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

D3.4 – Maturity Indicators and country (G)EO Profile (II)

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Executive Summary

GEO-CRADLE has introduced "**Maturity Indicators" as an independent, up-to-date and replicable methodology for the assessment and monitoring of EO maturity at national level**. The aim of this approach is to establish an analytical tool that allows quantitative measurement of the current EO capabilities of a given country and their evolution over time.

To that end, we have defined a set of indicators across three main fields: "Capacities", "Cooperation" and "National Uptake and Awareness". For each of the indicators, we have developed a methodology to allow the assessment of its maturity level. In parallel, we have established a standardized process for the collection and analysis of the necessary data ("**Information Requirements and Analysis Methodology Specification**"). This entails primary research by organisations with deep involvement in national and international EO activities, enhancement through publicly accessible data sources and a cross-validation of findings by renowned national experts.

This approach was tested over a period of 15 months, through the mobilisation of the GEO-CRADLE country partners, covering 11 countries from the Balkans, Middle East and North Africa. After analysing the collected data, we have developed a standardised visualisation in the form of a "maturity card" and we present the results of this methodology in this deliverable.

The **Deliverable has been prepared in two stages**:

(1) the first stage (M1 - M9) focussed on the establishment of a robust methodology and some preliminary assessment of few countries as a model for the maturity indicators.
(2) the second stage (M1 - M26 - M30) was devoted to the analysis of indicators for all the countries and the presentation of the results in the form of maturity cards. It also includes a presentation of lessons learned from the application of the proposed methodology and proposals for further improvements in the future.

The methodology was presented to and discussed with the project team and other stakeholders in several meetings:

- July 2016 in Novi Sad
- November 2016 in Limassol
- April 2017 during the Industry Workshop in Brussels
- June 2017 through the GEO European projects in Helsinki
- October 2017 in Washington during the GEO plenary
- June 2018 during the 3rd South-Eastern Europe Workshop

The initial results of the implementation of the methodology have been presented in the first version of this deliverable and were highly appreciated by the GEO Secretariat, country representatives and other stakeholders from organisations such World Bank in Washington or European industry. The feedback we have received was very positive and supportive of both the objective of the research and the specific methodological design.

The key messages from these stakeholders were that they:

- consider the work done novel, absolutely relevant to their activities and a prime example of how a project can align its activities to the needs of GEO
- are keen to pick up the methodology and its implementation as part of GEO activities beyond the end of the project
- are willing to mobilise the GEO offices network to implement the methodology beyond the region covered by GEO-CRADLE – also during the project's lifetime
- endorse the idea of publishing a paper around it
- will motivate regional initiatives (AfriGEOSS, AmeriGEOSS) to see the benefit of this approach

All in all, the maturity cards have proven to be a powerful tool to highlight strengths and weaknesses, communicate on identified gaps, understand the level of uptake of key initiatives such as Copernicus and GEO, and guide future EO activities.

Nonetheless, there are limitations to the implementation of this approach which should be underlined. First, there is a need for the definition and application of a parallel "benchmarking" methodology that will allow to establish more robust reference points against which to measure the current status of a given indicator for a given country. This extension shall be explored in the future.

Moreover some "thematic" limitations have been identified. For example, while this study includes some discussion of meteorology, we concluded that meteorological services are so broad that a dedicated study should be conducted to assess this properly. Similarly, it should also be noted that while local modelling capacities have been considered, there is a focus on space-based observations in the choice of the indicators. While some weaknesses remain, the methodology has made considerable progress in developing an index for a concept for which there is little existing information and we look forward to working further and iterating with other stakeholders to further develop the methodology.

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Acronyms and Abbreviations

Acronym	Description
DoW	Description of Work
CEDARE	Center for Environment and Development for the Arab Region and Europe
CERT	Research and Studies Telecommunications Center
CUT	Cyprus University of Technology
Dx.y	Deliverable number y from Work Package x
EARSC	European Association of Remote Sensing Companies
EC	European Commission
EO	Earth Observation
ESA	European Space Agency
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GI	Geo-information
GIS	Geographic information system
(G) EO	(Geoinformation / Geospatial) and Earth Observation
INCA	Institute for Nature Conservation in Albania
INOE	National Institute for Research and Development in Optoelectronics
INO	InoSens doo
IP	Intellectual Property
NOA	National Observatory of Athens
SBA	Social Benefit Areas
SRTI	Space Research and Technology Institute of the Bulgarian Academy of Sciences
STAR	Space Technology and Advanced Research (Romania)
UZAY	Scientific and Technological Research Council of Turkey Space Technologies Research Institute
RoI	Region of Interest
ROSA	Romanian Space Agency
WP	Work Package

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1. Introduction

1.1. Context

In view of the implementation of GEO vision, a number of concrete steps for the effective involvement of member states across the globe are required. This includes the creation of national focal points, the formulation of commitment in terms of contributions to flagships and initiatives, the development of platforms for data exchange, collaboration and capacity building, and the establishment of support mechanisms for regional coordination. Tightly connected to this – as Europe's primary contribution to GEO/GEOSS, Copernicus was conceived as a programme to bring a more coherent and efficient approach to the development of Earth observation capacity. More recently, it has also been recognised as an instrument for economic policy; therefore, it has the defined goal to generate economic growth and jobs in the European EO services downstream sector. It represents a great opportunity for Europe to take a lead in the market to deliver EO services.

In this context, mapping the "EO maturity" of each country seems to be an imperative first step towards establishing the right channels for know-how and best practices exchange between countries. To that end, GEO-CRADLE helps to construct an accurate picture of the state-of-play of EO activities in the Balkan, North Africa and Middle East regions. This is achieved through the implementation of the novel "maturity indicators" approach.

1.2. Project objectives

Alongside the profound changes occurring globally in the EO sector and the corresponding changes in national priorities around this sector, this project's aspiration is to constitute the "cradle" of sustainable, coordinated EO activities and capacities in the Region of Interest (RoI). This has been pursued through the exploitation of synergies amongst key EO partners and the creation of an ecosystem and a toolbox to address the region's needs within and beyond the project's lifetime, supporting the implementation of GEOSS and Copernicus in the RoI.

GEO-CRADLE has defined four objectives that have been driving the respective activities carried out in the project:

I. Support the effective integration of existing EO capacities (space/air-borne/in-situ monitoring networks, modelling and data exploitation skills, and past project experience)

II. Provide the interface for the engagement of the complete ecosystem of EO stakeholders (scientists, service/data providers, end-users, governmental orgs, and decision makers)

III. Promote the concrete uptake of EO services and data in response to regional needs, relevant to the thematic priorities of the Call (adaptation to climate change, improved food security, access to raw materials and energy), and

IV. Contribute to the improved implementation of and participation in GEO, GEOSS, and Copernicus in the region.

1.3. Methodology: Contribution to project objectives

The analysis of the maturity of the various countries in the RoI is an integral part of the overall scope and approach of GEO-CRADLE, contributing to the success of its objectives by:

- Providing an independent, up-to-date but also replicable methodology to assess the level of EO uptake (in particular GEOSS and Copernicus) at national level, thus allowing decision makers to make informed decisions on which activities to undertake and which gaps to fill.
- Providing information that can help regional stakeholders across the complete EO value chain to intensify their cooperation and seek collaborative actions.
- Evaluating awareness in EO and the engagement with Copernicus projects or GEO activities, thus informing both initiatives at programmatic level.
- Performing a maturity card of existing EO capacities, enabling the definition of a roadmap for future GEOSS implementation and Copernicus uptake.
- Weighing the readiness and maturity of each country to be integrated at the GEO-CRADLE roadmap (D5.7: Roadmap for future implementation of GEOSS and Copernicus)
- Identifying country challenges and setting country priorities which will feed the exploitation plan (D7.6: Sustainability Plan), providing the means (if adopted) for continuous and efficient reports maturation of participation in and contribution of countries to GEO, GEOSS and Copernicus.
- Integrating information from other project tasks such as the inventory (D2.2: Inventory of in-situ instrumentation and regional networks , D2.3: Inventory of numerical modelling and computing facilities , D2.4: Inventory of Spaceborne capacities) and reviewed the gap analysis (D3.1: Gap Analysis Report)

This report aspires to build adequate knowledge of the level and progress of GEO and Copernicus implementation in each country, integrating results from previous tasks, especially the inventory and the gap analysis. It highlights the critical indicators to lead to successful (G)EO strategy implementation feeding the GEOCRADLE long-term roadmap.

1.4. Document structure

The document allows for a comprehensive, yet concise, analysis of the level of maturity of a given country in various areas related to Earth Observation activities.

The methodology has been defined in two stages:

Stage I: The first part of the **deliverable D3.2 (I)** outlined the methodology and its boundaries and presented a preliminary assessment of the maturity indicators for a few countries. The interim document (delivered in month 9 – December 2016) was devoted to the formulation of appropriate indicators of (G)EO maturity at the country level. These indicators have been completed for all participant countries in the Region of Interest (RoI[1]). The indicators were grouped under three main categories “Capacities”, “Cooperation” and “National Uptake and Awareness” and have been measured throughout the whole project.

Stage II: For the elaboration of this **deliverable D.3.2 (II)**, we have worked closely with project partners and experts in the countries to implement the methodology and fine-tune it with a view to long-term sustainability. The results of this effort have been seen as a useful contribution to understanding and measuring EO capacity at the country level. In that regard, we have also introduced comments from stakeholders such as the GEO secretariat[2].

The report presents the findings in the **5 sections** described below:

[1] RoI: Region of Interest: Middle East, North Africa and the Balkans
[2] GEO: Comments received from GEO secretariat: A. Mlisa, W. Chu and C. Larlee

(1) **Introduction**: Introduces the context of the methodology, reviewing the objectives and context of GEO-CRADLE and the contribution of the deliverable to the project.
(2) **Methodology**: The core of the deliverable document. It provides an overview of guidelines defining the methodology that was used to perform the assessment of the (G)EO maturity, understanding the elements to construct a consolidated list of indicators to be measured by all participant countries.
(3) **Visualisation**: For each representation of the maturity: by countries or by indicators, we provide a synthetic description.
(4) **Insights**: Drafts and early ideas of the main findings gathered during the validation with stakeholders including a discussion of the future steps.
(5) **Annexes:** Includes detailed definitions for some elements of the indicators, contacts in the countries, and spider graphs for each of the countries for further analysis.

2. Methodology

There is a very little documentation on how to develop a maturity model that is theoretically robust, tested and widely accepted in the (G)EO domain. Therefore, the development of such a methodology is based on a novel approach proposed by GEO-CRADLE and realised in four phases:

- During the **starting phase**, the possible methodological steps to design the maturity assessment approach were analysed.
- In the **construction phase**, the tools to measure the maturity levels of the countries were built and the procedures for the deployment and management of the overall approach were defined, including definition of specific indicators.
- Finally, during the **deployment phase**, the maturity model and assessment tools were validated.

The results of the implementation of the above phases were summarised and visually projected in the **visualisation phase.**

2.1. Starting phase

The starting phase was concerned with the **design of a maturity assessment method** to measure the (G)EO readiness of the countries. Based on the data gathered by the GEO-CRADLE project at country level, we proposed five practices to set the ground for the investigation of country maturity. The latter was cross-checked by country partners participating in the project. Some of these approaches were rejected, and others kept, as discussed below.

2.1.1. Practices included

Below we present methods and actions selected for inclusion in this methodology. The approaches identified in this starting phase, were contemplated in the subsequent phases.

- **Integration of information from other project tasks**: This step evaluated and interpreted the country capacities from the inventory (Deliverable 2.1-2.4) and reviewed the results of the gap analysis (Deliverable 3.1) to help tie the maturity indicators with the rest of the GEO-CRADLE project findings. This allowed us to design and test ideas for the assignment of value to the indicators.

- **Desk research by country partners**: All desktop research conducted during the realisation of this project was based on available literature and publications. Other main sources consulted were the websites of institutions and companies. Finally, the country partners contributed their insights and expertise into the topics to feed into the report.

- **Semi-structured interviews with country partners organisations** and **validation of findings by experts**: In order to collect first-hand data and information on perceived impacts, trends and challenges, semi-structured interviews have been carried out with country partners. For the interviews a flexible approach was used throughout the project duration and taking advantage of project events for face to face discussions. To assure the overall quality of the report and to avoid the inclusion of incorrect findings, a feedback round took place. Firstly, country partners provided feedback on the methodology of the report. Secondly, some recognised research organisations such as National Contact Points (NCPs), companies or entities part of ministries in the country validated the findings (corrections and improvements). The consolidation of these enhancements was undertaken by EARSC (as task leader of T3.1) guided through the experience of country partners who mainly facilitated the setup of the necessary interfaces.

