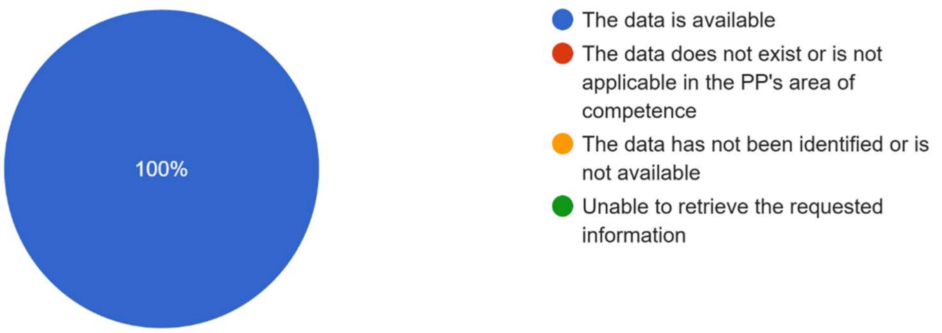


Following the visual and graphical analysis of each question's results in the questionnaire:

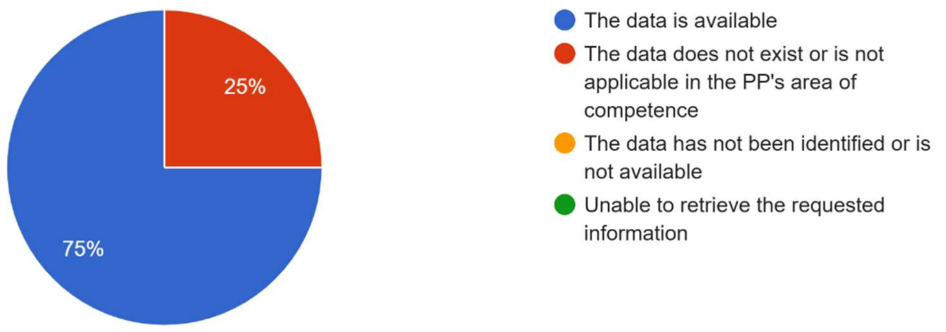
1 - Strategic structures
8 risposte



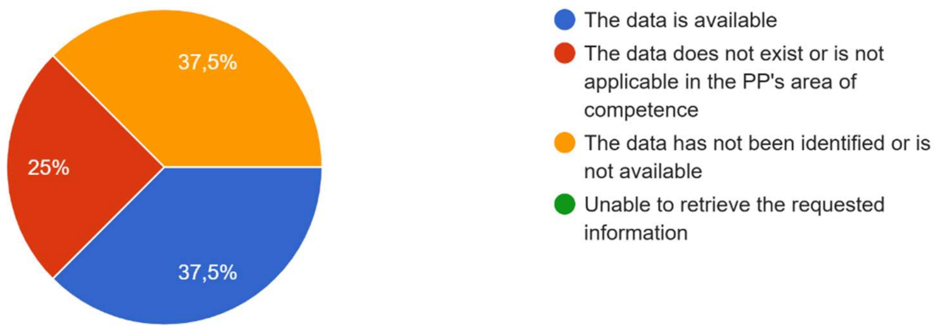
2 - Cemetery areas
8 risposte



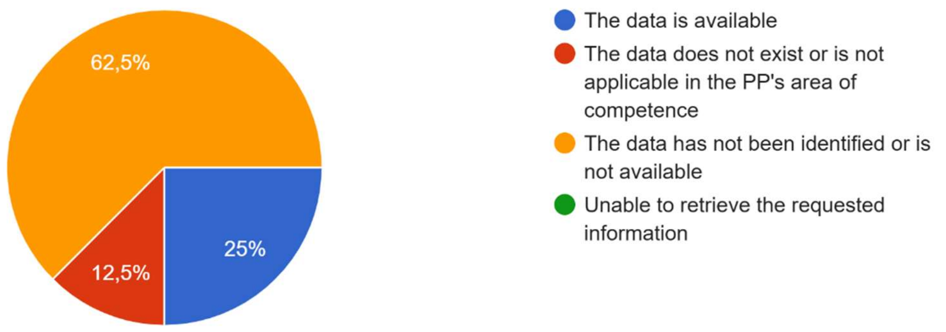
3 - Production facilities
8 risposte



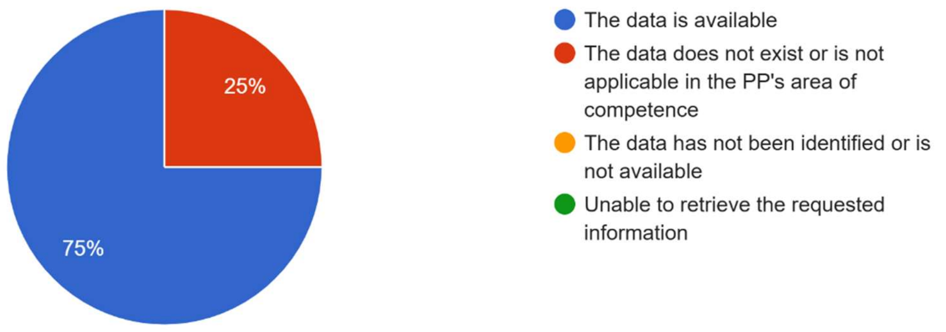
4 - Livestock facilities
8 risposte



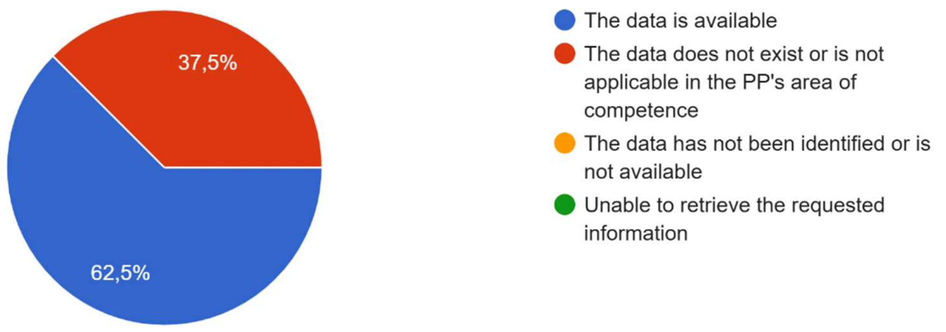
