Coordinating and integrating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East, and Balkans and Developing Links with GEO related initiatives towards GEOSS

D2.6 –User Needs Analysis Report (II)

Contract Number	H2020 SC5-18b-2015, Project GA number: 690133	**Acronym**	GEO-CRADLE
Full title	Coordinating and integrating state-of-the-art Earth Observation Activities in the regions of North Africa, Middle East, and Balkans and Developing Links with GEO related initiatives towards GEOSS.		
Project URL	http://geocradle.eu		
EC Project Officers	Ms Gaëlle LE BOULER		

Deliverable/Document	**Number**	D2.6	**Name**	User Need Analysis Report (II)		
Work package	**Number**	WP2	**Name**	Inventory of capacities and user needs		
Date of delivery	**Contractual**		M26	**Actual**	27/08/2018	
Status	Final					
Nature	Report					
Distribution Type	Public					
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Acronyms and Abbreviations

Acronym	Description
DAB	Discovery and Access Broker
DM	Dissemination Manager
EM	Exploitation Manager
EO	Earth Observations
GAW	Global Atmosphere Watch
GCI	GEOSS Common Infrastructure
GGO	Greek GEO Office
LO	Liaison Office
Lor	Liaison Officer
Los	Liaison Office Secretary
NOA	National Observatory of Athens
OB	Objective
PC	Project Coordinator
PCT	Project Coordination Team
PO	Participating Organization
RC	Regional Coordinators
RDH	Regional Data Hub
RoI	Region of Interest
WMO	World Meteorological Organization

Contents

1 Introduction

1.1 Report objectives

The current document integrates the needs and challenges expressed by end-users both through interviews carried out by project partners between January and July 2016 and beyond, as part of the Work Package 2, Task 2.4, as well as through user dedicated sessions within local and regional workshops. As such, the report summarizes the information obtained from the analysis of 93 exploratory interviews which sought to explore the bottom-up demand of geo-information services for end-users relevant to the thematic priorities covered by the project: adaptation to climate change, improved food security and water extremes management, access to raw materials and energy in the Balkans, Middle East and North Africa.

Drawing on the information collected between M1 and M26, the current document provides a picture of the end users' information needs within the regions of interest, highlighting the existing constrains encountered by interviewees when it comes to using satellite based information and Earth Observation (EO) and/or geo-information products in particular. Upon available information, the report goes further to suggest regional and cross-country cooperation opportunities of polling and sharing of capacities and data. The document also summarizes inputs received from both partners and end-users, with regards to the existing gaps in the current offer of skills and capacities, data sharing policies and financial support mechanisms, in particular taking stock of what potential needs can be further covered in the follow-up of the GEO-CRADLE project.

Altogether, the interviews were not limited to surveying the experience of end-users with geo-information only, but sought to scope as widely as possible the challenges that these users might face in carrying out their daily work, respectively: challenges relate to socio-economic factors, or time constrains, as well financial and natural environment constrains, to name a few.

Moreover, the document explores the benefits of a free and open data portal serving the three regions, such as the Regional Data Hub set-up through the project whose aim is to facilitate the

development of applications and services based on shared regional needs. In support of the overarching project objective of the Group on Earth Observations' (GEO) and Copernicus uptake, interviews also surveyed end-users' awareness and familiarity with Copernicus and the GEO activities and/or data portals.

The rationale for compiling this information is grounded on Eurisy's long time work with user communities which confirm that unless capacities and/or services are solidly anchored to market needs and supported by a regulatory framework (such as EU Directives) and dedicated funding schemes, the sustainable use of such Earth Observation and/or geo-information based services are subject to liability. In other words, the end-users as they are defined further in the report, are in need of products that respond simultaneously to top-down legislative frameworks, as well as localized needs. Indeed, a challenging task for stakeholders further up the value added chain. As an example, the absence of national and/or regional strategies to support the use of such services has been recorded by interviewees, as an important factor that hinders the sustainability and market uptake, alongside the need for cross-sector transfer of skills and know-how. Due to the limited size of the research sample and the diverse quality of the interviews received, the results of this report should not be considered as being fully representative of how satellite and/or geo-information based services are used within the three regions. The market and end-user profiles remain fragmented within EU member states and beyond. Rather, the feedback collected by Eurisy and GEO-CRADLE partners represents the first insight into a subject that deserves further studies and analysis so that top-down measures complemented by bottom-up ones, can help in consolidating the sector.

2 Methodology

2.1 Defining target groups

The landscape of Earth Observation products and the data value added chain is a complex sequence of public and private stakeholders working towards producing a geo-information product for a final user. Every actor in the value-added chain defines their client as a user. As such, the notion of "user" can apply to every actor in the value-added chain —any of them is the "user" of the preceding actor and has little visibility of the subsequent user of the geo-information product derived from the product they provide.

To navigate the complexity of the data processing value chain and achieve a comprehensive mapping of user needs and challenges, the need for partners to agree on a common set of definitions became immediately apparent. Inputs from partners should converge towards outlining the needs of those actors which we have defined as "end-users", rather than different types of stakeholders. This was represented in the following scheme which has also acted as a support for mapping capacities and gaps (D3.1) in the countries covered by the project.

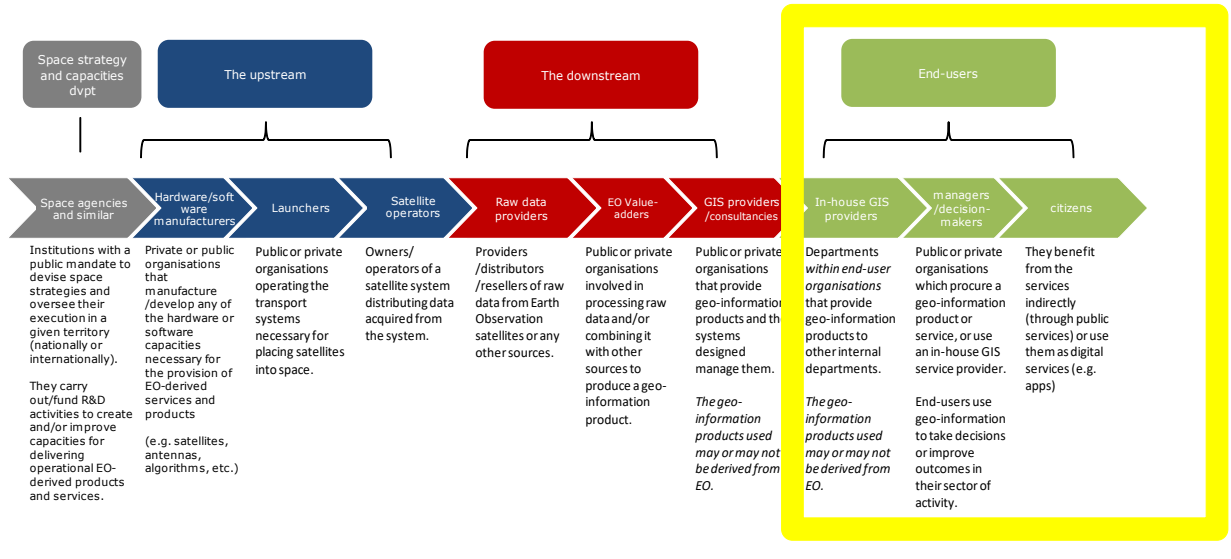

Fig. 1. T2.4 tool: drawing of the position of the end-users relative to the value-added chain

Definitions of target groups:	
End-users	Public or private organisations which procure a geo-information product or service, or use an in-house geo-information service provider. End-users use geo-information to take decisions or improve outcomes in their sector of activity. In the case of GEO-CRADLE: agriculture, food security and water extremes, climate change, energy, access to raw materials.[1]
In-house geo-information providers	Departments within end-user organisations that provide geo-information products to other internal departments. The geo-information products used may or may not be derived from earth observation.

Agreeing on a common definition of stakeholders was also aimed at orienting partners on how to speak to the interviewees: namely, on the kind of questions they can or cannot ask. The agreed definitions of end-users, on one side, helped in identifying them in the economic chain, and on the other side to note that end-users are outside the value adding chain. Indeed, end-users do not share the mission of actors along the value-added chain to produce an information product based on a less refined one, or on data. While a few may have data processing capacities, others will need either information pre-processed to some degree or products that are fully integrated within their working procedures. This means end-users are not familiar with geo-information technologies, nor should they be. Consequently, they do not speak the same language and belong to different professional communities. While outside the data value-added chain, end-users are inherently defined by their relation to the former. This means it was not enough to define the end-users, without offering definitions for the other actors that compose it. A set of common definitions (available here) helped to ensure that:

- The stakeholders across GEO-CRADLE countries are comparable against a common scale;
- Engagement is better targeted and adapted to the intended interlocutors;

[1] The definitions of the value added chain relies on Eurisy's extensive work to stimulate take-up of satellite information and services by end-users, as well as on various publications by EURISY, EARSC, Nereus OECD

- Partners had an easy go-to document for their benchmarking exercises.

Reaching a fully shared definition of the "end-user" has proved to be a prolonged process despite subsequent consultations with project partners. In other words, end-users continue to mean different things to different stakeholders. As such, upon analysing their mandate and responsibilities, 27% out of the 127 interviews gathered were deemed not compliant with the agreed upon definitions and thus considered outside the scope of this report. Indeed, the majority of these 35 non-compliant interviews covered universities and R&D focused organisations. Although in some countries covered by the project, these stakeholders are considered as the main users of geo-information (thus acting as "value added service providers", sometimes in the absence of private stakeholders to take on this role), it is outside their mandate to take policy decisions or draft legislative reports. As such, for the purpose of this project, the needs of research organisations and their feedback was only partially or on a case-by-case scenario included in the current report.

Fig 2. Distribution of compliant and non-compliant interviews among collected sample

2.2 Data collection

2.2.1 Interview guidelines

For the deliverables covering the end-user needs analysis, partners agreed on a qualitative rather than quantitative research. Rather than sending an online questionnaire for the end-user

organisations to fill in on their own, partners were asked to identify, approach and interview the end-users themselves on their needs and constrains, in an exploratory mode, without limiting responses to what the interviewer knows.

The rationale for this approach stems from the difficulties outlined above: **potential end-users do not define themselves as final end-users** since they are not part of the same professional community as those who collect information from them. This means that the targeted potential end-users must be accompanied by the interviewer, who must explain the background and objective of the interview in a language the end-user understands.

Furthermore, also because the potential end-user is not part of the same professional community as the interviewer, they are not interested in filling in a questionnaire since they do not stand to have any direct gain from it. A personal approach counters this obstacle.

While the members of the GEO-CRADLE consortium all share the same professional culture, to the extent to which they are all involved in some way in the production and distribution of data and geo-information products and services, end-users do not.

For this reason, there was a risk that it may be difficult for the interviewers to completely extract themselves from their background and shape their questions in a language suitable to a professional community they were not necessarily familiar with. Partners were thus provided with guidelines and an extensive list of examples of interview questions. The list included examples of potential end user profiles for the four thematic areas: climate change, access to raw materials, energy, and food security and water extremes management. As such, the guidelines sought to empower partners to be completely autonomous in identifying and carrying out the interviews, with the task leader playing only a support role. We also aimed to facilitate the work flow by cutting out language and cultural barriers between interviewers and interviewees. Indeed, partners were advised to use their knowledge of the local environment and tailor the interviews according to their needs.

Drawing on Eurisy's previous experience in exploring end-user needs, **the adoption of innovative services is rarely connected with technical factors or data richness**. Non-technological factors, such as socio-economic conditions, digitalization or "*smart*" policies or social norms play a greater role in determining users to adopt products and services. For this reason, the interview guidelines explored types of constraints the user may typically face in terms of: organisational constraints, economic conditions, industry constraints (does the end-user need to comply with industry standards and so on), regulatory (does the end-user have reporting obligations), natural environment constraints (farmers have to work with the variables of the regional climate), and so on.

Users also answered on information sources they already use. However, the relevance of this question is limited: the development of the downstream sector does not imply the one-to-one replacement of existing sources of information. In other words, **more data does not necessarily translate to more use**. Finally, beyond constrains and needs, the interviews were also an opportunity to assess the regional user's awareness of the Copernicus and GEO initiatives and programmes.

Following this set of common guidelines and exploratory questions, partners were asked to submit a report of maximum 2,500 words for each interviewee. The heterogeneity and complexity of the reports received differed greatly from country to country which in turn mirrors the complexity of the data value added chain. The interview guidelines are available for reference online here.

2.2.2 End-users interview reports

A total of 127 interviews were collected by M26, out of which 113 within the first six months of the project. The first round of interviews were gathered, analyzed and included under deliverable D2.5: User Need Analysis Report (I). Additional inputs and feedback was gathered through live consultations at regional and local events which will be detailed further in this report. Together, the partners covering activities under WP2 and WP3 managed to go beyond

the initial KPI set, which aimed at engaging a maximum of 150 stakeholders to participate in the dedicated surveys covering regional capacities, gaps and priorities.

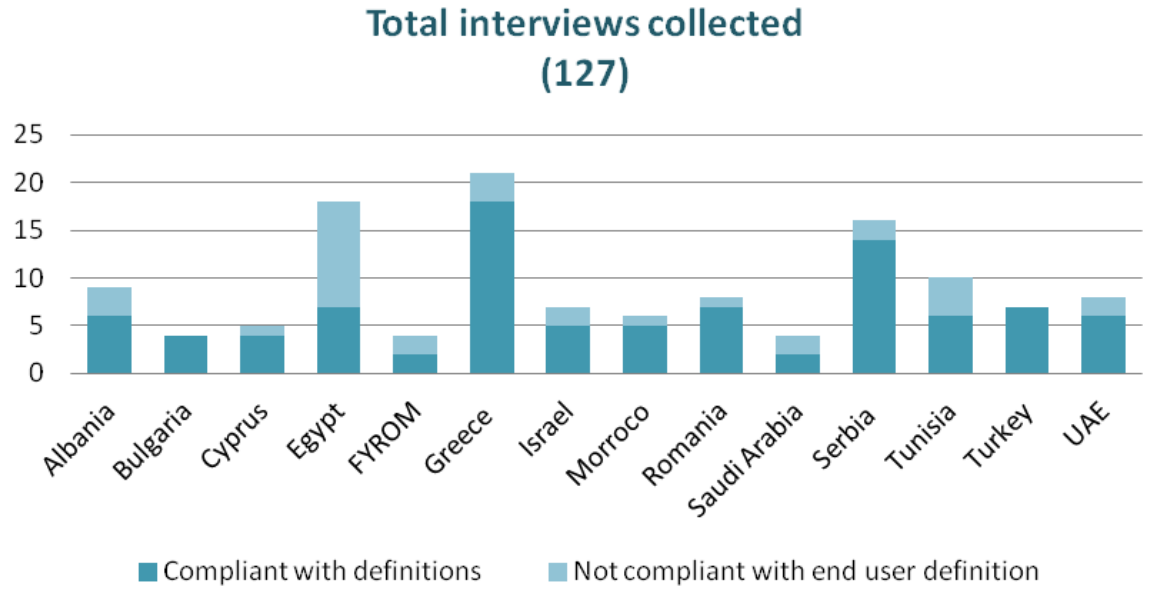

Fig 3. Distribution of compliant and non-compliant interviews per country

As mentioned above, for the purpose of this project, only interviews pertaining to the agreed upon definitions were taken into account. Following their assessment, 93 interviews were considered. Research organisations, GIS and raw data providers were excluded from the analysis. In countries covered by more than one project partner (e.g. Greece and Cyprus), the increased number of interviews received have allowed for a more detailed analysis and presentation of the end-user needs, challenges and information gaps. Across the regions, some difficulties in targeting and reaching end-users have been registered. In the cases where partners reported such difficulties in interviewing end-users, Eurisy complemented the received feedbacks with desk research and contacting familiar users within their own network. In some cases, the replies of research organisations were taken into account when they gave an indirect feedback on the local context (e.g. Egypt). However, these organizations were not included in the graph below.