- **Additional Analysis in relation to incomplete data or N/A**: This was considered for cases where we had insufficient responses from country partners against a particular category; for example,

the number of EO institutions per country, or in some cases where we wanted to provide a complete response even if this was not possible with the information gathered; for example, the total number of employees in public but also private organisations. The extrapolation potential was assessed estimating data on the basis of current information provided by country partners.

- **Comparative assessment**: Based on the previous approaches, the methodology allowed for an interpretation of findings (country level analysis) represented in the form of maturity cards.

2.1.2. Approaches declined

Whilst some other approaches may add value to the overall maturity indicators methodology, at this point in time and within the available resources of the project, they have been reviewed but not incorporated. These are:

- **Normalisation:** Each country performs differently in various aspects which can distort country level comparisons; such as economy, population, investment, competition, legislation and regulation, industry & innovation or public-sector involvement just to name a few. Furthermore, countries are all in different stages of development in terms of economy, environmental, population, health as measured for example by the Social Progress Index or UN Human Development Index[3]. This may affect the metrics used to evaluate the EO sector performance but are not typically taken into account in performance assessments. We considered the possibility to build more complex models to run effective country comparisons - such as normalising by GDP or economic performances - to produce a more realistic view of rankings. During the second stage of work, we concluded that this was outside of the scope of this deliverable and that we should rather focus here on developing a coherent and justifiable methodology for reviewing individual counties performances.

- **Benchmarking:** Following some of the steps from OECD research work[4], using the benchmarking approach, the assignment of values to the various indicators for a given country should follow – as much as possible – an objective approach and allow scrutiny/comparison against countries with well-mapped capacities. The benchmarking implementation follow these steps: (i) planning and selection of the maturity indicators (ii) collection of data from countries of the RoI (iii) selection of benchmarking reference (iv) comparison and evaluation of data collected (v) monitoring of the evolution of the maturity of each indicator (iv) implementation of improvements for future activities. The first three of these phases, aiming to set up reference indicators, have been defined based on a model country with a strong EO sector. With this perspective, all countries within the RoI are then compared against these reference values and this activity is shown in Annex 3. But here the difficulty lies with the selection of a given reference country as the one having the best performance against a given indicator. As can be easily understood, this task is highly complex in itself.

  A thoroughly implemented benchmarking approach requires an array of considerations and resources (establishing benchmarks that are applicable across countries with different GDPs, income levels, different populations and, of course, different EO needs). Taking this into account, we have decided to confine our efforts to simply organising the process of benchmarking in order to pave the way for more robust results in future studies. The benchmarking is explored as a method to fully compare the performance of the geo-information processes and products with the best performances of other countries in future activities.

  Alternatively, for some of the indicators, we also introduced a section to identify the **best practices leading the best performance**, studying the scope of various countries with well-known

[3] The Human Development Index (HDI) is a composite statistic of life expectancy, education, and income per capita indicators. Source . 2016 Social Progress Index.
[4] OECD research work

capacities. This activity will allow a more robust comparison of values for the different indicators, answering essentially the question: “Where does this country stand with regards to this indicator in comparison to the best-performing country?”. Nonetheless, this experience shows that it takes a lot of effort to gather and organise information to solve comparability problems. Comparability of a given sector is also a difficult issue. Even if two countries are providing the same type of geo-information services, different outcomes from the selected indicators may result depending on social and economic factors that the country has no control over. Thus, performance measurements alone are not sufficient to explain different levels of performance in each country. A test has been included in the Annex 3.

Based on the scope and relevance of the market for Earth observation services, global challenges, achieved growth rates, anticipated trends in the needs for geo-information, the existing knowledge and expectations in the supply of suitable satellite data, a **reference country selection** can be characterised as one of the most promising for the development of the EO sector. This selection should be made considering not only the market-based approaches outlined above, but also the national space-policy agenda as it is seen as "accelerator" that will increase the competitiveness of the sector-specific business. It can be difficult to identify one single nation to represent this benchmark as no single country is likely to demonstrate best practice for all dimensions of performance. So, if one country is chosen, it is important to focus on overall performance and not just on certain aspects, where there will always remain a broad scope and variance in national capabilities. More information on Benchmarking can be found in Annex 8.

2.2. Construction phase

2.2.1. Indicators

In this phase we have defined the indicators that will allow us to capture the EO maturity levels of a given country. This was accompanied by a detailed explanation of each indicator’s parameters and an overview of boundaries for their application. Through the measurement and monitoring of these indicators we should be able to document the state and health of the Geoinformation and Earth Observation sector of the target country first within and then beyond the GEO-CRADLE project. They will help to understand where the capabilities of the country are, and which way is the country going (projection and prospects). To support the definition of the indicators we are providing additional reasoning for the analysis that was undertaken. This provides assurance that the indicator is valid. We have grouped the indicators into strategic groups or strategic questions.

For each indicator, information has been gathered against a range of parameters. For some indicators, the parameters and the relationship to the indicator is clear. For others some explanation is needed to ensure a consistency of the analysis and that the indicators can be successfully compiled. The table below summarises the **major three pillars, Capacities, Co-operation and Uptake**, and indicators failing in each category.

Table 1: Indicators by strategic groups (capacities, collaboration, uptake)

Pillar	Group of indicators	Indicators
Capacities	Infrastructure	Space authority Own space-borne Access 3rd party mission Ground base facilities In-situ monitoring networks Modelling / computing facilities (G)EO data exploitation platforms
	Public EO R&D	No. public organisations Employment public sector Courses Publications
	Industry base	No. companies Employment private sector Resellers Clusters
Co-operation	Collaboration GEO	Participation in GEO Actions SDGs GEO office Data to GEOSS hub
	Impact Copernicus	Actions on Copernicus / projects
	International Cooperation	ESA Participation meteo agency UN ecosystem Spatial Infrastructure Standardisation
	EU Funds	R&D participation EU projects
Uptake	Networking	Networking / events Data portals
	Policy	Policy National budget investment
	Penetration	Use Capacity building

Where appropriate, the corresponding indicators will have different parameters (information resources/variables) which will describe the necessary elements required to assess the maturity (i.e. the actual state, the impact, response etc.).

To support the definition of the indicators we are providing additional reasoning (see *Error! Reference source not found.*) for the analysis that was undertaken for each of the country partners. This information has been sent to all partners to request inputs for each of the maturity indicators. This table helps to ensure that country partners would obtain the necessary information guaranteeing the basis for maturity analysis. The set of indicators acted as the major tool to get a compact, illustrated overview of country status in major issues related to the EO sector. Those are based on systematic descriptions of the national capabilities collected within GEO-CRADLE project.

The maturity indicators sections include both quantitative (involving numerical measurements) and qualitative measures which are described in the deployment section. A descriptive table has been sent to all country partners to gather the information. The table below presents for each indicator, its description, the information resources as parameters, constraints and the analysis. The table also includes a column as a reference for the Gap analysis (Task 3.1.) and Maturity indicators (Task 3.2.), where the task leader is requesting country partners what type of information is missing to complement the assessment of each

maturity indicator at country level (describe the situation in their country). It is also marked where the information is provided by Q=Questionnaire or R=Knowledge of local partners/desk research.

Table 2: Model of table sent to country partners as guideline for the Indicators

Ref.	Indicators	Description	Parameters	Constraints	Q/R	Gaps analysis (Task T3.1) Check-list for inventorying: additional inputs & questions to complement the information from survey	Maturity indicators (T.3.2.). Data required to assess each indicator at country level	Comments

Once the country contact submitted information related to maturity indicators, a preliminary **maturity card** was produced presenting an initial assessment of a country's performance against the various indicators. This first assessment was established by **indicator ranges** which related the country performance assigning score to each of the indicators. Specific guidelines and tables have been prepared to allow for the application of the methodology for each country.

The suggested boundaries on country performance (translated into maturity levels) assign scores to each indicator. The current proposal follows the scale score from 0-4 and after discussion with several stakeholders in the GEO community, the ranges were considered as appropriate and its applicability was evaluated by task leaders & project management.

The assessment of countries' maturity includes information provided in two rounds with country partners as during the course of the project more information became available, and we needed to re-evaluate the maturity scores and better define the guidelines.

We have identified some **benefits** in using a defined group of indicators and we have applied them to our case:

- providing quality feedback to drive direction of involvement in the EO sector per country
- supporting future decision-making and focusing attention on what matters most
- providing a common language for communication and helping understand performance
- providing a way to see if the investment in the EO sector is working
- Serving as risk triggers and early warning signs

Constraints need to be also quoted:

- Availability of data and literature for selected indicators
- The limited sample of interviews (budget constraint)
- Comparison of countries is challenging and has to be conducted across a limited set of dimensions.

The tables below provide the information distributed to partners for data collection.

2.2.1.1. Capacities

Focus on country and regional EO activities. What does the sector using EO in the area covered by GEO-CRADLE look like?

Table 3: Capacities Pillar

Ref.	Indicators	Description	Parameters	Constraints	Q / R	Gaps analysis (Task T3.1) Check-list for inventorying: additional inputs & Qs to complement	Maturity indicators (T.3.2.) Data required to assess each indicator at country level	Comments
1.1.	**National Infrastructure** This will capture the state of an Earth Observation Strategy by country. The goal here is to get a wide picture of the engagement in the area of Earth observations, the number and geographical distribution of EO service public and private organisations within the GEO-CRADLE region. Additional information will be provided by looking for the total number of employees for each country (public/private) and where possible classifying the companies by size (See Annex 1.2). It will also help to identify the national collaborative EO projects and if there are partnerships for implementing EO tasks and activities. It will answer questions such as where does the data discovery, access, and interoperability in the countries currently stand. This component focuses on supporting willing national and regional institutions to develop monitoring capacities through the use of Earth observation and modelling. Until recently, EO satellites used to be built and operated by governmental organisations. However, the launching of private sector owned commercial remote sensing satellites, which are capable of capturing high resolution imagery, not just started a new era but also encouraged some countries to have their own remote sensing satellites. Developing a space programme or the new generation of small satellites is also part of the scene.							
1.1.1.	**Space Agency or designated Space Authority**	Name of any organisation responsible for space policy in each country. This dimension will look at the key players involved in space activities at the			Q	Is there a national space policy or strategy, a space agency?		

		national level (policy organisation)						
1.1.2.	Own space-borne capacity	Get a wide picture if countries are operating their own space borne capacities (EO satellites, ground segments)	-N. of satellites operated by the country. -Type of mission	Lack of response at country level	Q / R	Requested additional inputs. For each sat capacities, it has been requested (i) title (ii) geographic coverage (region) (iii) catalogues (iv) web server (year collection of data (v) temporal resolution of data acquisition (vi) data availability policy (vii) data policy applied	Request to country representative space borne capacity operated by the country.	It will provide information on the space -borne infrastructure: number of organisations but most important the type of satellites and how those are operated up to date.
1.1.3.	Access to 3rd party missions (own ground stations)	Operating under contract to a satellite operator or other 3rd party.	-Total number of space missions	Lack of response at country level	Q	Requested additional inputs	Request to country representative and thematic experts in the country but also in the region if he knows who operates the ground station	
1.1.4.	Ground-based facilities	It will give information on the number of organisations operating the equipment necessary to control and to acquire data from EO satellites enabling the control of the	-Total number of Organisations with ground based/in-situ capacities	Lack of response at country level	Q	-Requested additional inputs & details such as: (i) Additional capacity in number of meteo stations, more details		-The questionnaire also provides information on (i) Meteorological Facilities (ii) Atmospheric Composition Facilities (iii) Hydrometric

		spacecraft, and distribution of payload data and telemetry among interested parties on the ground. EO satellite acquisition stations & antennas, mirror sites of GSs, Core GSs, etc.)	-Number of stations -Location & region			provided for water quality stations (ii) Besides owning or providing raw data, does the institute also process/model data, provide GIS/mapping services, is it an end-user? (iii) What type is it (meteorological/climatic, atmospheric composition/profiling, hydrometric/water quality, soil attributes/spectra, energy/radiation, other)? (iv) Is METADATA available?		Facilities (iv) Soil Attributes Facilities (v) Energy/ Radiation Facilities -Gaps analysis has requested also info on: Which are the measured attributes? - E.g. temperature, humidity, precipitation for meteorological/climatic - E.g. aerosols, clouds, atmospheric pollutants for atmospheric composition/profiling - E.g. water level discharge for hydrometric/water quality - E.g. soil size distribution for soil attributes/spectra - E.g. radiation for energy/radiation -Are these users willing to be data providers, therefore helping to fill gaps