5 - Animal shelters
8 risposte



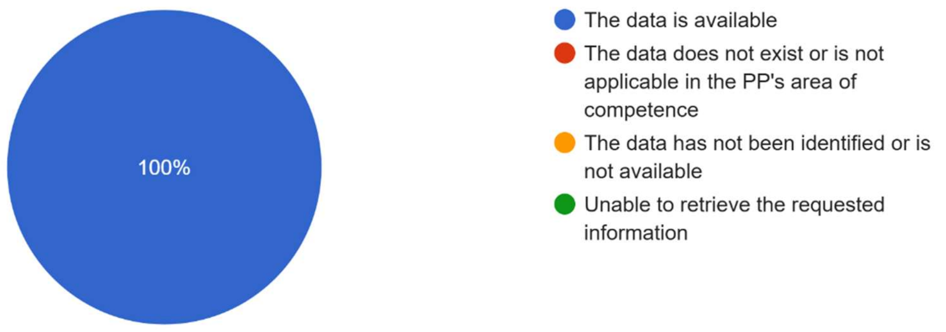
6 - Mobility infrastructure
8 risposte



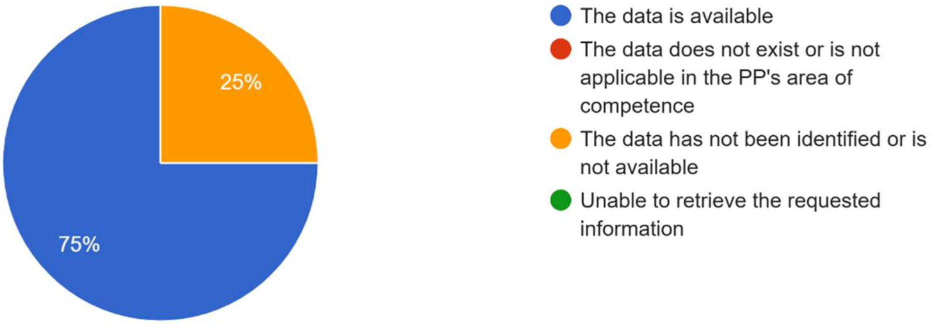
7 - Essential service networks
8 risposte



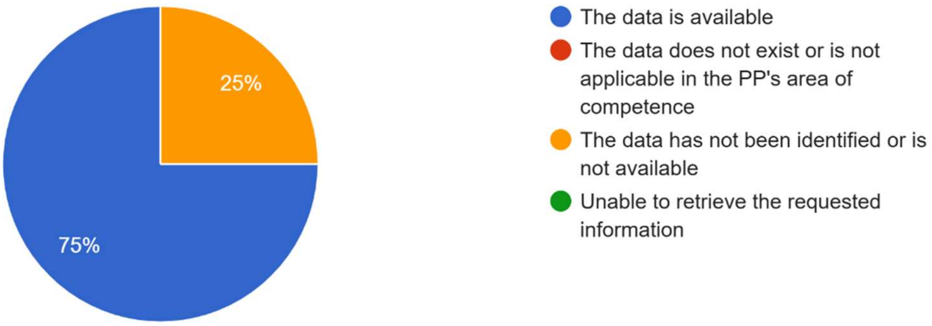
8 - Green wooded and protected areas
8 risposte



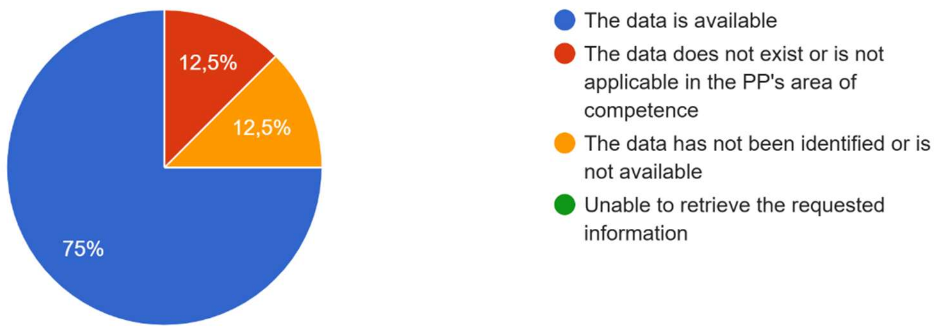
9 - Hydraulic risk areas
8 risposte



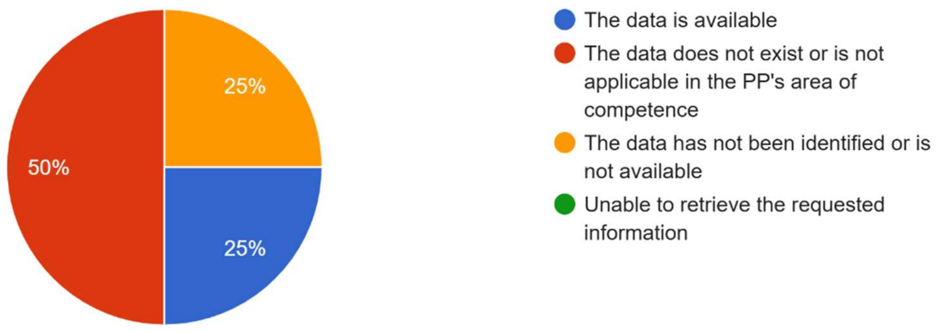
10 - Hydrogeological risk areas
8 risposte