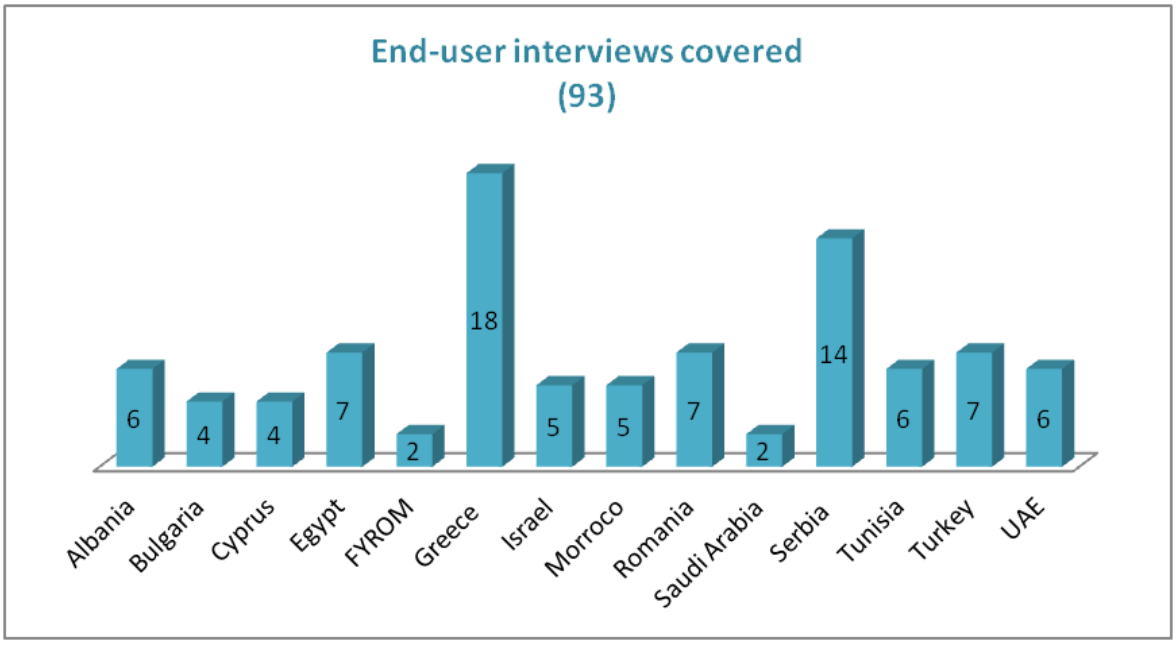

Fig 4. Distribution of compliant interviews per country

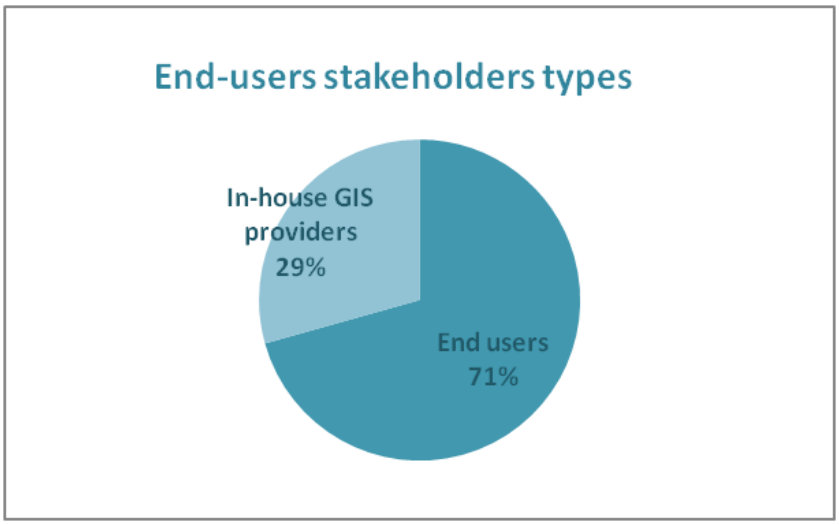

Fig 5. Types of end-users in sample

Among the collected reports, institutional end-users were predominant. They were easier to access by the interviewers, who regularly interact with public authorities as part of their mandate, and are also regarded as a significant part of the Earth Observation market at a European level.

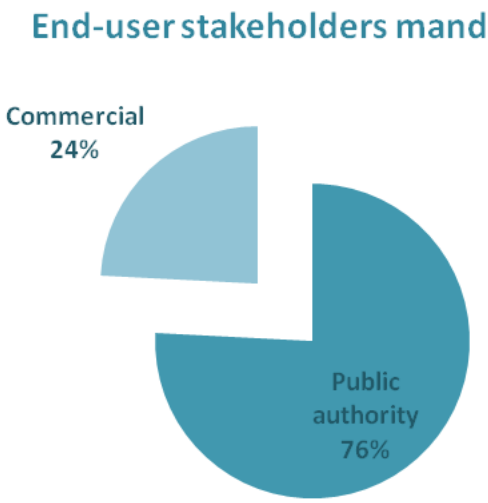

Fig 6. Distribution of end-users types in sample

Indeed, according to a 2016 European Commission report on "*Copernicus User Uptake*: *Engaging with public authorities, the private sector and civil society",* the programme is currently focusing on institutional users through its service portfolio rather than private ones.[2] Furthermore, a 2015 survey conducted by the European Association of Remote Sensing Companies (EARSC), indicated that approximately 65% of the market relies on public customers.[3] This percentage of market sales covering public authorities and international organisations customers dropped to 55% in 2017. However, according to the report, 60% of the revenues coming from public sector actors are connected to research and development activities. This underlines not only the volatility of the market but also the recurrent sustainability challenge of a product or service when going from research to market.[4]

At the same time, Eurisy's 2015 survey on the operational uses of satellite-based services in the public sector, illustrated that 26% (local authorities) and 44% (national authorities) of the

[2] https://publications.europa.eu/en/publication-detail/-/publication/62101cd2-fbba-11e5-b713-01aa75ed71a1/language-en

[3] European Association of Remote Sensing Companies (EARSC), A Survey into the State and Health of the European EO Services Industry, Brussels, 2015 [hereinafter EARSC, 2015]

[4] European Association of Remote Sensing Companies (EARSC), EO Industry Survey Report, 2017 http://earsc.org/news/earsc-eo-industry-survey

surveyed public authorities had taken-up a satellite-based service operationally after the completion of a demo-project.[5] This confirms that new services developed for demonstration purposes can result in operational long-term services where they are supported by complementary measures. Be they in the form of legislation or financial incentives.

When it comes to the geographic distribution of their mandate, 64% of the sample is composed of national authorities or private sector stakeholders. The weaker representation of regional authorities within the sample might suggest a top-down model of distribution of geo-information based data. In many countries, data is often collected at the ministerial level and then transferred to regional and local administrations. When considering these results we must, however, take into account that the majority of the GEO-CRADLE partners are engaged in activities and projects pertaining to national mandates. As such, in their position, they might have better-established communication channels with national and/or regional authorities rather than with local-level administrations. The preponderance of responses received from national and regional administrations can be thus explained by a difficulty in reaching out to local authorities. Drawing on Eurisy's experience and knowledge on the topic, we can argue that the diffusion of innovation and services from a national level to a local one, remains a recurring challenge with regards to Earth Observation data use. Local authorities are also likely to be less trained and/or knowledgeable about how to use geo-information data, less likely to take part in demo-projects, as well as less aware about existing services or available data. Very large national entities may be also less suitable for demo-projects despite the higher proportion of such entities participating in pilot projects. The analysis of the internal business of the entity and of its external context, its challenges, would be too complex for a complete business case for a new service. This trend is currently decreasing at a European level but nonetheless, it continues to remain a challenging aspect when it comes to surveying user needs. In response to this challenge, the pilot activities undertaken by GEO-CRADLE partners have sought the

[5] Satellites for Society, Reporting on operational uses of satellite-based services in the public sector, Eurisy, 2015 https://www.eurisy.org/data_files/publications-documents/28/publications_document-28.pdf?t=1467808834

engagement of both local and national stakeholders (E.g. Ministry of Electricity and Renewable Energy in Egypt, Hellenic Copper Mines in Cyprus).

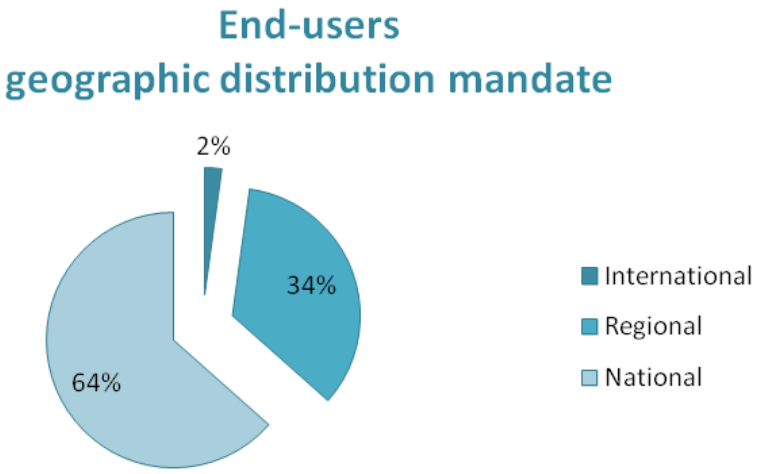

Fig 7. Geographic distribution of end-users responsibilities in sample

2.2.3 Local and regional workshops

Having established a panel composition *best practice* template with the first regional workshop which took place in July 2016 in Novi Sad, Serbia, GEO-CRADLE partners have sought to explore and question the use of geo-information in the country and/or region by inviting confirmed and potential users to share their experience and practices in using Earth Observation products. Following a common understanding among project partners of the benefits of such sessions, local public and/or private stakeholders engaged throughout the interviewing process related to WP2, were invited to present their activities, projects and challenges related to information needs on numerous occasions. Where Eurisy was tasked by project partners to organise user focused panels, the data collected through on-site presentations and Q&A was also complimented by phone interviews prior to the events. As such, the regional and local workshops organised by project partners acted as a tool, on one side, to counter balance the challenge of interviewing and surveying end-user needs, and on the other side, as a means to complement the information received from partners on the local data use environment. In

other words, such workshops have been an opportunity to enrich the picture of geo-information needs in the region and interact with stakeholders outside the project consortium. Between M1 and M26 the following regional workshops have included a user focused sessions:

Event	Location
3rd South-Eastern Europe GEO Workshop	Thessaloniki, June 2018
Middle East GEO-CRADLE Regional Workshop	Istanbul, March 2018
North Africa Regional GEO-CRADLE Regional Workshop	Tunis, December 2017
Israel GEO-CRADLE Regional Workshop	Tel Aviv, September 2017
Egypt GEO-CRADLE Regional Workshop	Cairo, May 2017
Romania GEO-CRADLE Regional Workshop	Bucharest, May 2017
Bulgaria GEO-CRADLE Regional Workshop	Sofia, March 2017
GEO-CRADLE & the 2nd EuroGeoSurveys Networking Meeting	Rabat, October 2016
Serbia GEO-CRADLE Regional Workshop	Novi Sad, July 2016

3 Key Findings

3.1 Overview

For the purpose of this report, 93 end-users interviews compliant with the agreed upon definition were reviewed by Eurisy. The aim was to understand the current landscape of user needs and challenges across the three regions, whilst highlighting potential catalyzing elements driving Earth Observation use. The following findings summarise some of the key aspects mentioned by the consulted stakeholders. The full list of end-users covered by the current report is available in **Annex 1**.

The first element to note is the fragmentation and patchiness of use of geo-information and Earth Observation data, in particular. Individual and regional needs of interviewed stakeholders vary widely, not only at a cross-regional level but also within countries, with recurrent gaps observed in disseminating information from national to local stakeholders. The diversity of the end-users community, be the public or private stakeholders, and the dispersion of users at several geographic levels, render the merger of user needs under a single umbrella a complex task, if not an impossible endeavor. However, the political and economic contexts, the geographic location and landscape of the countries, determine several cohesion areas where similar needs or challenges have been reported. For example, Serbia, FYROM, Albania, Turkey are all candidates to a potential EU accession which translates into various degrees of regulatory adoption of EU Directives as these countries are in process of implementing the EU *acquis communautaire*, as mentioned in most interviews. This generates common environmental monitoring needs which are easy to understand and relate to GEO-CRADLE topics. They apply to both the private and public sector: public authorities verify compliance of private institutions, the latter report to public institutions. This common link helps define common information needs. The *acquis* —in addition to geographic proximity— link up these countries with Romania, Bulgaria, Greece and Cyprus, which as EU members all apply or should apply EU Directives.

These EU regulations and directives, whether they cover water, climate, access to raw materials, agriculture and so on, create a **common reporting framework**, which makes it easier to go more in-depth in understanding the geo-information needs of the interested organisations. Agriculture and forestry are also very prominent themes in these countries, not only because a lot of the interviewed organisations work in these areas, but because they are important sources of economic revenue.

In Turkey, North Africa and the Middle East, the specificities of the political and economic context pose challenges that are quite different from the Balkan countries. However, a common topic is climate change – and especially the water management aspects (the use of water for irrigation, or in risk management and coastal zone management).

Such common environmental concerns, with their regional specificities, are both a constraint and an opportunity for the organisations using geo-information. One constraint can be that the users have information needs that cannot be met (e.g. because of cost, red tape, fragmentation of sources, lack of cooperation etc.). At the same time, this creates an opportunity, in that they generate a common framework of needs for which data can sometimes be mutualised.

Constraints identified across all countries are similar, though to varying degrees:

Data access: The data and/or maps available are not up to date, not detailed enough, too expensive, or it takes too long to obtain it. In some cases (e.g. Greece, Egypt, Bulgaria), its availability is highly dependent on externally-funded projects. Information about open and free data sources, such as Copernicus, remains limited within the EU and beyond.

Data fragmentation: Moreover, resources are extensively dispersed and fragmented over several website and access points, all with various levels of information being displayed. Particular notice and care should be given when building up new hubs or data access points as not to duplicate existing efforts.

Data sharing / Lack of cooperation: Organisations with common interests seldom share information between them. In addition, organisations which might have a public legal mandate

act as data providers, do not share information, or charge fees for it, especially when it comes to sharing data with private stakeholders. Insufficient cooperation among public agencies has been reported all across the three regions. Intrinsically, the lack of coordination between different entities, sometimes even between different departments of the same administration, has results, most often than not, in duplicated research efforts. In certain regions, such as North Africa and the Middle East, it has been noted that the political environment also exacerbates restrictions on data sharing across borders.

Open data principles are not applied: This challenge has been frequently reported by interviewees across the three regions, regardless of whether they are members of the EU (thus requested to apply open data policies) or not. Even in cases where data is shared amongst national stakeholders, the lack of implementation of common data collection standards continuous to hinder cooperation. Users in FYROM and Albania report no open data policies, though efforts to comply with the INSPIRE directive has been translated into national legislation. In FYROM, the Spatial Planning Agency reports that less than 40% of the data received has the appropriate format which leads to time consuming efforts when it comes to data merger.

Knowledge: In many cases, users with in-house GIS capabilities lack the necessary qualified personnel to process the data and are often dependent on externally-funded projects when it comes to benefitting from expertise, which is more often than not provided by research organizations. In other words, in many countries there is no mandate for continuous service provision outside the research scope and no budget lines dedicated to maintaining such services. Many of the user initiatives identified are supported with funding from the European Commission, through various mechanisms, however, the continuous and sustainable use of these initiatives remains sporadic as they are not consistently scaled-up at regional/national levels.

Red tape: Private stakeholders suffer from long delays in obtaining authorisations for various activities (construction, renewable energy infrastructure, mining, road building etc) from public

authorities and as such reporting obligations generate time-consuming red tape. Moreover, long tender procedures determined for the public entities also affect the timeliness of the activities and quality of prepared data, with deadlines and procurement procedures which are not always followed. Public users have also reported on the lack of cooperation structures and/or legislation that would allow them to share information with public counterparts. Some have reported sharing data on an informal basis.