								with in situ & satellite data records?
1.1.5.	in-situ monitoring networks	It will give information on the number of organisations operating in-situ networks (active or passive remote sensors, meteo/atmospheric/ water sensors, etc.)	-Total number of Organisations with in-situ capacities -Number of stations -Location & region	Lack of response at country level	Q	-Requested additional inputs & details such as: (i) Additional capacity in number of meteo stations, more details provided for water quality stations (ii) Besides owning or providing raw data, does the institute also process/model data, provide GIS/mapping services, is it an end-user? (iii) What type is it (meteorological/climatic, atmospheric composition/profiling, hydrometric/water quality, soil attributes/spectra, energy/radiation, other)? (iv) Is METADATA available?		-The questionnaire also provides information on (i) Meteorological Facilities (ii) Atmospheric Composition Facilities (iii) Hydrometric Facilities (iv) Soil Attributes Facilities (v) Energy/ Radiation Facilities -Gaps analysis has requested also info on: Which are the measured attributes? - E.g. temperature, humidity, precipitation for meteorological/climatic - E.g. aerosols, clouds, atmospheric pollutants for atmospheric composition/profiling - E.g. water level discharge for hydrometric/water

								quality - E.g. soil size distribution for soil attributes/spectra - E.g. radiation for energy/radiation -Are these users willing to be data providers, therefore helping to fill gaps with in situ & satellite data records?
1.1.6.	Modelling and computing capacities	Capacities for modelling and computing processing in GEO CRADLE are defined as: high-performance computer (HPC) facilities for their executions with multiprocessing systems and large external memory units.	-Total number of Organisations with modelling & processing capacities -Total number of models	Lack of response at country level	Q	-Does your organisation have sufficient available computing resources for the processing and exploitation of EO data and the models running (Server clusters, HPC clusters, Cloud infrastructure, Virtualization infrastructure, Processing power capacity – CPU, RAM, Storage Capacity)? -What is the source of EO data used in the model (geospatial	-If organisations do have the modelling and computing capacity then they are asked to provide a short description of what it is used for. -It is important to have an overview on the number of models (ie. models for atmospheric modelling, what	The questionnaire also provides information on (i) Total number of algorithms (ii) Models for meteo/climatic (iii) Models for atmospheric composition (iv) Models for hydrometric/water quality (v) Models for soil attributes (vi) Models for energy/radiation

						data, e.g. DTM; remote sensing data, e.g raw satellite high-level images; in-situ data, e.g. temperature, pressure, humidity; other)?	those are, what is the status and the research owner	-Interest to have thematic areas of interest per country
1.1.7.	EO data exploitation platforms (provision of VA services and products)	Coordinated monitoring networks, integrated analysis & modelling capacity	-Names of Organisations with data exploitation products -Type of organisation according to classification system	Lack of response at country level	Q	Requested for additional inputs		-GEO-CRADLE classification to be checked with EARSC classification and EARSC's own knowledge from industry survey (see Annex 1.1)
1.2	**Critical Mass of EO researchers** Identification of the different groups of researchers both in research institutions & universities/academia and how big these groups are.							
1.2.1.	Number of public organisations	It will show the number of public organisations in a given country and it will illustrate the geographical distribution of organisation	-Number and names of institutional, research/academic actors surveyed	-Limited number of responses in some countries -Accuracy will depend greatly on the number of answers	Q / R	-Besides owning or providing raw data, does the institute also process/model data, provide GIS/mapping services, is it an end-user? -What are the main thematic areas of activity of the	-The goal here is to get a wide picture of the number and geographical distribution of EO organisations per country. -Country partners should	-Additional Information on type of organisation by activity: (i) raw data producers surveyed (ii) value-adders surveyed (iii) GIS/mapping service providers surveyed (iv) End-users with in-house

				-Difficult to establish threshold groups or department sizes		organisation (climate change, food security, access to raw materials, energy, other)?	be able to provide the names of the organisations and what they do (the classification) -Note: it is assumed that these organisations do not go beyond in the value chain. So, any public organisation that represents more than end-users, will appear in section 1.1.	GIS surveyed and (v) End-users surveyed -Additional Information on the areas: (i) Actors active in climate change (ii) Actors active in food security (iii) Actors active in access to raw materials (iv) Actors active in energy
1.2.2.	Number of researchers (in Univ. & R&D labs)	Distribution of researchers by country. It might indicate the level of training and expertise deployed	-Estimated number of researchers employed or granted -Organisation location -Grouped according to doctorate,	-Gaps in the data (n. of groups offering EO education). This parameter will be difficult to fill since extrapolation in each country will be less accurate.	Q / R	Hard to find out the number of researchers in using any EO and geo-information data. It will depend of departments, considering staff in Earth observation: researchers, doctorates, graduates doing some training, etc... (% employees in EO and geo-information)	-Request to country representative more information on the number of departments & size of the research group (the number of people involved in it)	-How many researchers are employed in each country -Nice to have gender percentage (participation woman in the workforce)

			masters, degree?	-Grades could offer a dedicated subject in EO as satellite oceanography, EO for mining engineering, ecosystems.				-To be included at the score card - Try to understand consolidation of a research area – at the national & international level
1.2.3.	Courses being offered in universities, its diversity and maturity offered	N. Courses: Information about the quantity of courses and the investment in the future. It will give an idea on where the priorities of countries are in terms of education and the possible trend on the next generation of scientists. Diversity & Maturity: Most universities will also offer courses through a combination of lectures and specialized seminars. This indicator will understand where country priorities are.	-Number of courses offered -N. Years where courses have been first established -Type pf courses: Subject of Geo-information Science and *Earth Observation, C*ourses as for example: Remote Sensing, Photogrammetry, Digital processing, GIS or specific courses as	-Hard to accurately determine, both because of a lack of knowledge and general sensitivity around funding questions. It also shows difficult to measure the academic performance (e.g. number of high-impact papers published, # of PhDs, etc.) or to industry/economic performance of	R		-Request to country representative & desk research on the number of courses offered -Interview process needed -The country partner should provide a table including information on the courses related to EO / country. It will include the following parameters: (I) title (ii) type (master/post-	Maybe we could get an idea on how resources are being concentrated in academia? will be possible to do some correspondence with the large research institutes? - Consolidation: we might have some information on the investment in the future? -Specific courses are expected to provide a better basis for recognition on the research work

			monitoring climate from space, Observing Earth from Space, ...etc -Qualitative perspective	students after graduation -Difficult to identify quality and date when was the first year where the course has been in place -Difficult to score relevance & quality level of courses			graduate...) (iii) duration (iv) graduation requirements (v) start year (vi) estimate n. of students/course (vii) organisation partners (lecturing or sponsoring) (viii) academic performance (impact of the project)... -Request to country representative & desk research on the type of courses and for how long those have been offered the first time. Guidelines: the courses we are looking for are those ones in EO (SAR, Optical sensors), RS & image processing, GIS,	-To what extend does each country support the preparation of new generations of scientists and engineers in Earth Observation? It will quantify the total n. of students who have passed the courses -This information could provide some idea if there is any lack of infrastructure for Earth observation education and training -maybe it will raise some points on the quality of the courses offered. -A benchmarking could be done with other country taking space

							photogrammetry, etc	technology as measure -Diversity courses & how relevant are those courses. -Levels of evaluation: Results, transfer, learning, reactions
1.2.4.	Relevant Publications (in country only, not overseas containing word “satellite?”, "GIS", “earth observation, “geo information”,…	- It might provide information on the involvement with scientific community. i.e. publications (including papers, articles, books, magazines…) resulting from EU-funded projects and initiatives.	- N. of paper citations who have Impact factor (intensive reviewing procedures)	-Difficult to obtain and also check the relevance of papers that have been published in a large variety of magazines -Difficult to define relationship between research quality and group quantity.	R		Request to country representative & desk research about paper published in the last 5/3 years. Maybe reproduce a table with Title / Type (thesis research, article, scientific paper) / Publication (magazine, website, book) / N. citations / N. downloads	-Items to reflect: facilitation of communication (via papers) should form an important part of the research institutes which will show strengths of a research performing institution and the development of innovative research - Maybe interesting to have the number of citations of papers- the impact factor: Publishing in a journal (ie. Nature

								or Science has a high impact factor and is considered very prestigious for a marine biologist, however if paper is focussed on algorithm research or electronics and communications, maybe it is more relevant to publish in IEEE journals -If possible check “online page hits”? and track the number of visitors to the publications website from each research, academia, etc?. Generally, if too small and researchers have no one to bounce ideas off, they might have funding cuts while big groups normally bring fertile interactions and better-quality of

								work... but it is clear that not necessarily big groups do better research than small ones. We should need to look for existing indicators i.e. university rankings, number of publications). This section will help to identify the excellence of the research (performance & competitiveness)
1.3.	**Industry Base** The goal here is to get a wide picture of the number and geographical distribution of EO companies per country.							
1.3.1.	Number of companies	"It will capture the number of companies active in acquiring and supplying data from satellite or airborne platforms and /or their conversion into geo-information products suitable and accessible for their clients. If possible, it might give some view on the evolution in the last years and any	-Number of commercial actors surveyed -Companies location		Q / R	Requested additional inputs	-To relate with EARSC classification on type of activity (see Annex 1.1) Where the industry is operation: Are the country partners aware on the quality management? or standard processes within	- Information on their activity: (i) raw data producers surveyed (ii) value-adders surveyed (iii) GIS/mapping service providers surveyed -In future studies, this indicator will show an evolution of the industry by

		trends in the size distribution of companies					these companies? - Are the country partners aware on the quality management? or standard processes within these companies?	number of companies and any trends in the size of companies. -Maybe in future studies, should the subject in quality and standardisation be promoted?
1.3.2.	Scale of companies (large/medium/small/ micro)	Classification Small and medium-sized enterprises: -Micro: 0-9 employees < €2 million -Small: 10-49 employees (includes micro) < €10 million -Medium-sized: 50-249 employees < €50 million -Large: over 250 employees €50 million+	-Type of companies. -Split by size	Lack of information from companies responding the survey	Q / R		EARSC request to country representative & desk research. Maybe information could be under companies websites.	This indicator should follow the EARSC taxonomy to be comparable.
1.3.3.	Employment numbers, levels and changes	How many people are employed in each country	Total number of employees within the company	Lack of identification of companies and its existence	Q / R		EARSC request to country	-We could not be certain on the total number of

				through the years. Difficult to identify the total population			representative & desk research -estimated employees per company companies (company website)	companies by country. -It will be nice to know about the gender percentage
1.3.4.	Resellers or local representatives of European companies	Supplier relationship. How many partnerships exist in the sector and for how long they are existed.	-Number of partners or resellers -Country		Q / R		EARSC request to country representative & desk research on data providers resellers & partners	Will provide some idea of companies working as resellers in the region. -It could be extended to other companies
1.3.5.	Existence of Clusters	It provides a measure of the concentration and interconnection of business network, suppliers, and associated institutions in the geo-information field. Clusters are considered to increase the productivity with which companies can	-N. technology space, ICT clusters.				EARSC request to country representative & desk research on ICT clusters	-Clusters are considered to increase the productivity with which companies can compete, nationally and globally. It could be a measure of innovative performance and other related

		compete, nationally and globally. The clusters will operate within business groups providing to the value adding companies work by means crossover projects with the other type of businesses operating within said strategic sectors with the major goal to develop market-based 'next level of services.						output of a knowledge-based economy -Might help to understand innovation & competitiveness.

2.2.1.2. Cooperation

Cooperation is defined in relation to programmes that promote scientific collaboration at the international level (International Cooperation & policies). It will review how countries are evolving within international initiatives such as GEOSS and Copernicus. It will provide information on which countries have benefited by Copernicus or GEOSS and to what extent.

A coordinated EO-related effort is required to address global challenges, e.g. coordinated systems, interoperability, data policies, etc. Subsequently, international cooperation can provide a country with momentum and know-how to coordinate EO-related activities also at country level.