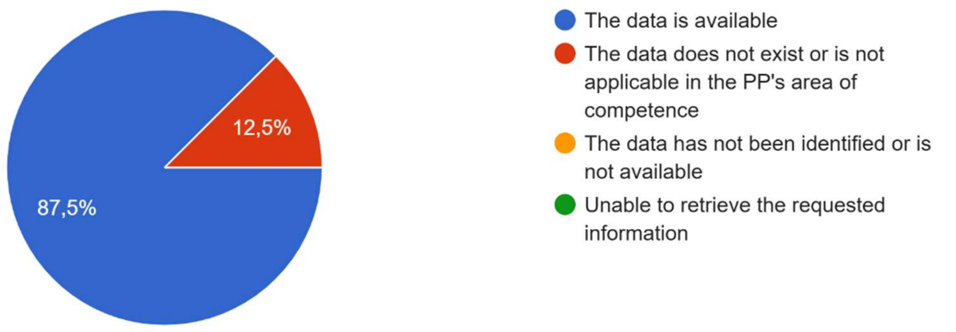
11 Critical points
8 risposte



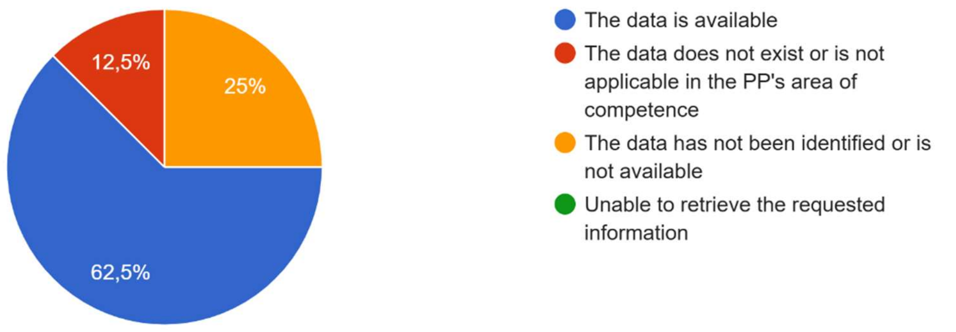
12 - Floodable areas due to dam collapse and rapid run-off of water
8 risposte



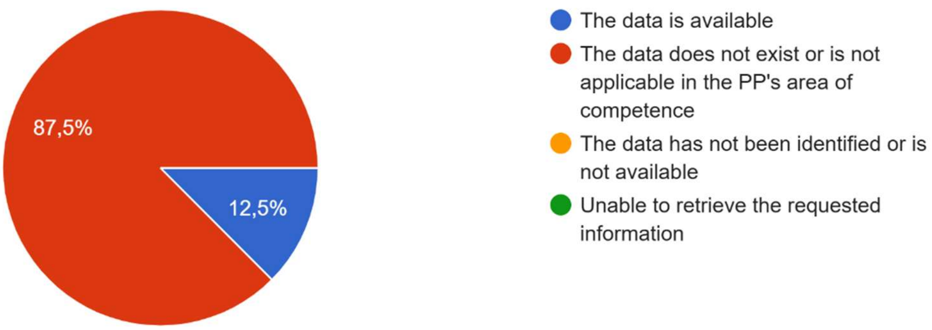
13 - Forest fire hazard areas
8 risposte



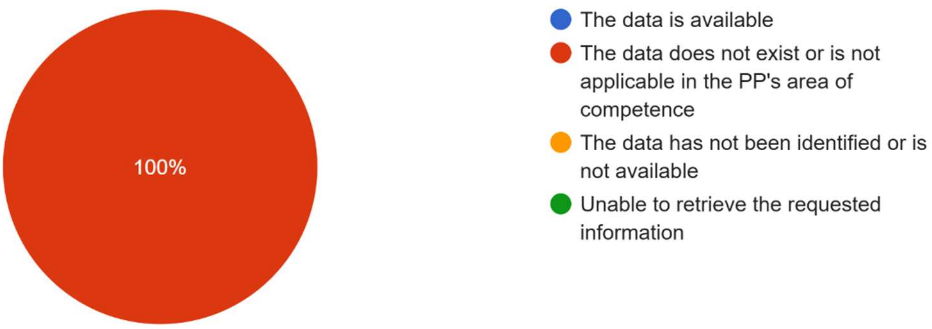
14 - Interface fire hazard areas
8 risposte