Infrastructure: In some countries (e.g. Egypt) there are even more stringent concerns than the lack of data: some research organizations sometimes do not have a basic internet connection, or the necessary IT infrastructure. In such cases, the need for more capacity building efforts appears quite stringent.

Digitalization: Although some more advanced GIS formats are quoted by in-house GIS providers, at the end-user level (e.g. forester going in the field), the use of paper maps is widely spread, with the exception of some more experienced users. For example, Albania users quoted that a lot of their reporting is still done in written hard copies (word and excel). Similar cases have been reported in Egypt and Bulgaria. In Greece, interviewed authorities have underlined the government's lack of incentive to digitalize national datasets and archives from municipalities and other decentralized administration offices.

Regulations: Despite their capacity to drive geo-information use, regulations are sometimes poorly enforced. For example, in the field of agriculture, subsidies drive monocultures which in turn lead to soil degradation.

Awareness raising: Significant efforts are still required to raise awareness on the benefits of using Earth Observation and/or geo-information in general, to improve existing services and/or policy implementations. Drawing on Eurisy's expertise in collecting end-user feedback with regards to satellite-based services adoption, few public or private authorities use such services and/or information to create new services from scratch. In most cases, the ability to respond to

pre-existing needs, whilst improving existing procedures and tools, emerges as one of the main drivers behind the adoption of satellite-based services.

Data availability does not translate into more data use: Users quote that data hubs that are just metadata are not regarded as bringing additional benefits to their daily work in the absence of a skilled workforce, tailored trainings, and capacity to analyze data, continuous funding mechanisms and so on. More mechanisms to match data users with data providers, as well as a need to focus on tailored services, have been quoted as a potential way to improve uptake.

Data certification: In case of public authorities, their use of free and open source data may be limited by their obligation to use only officially endorsed and certified sources of data for their reporting. Serbia is one of the cases where the only source of official geo-data is the Geographical Institute of Serbia (RGZ) which charges a fee for their services.

3.2 Quoted geo-information needs

The end-users need for information varies considerably across the three regions and is dependent on many factors ranging from their mandate, international and national reporting responsibilities to the maturity of their geo-information data collection infrastructure and R&D and EO industry sectors. While some users quoted specific data needs (e.g. high-performance counter current chromatography), the majority of them made reference to geo-information needs (e.g. soil quality for vineyards, urbanization maps, risk maps and so on).

From the collected interviews and reports, in some cases it is not clear to which extent those users quoting data sources can process them, even if they clearly do it up to a certain point. In other cases, it may be that the data requirements included in the reports were unwillingly influenced by the provider who carried out the interview, who knew how the information needs were translated into data needs, and included them later in the report.

Another important aspect to be taken into account is **the need for annex information**, which many users also mentioned, i.e. census, socio-economic indicators, environmental regulations,

eligibility to subsidies, livestock units and so on, which **highlights the end-users need for integrated services** (rather than just data).

Based on the information received from project partners, the following data is grouped according to double criteria:

a) Regional. The interviews are grouped on a regional basis.

b) Thematic. The information needs are divided according to the four thematic areas of the project:

1- Climate change

2- Access to raw materials

3- Access to energy

4- Food security and water extremes management.

It has been noticed that for some interviews we cannot apply the thematic criteria, since we acknowledged the existence of connections among the above-mentioned areas.

3.2.1 Serbia, Romania, Bulgaria

- ***Adaptation to climate change***

The need for information is concentrated on the importance to have more weather and climate data, natural risks assessments, water quality information, air quality data.

Romania focuses on biodiversity needs, while Bulgaria on changes due to extreme environmental conditions. This means that the information needs expressed are related to CO_2 emissions, forest, and wood types. Non-geographic data are mentioned in the interviews. Romania asks for legislation changes and energy strategic plans.

- ***Improved food security and water extremes management***

Serbia expresses its information need mainly in the food sector. This emerges by looking at the interviews, considering the relevance on their territory of vineyards. This means asking for data

on soil quality and a more efficient terroir categorisation. Besides this, also further data on agriculture yields changes, pest invasion, crop types, contaminated areas, and sites, with a focus on the transfer of pollutants are needed. Serbia quotes specific non-geographic data as an agriculture census. A special attention is dedicated to crop control, especially in the province of Vojvodina.

Romania and Bulgaria focus on food security only marginally. Highly relevant is to obtain data on crop types, terrain sustainability for plant production and water quality (irrigation, especially in Romania).

- ***Access to raw materials***

The data collected shows that the access to raw materials is not central. Drawing on the interviews received we can assume that there is a higher degree of interest towards data pertaining to raw materials in Romania, compared to Serbia or Bulgaria. There is a certain interest in obtaining non-geographic data from the end users' side. Land ownership, information on fair market and legislation changes are fundamental in this context to foster activities.

- ***Access to energy***

Major interests on access to energy derive from Serbia and Romania. In Serbia, interviewees have stressed the need for wind speed data. While Romanian private end-users expressed their need to have energy strategic plans made public.

3.2.2 FYROM and Albania

- ***Adaptation to climate change***

Considering that climate change is an emerging topic in both countries, it is important to notice that in both countries the institutions interviewed are using datasets to guarantee the best services to respond to societal needs. In Albania, three institutions are working on climate change issues. But information related to CO_2 and greenhouse gas emissions, weather and climate information would be a valuable support to the available datasets. In FYROM, the needs

are different since the data related to climate are used more than in Albania, especially in the spatial planning context. It is suggested to include further information to support the ongoing activities of the interviewed institutions. This information would be related to the land use and infrastructure maps, EO data for risk management and weather and climate information. It is interesting to highlight the need to have further information on waste, GHG emissions, and data on vulnerabilities and adaptation. Both countries are also interested in supporting their activities with non-geo information, such as demographic and socio-economic data.

- ***Improved food security and water extremes management***

Food security is not central to the activities of the interviewed institutions. Only one in Albania and one in FYROM need more complex information for their work. These are mostly geo-data information such as land use maps, detailed information on agriculture, such as the identification of crop types (especially in FYROM where such information would be an asset to subsidy primary producers) and the delimitation of parcel boundaries. It is important to get data on water quality for irrigation, soil quality, and composition. Demographic and socio-economic data are also requested to implement the available info on the ownership of agricultural plots.

- ***Access to raw materials***

Data connected to raw materials exploitation is relevant in FYROM more than in Albania, as emerged from the information collected by partners. In FYROM the access to raw materials is conceived in relation to food security, in a frame of selecting raw food for primary producers, or in combination with climate change tasks or access to energy. For this reason, FYROM interviewees ask for more information on soil composition and quality, water quality and land use maps. Albania has a more dedicated focus on the access to raw materials and mainly asks for more *ad hoc* additional information, such as infrastructure maps and EO data for risk management. In both cases, it would be relevant to have information on industrial stakeholders to complement the existing geo-data.

- ***Access to energy***

More information is necessary also in this field. Users from FYROM expressed the need to collect energy infrastructure maps to support their data sets for spatial planning purposes. Albania has the same needs.

3.2.3 Greece and Cyprus

- ***Adaptation to climate change***

Both commercial and institutional partners are involved in the sector. The need for additional weather data has been pinpointed, with a focus on humidity, cloud cover and flood risks. Other information concerns industrial pollution and location of pollution sources. Consequently, this means more details on air quality and air pollution data. In addition, the interviewees ask for Global Horizontal Irradiance (GHI) and Direct Normal Irradiance (DNI) information compiled in maps and tables for monthly and seasonal climatology values. Moreover, users would find it beneficial to have detailed information on the location of historical monuments, considering the threats related to the potential damages these can sustain due to extreme weather and climate conditions. Detailed information on environmental permits and compliance with EU legislation are also necessary.

- ***Improved food security and water extremes management***

Many of the Greek interviewees are active in the agricultural field. The institutions ask for soil spectrometry to help set up spectral libraries for all subsidized crops. This information would help in improving measured parameters for accreditation standards, as well as provide better tracking and add value in terms of product quality, traceability and ease of use. In addition, data on biodiversity, phytoremediation and flood monitoring are also necessary.

The quoted non-geographic data requested make reference to annual fertilizing limits and standards, livestock units and finally socio-economic indicators.

- ***Access to raw materials***

None of the interviewees expressed specific needs. However, it is acknowledged that Earth Observation data could contribute to mining and processing activities, especially in terms of measuring environmental impacts upon the closure of a mine. Such data could help user identify potential instabilities or leakages in the permeating solutions used which in turn can cause subsidence, sliding or soil pollution. An overview of such surface information would thus allow them to put together adequate mitigating solutions.

Within the GEO-CRADLE pilot project pertaining to this topic, led by EuroGeoSurveys, satellite Earth Observation data has been used to monitor several abandoned mines in Cyprus and Greece together with the factors that affect post-mining restoration activities. Cyprus has 33 mines and 32 of them are abandoned. Two abandoned mines and one active were under evaluation to estimate environmental impacts and to assess the potential of the extractive or mining waste to become exploitable as secondary resources. The information obtained was also meant to help involved stakeholders to report on environmental pollution mitigation obligations derived from the EU Water Framework Directive 2000/60/EC.

- ***Access to energy***

Among the interviewed Greek institutions, few are active in the energy sector. The available information needs to be integrated with additional data on infrastructures like energy networks. It might also be useful to have information on wind speed, light intensity/solar irradiation, wind, and photovoltaic energy potential production maps. Also, they ask for GHI and DNI both in map and table formats for energy potential estimations.

3.2.4 Morocco, Tunisia, Egypt, Israel

- ***Adaptation to climate change***

Water management is central to the activities in the area. The link between water management and climate change is evident especially in Morocco. The interviews received from CRTS highlighted that it would be good to have a map of public water resources and water users and

data on coast and coastal monitoring (e.g. seashore, beaches, dunes, island, cliffs, wetlands, and estuaries). Information on dust and dust events was also mentioned as being required by some users in Egypt as dust is regarded a major environmental challenge for the area influencing algae bloom and the costal ecosystem already very stressed due to urban sprawl.

Besides these data, complementary information is requested. Among them, additional data on flood risk monitoring, damage monitoring, environmental mapping assessment, water and humidity evaporation, data on bathymetry and finally forest coverage.

- ***Improved food security and water extremes management***

Water and food security is one important combination, with a focus on agriculture and fisheries. Available data would benefit from complimentary information on available public water resources and water users' maps, mapping of irrigation sites, as well as water spring drilling sites.

- ***Access to raw materials***

Data pertaining to the exploitation of raw materials is of central interest, particularly in Morocco and Tunisia, especially when it is linked to monitoring water resources. Additional information needs on mapping water areas and drilling sites has been quoted by users, together with data on extraction sites mapping, as well as the geographic distribution of gas and gas pipes.

- ***Access to energy***

The focus is on renewable energies. In this sense the role of water is predominant. Additional data can be a valuable support to the actors working in this field. Examples consist of maps and detailed information on the distribution of gas and gas pipes, as well as data on renewable energy potential, such as solar energy forecasting.

In response to this need, the GEO-CRADLE Solar Energy Nowcasting SystEm (SENSE) pilot, was focused on updating the entire Solar Atlas for Egypt for the benefit of the Ministry of Electricity and Renewable Energy and the New Renewable Energy Authority (NREA) of Egypt. Based on

EUMETSAT and Copernicus Atmosphere Monitoring Service satellite data together with local and regional data sets, solar atlas maps were produced for Egypt and for specific locations (greater area of Alexandria, Cairo, Luxor and Aswan). The Solar Atlas is intended to support the public authorities in managing solar-based electricity power plants and the development of grid integration strategies. Thanks to the GEO-CRADLE project NREA was able to update the country's solar energy atlas which had not been updated for the last 25 years.

3.2.5 Saudi Arabia, United Arab Emirates, Turkey

- ***Adaptation to climate change***

Only one interview covered environment and climate change challenges. But, as emerged from the consultations, a strong correlation can be drawn between environmental sustainability and access to raw materials.

The information needs in this context are additional weather and climate data. These need to be complemented by information on air quality and infrastructure maps together with land and forest cover to open new forest soil in Turkey. Water quality and monitoring are strongly correlated to climate change. Consequently, there is a need to have data on water quality. The end-users also quoted non-geographic data, such as sustainable fishing plans.

- ***Improved food security and water extremes management***

As a transversal topic, all the received interviews cover to some extent the topic of food security. The perceived focus on socio-economic data in correlation with the need for sustainable fishing management plans led us to perceive a high interest in this sector. In Turkey, agriculture was highlighted as the main domain driving geo-information needs (information on crop monitoring, yield forecasting). As parcels are heavily fragmented, the need for high-resolution data and ortho-photos has been subsequently mentioned by users.

- ***Access to raw materials***

The majority of the validated interviews lead to this topic. Considering the economic and industrial focus of the area and the profile of interviewed authorities, the need for more geo-

information related to this sector is evident. Among the needs expressed, we can mention: obtaining maps related to the land cover/land use and data on soil composition. All this information has to be complemented with high spatial resolution Earth Observation data, and interferometric data. Additionally, having more data on infrastructures in the area is necessary to locate drainage networks.

- ***Access to energy***

It can be assumed that there might be a focus on these countries for solar energy information, since both Saudi Arabia and the United Arab Emirates are investing in solar plants. Nevertheless, none of the received interviews covered extensively this topic.

3.3 Regulations driving geo-information use

The regulations are divided according to the double criteria of supranational and national regulations. When we describe the European legal context that drives the use of geo-data, the supranational regulations are further divided into European and non-European. Based on the reports received from project partners, interviewed end-users quoted several legislative frameworks that drive their reporting obligations, and subsequently, their need for information and data.

3.3.1 Serbia, Romania, Bulgaria

- ***Supranational Regulations***

Before going into details with the European regulations, it is important to recall that Romania is a member of the European Union since 2007, while Serbia's adhesion is in a negotiation phase. Nevertheless, Serbia is in process of aligning its legislation to the European acquis in specific fields, such as agriculture and rural development, food safety, veterinary and phytosanitary policy, fisheries and environment with national authorities aiming to align legislation on these chapters by 2020.

Romania, as well as Serbia, adopted the EU Common Agriculture Policy. In this context, Earth Observation data can be used to optimise the use of public funds and help in supporting the design and implementation of national agriculture strategies.

This sector is also regulated by the EU Protected Denomination of Origin (PDO) and Protected Geographical Indication (PGI), as foreseen by the legal framework provided by the EU Regulation 1151/2012 of the European Parliament and the EU Council Directive, adopted the same year, that regulate agriculture products and food. Besides this, the EC Regulation 1107/2009 from the European Parliamentarian Council concerning the placing of plant productions on the market can be included in this frame.

It is expected that following the European Commission decision as of May 2018, to allow data from the EU's Copernicus Sentinel satellites and other Earth observation data to be used as evidence when checking farmers' fulfilment of requirements under the CAP for area-based payments (either direct payments to farmers or rural development support payments) and cross-compliance, to support the proliferation of EO data use in the agriculture sector.

Environmental issues are regulated at European level by the EU Emission Trading System (EU-ETS) that represents a cornerstone in the European fight against climate change and proves to be a key tool for reducing greenhouse gas emissions cost-effectively.

The only international regulation mentioned by the interviewees in this region, has been the United Nations Framework Convention on Climate Change (UN-FCCC) which entered into force in 1994. Romania and Serbia ratified it respectively in 1992 and 2001.

- ***National Regulations***

Once these international and European regulations have been adopted by Romania and Serbia, they need to be incorporated in the national legislation.

Serbia adopted all the laws mentioned above. Serbia included in its regulatory system the PDO and PGI for their Local Wine and the Forest Stewardship Council certifications (FSC). This last certification aims at guaranteeing the customers that the authority/company responsible for

the management of the forestry in the country can operate in an environmentally, economically and socially responsible way. Besides this, the Ministry of Agriculture and Environmental Protection is obliged to approve and validate 10-year forest management plans.