Table 4: Cooperation Pillar

Ref.	Indicators	Description	Parameters	Constraints	Q/R	Gaps Analysis (Task T3.1) Check-list for	Maturity of Indicators (T.3.2.)	Comments

						inventorying: additional inputs & Qs to complement	**Data required to assess each indicator at country level**	
2.1.	**Collaboration through GEO** GEO's mission is to connect the demand for sound and timely environmental information with the supply of data and information about the Earth. The indicators selected will get information on the country relations with international GEO Secretariat Geneva and if the country is preparing positions in GEO Plenary Meetings & Ministerial Summits. It will also provide an indication of the extent to which the country has established strong ties with other GEO countries. Ideally the Indicators under 2.1 should be coordinated with the GEO Secretariat as the GEO M&E Framework is implemented. It would be desirable that the indicators supporting GEO-CRADLE are measures that will be tracked by GEO so that consistent data are available.							
2.1.1.	Participation in GEO or in projects which are linked to GEOSS	Information if the country is maintaining close relations with international GEO Secretariat Geneva. What is the participation in GEO projects up to now? Do people from the specific country participate in GEO meetings and projects It will also reply to Qs as if the country preparing positions in GEO Plenary Meetings & Ministerial Summits. Has the country established	-Country member of GEO -Number of projects	Provide limited selection of projects	Q/R	-Has your organisation participated in GEO/GEOSS SBA tasks, community activities or initiatives? -Would the organisation be interested in contributing to a regional initiative of GEO (perhaps under specific conditions)?	Country partner could dig out on which is the organisation dealing with GEO in the country and the type of projects	We should aim to have the list of all projects in which a country organisation has participation linked to GEO. Measuring the extent of participation or evaluating the projects can help to measure the impact of past projects and advocate for future initiatives. It will give an indication of 1) the projects participation behaviour and the impact of participatory actions 2) articulation of goals for more than one stakeholders 3)

		strong ties with GEO countries?						identification of adaptive measurement techniques and evaluative process for the projects, what was the project life after the financial proposal
2.1.2.	Specific actions on Sustainable Development Goals (SDG´s)	Earth observations, geospatial information and big data support the implementation of the SDGs at national, regional and local levels, and the monitoring and reporting against the global indicator framework. This indicator will provide a view on the involvement of country organisations in the implementation of SDG´s (at various levels) [it could also include additional points for countries whose orgs have contributed to the	-Number of participation occurrences in specific actions		Q/R	Has your organisation participated in GEO/GEOSS SDG´s tasks, community activities or initiatives?		

		monitoring or reporting of SDG´s						
2.1.3.	Designated GEO office	The GEO office will help to identify all national activities for possible integration into GEO. Information if the country has such office or department which links with GEO	-N. organisations with direct or at least indirect relevance to GEO/GEOSS -GEO office in a country -GEO focal point organisation		R		EARSC request to country representative about a country point of contact for GEO aspects and the number and name of organisations related to GEO activities per country. -Are there any other participating organisations members of the GEO community from each country?	Provide an assessment from the results of the Q: Would the organisation be interested to provide feedback to the GEO CRADLE consortium for establishing a roadmap for GEO and Copernicus implementation in the region?
2.1.4.	Provision of data to GEOSS	Information on the level of a countries uptake of GEOSS data sharing principles and the links (of its geo-portals – registered datasets) to GEOSS or their contribution to shared data, metadata and products	-number of resources brokered through GEODAB or number of n. of resources that can be directly accessed via the GEOSS Portal -completeness of metadata for		Q		-Info on data sharing: Country partners will provide an overview on the open exchange of data, metadata and products shared within GEOSS	-Access to data and information by GEOSS users is an integral part of GEO -part of the Data Sharing Working Group (DSWG) -Reference to the term "Open Data"[5] provides context for the interpretation of the use conditions pertinent to data shared as part of GEOSS Data-CORE, as well as brings GEOSS Data Sharing

[5] "Open data" is not a measure of maturity. It is a useful information obtained gaps analysis and will be used accordingly.

			brokered resources					Principles in line with the relevant international, regional, national and organisational developments
2.2.	**Impact of Copernicus** There are 6 core services delivered under the Copernicus programme: Land Monitoring, Marine Environment Monitoring, Atmosphere Monitoring, Emergency Management, Security, Climate Change. This section will evaluate the type of engagement with Copernicus projects to improve the management of the environment, understand and mitigate the effects of climate change and ensure civil security per country. The service provision of Copernicus services has been delegated by the European Commission to a number "Entrusted Entities", which act as "service providers" • The Copernicus Land Monitoring Service is provided by the European Environment Agency (EEA) for the Pan-European and local components, and by the European Commission Joint Research Centre (JRC) for the global land component; • The Copernicus Atmosphere Monitoring Services (CAMS) and the Copernicus Climate Change Service (C3S) are provided by the European Centre for Medium-Range Weather Forecasts (ECMWF); • The Copernicus Marine Environment Monitoring Service (CMEMS) is provided by Mercator Océan (the French centre for analysis and forecasting of the global ocean); • The Copernicus Emergency Management Service (EMS) is provided by the European Commission Joint Research Centre (JRC); • The Copernicus Security Service is provided respectively by FRONTEX for Border Surveillance, by the European Maritime Safety Agency (EMSA) for Maritime Security and by the European Satellite Center (SatCen) for Support to External Action. Copernicus will bridge the gap between the commercial very high-resolution satellite programmes and the existing national government satellite programmes.							
2.2.1.	Organisations involved in projects linked to Copernicus (projects using data from Copernicus	It will provide information on to which extent organisations have been users of products from Copernicus and maybe the type of Copernicus services they use (info about the involvement in supply of the	-N. Organisations -N. Copernicus Services/ organisation -Number of actions with Entrusted entities	Country partners to provide information on the projects involvement under Copernicus. This country information could be	Q	-Has the organisation participated in Copernicus service provision, Copernicus user requirements or Copernicus research and	- Country partner to inform which is the organisation/ministry dealing with Copernicus in the country and projects related - Request to country representatives their activity with Entrusted entities	

		Copernicus services)		contrasted via CORDIS - Ref GEO-CRADLE: There is a limitation if it is only concern to the four key thematic areas (adaptation to climate change, food security, access to raw materials and energy). -Countries have not the same level of involvement in Copernicus.		innovation action? -Would the organisation be interested in contributing to a regional initiative of Copernicus (perhaps under specific conditions)?		
2.3.	**Participation to other international efforts** Level of international collaboration to ensure country access to essential global EO information. It will provide information on international coordination agreements recognized. It might help to understand if the country is dependent on international systems to meet domestic requirements? observations of territories, type of observations as weather, climate, oceans or across all domains - meteorological, mapping, security, research, etc.							
2.3.1	ESA	Participation as members or Cooperation partner	-Member		Q/R		Contrast with country partners the information obtained by desk research	
2.3.2.	Meteorological: WMO, EUMETSAT, etc	Participation in Meteorological Organisations such as World Meteorological	-Member		Q/R		Contrast with country partners the information obtained by desk research	How much project involvement coming from organisations in a given country.

		Organisation (WMO) and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)						
2.3.3.	UN system as UN-GGIM, ...	Participation at United Nations programmes: as Committee of Experts on Global Geospatial Information Management (UN-GGIM), Unesco (Global Ocean Observation system- GOOS), UN-OOSA regional centres...	-Member		Q/R		Request to country partner an idea of country participation	
2.3.4	INSPIRE	Implementation of INSPIRE	-Report from countries		R		Contrast with Country partner, its involvement	-Implementing the INSPIRE Directive, MS have to report annually a number of indicators for monitoring the implementation and use of their infrastructures for spatial information. The information provided includes a

								list of spatial data sets and services belonging to those infrastructures. - MS reports: Bulgaria, Croatia, Cyprus, Greece, Slovakia, Slovenia, Romania, Candidate: Serbia, Turkey, FYROM
2.3.5.	Other International Standardisation organisations, e.g. OGC...	Membership to i.e, Open Geospatial Consortium (OGC). It is an international industry consortium from companies, government agencies and universities participating in a consensus process to develop publicly available interface standards.	-Member		Q/R		Request to country partner an idea of country participation in other international organisations	
2.4.	**Availability of EU funding** Showcase the exploitation of European Commission's funding, mainly in research programmes through H2020 (Balkans, Turkey & Israel). EUROSTARS, EIB-projects, LIFE, IPA, ENI and ESA programmes also have some EO-related projects.							
2.4.1.	R&D participation or other EU programmes Country partner to search through	Sources of funds. It will provide a general indication on the areas of	-ESA, EC budget contributions to EO programme	Some organisations do not make a distinction between	Q		-We shall try to obtain figures for R&D funds for EO services from ESA, EC, and National Institutes	Find out Statistics: EC figures of participation in H2020 projects for Earth

	CORDIS for the finite number of Copernicus related projects by country"	funding programmes.	-Budget received from the Copernicus framework.	contracts and R&D sponsorship				Observation (REA, DG-RTD)

2.2.1.3. National Uptake & Awareness

With the interest to advance the coordination of EO within the countries, how can a country establish sources of reliable, relevant and accessible EO information and products for its decision-making processes? What are the activities promoting national uptake and awareness?

Table 5: National Uptake & Awareness Pillar

Ref.	Indicators	Description	Parameters	Constraints	Q/R	Gaps Analysis (Task T3.1) Check-list for inventorying: additional inputs & Qs to complement	Maturity of Indicators (T.3.2.) Data required to assess each indicator at country level	Comments
3.1.	**Networking initiatives** Events which examine and discuss the many different aspects and applications of the Earth Observation and geo-information field from the thematic or market point of view. They could also include dedicated workshops as Earth Observation missions or specialized events dealing with physical, chemical, biological systems via remote sensing technologies, earth surveying techniques... They will cover all activities including generic events for dissemination activities or thematic workshops							
3.1.1.	Networking initiatives (events and thematic workshops)	It will cover activities related to (i) Awareness: Create awareness of the benefits of making information and descriptions available (responsibility dispersed across different actors) (ii) Dissemination: Create opportunities for further project development (responsibility dispersed across different actors but	-N. Events / activities -Focus for the events -Sector related	Timeline for the activities Period under examination (last 5 years)	Q/R	Can the organisation name high-impact, EO - dedicated workshops organised in the country in the last five years?	-Country partner to provide more information on the related events/workshops and who organises them -Research on networking activities	Could provide insights on duplication of Earth observation capacity building efforts. Ongoing comprehensive training via thematic workshops related to using and developing new Earth observation products

		also linked to other projects) and (iii) networking activities: Increase the number of partners of the consortium resulting in a more wide-spread network (responsibility dispersed across different actors and necessity to coordinate with other levels: municipal, regional, national) Regular Workshops on specific topics related to EO? e.g. disasters, agriculture, GIS, ICT etc Some issues to consider: Regularity (annual, bi-annual) events organised at national/regional level. Focus of these events? – R&D, thematic, ICT…etc. Relevant to the sector						
3.1.2.	Data Portals	Portal to distribute Earth observation data from diverse EO Missions or samples and auxiliary data from a number of missions and instruments	-Portal		Q/R	Provide an assessment following the Q: Would the organisation like their profile presented on the	Research information on country portals to access to EO data	-The data and products available through data portals and other similar systems should reflect the needs of users, particularly the needs

						GEO CRADLE portal (final approval before publishing)?		for near-real time data that could be utilised by the various user groups -Links to Data portals as ESA, Third Party Missions (TPMs), Copernicus Space Component (CSC)...
3.2.	**National Policies Implementation** It will attempt to highlight the importance given to EO as part of the political agenda and the engagement with Ministries.							
3.2.1.	Policy	Country policies linked to the supply side of EO services. i.e. industry, space policy, R&D	-N. data policies -N. of Ministries using these policies		Q/R	-What is the level of coordination of EO activities in your country (none, scarce, basic, fully integrated)? -What is the level of interaction between the EO community and decision makers (none, scarce, basic, fully integrated)?	-Country partners will provide information on their country's level of utilisation of EO data for monitoring the status of the National/European policies. -Policies that might be using EO data (i.e. water quality, air quality, land monitoring). -Which are the ministries using the EO data.	Earth observation is used to monitor and assess the status of, and changes in, the natural and man-made environment. Example policies could include the monitoring of the state and evolution of our environment, be it land, sea or air, and the ability to rapidly assess situations during crises such as extreme weather events or during times of human conflict.

3.2.2.	Budget. National R&D investment (internal to the country)	Budgets linked to national EO policies but also relevant R&D investment: while the EU Research and Innovation programmes have been pivotal in building GEOSS, this question is focused on National research and development (R&D / RTD) activities in connection with governmental innovation. It should be situated at the front end of the innovation cycle. Innovation builds on R&D and also includes commercialization phases. Specially those ones related to EO systems will be relevant	-Budget information designated to national funds	No budget figures It would be ideal to separate the budget from policies and from external R&D.	Q/R	Is there funding for EO activities available in your country (infrastructure development, EO market development, R&D)?	-EARSC request to the country representative the total % R&D investment in earth observation. -what is the space budget and which percentage goes to earth observation? -If private companies were investing in satellites/ground stations etc) ask also for the percentage. -Country partners will also provide information on the budget linked to these possible policies: i.e. EC-CAP (Common Agricultural Policy). It could be presented as table: Funds source (National/ Regional), Type (Space programme / Educational & Outreach programme / Categories: -Cartographic agencies -Civil Protection agencies -Defence and Security actors	- How important it the investment in R&D in your country?