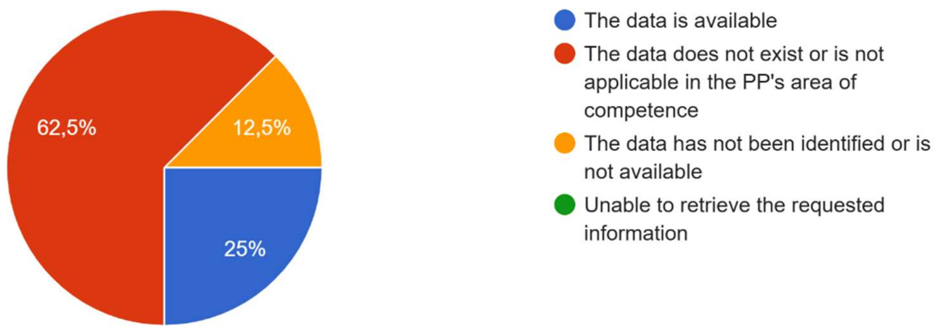
15 - Avalanche hazard areas
8 risposte



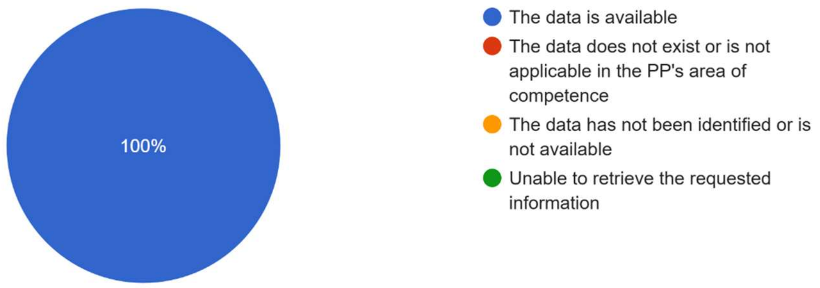
16 - Volcanic hazard areas
8 risposte



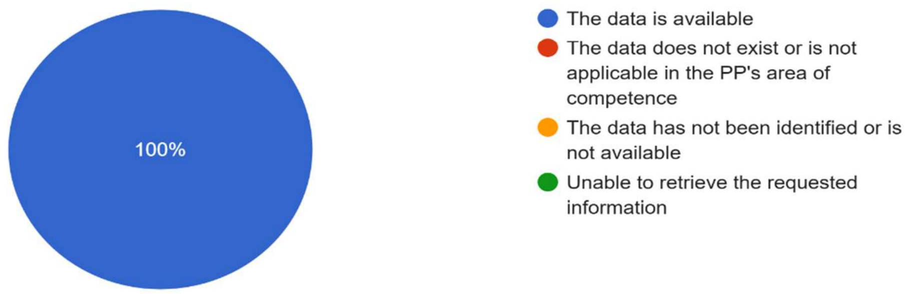
17 - Earthquake-induced tsunami hazard areas
8 risposte



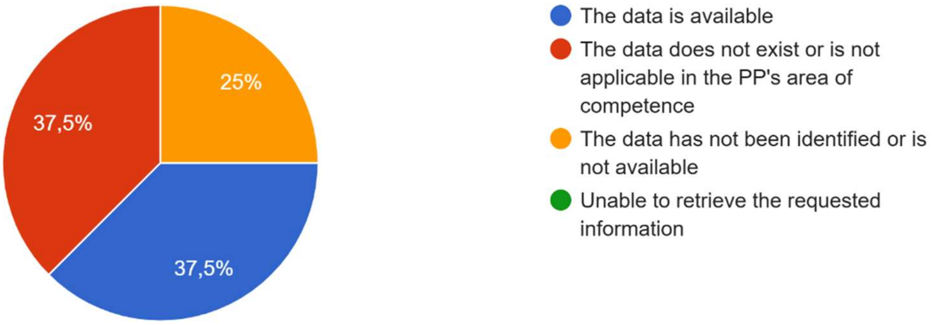
18 - Seismic hazard
8 risposte



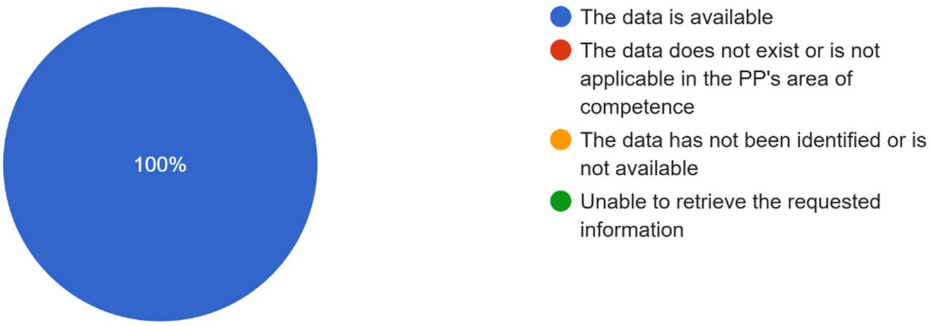
19 - Municipal Civil Protection Offices
8 risposte



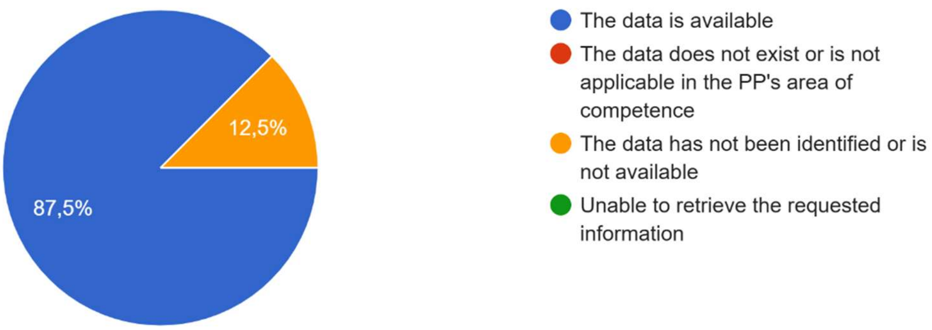
20 - Monitoring network
8 risposte



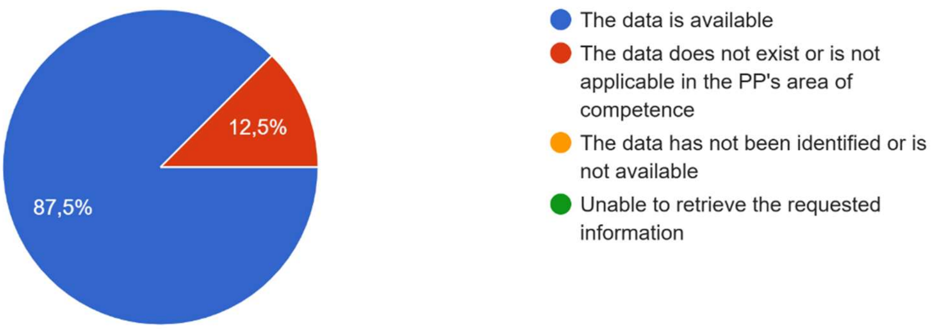
21 - Municipal Operations Center
8 risposte