Serbia promulgated also a Law on Planning and Construction. This Law does not take into account the information regarding the categorisation of the terrain, geological hazards, and risks. This gap highlights underlying challenges for the civil engineering community. Users have also quoted laws legislating Geological Research and insurances. The latter has been issued under the authority of the National Bank of Serbia. However, it is important to note that the existence of a legislative framework is insufficient without the necessary tools to back implementation. As an example, the law on Geological Research and the Law on Administrative procedure frames the department of Geological Research and Mining's activities, within the Serbian Ministry of Mining and Energy. As requests for information regarding the use of natural resources come in from various stakeholders, these laws define a two-month period for such requests to be analysed, or one month if the documentation is complete. However, the public authority can rarely make such deadlines, as there is not enough time and people to analyse them.

Romanian *corpus juris* related to the use of geo-data is more concentrated on the free access to information of public interest (Law 544/2001) and decisional transparency in public administration (Law 52/2003). A focus is also put on environmental issues from a legal perspective as indicated by the Law 86/2000 regarding the access to justice in environmental matters and the Government Decision HG 878/2005 on the public access to environmental information.

3.3.2 FYROM and Albania

- ***Supranational regulations***

Both FYROM and Albania's accession to the European Union is under discussion by the European Union. As in the case of Serbia, both countries started the process to integrate the

acquis communitaire. This means that FYROM and Albania are working to align their policies and laws with the European ones.

Fundamental is the adoption of the Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). This Directive aims at creating an EU spatial data infrastructure for the purposes of the European environmental policies or activities with an impact on the environment. INSPIRE will enable the sharing of environmental spatial data among the public actors to guarantee the exchange of information across Europe.

Besides this, both countries can benefit from the Instrument for Pre-accession Assistance (IPA). In Albania, for instance, thanks to IPA, the Albanian General Directory of Civil Emergencies can take part in the EU Recovery Programme for Floods.

Moreover, the Countries are certified with the ISO 9001:2008 for the quality management system.

- ***National regulations***

Even if the interviewees did not mention laws or legislation that drive their mission, they declared that they must report annually their activities and responsibilities with respect to standards and regulations. Nevertheless, we can still outline a legal context for both countries.

FYROM adopted a compilation of laws on agriculture and rural development, and one that helps the establishment of an Agency to provide financial support in this field. Another law that has been approved concerns the creation of a National Infrastructure of Spatial Data (NIPP). The Law incorporates the norms included in the Directive INSPIRE and it is expected to connect and harmonize existing national public data sets. Furthermore, it aims at supporting more data sharing policies between ministries and increase their access to additional national digital databases (Real Estate Agency, Hydro-Met Service, Spatial Planning Agency etc.)

In Albania users recalled four important strategies: the National Strategy on Development and Integration 2014-2020, the National Cross-Cutting Strategies 2015-2020 (which also includes

the national digital agenda for Albania), the National Plan for European Integration and a series of National Sector Strategies.

3.3.3 Greece and Cyprus

- ***Supranational regulations***

Agriculture, Energy, and Environment sectors are the sectors mostly regulated at international level. Regarding the agricultural field, there are international and European standards that both countries must adhere to. Among these, the GLOBALG.A.P. for the implementation of Good Agricultural Practices on farming, ISO 14001 and the EU Eco-Management and Audit Scheme (EMAS) (Environmental Management Systems), ISO 9001 (Quality Management Systems), the Hazard Analysis and Critical Control Points (HACCP) were mentioned. Besides these certifications, Greece and Cyprus take in high consideration the European Waste Catalogue and the International Featured Standard (IFS). This is a Global Food Security Initiative (GFSI), a benchmarked standard for auditing food safety and quality of processes and products for food manufacturers).

The energy market is regulated by the EU Directive 2009/72/EC together with the Greek national law 4001/2001. The national law assures the adoption of common rules in the organisation of the European electricity markets. It worth mentioning the Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources, amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The EU Floods Directive (2007/60/EC) and the EU Water Framework Directive (2000/60/EC) are the basis for the setting up of a national regulatory framework for environmental laws.

- ***National regulations***

In Greece, at national level the energy market is regulated by the National Action Plan that helps in reporting to the European Commission on the progresses in the promotion and use of energy from renewable sources. The target is to achieve a 20% share of energy from renewable

sources in the EU's gross energy consumption by 2020. The focus on renewable energies can be found in the Law 2773/1999 on renewable hydropower energy and in the Law 3851/2010, with a focus on the development and coordination of the off-shore wind parks and the green growth and green entrepreneurship. It is necessary to say that there are some upcoming amendments in the Greek Grid and Exchange Code that require renewable sources to participate in the electricity market.

In Cyprus, some private users have reported that the environment sector generally lacks standards and protocols and is thus insufficiently regulated. With the exception of the Geological Survey Department which reported on their legal obligations towards the Department of Antiquities in the case where ancient artefacts or sites are found in or close to mineral resources exploitation sites, no other legislative frameworks have been mentioned.

3.3.4 Morocco, Tunisia, Egypt, Israel

- ***International regulations***

The Jewish National Fund, reported to being committed to the implementation of international treaties to which Israel is a signatory in the sphere of afforestation and environmental protection, such as the United Nations Agenda 21, as well as the implementation plan pursuant to the afforestation sections of the Johannesburg Convention, the War on Desertification, Biodiversity conservation and more.

- ***National regulations***

Users acknowledged the existence of a Moroccan *Dahir* (Royal Decree) no. 1-95-154 of 18 Rabii I 1416 (16 August 1995) promulgating the Law no. 10-95 on water. This can be applied to every level of water management, and also implies an obligation to set up integrated water monitoring plans.

In Tunisia, the monitoring of costal ecosystems is defined by Article 3 of Law No. 95-72 which defines the mandate and reporting obligations of the Tunisian Agency of Protection and Coastal Planning. In the energy sector, the National Tunisian Solar Plan (TSP) regulates the design,

construction, operation and maintenance of installations of renewable energy and cogeneration, as well as the development of public-private partnerships. In addition, the law n°2009-24 of 11 Mai 2009, devised the Centre National de la Cartographie et de la Télédétection (CNCT) to be is in charge of geodesy, topography and cartography activities for the entire country. CNCT is thus the authority in change of providing basic maps, charts, thematic maps, city maps and perform aerial imagery activities throughout the national territory or supervise them when they are done by others.

In the case of Egypt, validated reports contained little to no information on national legislative frameworks for access to raw materials, adaptation to climate change and food security. However, the renewable energy sector has presented itself as the main topic of interest for this country within the project with many legislative frameworks supporting the work of the New and Renewable Energy Authority (NREA). The electricity sector in Egypt is governed by the National Electricity Law, July 2015, with the Decree No. 1947 of the Year 2014 on Feed-in Tariff and the Prime Ministerial Decree No. (2532) of the Year 2016 establishing the basis for Feed-in Tariff for energy produced from renewable energy projects and encouraging investment in renewable energy. Further legislation (Law 4 on the Protection of the Environment, Investment Law No. 8, 1997, the Prime Ministerial Decree No. (37/4/15/14) of the Year 2015 etc) define regulations for renewable energy projects, environmental protection and issuance of permits and licenses for generation, transmission and distribution of energy in the country.

In Israel, the Golan Heights winery has reported their need to comply with international ISO standards of environment protection and factories, as well as, national standard for wine growing.

3.3.5 Saudi Arabia, United Arab Emirates, Turkey

No supranational regulations were mentioned by interviewed users.

With regards to the legislative frameworks pertaining to national levels, where possible, Eurisy has complimented the information received from project partners with desk research as both

countries reported on the need for public authorities to comply with strict national regulations. Besides this, no further details were given especially regarding the regulation standards.

In the United Arab Emirates, the Abu Dhabi Urban Planning Council is responsible for the implementation of the Capital 2030 Urban Structure Framework Plan and the 2030 Plans for Al Ain, Al Gharbia, and the Emirates' maritime areas. Under these plans, the public authority is required to present reports to the government and the executive council. These reports must include the geo-data used by the national actors.

Saudi Arabia has a similar obligation. Indeed, the National Water Company follows national and international standards for Treated Sewage Effluent (TSE). The Company is the result of a Public-Private Partnership. For this reason TSE must report on its activities on a frequent basis to the government and to board members.

In Turkey, the interviewed Turkish Sugar Authority quoted Law 4634 for sugar as the regulation driving forward their mandate to regulate and audit sugar market to ensure a sustainable production flow that would satisfy export quotas and internal needs.

3.4 Funding schemes assisting geo-information use

In general, there is missing detailed information on the funding schemes adopted by the countries interviewed. A relevant number of European funding schemes is quoted.

3.4.1 Serbia, Romania, Bulgaria

The funds allocated for the projects described in the interviews have been allocated on a case-by-case basis. The sustainability of these projects and the provision of geo-information services to final users, is however not clear.

The Climate Change Unit of the Ministry of Agriculture and Environmental Protection in Serbia quoted the use of grants from the Global Environmental Facility (GEF), the EU Commission and the United Nations Development Programme Support.

Few references are made to the EU Strategy for the Adriatic and Ionian Region. Together with this, funds provided through the EU strategy for the Danube Region (Interreg Danube) are being used by the Public Company Vojvodina Sume to complement their revenues and build capacity. The Company also quoted having received financial support from the Norwegian Forestry Group. In fact, the company's use of EO data was started as a result of this initial development project between the Government of Serbia, the Norwegian Forestry Group and the Faculty of Forestry of the University of Belgrade.

Within the Balkans areas and beyond, research organizations continue to depend on support from foreign governments to implement existent activities. A donation from the government of Japan made it possible to map 27 municipalities affected by floods thanks to experts from the Sector for Geological Research and Mining of the Ministry of Mining and Energy, the University of Belgrade and Geological Survey of Serbia.

The EU Instrument for Pre-Accession Assistance (IPA) allows Serbia to also access dedicated funds, which covered mining waste-related projects.

3.4.2 FYROM and Albania

The retained interviews from FYROM and Albania did not quote any funding schemes. The Albanian Ministry of Environment declared to receive data through different projects, however, no details were given related to the financing structure.

At the time of the interview, the Albanian Geospatial Information Agency reported that the Albanian General Directory of Civil Emergencies still does not use GIS products. One of the few projects mentioned is "Increasing resilience using Earth Observation" in which the Albanian General Directory of Civil Emergencies took part between 2012 and 2013. The project took place under the European Commission 7th Framework Programme, under the cooperation Theme 9: Space, Support to emergency response management (SPA.2012.1.1-04, collaborative project grant agreement no.: 312461). In continuation of this project, the implementation of component 2 "Upgrading civil defence preparedness and disaster risk reduction" with the

support of the EU IPA Recovery Programme for Floods, will allow the Directorate to upgrade its infrastructure with a GIS system.

3.4.3 Greece and Cyprus

Most of the interviews retained for the report illustrate Greece's ample participation to European financing schemes. Greece reported the participation in the EU LIFE funding schemes for supporting environmental, nature conservation and climate action projects.

Greece took also part in projects framed under the EU Inter-Regional Programmes, the European Commission's 7th Framework Programme and Horizon2020.

The Rural Development Programme (RDP) 2014-2020 in Greece is one of the most important growth-promoting tools of the country. This strategy aims at ensuring the continuity of operations implemented before 2014. The RDP has also a strong correlation to the Integrated Development Programmes for Rural Areas which facilitate stakeholders' access to funding and support the identification of potential consortium partners.

Greece, as participating Member State to the European Space Agency (ESA), also take part in ESA's Programmes and funding schemes for industrial development and space applications. It is also worth mentioning the national Greek funds for R&D.

3.4.4 Morocco, Tunisia, Egypt, Israel

The interviews received did not mention any funding scheme. It may be possible that private funds are used, as is the case of the Jewish National Fund (KKL-JNF) which funds its activities through donations.

In Egypt, local users and research organisations have reported a stringent need to train their personnel on how to access international funding schemes to supplement their budget.

3.4.5 Saudi Arabia, United Arab Emirates, Turkey

No particular funding schemes have been offered as examples by the interviewees. However, during the GEO-CRADLE regional workshop in Istanbul, TUBITAK have quoted several FP7 (GAMALINK, THOR, EOPOWER, Earth Observation for Economic Empowerment, COGSENSE, Cognitive and Cooperative Signal Processing Technologies for Remote Sensing Application etc.) and Horizon2020 funded projects in which they are working together with local end-users in the field of agriculture, respectively: HASSAS & AKTAR Projects and a feasibility study for UASIS, the Turkish land cover/land user classification and monitoring system.

3.5 Hubs and geo-information sources in use

Respondents quoted a number of local and international databases and sources which are listed in **Annex 2.**

Going from national to regional and local communities and thematic policy implementation mandates (energy, access to raw materials, climate change and food security), the information sources quoted by end users differ greatly. Such discrepancies in information sources use and awareness have been subsequently reinforced throughout the interviews and live presentations, thus posing significant challenges in drawing-up regional trends and country-specific priorities.

While some users quoted very specific data sets, many also quoted the use of more “user friendly” interfaces such as Google Maps. For some, this information is sufficient to fulfil their mandate and reporting obligations. In addition, many respondents declared obtaining data from field surveys, from ground sensors of their own, and some even carry out their own aerial campaigns. Some international databases were quoted, including the use of Landsat images; however, their application to the field of work of the end-users is limited by the available resolutions.

In the case of private companies, these have often highlighted the encounter obstacles in accessing public geo-information: from weather data to cadastre and socio-economic

indicators. When they can get some access, they are systematically charged for the data (unlike some public organisations, which are not). An open data hub can thus alleviate some of the data access challenges quoted by them.

The usefulness of any data hub should also take into account both international sources which are already known to more advanced users, and local sources, which cannot be matched or replaced because of the specific resolution requirements. Another constrain related to the cross-border use of information sharing is language. Many of the national data sets quoted by users are available in the local language which renders their cross-border use difficult. However, an interesting aspect of the created Regional Data Hub is its free and open policy data, and the fact that it encourages stakeholders to make their data available under such conditions. This would remove the barriers users quoted in accessing data, including red tape (which is considerable), providing a considerable advantage to the region.

3.6 GEO and Copernicus programme awareness

Drawing on the project's underlining mission to contribute to the implementation of GEOSS and to raise awareness on the Copernicus programme by showcasing the potential of consolidated regional EO platform through the pilot projects, the interviews were also an opportunity to assess the regional user's awareness of the two initiatives and programmes. As a whole, interviewees have indicated a higher awareness with regards to the Copernicus programme (48%) than GEO initiatives and projects (28%), whilst over 30% of the sample did not provide any feedback to these questions.

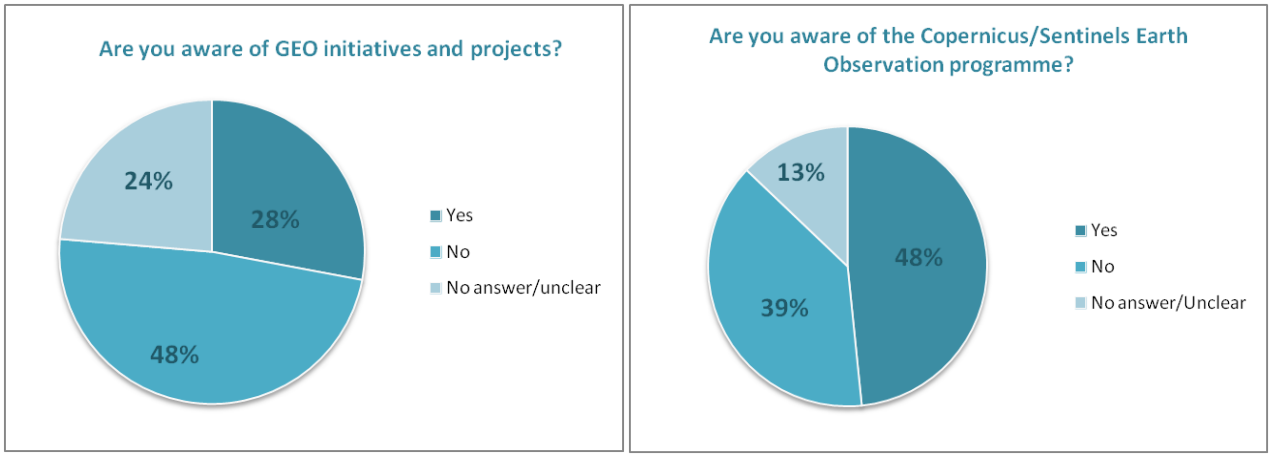

Fig 8. GEO and Copernicus awareness amongst interviewed end-users

It is important to note, however, that awareness does not necessarily translate into use and as such, although the numbers are encouraging especially with regards to Copernicus, the need for more awareness raising initiatives in the regions was frequently referenced by users during events and workshops. The degree of awareness about GEO and Copernicus also varies greatly across the three regions and within national borders.