							-Cultural Heritage authorities- Environmental bodies -Forestry and resource management bodies - Meteorological bodies -Maritime authorities -Transport bodies -IT and communication organisations -Research Institutes	
3.3.	**Penetration & Capacity building** Penetration: It will provide information to Identify and coordinate possible execution of national activities at regional level. Beyond the weather, climate and disasters societal benefit areas, decision makers are quite unaware of EO and their potential use for sustainable development, particularly related to health and energy. How is this perception at country level? Capacity building: The fundamental goal of capacity building is to enhance the abilities of stakeholders to evaluate and address crucial questions related to policy choices and different options for development; Human, Institutional, Infrastructure capacity building on elements of relevance for Earth observation. Ideally, National Earth observation capacity building efforts should be coordinated.							
3.3.1.	Use of Geo-information	-Awareness of the capabilities of EO -Use of satellite imagery by government agencies -R&D Uptake activity	-Name of agencies and domains which they operate -Maturity of the use of satellite data and how the information is used	Difficult to get the exact definition on the type of data needed for these indicators	Q/R		Country partners should get information (i) if public organisations are generally aware of the capabilities of EO - Name of agencies (ii) level of the use (volume & regularity) & how they use the EO satellite data by Government agencies & departments to support vital operations (iii) uptake activities specially	-It will give information on (i) gaps between Earth observation research and operational applications (ii) lack of information exchange between providers and users of EO information (iii) lack of awareness about the value of Earth

			-Volume and regularity of use -Activation of international observation resources (i.e. EMS, charter)				by activation of programmes. -EARSC has done some preliminary research on the charter activation	observations among decision makers -The uptake activities could give some information on how to move from R&D to operational activities (from developing concepts into making them ready to be sold in the commercial market) -Educational outreach to decision makers reinforces the value of such a system as an environmental decision support tool
3.3.2.	Capacity building EO focused actions	Other EO actions on capacity building on the human, institutional or infrastructure level	-EO related projects	Open indicator	Q	Has the organisation participated in EO-related projects? How would you rate your organisation's level of collaboration with other EO actors in your country and abroad (none, 1-4 actors, 5-10 actors, >10 actors)?	We should like to better understand evolving information on capacity building activities from the Earth observation community	Info on access to capacity building resources. This point might seek to give lines for future coordination and build upon existing national efforts to increase the efficient use of EO resources

2.3. Deployment phase

The deployment phase is summarised in the steps below:

1) Indicators collection (1st iteration with country partners)
2) Preparation of country model maturity indicators spreadsheet (one per country)
3) Request for data missing & complementary information (2nd iteration with country partners)
4) Cross check inventory at GEO-CRADLE Networking Platform (D 2.2-2.4)
5) Integration of Gap Analysis information (D.3.1)
6) Elaboration of first assessment by level and presentation to country partners to get feedback (3rd iteration with country partners)
7) Request and contact experts in each country (min. 2 and max. 5 experts contacted per country from academia, research, industry & government)
8) Exchange with country experts on the maturity indicators. In some cases, a first assessment (maturity level) was delivered to open discussion and experts commented and provided views.
9) Interpretation of results and average score of the data obtained. media assessment
10) Elaboration of maturity cards per country

Figure 1: Methodology process steps

2.3.1. From data collection to maturity card

Collection of data

We have asked GEO-CRADLE partners to collect and provide the necessary, up-to-date information against each indicator for the three main groups (i) capacities (ii) cooperation and (iii) uptake, so the consortium continued a proactive approach to desk research initiated during the gap analysis phase (Deliverable (D.3.1.))[6]. The main categories used under the gap analysis (geographic, observational, structural, qualitative/quantitative and capacity) have been also included in one way or another in the groups and the corresponding indicators.

The information provided was under the responsibility of country partners. Contacting partners to validate certain responses was often necessary. Country partners adopted a variety of strategies to deliver results such as relying on existing networks, asking for referrals to other EO actors or organising workshops with key EO actors; however, Information holes still remained at the end of this phase due to failure of key EO actors to respond to the survey, and because of a lack of adequate capacity in a given country. Desk research filled in the information holes as best possible using the outcomes of the gap analysis deliverable. This was particularly done where some country capacities had to be validated.

[6] Deliverable D3.1 Gap Analysis

In addition, we asked country partners to provide us with the names of at least two recognised experts in the country outside the consortium to ensure an independent validation/enhancement of the information we have received from country leaders in GEO-CRADLE. Despite all the measures, it often remained difficult to sufficiently engage regional stakeholders to the extent that the required level of detail was collected.

We have discussed with the different appointed experts in the RoI, explaining the context of the project but especially clarifying the use of the "maturity indicators" as the innovative methodology for the assessment and monitoring of EO maturity at national level. We explained the approach to establish an analytical tool that allows quantitative measurement of the current EO capabilities of the country and their evolution over time. The experts appreciated the introduction and clarifications on the validation process which helped them to better produce their assessment.

Experts did not have extra time to spend on preparing their validation inputs, the current EO/GI expertise was sufficient to provide the required feedback on the discussion about the different maturity levels (L0 to L4) for indicators & sub-indicators corresponding to major pillars related to Capacities, Collaboration and Uptake/Awareness of the EO activities in their countries.

Basically, the discussions were centred around their institutional, academic, research or industry perspectives and experiences in the country, which we utilised to complete a cross check of the methodology and the specific assessment of the country maturity.

The contribution of the different experts (see table below) was very important to help ensure that maturity indicators for the Countries in the Region of Interest were validated and met the objective to gather a comprehensive and accurate (G)EO picture in the Region. A range between 2-4 experts were contacted per country.

Table 6: Experts validation

Experts validation per countries	Validation by Country Partner	Validation Industry Expert	Validation Member Govt	Validation by Academia	Validation by R&D
Albania (3)	✓	✓	✓		
Bulgaria (3)	✓	✓			✓
Cyprus (4)	✓		✓	✓	✓
Egypt (2)	✓			✓	
FYROM (3)	✓			✓	✓
Greece (5)	✓	✓		✓	✓
Israel (4)	✓	✓			✓
Romania (3)	✓	✓			
Serbia (3)	✓			✓	✓
Tunisia (4)	✓	✓	✓		✓
Turkey (4)	✓	✓			✓

Maturity Card

The **maturity card** characterises the Earth Observation capacity in the countries within the GEO-CRADLE area, providing concrete information on its EO activities. The cards illustrate the implementation of the maturity model assessment. By assessing the maturity of different aspects, it gives information on the country strengths and weaknesses and where improvements are needed.

Each card includes a concrete **set of indicators** that can translate information into a certain level of maturity. In other words, the maturity card allows an evaluation of country performance against the

indicators. For each indicator we created a mapping between the overall range of values (0 to 4) and a reasonable scale (sometimes quantitative others qualitative)[7]. This mapping dictated the final documented maturity level.

The **maturity level** provides a quasi-quantitative measure of how well a country is performing against a given indicator. The purpose of this maturity level is to provide a framework to semi-objectively classify each of the indicators and ensure a comparable usage of metrics (both across countries and over time). The aim is to translate the information collected against the various indicators into a value that falls within a certain range (e.g. 0 to 4), thus ensuring the ability to compare between countries. Some examples on how the assessment has been extracted below.

As an illustration, the table 7 presents the Space Authority indicator for the case of Serbia (Capacities pillar). The data collected during the deployment phase from left to right correspond to: [Indicators Reference | Indicator name | Iteration with country partners columns maturity indicator (i) (ii) and (iii) | Columns for iteration with experts | Iteration with experts | Information extracted from the gap analysis |first assigned level| FINAL assigned level| Description | Comments|. Combining the responses provided by country partners and experts, the insights from the gap analysis and the outputs of literature research, the Final column illustrates the Final assessment. For comparison, we have added the example of Tunisia. The reading for the space authority level is contrasted with table 9. Basically, this type of table collection reproduced all the methodology process steps introduced in the figure 1 about the process steps.

Table 7: Example of level indicator assessment (Serbia> Space authority)

Ref.	Indicator	Maturity Indicators (I)	Maturity Indicators (II)	Maturity Indicators (III)	Maturity Indicators (EXPERT I) (Lazar Lazic lazar@ff.bg.ac.rs)	Maturity Indicators (EXPERT II) Ana Vuković - pazisadana@gmail.com	Gap Analysis	Level	FINAL	Description	comments
1.1.1.	Space agency or designated Space Authority	none	none		level 0	level 0	Serbia does not have a space strategy or a space agency. Most respondents did not voice an opinion about the national coordination of EO activities (54%) and interaction with decision makers (50%)	Level 0	Level 0	no organisation, nor government ministry leading the space activity	EO in Serbia gravitates towards the public sector. In part, this is due to the fact that the public sector dominates the Serbian economy, particularly in industries where the application of EO brings clear benefits and the beneficiaries already have strong geospatial sectors. Furthermore, engagement of public institutions and research organisations with EO is growing, driven by financial and technical support from European actors. Ten commercial companies have been

[7] Initial: ad-hoc practices (guidance)
Basic: formally defined steps (early pilot)
Intermediate: managed result metrics (limited use)
Advanced: advanced process (deployed)
Optimised: fully consolidated activities in EO (integrated)

											identified that provide EO products, mainly to the public sector and to construction companies.

Table 8: Example of level indicator assessment (Tunisia> Space authority)

Ref.	Indicator	Maturity Indicators (I)	Maturity Indicators (II)	Maturity Indicators expert (I) (Karem Ben Khaled > karem@3g-consult.de)	Maturity Indicators expert (II) (CNCT@defense.tn) > Thouraya Sahli Chaned (Centre National de la cartographie et la Teledeteccon)	Porf Zohra Lilli Chabaane >	Gap Analysis	Level	FINAL	Description	Commetns
1.1.1.	Space agency or designated Space Authority	National Centre for mapping and Remote Sensing CNCT (National). The CNCT is under the auspices of the Defense Ministry. For the organisation chart see the link : http://www.cnct.defense.tn/index.php/fr/site-map/presentation	National commission of Space Extra atmospheric under the Ministry of Higher Education and Scientific research, the secretariat of the commission is under CNCT	level 3	level 2(no space agency io Tunisia)	level 2	Several projects and studies using satellite imagery as a source of information is conducted within the National Center for Cartography and Remote Sensing with national partners in the main themes : • coastal and marine environment ; • Development ; • Desertification ; • Natural Hazards ; • Agriculture.	Level 2	Level 2	one ministry leading and few ministries interconnected to the space activities in the country	

Once we have the information, it is now time to designate the value as per the information below

Table 9: Assigned level for space authority

CAPACITIES	level 0	level 1	level 2	level 3	level 4
National Infrastructure: It will understand the Earth Observation Strategy by country.					
Space agency / Authority	[no authority]	[1 ministry]	[1-various ministries]	[1 authority]	[1 operational authority/agency]

Another illustrative example is using the gathering data for the indicator on Data portals (uptake)

Table 10: Example of level indicator assessment (Turkey> data portal level 3)

Ref	Indicator	Maturity Indicators (I)	Maturity Indicators (II)	Maturity Indicators (III), consensed with expert (JEODIGITAL)	Maturity Indicators - Yucel Erbay <yucel@nik.com.tr>	Maturity Indicators - ozgur.acir@jade.org.tr	Gap Analysis	Level	FINAL	Description	Comments
3.1.2.	Data Portals	Especially the Turkish Research Community requests new satellites with more spatial resolution, more bands (speciality according to applications, for example red edge for vegetation). There is a need to develop strategies to increase the number of	level 3)	Especially the Turkish Research Community requests new satellite imagery data with higher spatial and spectral resolution depending on the application, i.e., red edge for vegetation. There is a need to develop strategies to increase the number of	level 2) Local data portalas are only open to either organisation staff or only for governmental staff not public or private sector in general	level 3		Level 2	Level 3	one country data portal established which implies a certain strategy to increase the number of users and types of	data sharing between organisations on the operational level is scarce, as most data collected and processed is

		users and types of applications in Earth Observation. GEZGİN Geoportal should be more developed by preparing online training videos with some case studies and by preparing up-to-date example web sites (e.g.: blog pages during disasters) and by enlarging the service to outside of Turkey. There should be also synergies with Copernicus Programme, GEO Activities and EURISY activities. The aim of GEZGİN Geoportal project is to enable the easy access to satellite images (RASAT Satellite Images and more satellites in the future) and receive new requests from stakeholders. To provide this end users must reach all archive data according to area of interest, must reach to up-to-date data, must reach data without fighting many procedures, must be able to request new image data for their needs. Website: http://www.gezgin.gov.tr -Usage statistics as of the end of November 2015: 1601 members 4230 RASAT images downloaded by members. 140,000 total visitors. - Usage statistics for November 2015 – March 2016: 7192 new members registered, and old memberships have been cancelled. 5330 RASAT images downloaded by members. 52,000 visitors.		users and types of applications in Earth Observation. GEZGİN Geoportal should be further developed by preparing online training videos with some case studies and by preparing up-to-date example web sites (e.g.: blog pages during disasters) and by enlarging the service to outside of Turkey. There should be also synergies with Copernicus Programme, GEO Activities and EURISY activities. The aim of GEZGİN Geoportal project is to enable the easy access to satellite images (RASAT Satellite Images and more satellites in the future) and receive new requests from stakeholders. To provide this end users must reach all archive data according to area of interest, must reach to up-to-date data, must reach data without fighting many procedures, must be able to request new image data for their needs. Website: http://www.gezgin.gov.tr -Usage statistics as of the end of November 2015: 1601 members 4230 RASAT images downloaded by members. 140,000 total visitors. - Usage statistics for November 2015 – March 2016: 7192 new members registered and old memberships have been cancelled. 5330 RASAT images downloaded by members. 52,000 visitors.						applications in Earth Observation	kept in-house.