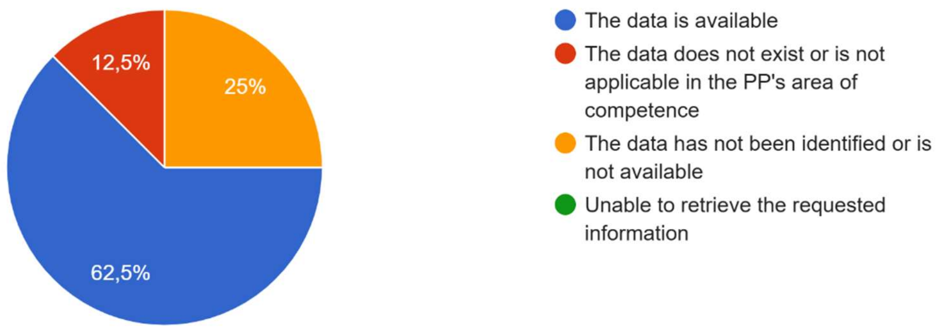
22 - Joint Operations Center
8 risposte



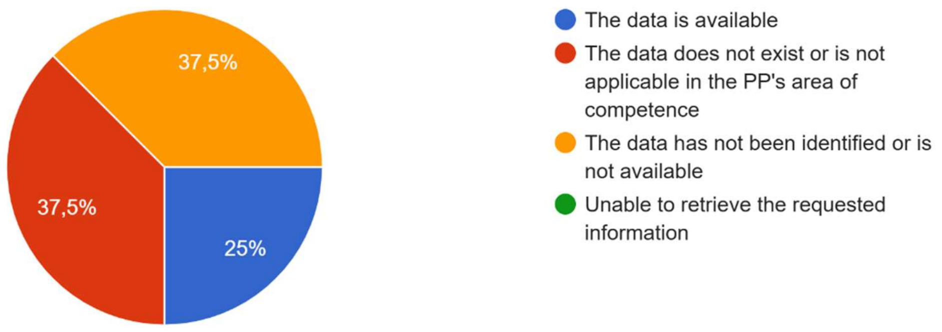
23 - Arrival point areas or population assistance areas
8 risposte



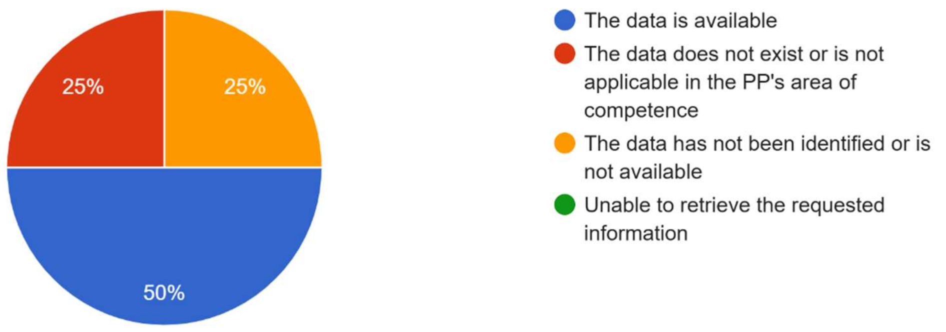
24 - Areas for gathering rescuers and for sheltering/assisting the population for field camps
8 risposte



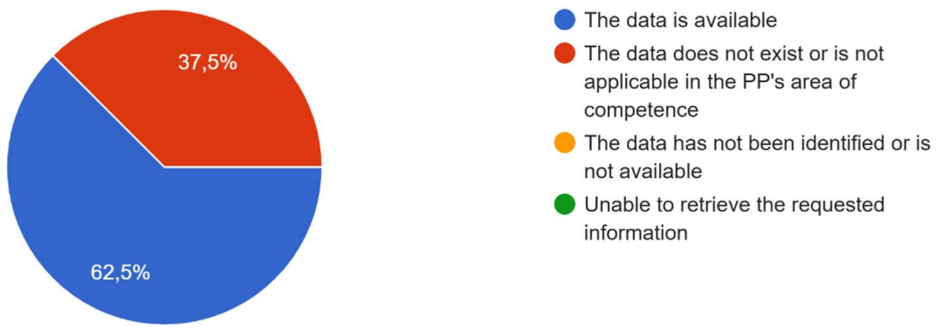
25 - Population Housing Assistance Centers
8 risposte