- ***Serbia, Romania, Bulgaria***

Only one end-user (VojvodinaSume) seemed to be fairly acquainted with the two, as they are more advanced in EO exploitation (plans to introduce use of Sentinel data on a regular basis).

- ***Albania and FYROM***

Among the entities interviewed in Albania, only the General Directory of Civil Emergencies declared to have knowledge of both Copernicus and GEO. This could be explained through the Directory's previous participation in an FP7 Programme" *Increasing resilience using earth observation*" (2012-2013 Grant agreement no.: 312461). The rest of the interviewees declared to have no knowledge of Copernicus or GEO.

The Department for Land Parcel identification system (Ministry of Agriculture) in Albania is aware that there are existing EO programmes, but the Department has never used any in particular. The same can be said about the National Spatial Planning Agency, which also

declared as being aware of the existing EO programs, but has never been part of any programme.

- ***Greece and Cyprus***

By comparison to its regional neighbours, Greek entities, especially private ones, have a higher degree of knowledge of Copernicus and its services. This is also due to a greater EO market maturity and the proliferation of knowledge through EU projects and directives. Knowledge of GEO is however weaker, with respondents stating that a major challenge relates to raising awareness of all these services and tools towards stakeholders. The more local we go, the fewer end-users are aware of these two programmes. For end users, such as the Municipality of Thessaloniki, there is a need for more information about the Sentinel products especially for urban planning purposes.

The interviewed SME was aware of Copernicus, but was not familiar with GEO activities.

- ***Morocco, Tunisia, Egypt, Israel***

In Morocco interviewed users have reported little to no knowledge about the Copernicus programme and Sentinel Earth Observation data, but have expressed their interest to benefit from the programme to improve and facilitate their exploitation of satellite images. As CRTS is mandated to also train experts within public administrations and ministries, all of the interviewed users were fully familiar with remote sensing data use and possess in-house GIS capacities to analyse (even partially) data received through CRTS. This is also the case of Tunisia where CERT holds a similar mandate to that of CRTS. In Egypt, some of the users have reported being knowledgeable about the two programmes and the available data, however, this remains mostly confined to the research sector. In Israel, users have reported being aware of the Copernicus data, but interviewed stakeholders consider only its complimentary use as the resolution is insufficient for their needs.

- ***Saudi Arabia, United Arab Emirates, Turkey***

In the case of the United Arab Emirates there is little to no knowledge reported on the Sentinels programme. None of the interviewed public authorities uses any Sentinel data. The UAE have recently become a GEO member, which could result in future awareness raising campaigns.

The interviews received from Saudi Arabia are not very conclusive as to whether there is an awareness and/ or use of Copernicus and Sentinel Data & GEO resources, while in Turkey three out of the five interviews received reported having knowledge on Copernicus and Sentinel Data. It is unclear whether in this case the data was used only sporadically for research purposes.

4 Overview - The Balkan Region

4.1 Serbia, Romania, Bulgaria

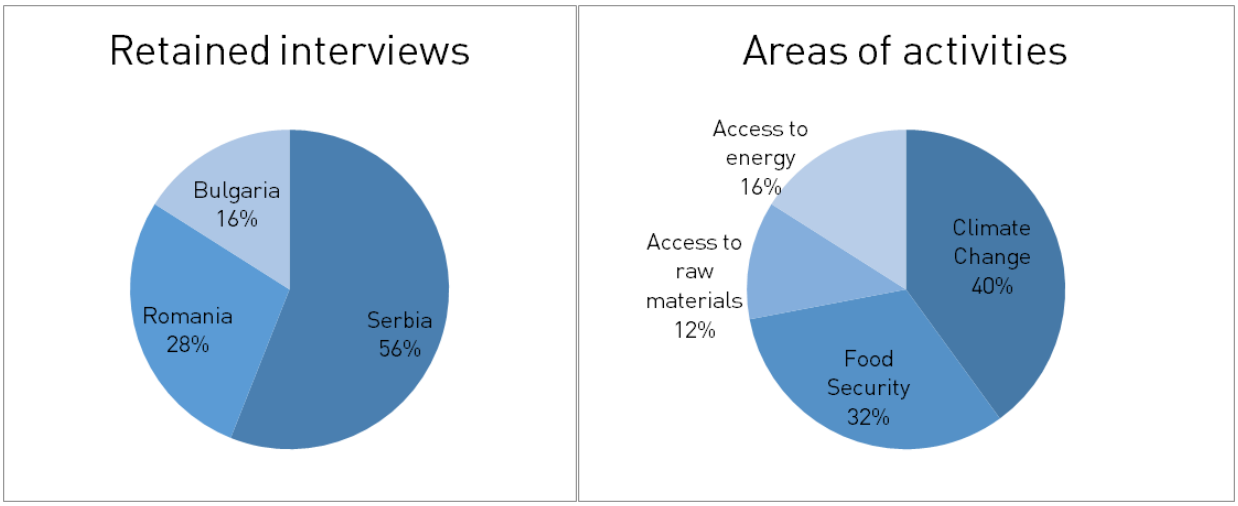

Fig.9 Percentages per country and project thematic area

4.1.1 Overall observations

In most of the themes covered by GEO-CRADLE, the interaction between public and private stakeholders is quintessential. This symbiotic relation is thus translated and comprised in regulations. For example, when it comes to energy and the environment, private and public stakeholders use a lot of the same kind of information on the natural and built environment. Public authorities deliver building permits, report on environmental parameters and risks, manage public assets (forests, waterworks etc.). They are also bound to report regularly to EU institutions (almost all public end-users interviewed). These responsibilities link them up with the private sector. For instance, public authorities require environment impact assessments in all energy projects. In Serbia, the Ministry of Agriculture and Environment gives approvals for the exploitation of mineral and water resources based on impact assessments carried out by candidate companies. Furthermore, they must obtain permits issued by Institute for Nature Conservation of Serbia and Institute for the Protection of Cultural Heritage of Serbia. Tractebel Romania — an energy company — reports similar regulation compliance needs, as well as CEZ Trade Romania — an electricity trading company —, which must report on any intentions of

extending energy distribution network. Both companies report that compliance and reporting involve extra cost, at a time when price pressure during public calls for tender is particularly strong. Moreover, both the public and private sector respondents **point to red tape causing unnecessary delays and obstacles.**

Agriculture and food security are two areas of particular focus for Serbia, Romania and Bulgaria as they represent an important source of revenue and employment for the three countries. Moreover, Romania and Bulgaria whose agriculture land covers almost 50% of their surface, need to monitor and report on subsidies advanced to farmers, which is compulsory under the European Common Agricultural Policy. In Serbia, the Government of the Autonomous Province of Vojvodina has entrusted the control over agriculture monitoring to the Secretariat for Agriculture, Forestry and Water. Earth Observations (EO) data is thus particularly fit to audit subsidy declarations and avoid potential dishonest declarations. Alternatives to using EO have proven unfeasible on a large scale, i.e. visitation audits, or unreliable, e.g. using data on seed and fertiliser sales. In addition, all three countries' farming sectors are characterized by small farms and fragmented land ownership following land restitution processes (in Romania, 92.2 % of the holdings are less than 5 ha)[6]. Following the adoption by the European Commission of new rules that will allow member countries to use Copernicus satellite data to monitor land parcels and thus support paying agencies by lowering the number of required on-the-spot checks, the challenge remains to see whether the resolution and revisit time of the Copernicus programme will be sufficient to respond to monitoring such small farms structures.

Crop control is also important. In Vojvodina, lease agreements have provisions to maintain soil quality by restricting monocrops on the same plot of land in successive years. It is costly to enforce these provisions with field visits. In this case, using EO makes sense. Farmers plant high-value crops on leased land to push profit. They have no incentive to upkeep soil quality of

[6] EC Cap in your Country report, June 2017, https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/by_country/documents/cap-in-your-country-ro_en.pdf

parcels they do not own. This effect of this incentive mechanism, if left uncontrolled, damages the productive potential public lands (e.g. by depletion of organic matter).

In the Autonomous Province of Vojvodina, the exploitation of forest resources falls under the mandate of the public company VojvodinaSume. With only 7% of the region covered in forest, for them it is imperative to keep a steady supply of wood through re-growth, intelligent plantations and cuts, disease and stress warnings. VojvodinaSume uses external and internally-generated (drones and sensors) geo-information data. As a public company, external satellite data is sourced through public procurement from data resellers. If appropriate for the task, archive data is also sometimes purchased due to a lower price and their budget limitations. They are currently in the process of integrating images from Sentinels, however, they needed to secure the necessary funding to purchase the required GIS software through external project financing between the Government of Serbia, the Norwegian Forestry Group and the Faculty of Forestry of the University of Belgrade.

The Sector for Geological Research and Mining from the Ministry of Mining and Energy sells geo-referenced raster maps. They provide a cadastre of exploitation fields, permits for research of mineral resources and groundwater (Basic information about the permits— organisation, performing research, locality of the research, etc.). Other information is available transparently, based on the program or project agreement. The sector (which has a double function of user and provider) also relies on remote sensing, aerial imagery, topographic data, LANDSAT data and in-situ data. Budget limits the campaigns to surface samples which are collected and chemically analysed. Drilling for samples has been performed in the past.

4.1.2 Constraints

Based on our previous knowledge of Romania, we can argue that **government data is seldom open and free to access in the country**. In Serbia, some users **deplored limited access to data** produced by the National Geodetic Authority — the national mapping agency. Another example quoted was that of the Serbian Laws on Administrative Procedure and the Law on Geological

Research, which define a 2-month period for analysis of requests for issuing mining authorisations etc. or 1 month if the documentation is complete. Due to **lack of qualified personnel and resources,** the public authority thus struggles to keep up with these deadlines. Other constraints quoted include:

Human resources: The Serbian Group for Viticulture and Wine Production, the Serbian Ministry of Agriculture and Environmental Protection and the Serbian Ministry of Energy have quoted the lack of qualified personnel to analyse required data. Moreover, restrictions in hiring in the public sector do not allow public users to overcome this barrier.

Financial constraints: to hire such skilled staff, or procure geo-information or the necessary GIS software and/or licenses to analyse data. The Serbian Ministry of Mining and Energy highlights budget limits the campaigns to surface samples which are collected and chemically analysed. In the case of the Mountain Rescue Service Serbia, they reported insufficient funds to purchase appropriate rescue gear or GPS team-coordination connected devices. In Romania, the DAKIA-Association for Sustainable Development also highlighted the lack of financial allocations from national funds for the management of protected natural areas which slow down the implementation of programs financed through European structural and cohesion funds. As such, local rural populations usually perceive biodiversity conservation as a bottleneck to development and a reason for poverty which brings us to:

The need to generate and increase public awareness: on climate change and sustainability efforts. For example, in Serbia, some climate change mitigation strategies and plans are not well understood by the general public, or the value of using geo-information to implement or monitor them. In the case of the City of Belgrade, citizens often request on-line real time information, but in general it is very hard for the city to provide and maintain this kind of information up-to-date.

Limited data quality, quantity: (short time series especially in some sectors e.g. biodiversity, health and availability. In some cases (forestry, agriculture), seasonal limitations have been

reported: only data from spring to autumn can be used. Increased cloudiness during spring and autumn also pose physical limits. The Group of Viticulture and Wine Production within the Serbian Ministry of Agriculture and Environmental protection also pointed out the insufficiency and/or lack of precision for geo-referenced data which limits the inclusion of some wine and grape producers into the organisation's vineyard registry. The Serbian Urban and Spatial Planning Institute of Vojvodina also note instances where municipalities provide outdated cadastre data. Both Serbia and Romania highlight the need for a nationwide digital cadastre.

Data delivery delays: (e.g. Romanian Air Traffic Administration, Generali Osiguranje Serbia) sometimes due to poor broadband connectivity.

Complex public procurement: Both public and private stakeholders in the region denounce red tape connected to public procurement as a challenge for acquiring new data or services. So, complementing or changing the data sources that these organisations use would involve reshaping public data procurement processes, or making a data hub formally recognised as a valid source for public organisations. In Romania, the costs related to environmental regulation compliance was quoted by energy companies.

Lack of multi-stakeholder consultation and operational coordination: Politics are often an obstacle. Coordination among public institutions, as well as between public and private stakeholders is perceived as being slow and difficult.

Data sharing challenges: Many interviewees reported to having their own internal geo-portals where data were available only to internal staff. In all three countries public users have reported that data is being shared following cooperation agreements and memorandums of understanding, in most cases only for research purposes. Meanwhile, private companies often complain that they encounter obstacles in accessing public geo-information: from weather data to cadastre to socio-economic indicators. When they can get some access, they are systematically charged for the data (unlike some public organisations, which are not). Open Data policies are gradually introduced in EU countries, but the full set up has yet to take place.

Certified geo-information: In the case of public authorities, introducing new sources of geo-information (like a data hub) is made more difficult by the fact that these organisations already have formal processes in place to produce or procure data. In some cases in the region only data obtained **through formal sources is valid for compliance reporting**. For instance in Serbia, the Government of the Autonomous Province of Vojvodina —Secretariat for Agriculture, Forestry and Water— can only use official data and information for its work and in its reports. The only source of official geo-data is the Geographical Institute of Serbia (RGZ), which asks high prices for their data services despite being a public authority as well. However, private companies are less constrained by an obligation to certify the geo-information they use, if they use it for their own purposes. Even if the data source is not certified, a geo-information service proves its worth (or not) through hands-on use. This introduces complexity in the kind of (geo-) information these companies need, but it is also an opportunity to regional (supra-national data hubs) to be useful. In particular, it may make **private users less reliant on government data sources**, in cases when they are able to process the data themselves.

4.2 FYROM and Albania

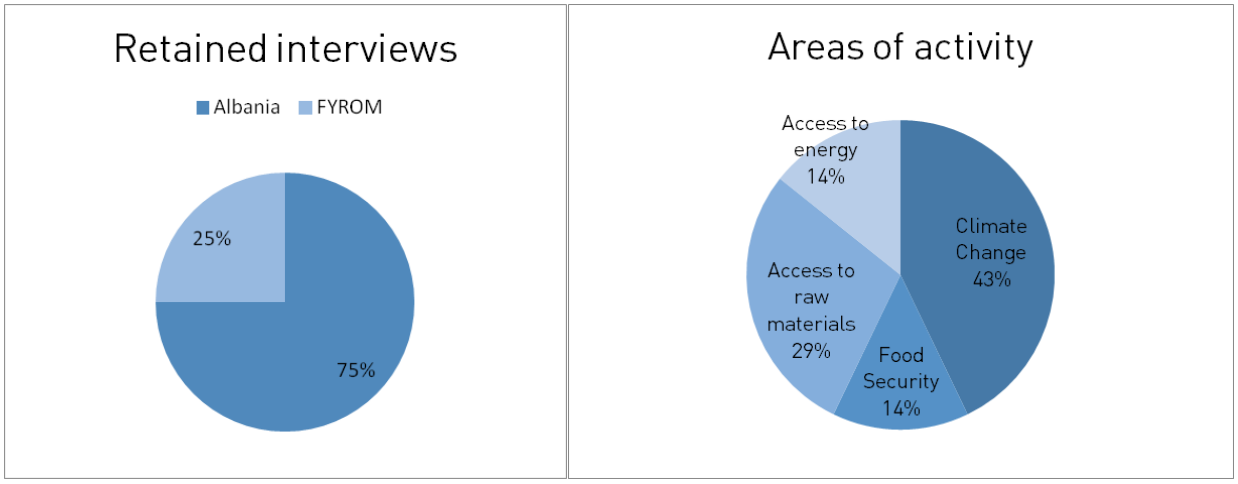

Fig 10. Percentages per country and project thematic area

4.2.1 Overall observations

The interviews provided for FYROM gave a sufficient level of detail, though further information on the end-user needs may be useful in the future. In the case of Albania, the information we received was very scarce, and as such, we could only infer what the market needs might be in the country.