Table 11: Example of level indicator assessment (Egypt> data portal> level 1)

Ref.	Indicator	Maturity Indicators (I)	Maturity Indicators (II)	Maturity Indicators (II)	Maturity Indicators (EXPERT I) (Mohamed.elraey@Alexu.edu.eg, melraey@gmail.com)	Maturity Indicators (EXPERT II) (saleh.mesbah@aast.edu)	Gap Analysis	Level	FINAL	Description	Comments
3.1.2.	Data Portals	no		We assessed as level 1 (plans to develop a focused EO data portal, the country need to develop a strategy to increase the number of users and types of applications in Earth Observation. i.e portals: land surveys, geospatial information, open data, air quality, meteo...etc) please confirm	level 1	level 1	Although there are global satellite systems that provide free and open access to data, the limitation of ICT infrastructures in the governmental sector possesses another marked barrier. These infrastructure limitations also limit the ability to exchange data between the institutions. In this context, a solution to overcome the problem of sharing the data is making a full or a partial exemption for EO access, especially for use by public sector actors and for research and education purposes. NARSS, as the leading EO data producer in the country, can provide ample data and other EO value-addition services to the public sector – particularly for pertinent national issues and/or situations. The organisation is also positioned to generate a strong link for research and education through universities and cooperation with other research institutions. This data could be provided	1	1	plans to develop a focused EO data portal, country need to develop a strategy to increase the number of users and types of applications in Earth Observation. i.e portals: land surveys, geospatial information, open data, air quality, meteo...etc	data sharing between organisations on the operational level is scarce, as most data collected and processed is kept in-house.

				and name few examples > There is a plan to develop national geospatial portal as SDI on national level.			most efficiently through a dedicated geoportal.				

Table 12: Assigned level for data portals

Uptake	level 0	level 1	level 2	level 3	level 4
Data Portals	[no data portals]	[plans data portals]	[one data portal]	[> one data portals in various thematics]	[> one data portals in various thematics and fully integrated]

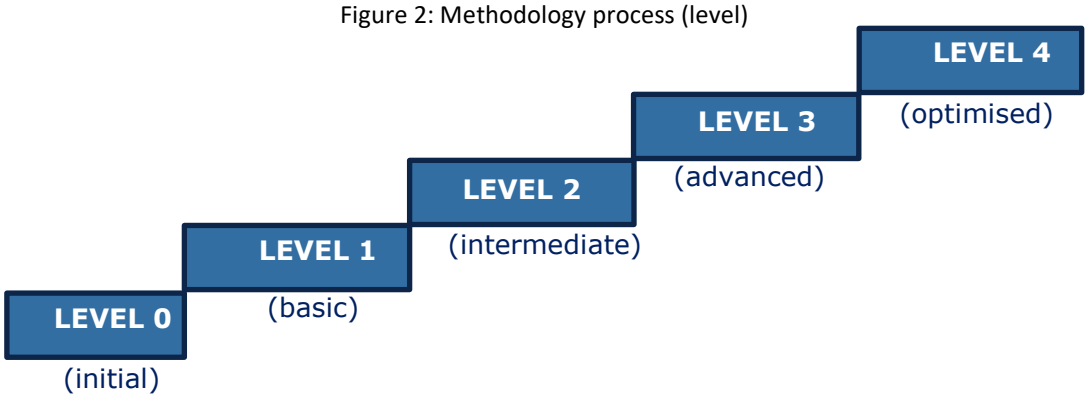
2.3.2. Assigning maturity levels

The tables below assign values from L0-L4 to the different indicators. The proposition for the generic maturity level is as follows:

- **L0 – Initial**: This value provides guidance to think about the country approach. The intention is to raise awareness and aid country partners in thinking about the status of the indicator and its performance (ad-hoc practices (guidance))
- **L1 - Basic**: The value describes country practices that are in early pilot use and are demonstrating some successful results (formally defined steps (early pilot))
- **L2 - Intermediate**: The value describes country practices that are in limited use in industry or government organisations for the EO sector (managed result metrics (limited use))
- **L3 - Advanced**: The value describes country practices that have been successfully deployed and are in widespread use. Experience reports and case studies are typically available to evaluate this level (advanced process (deployed))
- **L4 - Optimised**: The value describes practices that have been fully integrated and optimised by the country (fully consolidated activities in EO (integrated))

The description of the highest level of the index "optimised" seems perhaps overstated when considering the criteria used for the individual indicators. The criteria for the levels have been adjusted during the deliverable (II) to ensure that the values are applied consistently across the RoI.

Figure 2: Methodology process (level)



2.3.2.1. Capacities

Table 13: Maturity Level: Capacities

		level 0	level 1	level 2	level 3	level 4
1.1.	**National Infrastructure**					
1.1.1.	Space agency or designated Space Authority	Space Agency or designated Space Authority: This dimension will look at the key players involved in space activities at the national level. Idea of the hierarchy, organisation chart and where does relates with other institutions.	no organisation / authority, nor government ministry leading the space activity [no authority]	one ministry leading and coordinating with space activities [1 ministry]	one principal & various ministries leading and interconnected to all the space activities in the country [1-various ministries]	an official governmental space agency, an operative /active (G)EO space authority in charge of coordinating the space activities [including (G)EO activities in the country) and other stakeholder's relations which are equally active in the EO domain] [1 authority]
1.1.2.	Own space-borne capacity	Request to country representative information on space borne capacity operated by the country. (N. of satellites operated by the country and the type of mission)	no commitment towards space-borne capacity (generic) [no missions]	existing technical ability to possess this capacity but no actual activities [generic space-borne interest]	at least one satellite (EO satellite) operated by the country [1 EO mission]	more than one (EO) mission, future mission planning with improvement degree [2-5 missions]
1.1.3.	Access to 3rd party missions (with own ground stations, inc. meteo)	Request to country representative and thematic experts in the country but also in the region if he knows who operates the ground station (satellite operator or 3rd party mission / including meteo).	no access to other missions [no access missions]	access to one 3rd party mission (not owned nor operated by the country) (*) - country has ground stations for EO satellites. country has ground stations for EO satellites. example of party missions: ie. Deimos, QuickBird, GeoEye, Worlwide, Oceansat, WorldView, IKONOS, TerraSAR,	access to more than one 3rd party missions (2-5) with capability for downlinked data from various Remote Sensing Satellites with (at least one) medium, high and very high-resolution imagery. - n. of institutions operating the party mission [access 2 to 5 3rd party missions]	access to several (between 5- 10) missions for EO satellites with capability for downlinked data from various Remote Sensing Satellites with (all) medium, high and very high-resolution imagery (meteo, active or passive sensors) [access between 5-10 3rd party missions]

				PLEIADES, SPOT, RADARSAT, Proba, RAPIDEYE, Landsat, COSMO-SkyMed, ALOS, GRACE, GOSAT, Aqua/Terra, DMC, Image206, IRS, TROPFOREST,SEASAT, Kompsat, ODIN, OrvView, SCISAT (ACE), FORMOSAT, IPY Antartica. overview: https://earth.esa.int/web/guest/missions/3rd-party-missions/overview [access 1one 3rd party mission]		
1.1.4.	Ground-based facilities	Requested additional inputs on the number of organisations operating the equipment necessary to control and to acquire data from EO satellites (active or passive remote sensors, meteo /atmospheric/water sensors, etc.) (Total number of Organisations with ground based/in-situ capacities. Number of stations -Location & region)	no capacity for ground-based control elements of EO spacecraft system [no ground-based capacity]	limited experience with at least one ground station [1 station]	demonstrated capacity [2 to 5 ground stations]	demonstrated capacity of ground stations, mission control centers and ground networks [6-10 stations]

1.1.5.	In-situ monitoring networks	Requested additional inputs on the number of organisations operating the equipment necessary to control and to acquire data from in-situ (active or passive remote sensors, meteo /atmospheric/water sensors, etc.) (Total number of Organisations with ground based/in-situ capacities. Number of stations -Location & region)	no capacity for in-situ monitoring networks to determine the spatio-temporal distribution of certain parameters in thematic areas [no in-situ capacity]	provide some access to spatial reference data and demonstrated capacity to one of the following facilities (cover by GEO-CRADLE project): meteorological, water, atmospheric, hygrometry, soil, energy/radiation. [at least one in-situ network]	demonstrated capacities in more than one of the following facilities (cover by GEO-CRADLE project): meteorological, water, atmospheric, hygrometry, soil, energy/radiation. [between 5 to 10 in-situ networks]	besides owning or providing raw data also process/model data (it covers full value chain). It could have open access of the in-situ data. [between 10-20 in-situ networks]
1.1.6.	Modelling and computing capacities	If organisations do have the modelling and computing processing capacities (high-performance computer (HPC)) then they are asked to provide a short description of what it is used for. It is important to have an overview on the number of models (ie. models for atmospheric modelling, what those are, what is the status and the research owner (Total number of Organisations with modelling & processing capacities and Total number of models)	no modelling capacities (high-performance computer capacities to to efficiently turn massively large data into valuable information and meaningful knowledge (HPC) facilities) [no modelling capacities]	one institution with high-performance computer (HPC) facilities for their executions with multiprocessing systems and large external memory units. [one HPC]	multiple computing resources for the processing and exploitation of EO data for one or more institutions. [between 2 to 10 modelling capacities]	Models covering all thematics for GEO-CRADLE: for meteo/climatic, atmospheric composition, hydrometric/water quality, soil attributes and energy/radiation. Entities are responsible for the development and implementation of all numerical models for forecasting. [between 10-20 modelling capacities]

1.1.7.	(G) EO data exploitation platforms (provision of VA services and products)	Request about coordinating monitoring networks, integrated analysis & modelling capacity. -Names of organisations with data exploitation products (Type pf organisation according to classification system)	no involvement in exploitation platforms (collaborative, virtual work environment providing access to EO data and the tools, processors, information and communication technology resources). capacity to develop and offer virtual work environment providing access to EO data and the tools, processors. firstly, internally to the country and finally outside of it. [no exploitation platforms]	one organisation has the capacity to develop the collaborative virtual work environment (data, software, algorithms, etc) and offer VA products to others. [one exploitation platform]	more than one organisation (2-5) have the capacity to develop collaborative virtual work (data, software, algorithms, etc) and offer VA products to others (mainly in more than one capacity/area/thematic) [2-5 exploitation platforms]	5-10 organisations in the country have leading capacities to develop and offer collaborative virtual tools (data, software, algorithms…) VA products: data, processes, measurements...etc in few thematic areas. Small dissemination and promotion of the commercial exploitation results. [5-10 exploitation platforms]
1.2	**Critical Mass of EO researchers**					
1.2.1.	Number of public organisations	Country partners should be able to provide the names of the organisations and what they do (the classification - information of those institutions activity and areas). It is assumed that these organisations do not go beyond in the value chain. So	no public organisation involved in EO related activities [no (G) EO research/Univ. departments centers]	at least one public organisation providing any of these activities (i) raw data producers (ii) value-adders (iii) GIS/mapping service providers (iv) End-users with in-house GIS (v) End-users. [one (G)EO organisation]	at least the country has more than one organisation in government, PSB, institute, academia/university that besides owning or providing raw data, also process/model data, provide GIS/mapping services, etc. [between 2-10 (G)EO organisations]	apart from having different types of organisations, the country has organisations active in a wide range of thematic areas of activity (GEO-CRADLE is focus on: climate change, food security, access to raw materials, energy...etc) but could be much more. With ref. employment: usually the remote

		any public organisation that represents more than user they will appear in section 1.1.				sensing departments or laboratories dealing with EO activities are rather small, having around 10 employees as media. [between 11-25 (G)EO organisations]
1.2.2.	Number of researchers (in Univ. & R&D labs)	Request to country representative more information on the number of departments & size of the research group (the number of researchers) – How many researchers are employed	no significant number of researches in the EO domain [no significant (G)EO staff]	less than 5 groups of research communities in whole country. [less than 50 (G)EO employees]	between 5-10 groups of research communities which have between 1-5 staff / each. [between 50-250 (G)EO employees]	more than 10 groups of researchers which employ large group of staff. [between 250-500 (G)EO employees]
1.2.3.	Courses being offered in universities, its diversity and maturity offered	Request to country representative & desk research on the number of courses offered: Information about the quantity of courses and the investment in the future. The country partner should provide a table including information on the courses related to eo / country. It will include the following parameters: (i) title (ii) type (master/post-graduate...) (iii) duration (iv) graduation requirements (v) start year (vi) estimate n. of students/course (vii) organisation partners (lecturing or sponsoring) (viii) academic performance(impact of the project)...	no courses being offered in the EO domain. no diversity of courses offered in the EO domain. [no (G)EO courses]	range of courses being offered in the areas of remote sensing, photogrammetry, digital processing, GIS. some training focused on specifics of EO data management. note: ideal courses / GDP. [between 1-10 (G)EO courses offered]	wide range of courses being offered in the areas of remote sensing, photogrammetry, digital processing, GIS, but also specific courses as monitoring climate from space, Observing Earth from Space, ...etc. other examples: photogrammetry, digital processing, G.I.S., .. or specific courses as monitoring climate from space, observing Earth from Space, ...etc. note: courses / GDP (ideal by county's Gross Domestic Product) tbc. [between 10-50 (G)EO courses]	continuous courses being offered which will show some organisational training activity and investment plans at universities. continuous courses offered in the last years. Applications such as agriculture monitoring, crop water demands, surface water and flash floods... note: courses / GDP (ideal county's Gross Domestic Product) [between 50-100 specialized (G)EO courses]