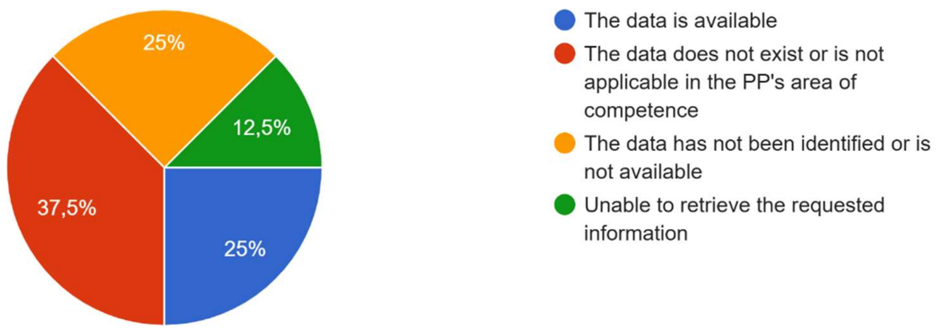
26 - Accommodation facilities
8 risposte



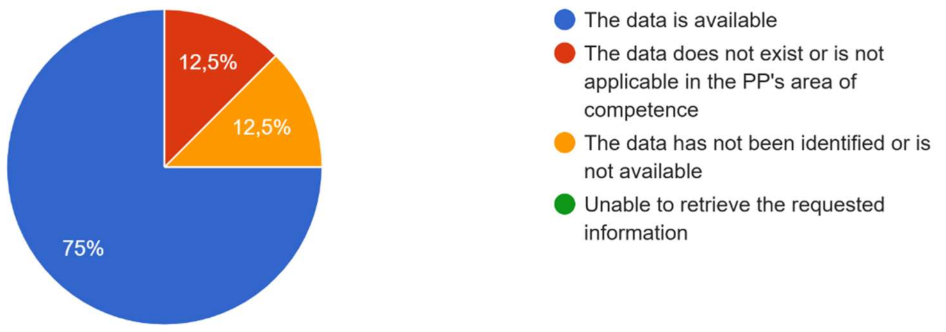
27 - Helycopter landing areas
8 risposte