On the basis of the interviews we received, analysis for the two countries could be oriented to **climate change** and the agriculture sector, especially to the extent to which they are related (agriculture generates water pressure, food production can suffer from the effects of increased natural hazards as a consequence of climate change, and so on).

Aligning both countries' policies with those of the European Union plays an important role in driving the Ministries' activities and long term policy planning. **Compliance obligation**s, such as the **INSPIRE Directive**, **have played a positive role in networking and harmonizing national datasets both in Albania and FYROM**.

Drawing on the feedback collected, in Albania climate change is only regarded as an emerging theme. According to interviews, efforts are only now beginning to include the notion of climate change in national policies and regulations. Since the notion has yet to be transposed into policy, we can assume that procedures and processes for obtaining climate change data are not yet in place. This means that the country may benefit immediately from additional sources of climate change data —so potentially from the GEO-CRADLE Data Hub.

In FYROM on the other hand, climate change seems to have a slightly higher profile, since geo-information on climate change is already used by the Spatial Planning Agency (SPA) in connection with energy, access to raw material and agriculture. The Spatial Planning Agency also acts as an in-house GIS provider towards various national institutions, notably by providing the national spatial plan, GIS services, thematic maps (construction, forestry and agriculture) and so on. Among the main users of their data are the Ministry of Environment and Spatial Planning, the Ministry of Agriculture, Rural Development and Water Management and the

Ministry of Transport and Connections. In the case of the Ministry of Environment, the stored data is accessible for public use through their web portal, but only for previews. **No data can be downloaded for public use** except for projects and studies related to the main scopes of interest of the Ministry and other governmental bodies. Municipalities also use geo-information to a certain extent. Unfortunately, to what extent local authorities use geo-information products was not mentioned in the interviews.

As the National Spatial Plan is a public good, some of the Agency's data is available for free download on the SPA web portal. For scientific and governmental purposes, or internal use, the Spatial Planning Agency provides all its final geo-information products for free. However, the databases from which the geo-information products are derived and from which the plans are developed are **not for public use, thus are not available for free**. According to interviewees, the SPA also provides specific data on special request by individuals, legal entities and institution **based on a Cooperation Memorandum or on request by the end user (individuals and legal entities)**. For these services they charge certain fees.

As users of data for the development of the spatial and the urban plans, the SPA relies on other institutional geo-portals to obtain the needed information, such as those provided by the National Infrastructure for Spatial Data, the geo-portal of the Real Estate Cadastre Agency, as well as the European Environment Agency's geo-portal.

Going back to the connection between climate change and agriculture, the FYROM Ministry of Agriculture, Rural Development and Water Management delivers data products used as input for the quantification of pressures arousing from/on agriculture (water scarcity, natural phenomena and so on). Meanwhile, in Albania, the Ministry of Environment's Department of Climate Change declares receiving geo-spatial data through different externally funded projects as **no national system seemed to be in place so as to ensure a regular stream of geo-information data acquisition**. This consolidates the idea that formal, recurrent procedures for data provision are not yet in place. Since climate change is not a political priority, investing in

obtaining climate-change related data is also probably not a priority. Thus, the region would benefit from a free and open source for such climate related information.

In FYROM a good system for agriculture seems to be in place. The Department of Land Parcel Identification System of the Ministry of Agriculture is permanently tasked to provide the Paying Agency with information on the identity of producers, types of crops, identification of land use, agricultural practices. It performs periodical controls of land use of agricultural area on a parcel level, by the means of RS data (ortho-photos). All are used to check subsidy eligibility, similar to the Serbian case.

4.2.2 Constraints

Human resources: Both countries have reported constrains related to the lack of permanent skilled and trained staff, together with the lack of periodical training programs for the staff on advanced techniques of geo-data processing. A lack of professional personnel in the IT sector has also been identified.

Budget constrains: Limited budgets to purchase geo-information data and equipment, together with the lack of technical capacities to conduct field work, as reported by the National Hydro-meteorological Service.

Lack of cooperation: An insufficient interaction with other departments regarding data sharing has been highlighted by interviewed candidates. In the case of FYROM, respondents have commented on their restricted access to other public agencies' data, such as, the Real Estate Agency Database, Soil Information System Database, Hydromet Service or the Spatial Planning Agency. The need to link-up the existing complimentary datasets at the national level has been underlined by interviewed organizations. At the time of the interviews, it was expected by intermediate data users that under a new Law targeting the national infrastructure of spatial data (NIPP), existing national datasets would be networked and harmonized in line with the INSPIRE Directive.

Data gaps and limited formats: Both countries have underlined the low quality of existing national data sets and the lack of standardization procedures in data collection between public institutions. The Spatial Planning Agency of FYROM reports that less than 40% of data it needs from other public institutions is received in an appropriate format. **Much of the existing public data is still available only in an analogue format**.

Burdensome public tendering procedures: Entities in FYROM highlighted that the long tender procedures affect the timeliness of their activities and the quality of the prepared data.

4.3 Greece and Cyprus

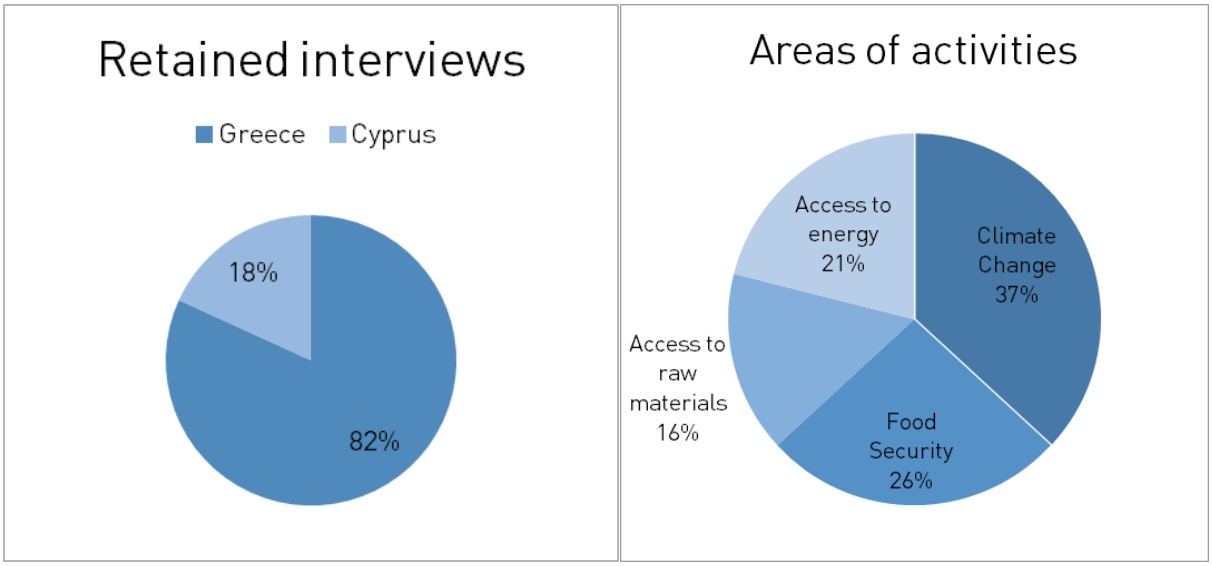

Fig 11. Percentages per country and project thematic area

4.3.1 Overall observations

Drawing on the collected interviews received from Greece, these can be grouped around three main themes: **environment**, **energy** and **agriculture**. In comparison with their Balkan neighbours, the geo-information and satellite technology market seems more mature, with several service providers available on the market. However, there is a need for a better understanding of the market needs and potential exploitation of environmental data in particular. Although the legislative background in terms of rules and regulations is quite solid,

interviewees have on several occasions mentioned the lack of control and implementation mechanisms. In addition, the financial crisis coupled with tight austerity measures and public spending freezes, have considerably affected the purchasing power of earth observation products by public institutions, according to the interviewed stakeholders.

Shrinking budgets, although a threat to private companies, could also represent an opportunity to shift behaviour towards the use of open data sources. Most interviewees felt that the state should strengthen the dissemination and availability of EO data to potential end-users by establishing a transparent and user-friendly interface with key contact points for different market sectors.

In the agriculture and environment sectors, many users are dependent on external EU funding and subsidies. In some cases, **up to 60% of an organisation's budget could be dependent on EU projects funding**. As for farmers and agricultural cooperatives, their decisions on what crops to grow are heavily dependent on the EU Common Agriculture Policy subsidies available per crop on a yearly basis.

Existing environmental rules are deemed to be appropriate for the most part, however, the lack of enforcement and control of these standards has also been highlighted by both Greek and Cypriot interviewees.

Several interviewees highlighted a limited access to real-time or near-real-time EO data, with metadata often being an issue. It is unclear though if the end-users themselves are missing this data or not, since they may not be able to exploit it. Furthermore, according to the Municipality of Thessaloniki, there is **limited availability of EO data for urban areas and urban scale use**. In addition, EO data with high spatial and temporal resolution at regional and local scale concerning air pollution and climate (especially ozone, particulate matter and dust) is also needed. Some respondents have also underlined **gaps in national datasets**, as well as **difficulties in finding harmonized data**. Draxis Environmental SA —a Greek consultancy, also called for an easy and user-friendly access to open data in near-real time and **stronger**

recommendations from the General Secretariat for Research and Technology for data providers to follow open data protocols.

The limited access of private stakeholders to public data sets has also been highlighted by Cypriot end-users. Atlantis Consulting, one of the Cypriot companies interviewed for this project, reported that the **restricted access to public data sets is often a problem for private companies in the country**. This challenge has also been echoed by Greek private sector (GEOAPIKONISIS, Geospatial Enabling Technologies, Draxis and TerraSpatium during the 3rd South-Eastern Europe GEO Workshop) as a factor hindering the sustainable EO data use in the region.

For the private sector **data acquisition constrains translate into missed business opportunities**. To tackle such challenge, private sector stakeholders will sometimes choose to recourse to international sources of data rather than going through national organisations.

Also, in terms of data availability and data accessibility, this seems to also vary considerably in both countries. While some institutions follow open data and open access principles, some do not and will only release data on demand after evaluating the scope of its use. For example, the Special Secretariat for Water, within the Greek Ministry of Environment and Energy, offers only parts of its data freely for public use. Hydro meteorological data is also not always open and interested parties need to go through official request procedures in order to obtain it. A similar case can be found within the Greek Centre for Renewable Energy Sources and Savings. The centre offers 90% of their data for freely to the public, while the rest remains confidential due to contract constraints. Memorandums of understanding and applied fees are thus needed to access the full spectrum of information.

Another frequent challenge reported by users is the lack of digitalized data sets. For example, interviews reported that all information collected from the relevant authorities and stakeholders for the management of flood events is provided in hardcopy, which sometimes

creates delays in responding to emergency situations. In addition, according to interviewed farmers, crops, fields localisation and traceability is still done by paper trail.

4.3.2 Constraints

Legislative constraints: In the field of agriculture, Greek interviewees have reported on the lack of a coherent national agricultural strategy. In Northern Greece, agricultural cooperatives have pointed out the government's lack of support towards helping them promote their products externally.

Furthermore, as it is the case in Serbia, Romania, and Bulgaria, EU CAP subsidies drive the plantation of crops farmers will favour, since agriculture is heavily depended on legislation and funding. This may lead to soils losing qualities and therefore weaker yields. According to ATLANTIS Consulting, the environmental sector in Cyprus generally lacks standards and protocols. Competition is tough and the market is rapidly changing.

Budget constraints: The majority of Greek interviewees have underlined the short to long-term negative effects of their country's austerity measures. For example, some end-users believe that the current economic crisis in Greece has shifted social interest from environmental issues to financial issues. Similarly, during GEO-CRADLE activities, respondents cited lack of funding as a barrier to accessing satellite images, orthophotos and other Earth Observation data.

Furthermore, the need to cut costs has pushed organisations to cut staffing budgets. Public sector budget cuts have also resulted in less financial support being allocated to use and purchase of new Earth Observation data which also leads to:

Human resources: The lack of qualified staff with data and/or Earth Observation data analytics expertise, lead to a low ability to develop value-added services to support decision-driving management systems.

Lack of awareness & user know-how: on the use of Earth Observation for Environment and Agriculture. As expected, end-users have little knowledge of geo-information data and its potential, thus targeted awareness campaigns and greater support should be offered to them

by either private or governmental bodies. Moreover, efforts should be redirected towards moving knowledge from academia and research institutions (who are otherwise very active in the geo-information sector) to public authorities and private stakeholders. The Greek company Draxis also suggested that the "*state should strengthen the dissemination and availability of EO data to the potential end-users by establishing a transparent and user-friendly interface with key contact points for different market sectors*".

Data gaps: In Greece, interviewed authorities have underlined the government's lack of incentive to digitalize national data sets and achieves from municipalities and decentralised administration offices. In addition, some of the interviewees have highlighted serious gaps in nationally archived and collected data. On the opposite side, as Greece has an established experience in dealing with EU funds, several databases seem to have been set in place throughout the years. Thus, any additional data hubs should consider bringing together previously created datasets. A particular care should also be given to **avoiding the duplication of existing data** and reinforce stakeholders to mutualise the use of relevant information.

Lack of cooperation: Among the interviewed candidates, several public authorities have underlined the existing difficulties with regards to internal communication and interaction between different departments within national ministries. As mentioned before, this challenge is particularly common across all the three regions. These observations are also sustained by the survey results presented in the GEO-CRADLE deliverable D3.1 which notes the very low collaboration among local Earth Observations players.

Data sharing: While Greece is reported to have a higher degree of open data sharing policies, in Cyprus data sharing between organisations requires in many cases specific contracts and MOUs. A limited access to the digital cadastre maintained by the Department of Cadastre and Chronometry within the Ministry of Interior has been particularly noted. Both private and public stakeholders, as well as research organisations, are charged to access the data in this case.

Burdensome public tendering: Public tender procedures are seen not as an opportunity but rather as a burdensome process that creates delays and issues for both private and public entities.

Capacity gaps: respectively, the lack of technical equipment and specialised personnel due to budget restrictions.