1.2.4.	Relevant Publications	Request to country representative & desk research about paper published in the last 5/3 years. Maybe reproduce a table with Title / Type (thesis research, article, scientific paper) / Publication (magazine, website) / N. citations / N. downloads	no papers published. [no (G)EO publications]	between 1-25 papers published at department level and which will facilitate the communication in other scientific communities (from those at least 10 paper citations who have an impact factor in the last 5 years) (for example: indexed in Elsevier's Scopus and Compendia...publications in journals ranked in JRC among the top 30% of journals in the (G)EO field should be taken into account) [1-25 papers]	between 25-100 papers published that will provide some excellence of the research resulting from national projects related to EO funded by Government or other EU funding (from those at least 25 paper citations who have an impact factor in the last 5 years) (for example: indexed in Elsevier's Scopus and Compendia...publications in journals ranked in JRC among the top 30% of journals in the (G)EO field should be taken into account) [25-100 papers]	100-500 scientific papers (+ thesis research) produced by research organisations and universities on innovative topics (as the focus of Geo-cradle: adaptation to climate change, access to raw materials, water resource management, food security and access to energy. (from those at least 50 paper citations who have an impact factor in the last 5 years) .(for example: indexed in Elsevier's Scopus and Compendia...publications in journals ranked in JRC among the top 30% of journals in the (G)EO field should be taken into account). [100-500 papers]
1.3.	**Industry Base**					
1.3.1.	Number of companies	Request number the companies and the number of commercial actors surveyed and its location. It should be related with EARSC classification on type of activity: (i) Satellite operator: defined as the owner of a satellite system (ii) Data reception and distribution: owner or operator of a ground station (EO). (iii) Data reseller: satellite or other data from non-EU sources (iv) Value-adding services: company	no private companies in the EO domain [no companies on (G)EO]	between 1-5 companies in the country serving any category in the EO value chain (Definitions in Annex) [between 1-5 companies]	the country has between 6-25 companies serving at least 3 categories covering the EO value chain [between 6-25 companies]	the country has between 26-50 companies serving at least 3 categories covering the EO value chain [between 26-50 companies]

		using EO data to produce products (v) Downstream / GIS services: but with a satellite data element. (vi) Consultancy - studies / analyses not VA services. (vii) Hardware / software provision Where the industry is operation: Are the country partners aware on the quality management? or standard processes within these companies?				
1.3.2.	Scale of companies (large/medium/small/micro)	EARSC request to country representative & desk research on the type of companies and split by size. Maybe information could be under companies websites. Classification Small and medium-sized enterprises: (i) Micro: 0-9 employees < €2 million (ii) Small: 10-49 employees (includes micro) < €10 million (iii) Medium-sized: 50-249 employees < €50 million (iv) Large: over 250 employees €50 million+	[no comparable]	the country has micro companies (Classification in Annex 1.2) [micro]	the country has micro and small companies [small]	the country has micro, small and medium companies [SMEs]

1.3.3.	Employment numbers, levels and changes	EARSC request to country representative & desk research (estimated employees per company companies (company website)	private sector employment up to 10 employees [up to 10 employees]	Private workforce between 10-50 employees. Note: usually the EO companies are the small size ones. They have around 2-10 employees/company [10-50 employees]	Private task force between 51-150 employees [51-150 employees]	Private task force between 151-300 employees [151-300 employees]
1.3.4.	Resellers or local representatives of European companies	EARSC request to country representative & desk research on the number of data providers resellers & partners	no reseller activity, nor companies that are members of international specialized groups. [no resellers]	one company who is resellers (for software or data reseller) in the region. Examples of missions whose data are resold are listed Annex [1 reseller]	2-5 companies who are working as resellers in the region [2-5 resellers]	5-10 companies who are working as resellers in the region [6-10 resellers]
1.3.5.	Existence of Clusters	EARSC request to country representative & desk research on ITC clusters	no concentration of business activities around geo-information [no clusters]	at least one ICT cluster which could promote innovation and technological development [1 cluster]	between 2-5 professional cluster organisations involved in technological transfer and innovation [2-5 clusters]	Between 6-10 cluster in more than one thematic. one cluster with silver impact [6-10 clusters]

2.3.2.2. Cooperation

Table 14: Maturity Level: Cooperation

		level 0	level 1	level 2	level 3	level 4
2.1.	**Collaboration through GEO**					

2.1.1.	Participation in GEO or to projects/initiatives which are linked to GEOSS	Country partner could dig out on which is the organisation dealing with GEO in the country and the type of GEOS projects	no participation in GEO [no participation GEO]	participation at least in one GEO project from the Regional & Global initiatives (*) [participation 1 project]	participation in GEO and participation to more than one projects which are linked to GEOSS or contribution to EO for decision making through societal benefits areas (**) [participation >2 project initiatives]	designated representative in GEO actions and active contribution to GEO networks [designated representative active in GEO plenaries]
2.1.2.	Specific actions on Sustainable Development Goals (SDG´s)	Request to country partners if they have participated in GEO specific actions such SDGs (also SBA tasks), community activities or initiatives	no actions related to helping with the monitoring/reporting of SDG´s [no SDGs actions]	action at least in one SDG´s [1 SDGs action]	more than one action in SDG´s [2-5 SDGs actions]	active contribution to different actions in SDG´s [5-10 SDGs actions]
2.1.3.	Designated GEO office	EARSC request to country representative about a country point of contact for GEO aspects and the number and name of organisations related to GEO activities per country. Are there any other participating organisations members of the GEO community from each country?	no designated office [no office]	plans for office / staff coordinating GEO activities in the country [plans for office]	one organisation which is taking care of GEO activities (apart form their own activities) [1 organisation supervising GEO activities]	Truly dedicated office. one organisation which already nominated own dedicated staff to take care of GEO activities [Truly dedicated office no staff]

2.1.4.	Provision of data to GEOSS	Info on data sharing: Country partners will provide an overview on the open exchange of data, metadata and products shared within GEOSS (data linked to GEOSS portal)	no data transferred to GEOSS. (no resources brokered directly through the GEODAB (accessed via the GEOSS Portal)) [no data to GEOSS]	plans for provision of data to GEOSS. some planning of data sharing at country level (plans for sharing metadata brokered directly through the GEODAB) [plans for data to GEOSS]	provision of one to five metadata types brokered directly through GEODAB (accessed via the GEOSS Portal) [1-5 datasets to GEOSS]	provision of 5 to 15 metadata types brokered directly through GEODAB (accessed via the GEOSS Portal) [6-15 datasets to GEOSS]
2.2.	**Impact of Copernicus**					
2.2.1.	Organisations involved in projects linked to Copernicus	Country partner to inform which is the organisation/ministry dealing with Copernicus in the country and projects related with EC and Entrusted entities. Request information on the type of organisations which have been users of products from Copernicus and maybe the type of Copernicus services they use.	no projects using data from Copernicus (no organisations involved) [no projects using Copernicus services]	1-5 projects using data from Copernicus services (organisations involved) [1-5 projects using Copernicus services]	6-25 projects (organisations) related to Copernicus programme. (*) Copernicus services: Atmosphere, Marine, Land, Climate Change, Emergency, Security [6-25 projects using Copernicus services]	25-50 projects related to Copernicus services. [25-50 projects using Copernicus services]
2.3.	**Participation to other international efforts**					
2.3.1	ESA	Contrast with country partners the information obtained by desk research on participation as	no cooperation agreements with ESA [no cooperation agreements with ESA]	plans to establish a cooperation agreement with ESA [plans cooperation	participation of public organisations and industry under the ESA programmes	ESA European Cooperating State Agreement (cooperation agreement), strengthening its relations with ESA [ESA European Cooperating State Agreement]

		member or cooperation partner		agreements with ESA]	[participation under some ESA activities]	
2.3.2.	Meteorological: WMO, EUMETSAT, ...	Contrast with country partners the information obtained by desk research on EUMETSAT participation	no cooperation agreements with meteo organisations [no cooperation meteo]	participate at the National meteorological administration [participation national Meteo]	participation to international organisations through the National agency [participation National Meteo & sporadic Int. cooperation]	continuous participation to international organisations through the National agency [participation National Meteo & Int. Cooperation & one international membership: i.e: EUMETSAT]
2.3.3.	UN system as UN-GGIM, ...	Request to country partner an idea of country participation to UN programmes or relations with UN institutions	no membership of UN bodies related to Space activities nor participation in UN activities [(G)EO activities in UNITAR, UNOSAT, UN-OOSA, UN-SPIDER, UNEP, ...)] [no participation UN bodies]	participation in UN [(G)EO activities (events w/g´s) in UNITAR, UNOSAT, UN-OOSA, UN-SPIDER, UNEP, ...)] [at least 1 active participation in UN agency/organisation]	participation (between 2-5 activities) or plans for links to reference UN sites to focus international efforts, facilitate traceability and enable the establishment of measurement 'best practices' and active participation at one of the UN offices (UNITAR, UNOSAT, UN-OOSA, UN-SPIDER, UNEP, ...) [participation in 2-5 UN agencies/organisations]	active participation in more than 6 of the UN offices (UNITAR, UNOSAT, UN-OOSA, UN-SPIDER, UNEP, ...) [participation in >6 UN agencies/organisations]

2.3.4	Establishing an Infrastructure for Spatial Information [ie. European Community (INSPIRE)]	Contrast with Country partner, its involvement with Infrastructure for Spatial Information [for example the INSPIRE directive (monitoring or n. of reports about the implementation and use of their infrastructures for spatial information)]	Infrastructure for Spatial Information directive not established [no directive for Spatial Information]	Plans to establish the Directive (i.e: sporadic participation at INSPIRE directive events) [plans to establish a directive for Spatial Information]	One requirement of the Infrastructure for Spatial Information Directive. [example the INSPIRE Directive (*) The Directive requires Member States: (1) set up coordination structures and adopt and implement legal measures to remove procedural obstacles to the sharing of spatial data; (2)identify their spatial data relevant to environmental policies and those actions with an environment impact; (3)document the spatial data so that they can be accessed on the internet together with other information; (4)implement online services allowing the discovery, visualisation and download of spatial data; (5) gradually organise and publish the spatial data in common data models.] [one requirement for a directive for Spatial Information]	At least 3 of the Infrastructure for Spatial Information Requirements. [2-3 requirements for a directive for Spatial Information]

2.3.5.	Participation in Standardisation organisations i.e. as OGC...	Request to country partner an idea of country participation in other international organisations dealing with interoperability, standards, etc such as OGC	not following programmes on standardisation processes: compatibility, interoperability, safety, repeatability [no engagement with Standardisation discussions]	one public or private organisation participating in one of other international organisations dealing with standardisation, interoperability…etc [one organisation engage with Standardisation discussions]	more than one organisation in the country which has fully implemented and developed technical standards for EO [2-5 organisations engage with Standardisation discussions]	between 6-10 public or private organisations participating in one of international organisations dealing with standardisation, interoperability…etc [6-10 organisations engage with Standardisation discussions]
2.4.	**Availability of EU funding**					
2.4.1.	R&D participation or other EU programmes	We shall try to obtain figures for R&D funds for EO services from ESA, EC, and National Institutes	no R&D participation [no EU R&D participation]	participation at least one line of research projects where EO could be used [one EU R&D participation]	participation in EU funded projects in the region [2-10 EU R&D sustained participation/sustained]	participation in (10-20) projects in the region sustained in the last 5 years [11-20 EU R&D participation/sustained 5 years]

2.3.2.3. National Uptake & Awareness

Table 15: Maturity Level: National Uptake & Awareness

		level 0	**level 1**	**level 2**	**level 3**	**level 4**
3.1.	**Networking initiatives**					
3.1.1.	Networking initiatives (events and thematic workshops)	Country partner to provide more information on the related events, their focus, sector related and who organises them.	no networking events in EO activities [no networking]	1-5 planned networking events in EO activities [1-5 networking activities/year]	between 6 -15 networking events per year in EO activities, , for example Aerosols, integrated activities, water forecast, research infrastructures, etc… [6-	between 15-25 networking events in EO activities. focus on dissemination to stakeholders. activities which helped on the dissemination [> 25 sustained networking activities/year]