28 - Areas for semi-permanent settlements
8 risposte

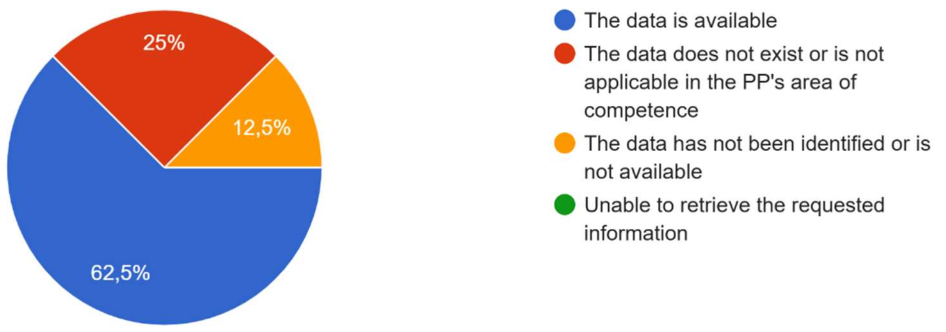


29 - Emergency waste management
8 risposte



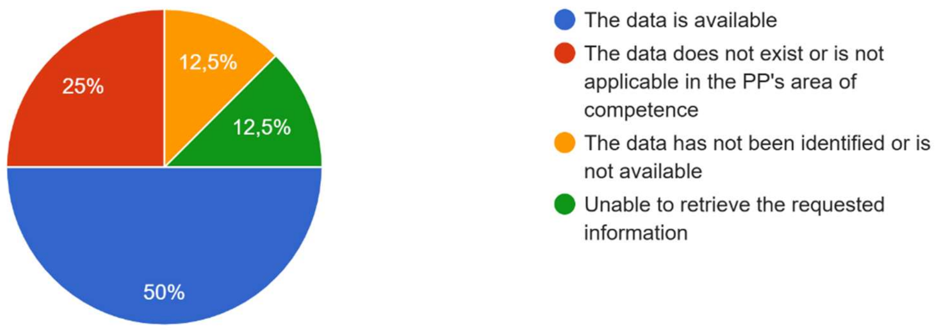
30 - Telecommunications system

8 risposte

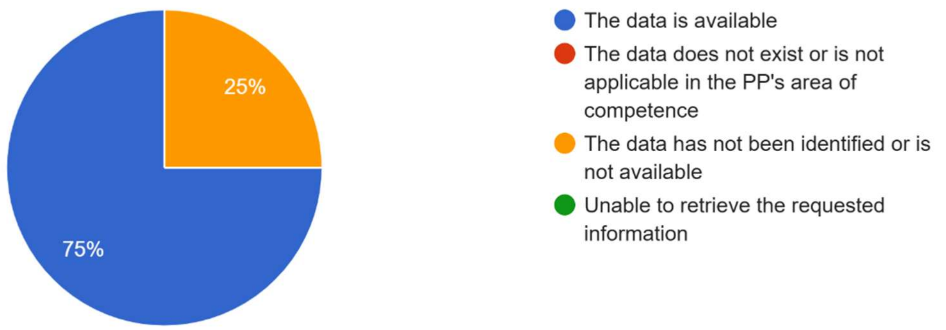


31 - Base Radio Stations

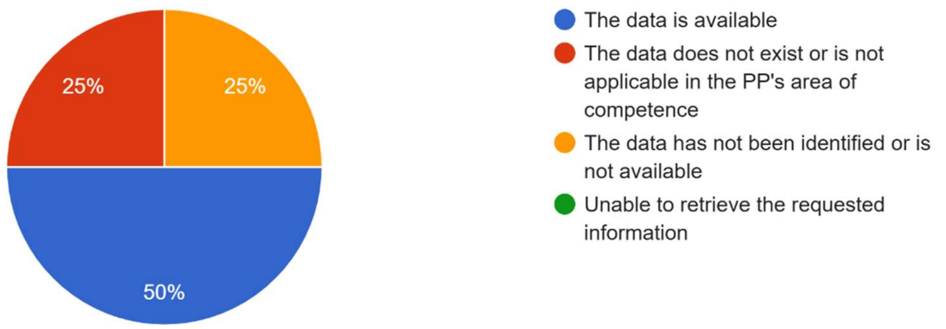
8 risposte



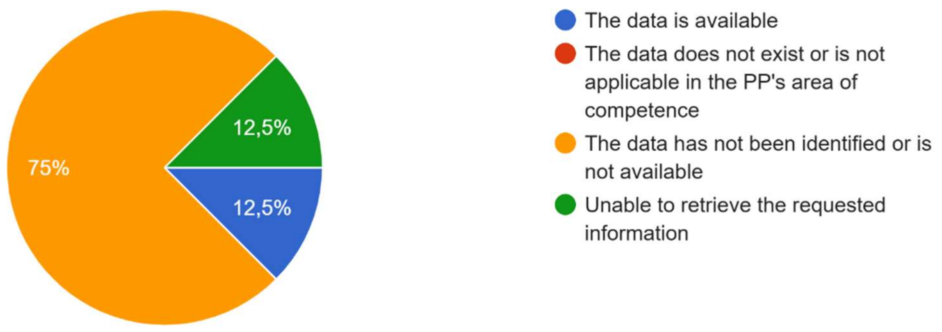
32 - Main accesses to the municipal territory
8 risposte



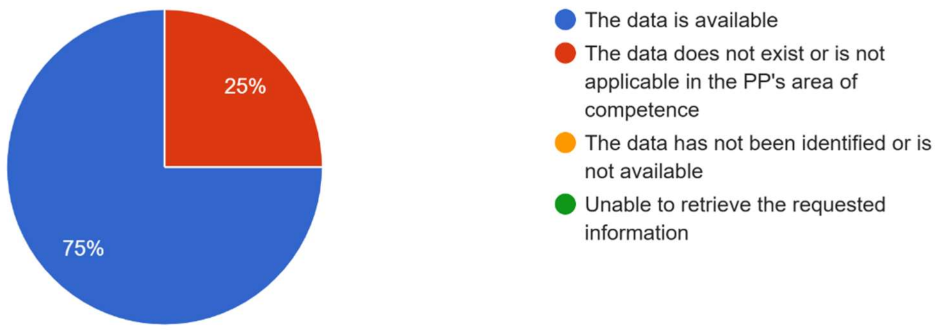
33 - Gates
8 risposte



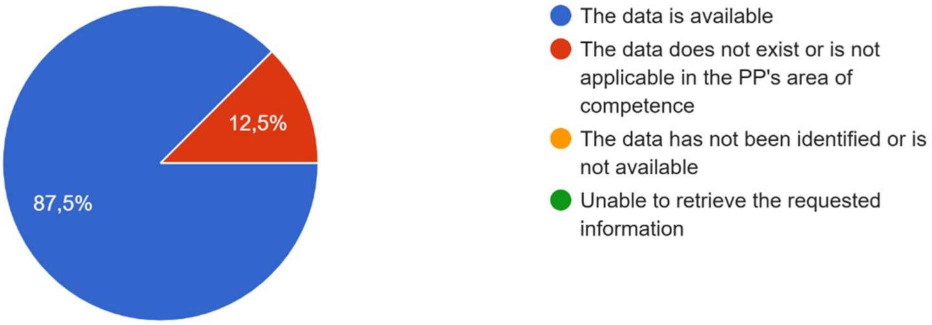
34 - Observation point
8 risposte



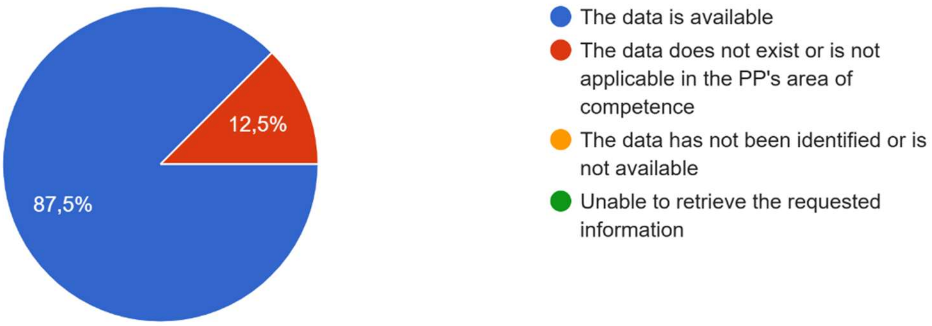
35 - Hospital and social-healthcare facilities
8 risposte