5 Overview - The Northern African Region

5.1 Morocco, Tunisia, Egypt, Israel

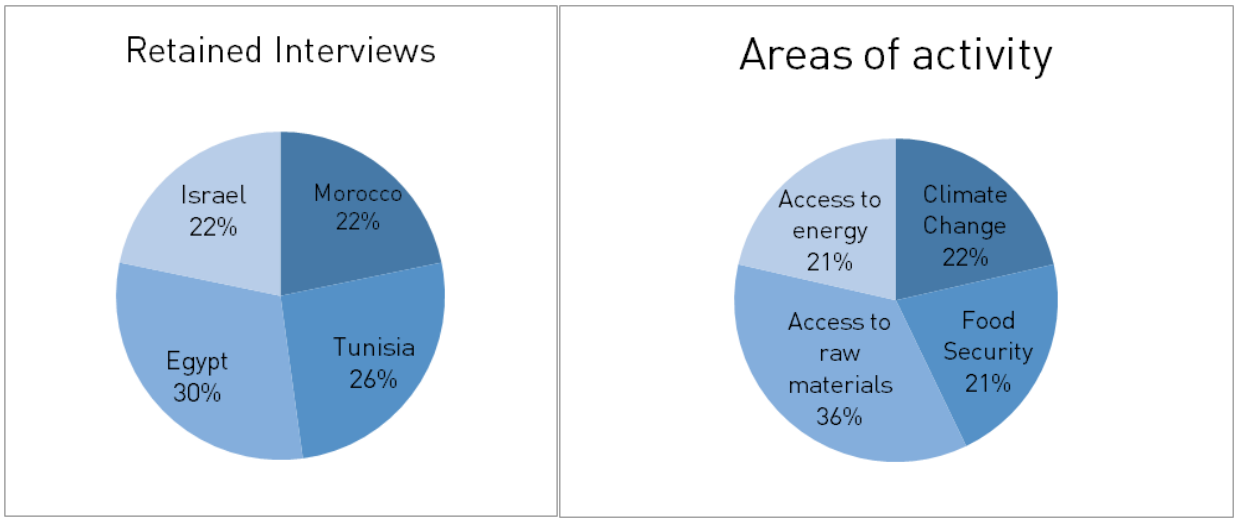

Fig 12. Percentages per country and project thematic area

5.1.1 Overall observations

Sixteen interviews were received from Egypt, out of which eleven have been considered as not compliant with the agreed upon definition and categorisation of end-users. As most of these covered academia and research organisations, they did not fall within the required target group for this task. However, we have considered that the messages and challenges reported by these research organisations to be of importance and thus have included them in our observations. On the basis of the user interviews submitted, **water** and **climate change** seem to be a good potential common thread to be exploited in Morocco and Tunisia in particular, through its implications in agriculture, in energy production, in risk management.

In Morocco, the Water Basin Directories are very strong actors with wide-ranging responsibilities for managing water use in the private and public sector (including by the general public). This means that they are linked with a whole range of organisations and companies which are dependent on the Directories' management of water, and likely to need or use the same type of data and information. Water Basin Directories can thus be seen as focal

points and demand aggregators. In Tunisia, we can assume that the General Directorate of Farmland Planning and Protection can withhold a similar role, which can offer a gateway to similar organisations to the Water Directorates in Morocco.

In Morocco, the interviews were carried out by the CRTS (Royal Remote Sensing Centre) – a key actor in Morocco with a formal mandate to procure satellite data for the country, to provide remote sensing expertise, data, and value-added products to final users. CRTS has a very strong end-user focus and a large network of user organisations.

Many of the end-users interviewed here use satellite-derived information provided by CRTS. The Water Basin Directorates own and use data related to monitoring systems for groundwater and rivers, hydrological stations, but users also quoted aerial images, radar data, and Google Earth. Due to the training courses provided by CRTS some are advanced enough to process the data themselves to a certain extent. In addition to procuring satellite data for all of Morocco's public authorities, CRTS also acts as a service provider in some cases, which allows it to respond to calls for tender and charge fees for its services. According to CRTS, the launch of the kingdom's first high-resolution Earth observation satellite has resulted in an increased demand from local authorities for Earth Observation based information services. In Tunisia, CNCT (Centre National de la Cartographie et de la Télédétection) seems to have an equivalent role to that of CRTS.

In Morocco and Tunisia, both CRTS (Royal Remote Sensing Centre) and CNCT (National Mapping and Remote Sensing Centre of Tunisia) have a state mandate to provide geo-information to local end-users. This also means that they procure data for such users. As such, the two organizations represent key entry points to final end-users and can thus federate their needs and mutualise their data use. Drawing on their similar mandate, cross-border mutualisation of data and/or information relevant to both countries into a single hub could be considered (e.g. water management directories). Furthermore, in Tunisia, some users deplore that being dependent on CNCT creates red tape and therefore delays in receiving their data. It can be envisaged that some users might benefit accessing additional data directly. Depending on the

processing status of the data available on the hub, they may or may not require training (including from CNCT). In Egypt, the situation is more difficult, where in some cases research centres can even lack a basic internet connection. Furthermore, Egyptian interviewees report on the poor quality of existing data sets (outdated data, wrong formats and wrong corrections on geographical locations). Thus, Egypt would greatly benefit from using open data sources provided in a free and open data hub, such as the one created through the GEO-CRADLE project.

Drawing on the interviews received from Egypt, we can also pinpoint the availability of recent geo-information data, which remains limited due to economic constraints. In some cases, local authorities or research centres have **reported spending up to 60 % of their budget towards acquiring satellite data**. Often interviewees have reported that due to budget constraints they had to resort to older outdated data sets. When it comes to the environment, users reported that due to the struggling political environment there is a weak implementation of environmental protection and conservation laws and policies. Interviewees have reported industry irregularities in respecting legal standards coupled with the inability of public authorities to monitor breaches due to budget cuts and lack of monitoring capabilities.

5.1.2 Constraints

Data availability: Users in Morocco and Tunisia have reported difficulties in collecting data on natural resources and validating it through in-situ measurements. Data parameters change quickly and are sometimes inaccurate. Geometrics data describing the geographic distribution of Tunisia resources are often difficult to collect and hard to verify according to some users. The data acquisition is also often subject to data inaccuracy as they come from multiple sources. Additionally, national data providers seem to be reluctant to deliver data for research purposes, as some private consulting offices are using researchers to bypass public data access fees. Egyptian users have also reported a lack of access to affordable near-real-time high-resolution Earth Observation images. This observation is in line with reports on a limited number of ground segment facilities in the country which do not provide sufficient in-situ coverage,

particularly in relation to the energy sector. Further research is needed to understand data availability challenges in Egypt considering that the country has its own Earth Observation satellite programme (Egyptsat-2) and a designated national authority in charge of remote sensing activities (National Authority for Remote Sensing & Space Sciences).

Legislative constrains: Under Tunisian legislation, every tender must go through CNCT for validation and approval which often causes delays in data and/or services procurement. In Egypt, interviewed authorities reported that in some cases outdated rules and legislations obstruct the use and development of geo-information use within the public sector. Moreover, environmental protection legislation is regarded by some end-users/citizens as an impediment to economic growth. An argument similar to that expressed by a Romanian user which highlights the needs to increase awareness raising on climate change and environmental protection in general.

Human resources: Egypt reported on human resources limitation, including the lack of training in using GIS systems. Challenges regarding the limitation of available staff working on data processing and analytics have also been reported in Tunisia and Morocco. In Tunisia, SONEDE has quoted their personnel's reluctance to use new technologies.

Financial constraints: In Egypt, some research centres could spend up to 60% of their budget on data acquisition. Similar constrains have been quoted in Tunisia.

Cooperation constraints: The Waste Management Department within the Egyptian Environment Agency report that inter-departmental cooperation is an issue within the ministries, together with lack of data collection standards and data sharing. These challenges appear to be recurrent for most of the public authorities interviewed. In Tunisia, the lack of coordination between different directions and entities of the Ministry of Agriculture, Hydraulic Resources and Fishing is reported to have resulted in duplicated research efforts.

6 Overview - The Middle Eastern Region

6.1 Saudi Arabia, United Arab Emirates, Turkey

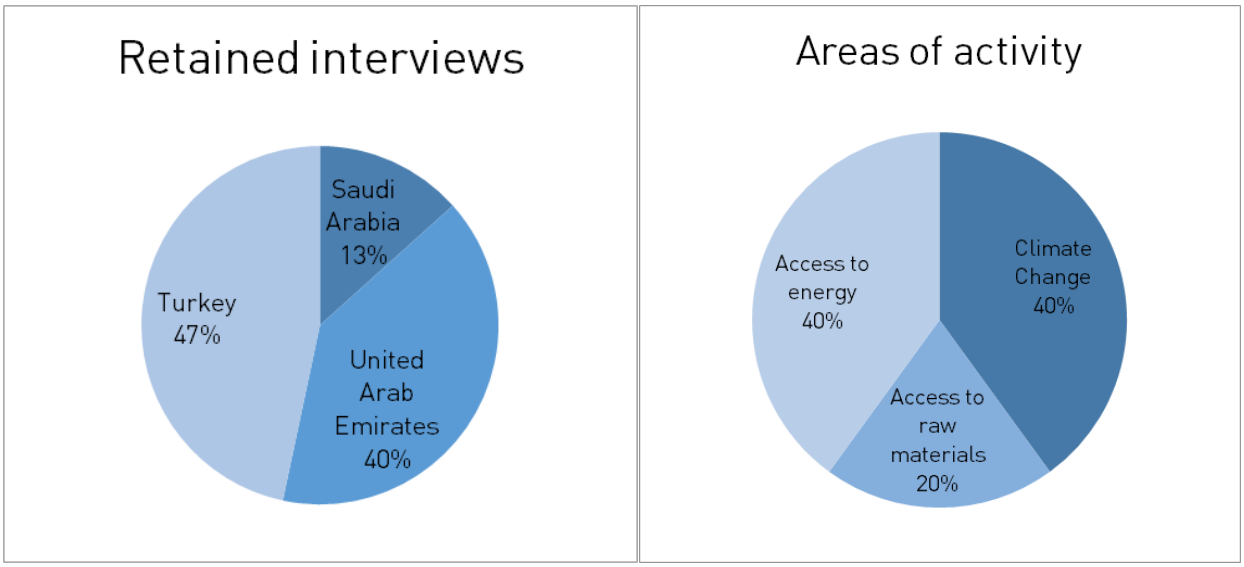

Fig 13. Percentages per country and project thematic area

6.1.1 Overall observations

While only one major oil company was included in the interviews —the Saudi Arabian Oil Company— it is difficult to ignore that access to raw materials and natural resources is a major point of interest, specifically for the Kingdom of Saudi Arabia (KSA) and the United Arab Emirates.

In addition, drawing on the received interviews, climate change and sustainability appear to drive a majority of Saudi Arabia's and UAEs' public policies, whether they cover environmental, water, energy or access to raw materials. This can be explained by their strong economic dependence on natural resources and also the need to supply their growing population with water and agricultural products. Water scarcity is an issue for both Saudi Arabia and UAE, whilst water management is also of utmost importance for Turkey's agriculture sector. In Saudi Arabia, the National Water Company has initiated a TSE (Treated Sewage Effluent) initiative to address water shortage challenges in the Kingdom. The coast of the United Arab Emirates in the

Persian Gulf hosts also some of the largest desalination plants in the world (in 2011 it was the second producer of desalinates sea water, after Saudi Arabia). Thus, environmental and water quality monitoring is central to ensuring sustainable access to water resources, both for citizens and industry. Moreover, the two countries' exposure to maritime coasts, their similar climate, geography, needs, and challenges create an opportunity for using common data sets. Unfortunately, the collected interviews from UAE and Saudi Arabia did not contain any information regarding the existence of cross-border data sharing policies.

All three countries use and operate their own Earth Observation satellites (SaudiSats, DubaiSats, GoktukSats). However, users in Turkey reported on the limited access to their national satellites data, as these are under the mandate of the Ministry of Defence, and there is a need for special government permits to use such data. Additional data sets are acquired from private retailers depending on the user's needs and no data access challenge have been recorded by interviewees in UAE and KSA. Most of the interviewees across the three countries reported having and managing their own geo-portals, making parts of their data available for public use. Furthermore, both the governments of Abu Dhabi and Dubai manage national databases containing various types of high spatial resolution data. The government of Abu Dhabi provides public authorities with a national geo-portal: In the case of Dubai Municipality, 100% of the primary information used comes from spatial sources, remote sensing, aerial photos, field surveys and mobile mapping. In the case of the Abu Dhabi Environment Agency approximately 80-90% of the information required by the Agency reportedly comes from Earth Observation data.

It is unclear from the interviews received from Turkey, whether the public authorities share access to their geo-portals amongst each other or whether these are only for internal use. The Turkey Ministry of Food Agriculture and Livestock General Directorate of Agricultural Reform reports for example that the online parcel information cannot be accessed from the General Directorate of Land Registry and Cadastre (Land Registry and Cadastre Information System

TAKBIS). The same Ministry reports the use of their own Agricultural Monitoring Information Systems which covers the entire country and which is made up mostly of ortho-photo data.

6.1.2 Constraints

Human resources: Both the UAE and Saudi Arabia report a lack of local skilled personnel and their dependence on foreign expertise. Long-term retention of the international staff represents a recurring challenge for the sustainability of their activities and projects. Both Saudi Arabia and the UAE state have equipped their public authorities and companies with the latest technical equipment and software solutions which enables them to fully benefit from new geo-information sources.

In Turkey, the Ministry of Development Konya Plain Project (KOP) Regional Development Administration and the Ministry of Food Agriculture and Livestock, General Directorate of Agricultural Research and Policies, have reported challenges due to personnel shortages. However, it is unclear whether this is due to budget restrictions or freezes in public sector hiring.

Reporting requirements: Users in both Saudi Arabia and UAE, such as the KSA National Water Company or the Abu Dhabi Environment Agency, mentioned that their reporting obligations take a huge amount of effort and time. In the case of private sector actors these would need to pay high penalties if reports are not delivered on time.

Industry constrains: Both Saudi Arabia and UAE have reported a strong linkage between fluctuating oil prices, foreign expertise and available budgets for training. In late 2016, in the case of the Abu Dhabi Environmental Agency, strong budgetary cuts (up to 40%) due to low oil prices have resulted in the curtailing of major projects, such as the Abu Dhabi 2030 Climate Change Action Plan. The Dubai Municipality is also reported to have frozen some of its projects due to budget constraints.

7 Looking forward

The current report was not intended as an exhaustive analysis of end-user needs but rather as an exploratory exercise to identify examples and gather relevant feedback on areas which require further attention, both in terms of policy efforts, as well as awareness raising and capacity building, in line with the project's overarching objective to support the effective integration of Earth Observation capacities in these regions. Due to the underlining fragmentations, among and within the countries covered by the project, it has proven challenging to establish benchmarks that could be applicable across countries. Each country has different needs with regards to geo-information use, as well as different legislative, data sharing and cooperation cultures. Likewise, each user has its own particular needs, internal working processes and so on. And whilst within the European Union, such needs could be more easily mutualised through EU Directives which require similar reporting responsibilities across member states, merging and facilitating information sharing across North Africa and Middle East poses a greater challenge in itself.

Drawing on the encountered challenges summarised in the previous chapters, the below recommendations are not only rooted in the observations included in the chapters above, but also in Eurisy's institutional knowledge:

R1. Bridging the gap between research activities and market development

While public sector stakeholders are expected to drive the growth of the Earth Observation and geo-information markets and act as the main customers for service providers, they rarely have the in-house capacity, knowledge or skills to use, read or process such products. These challenges have diverse sources and could be related to factors ranging from budget constraints to limited IT infrastructure (either for storing or processing data), to the simple lack of awareness on the potential benefits of such services. Even in cases where such in-house expertise exists at a national level (which is quite frequent) this seldom trickles down to regional and local stakeholders. At the same time, private stakeholders have difficulties in

selling their products, no matter how innovative these are, as **market demand remains immature**, with many private companies reporting considerable amounts of time spent in educating their potential customers. Research organisations are both a source of technical expertise and innovation but lack business acumen. Yet, despite their complimentary, these three types of stakeholders rarely meet, belong to different professional communities and communicate in different ways. As such, more efforts need to be put in transferring knowledge and know-how systematically all across the data value added chain, whether this is done through events, non-technical presentations in institutions, pilot and demo projects and so on. Moreover, within this context, knowledge exchanges among different types of users can help persuade decision makers of the added value of investing in services that have already yielded efficient results. Each action is laying the groundwork to upscale the use of geo-information data and services and build trust. Supported by open data policies, this trust has the potential to act as the bedrock for more openness towards data sharing.