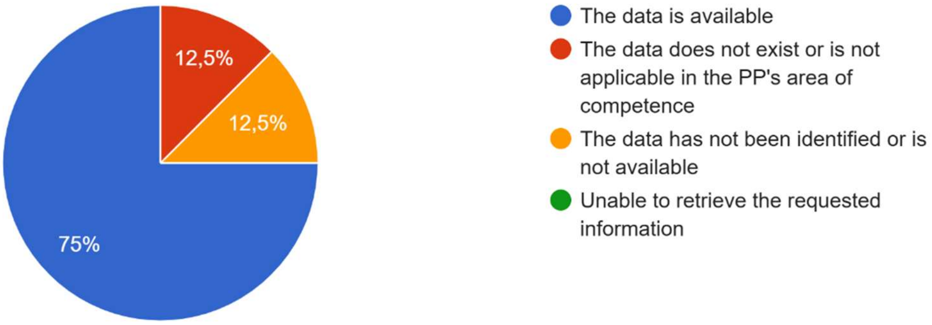
36 - Operational structures
8 risposte



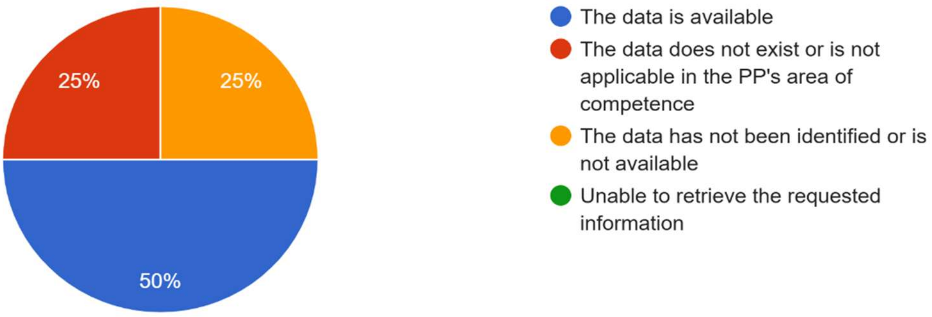
37 - Volunteer organizations
8 risposte



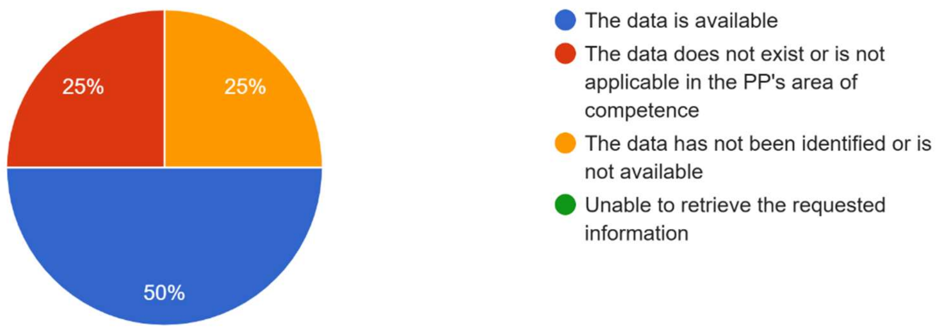
38 - Fire hydrant systems
8 risposte



39 - First aid supplies
8 risposte



40 - Material and equipment storage facilities
8 risposte



Conclusions:

The graphical analysis provides a visual synthesis of how project partners evaluated the availability and accessibility of thematic data layers required for the digitalisation of Civil Protection Plans. These graphics derive directly from the questionnaires circulated among the partners and highlight the degree of readiness and standardisation across different territories.

1. Representation of Data Availability

Each graphic categorises responses into four main classes:

- *Data available*: information already collected, structured, and stored in existing databases, ready to be used for civil protection planning.
- *Data not existing / not applicable*: situations where the phenomenon or resource is irrelevant for the territory (for example, avalanche risk in coastal municipalities).
- *Data existing but not available*: cases where the risk or resource is recognised, but either lacks official certification or is not yet in a structured, accessible dataset.
- *Data cannot be retrieved*: information that local authorities are unable to access due to missing resources, technical capacity, or institutional limitations.

The graphics show that, while there is heterogeneity between partners, a large proportion of information falls into the *available* category, creating a promising foundation for interoperability.

2. Variation Across Thematic Categories

3. Thematic layers cover a wide range of criticali nformation, including:

- **Strategic and operational facilities** (hospitals, civil protection offices, command centres). These show a relatively high level of availability, as such facilities are usually mapped and institutionalised.
- **Critical infrastructure** (roads, networks, ports, airports). Here, some gaps emerge, particularly in areas where datasets exist but are fragmented or held by multiple agencies.
- **Risk zones** (seismic, flood, fire, hydrogeological hazards). Variability is more pronounced: some territories maintain detailed risk mapping, while others report risks as “existing but unavailable,” indicating an urgent need for harmonisation.
- **Environmental and protected areas**. Most partners report availability, reflecting the existence of national or EU-level environmental datasets.
- **Emergency management sites** (assembly points, helicopter landing zones, shelters). Availability differs widely, with some municipalities well-prepared and others lacking formalised information.
- **Monitoring and support systems** (sensor networks, communication towers). Responses often indicate *existing but unavailable*, signalling that the infrastructure is present but not yet systematically integrated into databases.
- **Resources and supplies** (fire hydrants, emergency depots). These data are frequently dispersed across different local agencies, contributing to inconsistency in responses.

3.National and Local Discrepancies

The graphics also underline differences between Italian and Croatian partners, as well as variation within each country. These discrepancies stem from:

- the territorial nature of hazards (mountainous vs. coastal areas, urban vs. rural contexts),

- the maturity of local civil protection systems, and
- the institutional frameworks governing data collection and sharing.

Even within the same country, municipalities with similar risks report different levels of data readiness, reflecting uneven institutional practices.

4.Implications for the IoT DSS Platform

The heterogeneity visible in the graphics confirms the necessity of a platform that can harmonise diverse data sources. The project requires not only technological integration but also agreement on *common standards*—file formats, database structures, and metadata definitions.
The fact that most partners reported at least some availability of critical data layers is encouraging. It suggests that the platform can start with existing material and progressively integrate missing or unavailable datasets. The identification of gaps is equally valuable, as it provides a roadmap for capacity building, targeted data collection, and institutional reinforcement.

5.Strategic Value of the Analysis

The graphical results do not simply reflect a technical inventory; they provide a strategic tool for planning the next phases of the project. By highlighting strengths (where data is already available and standardised) and weaknesses (where data exists but is inaccessible or missing), they guide both the design of the IoT DSS platform and the transnational cooperation process.