R2. End-users engagement in product development / building on existing services

End-users, whether private or public, will be more likely to adopt a product that has the ability to respond to existing needs. As such, **users should actively be engaged in the development of new services or their tailoring from the start**. As noted with the previous chapters, the high variety of end-user profiles and fragmentation of needs, makes off-the-shelf products difficult to uptake and scale up. Some degree of tailoring will be, more or less, always needed and consequently users should not be required to adapt themselves to the new technologies developed but rather include them in the existing workflows. Building on existing services and work flows could thus help reduce resistance to change and new technologies. In the case of public authorities, introducing new sources of geo-information (like a data hub) is made more difficult by the fact that these organisations already have formal processes in place to produce or procure data. Moreover, users should not be expected to voice their complete list of technical and information needs and requirements. Many will not have the technical expertise

to do so. It is up to service providers and research experts to work closely with them to understand their needs and turn them into services.

One of the products resulted from the GEO-CRADLE project, the SENSE: Access to Energy Pilot, has clearly responded to the Egyptian Ministry of Electricity and Renewable Energy's need to update its information on the country's solar atlas. The question remains however, whether this product is to be transferred to a service provider and whether the public authority would also pay for such a service in the future after having acknowledged its benefits. Long-term sustainability should be prioritised over short-term funding.

R3. Data abundance is not innovation. Innovation will come from data use.

As previously mentioned in the report, our observation is that the adoption of innovative services is rarely connected to data richness. Non-technological factors, such as socio-economic conditions, digitalization or "*smart*" policies or social norms play a greater role in determining users to adopt geo-information products and services. Although increasing the quantity of open data has clear benefits in terms of economic return, data dumping should be avoided, as **users do not necessarily need higher amounts of data - they need more insights** that could in turn trickle upwards into the decision making process. A map, a picture or a graph can have zero value without the necessary background and annex information to interpret it.

R4. Boosting the focus on private sector actors

Although the Copernicus Earth Observation program is focusing more on public authorities through its service portfolio, the potential marker share of private end-users, as in companies who perform activities in sectors completely unrelated to Earth-Observation or geo-information, should not be underestimated. In comparison to their public sector counter parts, they have more flexibility in adopting new technologies and services into their work streams and are more inclined to risk taking. In addition, they would not need to go through lengthy public procurement procedures to obtain them. Once again, because such users belong to different professional communities and would be less inclined to go outside their own network,

the information on the benefits of integrating satellite-based services should be brought to them, not the other way around. This cross-sectorial exchange of information, know-how, needs and best practices could be fostered by identifying thematic user forums, either at a national or European level, and ensuring the presence of GEOSS and Copernicus together with service providers in a systematic way (e.g. Health, Water Management, Biodiversity, Transport, Agriculture etc.) User-friendly presentations and service portfolios should be tailored depending on the topic and audience profile.

R5. Increase awareness raising on existing data, GEOSS and Copernicus

Increase dissemination of the two programmes and their advantages across the entire data and services value added chain, from data providers to decision makers to operational level civil servants by leveraging existing networks and industry associations, especially in user domains. Regional and local distribution should be prioritised to tackle information and communication flow hurdles between national and local authorities. Many of the observations highlighted in the previous chapters of this report with regards to awareness raising and user uptake initiatives challenges have also been underlined in the 2016 *Copernicus User Uptake- engaging with public authorities, the private sector and civil society report*[7]. As such, the current report aims to lend its support to and reinforce those recommendations and associated actions related to the need for more communication activities, specialised trainings and development of user-friendly toolkits**. For the market to develop and reach a maturity stage, more efforts need to be directed towards "educating" potential clients**. Potentially, such activities should be developed and strategically implemented at a European level, so as to lessen the time spent by service providers in doing so.

R6. Support and ensure policy alignment

[7] https://publications.europa.eu/en/publication-detail/-/publication/62101cd2-fbba-11e5-b713-01aa75ed71a1/language-en

Ultimately, policies and governance play a key role, if not, a critical one in the diffusion and adoption of Earth Observation and geo-information use or innovation in general. Whether they touch on data-sharing and open data principles, standards, procurement practices, funding opportunity or reporting obligations, all these continue to vary widely among countries and/or regions. Due to these variations in regulatory frameworks, market maturity levels also differ, not only in terms of data exploitation, but also data use, availability, diversity, integration into policies and so on. Fragmentation across sectors and communities makes the elaboration of a "one-size-fits" all solution impossible, but **policy alignment can ease the way for innovative geo-information based products to find their niche markets and grow**.

R7. Overcome technical challenges through training and knowledge exchange

Many responders quoted challenges with regards to the lack of qualified personnel within their organisation to use or process geo-information challenges. This challenge was particularly evident throughout the three regions, at all levels and covering all the thematic sectors. Indeed, public organisations face particular technical or organisational challenges when adopting new technologies or geo-information based services in general. It is therefore important to launch programmes and initiatives aimed at training operational civil servants and managers on using such new services and/or data. Such trainings should also be continued after the completion of pilot projects to support the sustainable use of the created solution and should include personnel from different and various departments. To avoid additional costs, **investments in training could and should be integrated in the procurement budget of new services**. In addition, such training should be based on existing platforms which provide open Earth-Observation data and include hands-on examples which would be relevant to the trainee's day-to-day tasks. Such efforts should be particularly direct towards smaller local authorities who appear to have less access to data and expertise than their peer organisations working at a national level. Such trainings should be developed together and in cooperation with the regional and local authorities to ensure that these respond to their needs.

8 Annex 1 – Retained end-user interviews

Eurisy received and validated reports on the following organisations:

Organisation Name	Department	Country	Type
National Environment Agency	Local Agency for Environmental Protection	Romania	institutional
DaKia Association for Sustainable Development		Romania	commercial
Magurele City Hall		Romania	institutional
Tractebel Engineering SA GDF SUEZ		Romania	commercial
R.A.ROMATSA (Romanian Air Traffic Services Administration)	Operational Department	Romania	institutional
S.C. Agro DECVRM SRL, Romania		Romania	commercial
CEZ TRADE		Romania	commercial
GEOCAD-93		Bulgaria	commercial
Remote Sensing Applications Center (ReSAC)		Bulgaria	commercial
Strandja Nature Park Directorate (NPD)		Bulgaria	institutional
Executive Forest Agency		Bulgaria	institutional
Government of the Autonomous Province of Vojvodina	Secretariat for Agriculture, Forestry and Water	Serbia	institutional
Public Company VojvodinaSume (Forest Company)		Serbia	institutional

Ministry of Agriculture and Environmental Protection	Group of Viticulture and Wine Production	Serbia	institutional
Ministry of Agriculture and Environmental Protection	Climate Change Unit (CCU)	Serbia	institutional
Ministry of Mining and Energy	Sector for Geological Research and Mining	Serbia	institutional
City of Belgrade	Secretariat for Environmental Protection, City Administration	Serbia	institutional
Institute for Field and Vegetable Crops		Serbia	commercial
SrbijaSume		Serbia	institutional
Urban and Spatial Planning Institute of Vojvodina		Serbia	institutional
Public Water Management Company VodeVojvodine		Serbia	institutional
Mountain Rescue Service		Serbia	institutional
Generali Osiguranje Serbia	Product Development Technical Department	Serbia	commercial
Galenika Fitofarmacija		Serbia	commercial
Ministry of Interior	Sector for Emergency Management	Serbia	institutional
National Food Authority		Albania	institutional
Ministry of Environment, Sector of Climate Change		Albania	institutional
National Agency of Natural Resources		Albania	institutional

National Environment Agency of Albania	Statistical and Information Directorate/GIS Section	Albania	institutional
General Directory of Civil Emergencies		Albania	institutional
Ministry of Environment		Albania	institutional
Ministry of Agriculture, forestry and water economy	Land Policy Unit, Dept for Land Parcel Identification system	FYROM	institutional
Spatial Planning Agency		FYROM	institutional
Technical Committee for the Restoration of Abandoned Mines		Cyprus	institutional
Ministry of Agriculture, Rural Development and Environment	Department of Forests	Cyprus	institutional
Hellenic Copper Mines Ltd		Cyprus	commercial
Atlantis Consulting Ltd.		Cyprus	commercial
AC Nestos (Farming cooperative)		Greece	commercial
AC Nespar (Farming cooperative)		Greece	commercial
Croop Xanthi (Farming cooperative)		Greece	commercial
Bank of Greece	Climate change impacts study committee	Greece	institutional
Centre for renewable energy sources and savings (CRES)		Greece	institutional
Independent Power Transmission Operator (IPTO or ADMIE)		Greece	institutional
DRAXIS Environmental S.A		Greece	commercial
LDK S.A.	Environmental Department	Greece	commercial

Municipality of Thessaloniki	Department of Environment	Greece	institutional
Planetek		Greece	commercial
Public Power Corporation S.A.	Hydroelectric Generation Department	Greece	institutional
Ministry of Environment, Energy and Climate Change (YPEKA)	Special Secretariat for Water	Greece	institutional
Ministry of Environment, Energy and Climate Change (YPEKA)		Greece	institutional
Aeiforiki S.A		Greece	commercial
Development Agency of Thessaloniki (ANETH S.A)		Greece	institutional
AKKT S.A		Greece	commercial
Directorate of Agricultural Affairs of East Macedonia-Thrace		Greece	institutional
Directory of Southern Greece	Inspectorate of Mines Department	Greece	institutional
Water river basin agency for the Bouregreg and the Chaouia		Morocco	institutional
Settat Urban Agency, Province of Settat - Province of Khouribga		Morocco	institutional
Ministry of Town and Land Planning	Land Planning Directorate	Morocco	institutional

Office for Agriculture Promotion of the Gharb (ORMVAG)		Morocco	institutional
Water Basin Agency of the Oum and the Rabia		Morocco	institutional
National Water Distribution Company (SONEDE)	GIS Unit	Tunisia	institutional
Tunisian Electricity and Gas Company		Tunisia	institutional
National Rural Engineering Research Institute (INGREF)		Tunisia	institutional
Ministry of Agriculture and Water	General Directorate of Farmland Planning and Protection	Tunisia	institutional
Agency for Protection and Coastal Planning (APAL)		Tunisia	Institutional
Municipality of Monastir		Tunisia	institutional
Egyptian Environmental Affairs Agency	Waste Management Department	Egypt	institutional
Ministry of Agriculture	Agriculture and Food security Department	Egypt	institutional
EMATIC Consulting Company		Egypt	commercial
Ministry of Agriculture and Irrigation	Central Laboratory for Environmental Quality Monitoring	Egypt	institutional
Ministry of Water Resources and Irrigation	Administration for Information, Documentation and	Egypt	institutional

	Decision Support		
New and Renewable Energy Authority		Egypt	institutional
General Authority for Fisheries		Egypt	institutional
Keren Kayemeth LeIsrael – Jewish National Fund (KKL-JNF)		Israel	commercial
Golan Heights Winery		Israel	commercial
Experimental Plant – Israeli Regional Center for Agricultural Research		Israel	institutional
The Dead Sea and Arava Science Center		Israel	institutional
Israel Water Authority		Israel	institutional
Abu Dhabi Urban Planning Council	GIS Section	UUAE	Institutional
Abu Dhabi Environment Agency	Environmental information, Science and Outreach management section	UUAE	Institutional
Dubai Municipality	GIS Department	UUAE	Institutional
Department of Municipal Affairs and Transport	Geographic Information Systems Office	UUAE	Institutional
Government of Dubai - Road and Transport Authority	Corporate Technical Support Services Sector	UUAE	Institutional
Government of Abu Dhabi, Abu Dhabi Systems and Information	Abu Dhabi Spatial Data	UUAE	Institutional

Centre (ADSIC)	Infrastructure (AD-SDI)		
Saudi Arabian Oil Company (ARAMCO)		Saudi Arabia	Commercial
The National Water Company (NWC)		Saudi Arabia	Institutional
Ministry of Development Konya Plain Project	Regional Development Administration	Turkey	institutional
Ministry of Forestry and Water Affairs	General Directorate of Forestry	Turkey	institutional
Ministry of Science, Industry and Technology	Turkish Sugar Authority	Turkey	institutional
Ministry of Food Agriculture and Livestock	General Directorate of Agricultural Reform	Turkey	institutional
Ministry of Food Agriculture and Livestock	General Directorate of Agricultural Research and Policies	Turkey	institutional
Prime Ministry Disaster and Emergency Management Authority		Turkey	institutional
The Ministry of Forestry and Water Affairs	Turkish State Meteorological Service	Turkey	institutional

9 Annex 2 – Quoted information sources

Region	Country	Quoted information sources	
		National	International
Balkans	Serbia	Republic Geodetic Authority of Serbia: www.geosrbija.rs Hydro meteorological Service of Serbia Climate Change Unit of the Ministry of Agriculture and Environmental Protection communications within UNFCCC (documents, reports, tables) Serbian Agency for Environmental Protection (Greenhouse Gas emissions) Statistical Office of Serbia Ministry of Science and Technology (soil maps) Ministry of Agriculture and Environmental Protection - Group of Viticulture and Wine Geo-portal on geo-referenced data about vineyard parcels (size, location), graphical representation, grape variety (cultivar), rootstock, training system. National Forest Inventory Forest GIS GIS - JP "Vojvodinašume The Sector for Geological Research and Mining of the Ministry of Mining and Energy Public Company Ski Centres of Serbia Department for emergency situations Serbia Ministry of Internal Affairs Agricultural Extension Service of AP Vojvodina Vojvodina Sume Regional Forest Authority City of Belgrade, Secretariat for Environmental Protection Associations of Grape and Wine Producers Public Company Srbija Sume The Urban and Spatial Planning Institute of Vojvodina	US Geological Survey (https://www.usgs.gov/) WAFC: World Area Forecast Centre (real-time meteorological information broadcasts for aviation purposes) Eumetsat Landsat Google Maps Google Earth European Environment Agency CORINE Land Cover Database Airbus Open Street Map NASA Earth Data ASTER Global Digital

		Ministry of Mining and Energy, Geological Research Department geo-portals http://geoliss.mre.gov.rs and http://geoliss.mre.gov.rs/beware/	Elevation Map RadarSat Ikonos High Resolution Mapping SPOT images Nile River Water Quality Index maps;
		Seismological Survey of Serbia	
	Romania	Integrated Environmental Portal (IEP)	
		Weather forecasts, topography information (cadastre, geo-technical prospection)	
	Bulgaria	No national hubs have been shared by users	
	FYROM	Spatial Planning Agency	
		Real Estate Agency WEBGIS Portal	
		WEBGIS Portal for Macedonian Soil Information System	
		National Cadastre Agency	
	Albania	ASIG/Albanian Geospatial Information Agency	
		National Food Authority Geo-portal	
	Greece	National Cadastre Data	
		National Energy Information System	
		http://www.protectedplanet.net/	
		https://www.eionet.europa.eu/	
		Thessaloniki Open Data Portal	
		www.envdimosthes.gr	
		http://www.ypeka.gr/Default.aspx?tabid=252&language=el-GR	
		http://maps.ypeka.gr/flexviewers/gis/ (Greek Special Secretariat for Water, Ministry of Environment & Energy)	
		http://floods.ypeka.gr/	
		http://www.ktimatologio.gr/sites/en/Pages/Default.aspx	
		National Data Bank of Hydrological & Meteorological Information	
		Greek Hydrologic database	
	Cyprus	No national hubs have been shared by users	

Middle East		DubaiSats
	UAE	Abu Dhabi National Geo-portal
		Abu Dhabi Environment Agency
		UAE Planning Urban Planning Council Geo-Portal
		Dubai Municipality Geo-portal
	Saudi Arabia	Saudi Sats
	Turkey	Turkish users quoted internal geo-portals from the General Directorate of State Hydraulic Works, Ministry of Forestry and Water Affairs General, Directorate of Forestry and the Ministry of Food Agriculture and Livestock General Directorate of Agricultural Research and Policies without providing external access links.
North Africa	Morocco	Géoportail de localisation des services publics
		Hydrologic stations measurements & Meteorology data
		Géoportail de l'Agence Urbaine d'Agadir
	Tunisia	No national hubs have been shared by users
	Israel	The Golan Heights Vinery does not use any geo portals but they have meteorological stations in the fields when all data is provided by a company name and is freely available to the public: http://meteo-tech.co.il/golan_new/golan_he.asp
	Egypt	No national hubs have been shared by users