					15 networking activities/year]	
3.1.2.	Data Portals	Research information on country portals to access to eo data (ie: ESA, Third Party Missions (TPMs), Copernicus Space Component (CSC)…)	no involvement in data portals [no data portals]	plans to develop a focused EO data portal, country need to develop a strategy to increase the number of users and types of applications in Earth Observation. i.e portals: land surveys, geopatial information, open data, air quality, meteo...etc [plans data portals]	one country data portal established which implies a certain strategy to increase the number of users and types of applications in Earth Observation [one data portal]	more than one data portal in other thematics as described in level 2& 3 [> one data portals in various thematics]
3.2.	**National Policies Implementation**					
3.2.1.	Policy	Country partners will provide information on which are the countries using EO data for monitoring the status of the National/European policies (i.e. water quality, air quality, land monitoring). Information on which are the ministers using the EO data will be also requested	no national policies implementation [no national policy on (G)EO aspects]	at least one governmental authorities or ministries are using EO data for the monitoring status of the National/European policies. [one national authority/minister engage with on (G)EO aspects]	coordination of the space activities and collaboration in international space programs by at least one organisation. i.e: some monitoring of the air, land and water combining eo and in situ data. [2-5 national authority/minister engage with on (G)EO aspects & collaboration at international level]	list of > 5 Ministries that are actively using EO data (i.e: Ministry of Ministry of Environment, Water and Forests, Agriculture and Rural Development, Energy, Regional Development and Public Administration, Education and Scientific Research...etc) [> 5 national authorities/ministers engage with on (G)EO aspects & collaboration at international level]
3.2.2.	Budget & investment (internal to the country)	National R&D investment (internal to the country). EARSC request to the country representative the total % R&D investment in earth observation. what is	no budget planned for national policies implementation. Ideally evaluate against the % of GDP [no budget line	at least one line of research projects funds in the domains of Earth sciences (any) or funding for applications where EO could be used. Ideally evaluate the % of GDP.	a dedicated budget line or programme for (G)EO, EO / geo-information research projects funds funded by government. Ideally evaluate the % of	EO research projects funded but more than one line (2-5 lines) of budget funded by government but also regional funds. Ministry implementing the EO research programme.

		the space budget and which percentage goes to earth observation?. If private companies were investing in satellites/ground stations etc) ask also for the percentage. Country partners will provide information on the budget linked to these possible policies: i.e. EC-CAP (Common Agricultural Policy). It could be presented as table: (I) Funds source (National/ Regional) (ii) Type (Space programme / Educational & Outreach programme (iii) Categories: a) Cartographic agencies b) Civil Protection agencies c) Defence and Security actors d) Cultural Heritage authorities e) Environmental bodies f) Forestry and resource management bodies g) Meteorological bodies h) Maritime authorities I) Transport bodies j) IT and communication organisations k) Research Institutes	designated to (G)EO activities]	[one budget line designated in other domains where (G) EO is used]	GDP. [one dedicated budget line designated to (G)EO activities]	Ideally evaluate the % of GDP. [2-5 budget lines designated to (G)EO activities]
3.3.	**Penetration**					

3.3.1.	Use of Geo-information	Country partners should get information on the Awareness of the capabilities of EO and the Use of satellite imagery by government agencies (i) if public organisations are generally aware of the capabilities of EO - Name of agencies (ii) level of the use (volume & regularity) & how they use the EO satellite data by Government agencies & departments to support vital operations (iii) uptake activities specially by activation of programmes. EARSC has done some preliminary research on the charter activation.	no use of geo-information within country policies [no use (G)EO /penetration]	sporadic activities and pilot projects where EO could be integrated in country policies [sporadic activities in (G)EO / low penetration]	at least one national activity where EO has been integrated in country policies (eo uptake in a defined thematic area of interest) [one dedicated activity in (G)EO / medium penetration]	regular national activities in various thematic areas where EO has been integrated in country policies [2-5 dedicated activities in (G)EO / advance penetration]
3.3.2.	Capacity building EO focused actions	We should like to better understand evolving information on capacity building activities from the Earth observation community. Initiatives for Capacity Building: Human, Institutional, Infrastructure capacity building on elements of relevance for Earth observation.	no current EO actions [no capacity building actions]	some national program for capacity development in EO and geoinformatics [one capacity building action]	capacity building funded projects/actions in the region [2-5 capacity building actions]	capacity building funded projects/actions in the region [6-10 capacity building actions]

2.3.3. Example of collection of data

As indicated in the gap analysis (D3.1), certain elements of EO capacity are more easily measurable, e.g. geographic coverage whilst others such as the strength and coherence of the network of data stream are not. Measuring all these elements and their relationships requires a detailed network analysis befitting of a case-study and was considered beyond the scope of GEO-CRADLE, therefore the collection of data is based in key indicators.

As indicated earlier in the document, through several iterations with country partners & experts, we have collected the data for each indicator in single spreadsheets per country as shown in the tables below.

Table 16: Example collection of data for Greece

		Maturity Indicators (I)	Maturity Indicators (II)	Maturity Indicators expert (i) (xtsili@admin.grnet.gr)	Maturity Indicators expert (ii) (Evangelos Kosmidis <kosmidis@draxis.gr>)	Maturity Indicators expert (ii) (g.kalousi@teraspatium.gr)	Maturity Indicators expert (iv) (Un. Patras)	Gap Analysis	Level	FINAL	Description	
CAPACITIES												All in all the ranged version seems much more realistic than the rounded one.
1.1.	National Infrastructure				the infrastructure level is rather lower. Typically the infrastructure may be there			active in EO, with a high level of human capital, advanced space-borne				
1.1.1.	Space agency or designated Space Authority	Space Committee under the supervision of Technology and Research General Directorate	*Hellenic Space Organisation under the Ministry of Digital Policy, Telecommunications and Media * H2020 Space Committee under the supervision of Technology and Research General Directorate under the Ministry of Education, Research and Religions	Recently, in Spring 2018 the Hellenic Space Organization was incorporated. However in preceeding years before the HSO, Secretariat Genral of Research and Technology was the public Authority in charge of Space activities along with the ministry of	level 2) agree in principal but in practice this organization is not currently working and is not going to do so in the next 1-2 years due to the political situation.	3	level 2 > The governmemtn space agency has just been established, no real work on space has began		3	3	a governmental space agency is in charge of coordinating the space activities in the country and other stakeholder's relations which are equally active in the EO domain	
1.1.2.	Own space-borne	None	None	2) Hellas Sat is a premium	level 0)	0	level 2 > HellasSat 3 /	In Greece, the survey reached four	0	1	no commitment towards space-	
1.1.3.	Access to 3rd party missions (own	3 Organisations in total with a range of missions: 1. NOA, Athens:	4 Organisations in total with a range of missions:		level 3)	3	level 3		3	3	access to several (between 2- 10) ground stations for EO satellites	
1.1.4.	Ground-based	13 Organisations in total with	13 Organisations in total with significant		the semantics. It looks OK	4	level 4	Ground segment of ESA	4	4	demonstrated capacity with	
1.1.5.	In-situ monitoring				level 3) I can say it is closer to level4. But 3 is a good	3	level 3	The survey reached 19	3	3	besides owning or providing raw	
1.1.6.	Modelling and computing capacities	13 Organisations with Modelling and Computing Processing Capacities with at least 14 models in all the following categories: Meteorological/Climatic, Atmospheric, Composition/Profiling, Hydrometric/Water Quality , Soil attributes/Spectra, Energy/Radiation . Please refer to 1.1.4 sheet.	17 Organisations with Modelling and Computing Processing Capacities with at least 11 models in all the following categories: Meteorological/Climatic Atmospheric Composition/Profiling Hydrometric/Water Quality Soil attributes/Spectra Energy/Radiation Please refer to 1.1.4 sheet.	NOA, NTUA remote sensing laboratory, Harokopion Univeristy, Astronomy Insitutes in various universities (Crete, Ioannina, Athens, Thrace Polytechnic School, university of Peloponnese, University of Patras) all have teams working in the Space Domain, having access to GRNETs HPC facilities in principle: The Greek Research and Technology Network provides high performance	level 3) It looks OK. There is a tendency (infrastructure wise) to move to level4	3	level 4	The survey reached 13 organizations in Greece with modelling and processing capacities, most of which are research oriented. 62% of organizations with modelling capacities that responded to the survey have taken part in EO related projects. 31% of organizations participated in Copernicus service provision, Copernicus	3	3	Models covering all thematics for Geocradle: for meteo/climatic, atmospheric composition, hydrometric/water quality, soil attributes and energy/radiation. Entities are responsible for the development and implementation of all numerical models for forecasting. (between 10-20 modelling capacities)	
1.1.7.	(G) EO data exploitation platforms (provision of VA	20 Organisations with EO data exploitation platforms (provision of VA services and products): 5 Institutional, 5 Research &	24 Organisations with EO data exploitation platforms (provision of VA services and products): 5 Institutional	GRNET is deeply involved into e-science and virtual laboratories field, serving Greek Universities and	level 4) true in principle but as in 1.1.1 the organization is bad and the imminent results are not well described or	4	level 4	In Greece, the survey reached 10 organizations with data exploitation capacities.	4	4	more than five organizations have a fully-fledged portfolio of EO data exploitation platforms capacities (EO data, tools,	

Table 17: Example collection of data for FYROM

		Maturity Indicators (I)	Maturity Indicators (II)	maturity indicators (expert SS. Cyril & Methodius University)	marija.vukelic.sutoska@gmail.com > Ss. Cyril and Methodius University in Skopje	Gap Analysis	Level	FINAL	Description	
CAPACITIES										
1.1.	National Infrastructure					margins of research and operational activities. The sector is predominantly based on state owned/operated in-situ				
1.1.1.	Space agency or designated Space Authority		no	no	level 0	There is no National Space Agency or any relevant activity/strategic documents drafted. FYROM does not have a space strategy or a space program	0	0	no organization, nor government ministry leading the space activity	
1.1.2.	Own space-borne capacity	FYROM has no space-borne capacities.	no	no	level 0	Space-borne capacities in the country are limited to an	0	0	no commitment towards space-borne capacity	
1.1.3.	Access to 3rd party missions (own ground stations)	1	Satelite receiver DAWBEE supplied by Eumetstat. Owner is National Hydrometeorological Service of	Satellite receiver DAWBEE supplied by Eumetstat. Owner is National Hydrometeorological	level 0		0	1	access one meteo missions	
1.1.4.	Ground-based facilities	6	The number provided is for in-situ	The number provided is for in-situ	level 1		1	1	no capacity for ground-based onctrol	ground base but
1.1.5.	In-situ monitoring networks		The ground-based networks: // 1. National Hydrometeorological	The in-situ networks: 1. National Hydrometeorological	level 2	Five organizations with in-situ networks were reached. Four are	2	2	demonstrated capacities in more than one of the following facilities (cover by	
1.1.6.	Modelling and computing capacities	7 to 9	If this should be related to High Performance Computing (super computers) we have note. All modelers use normal computers.	If this should be related to High Performance Computing (super computers) we have note. All modelers use normal computers.	level 2	Of the seven organizations reached by this survey, three were identified as institutional, two as commercial, and two as research based. Two organizations specified that they have not participated in previous EO-related projects while four have not. Modelling capacities exist in various institutions in the country and various models are in use. Higher-education and research institutions host most of the country's modelling capacities and most of its models. However, this modelling is just for scientific purposes and not in operational use. Operational	2	2	[between 5 to 10 modelling capacities]	All organizations have EO capacities besides modelling and processing capacities. Sources of EO data are varied, including geospatial data, remote sensing data and in-situ data. Other data sources include high resolution aerial photos and satellite images from LANDSAT.
1.1.7.	EO data exploitation platforms (provision of VA services and products)	6 in total but 2 related to EO	Macedonian Forest Fire Monitoring Network use satellite data, combined with in-situ monitoring in order to derive forest fire risk indicators and maps	Macedonian Forest Fire Monitoring Network use satellite data, combined with in-situ monitoring in order to derive forest fire risk indicators and maps	level 2	Of the five organizations active in data exploitation reached, two are research-based and two are commercial. Two organizations have not taken part in EO-related	2	2		
1.2	Critical Mass of EO									
1.2.1.	Number of public organizations	8	University of Ss Cyril and Methodius in Skopje University Goce Delchev in Stip Real Estate Cadastre Agency	University of Ss Cyril and Methodius in Skopje University Goce Delchev in Stip Real Estate Cadastre Agency	level 2		2	2	at least the country has more than one organization in government, PSB, institute, academia/university that besides owning or providing raw data, also process/model data, provide GIS/mapping services, etc. (between 2-10 organizations)	

Out of the data collection per country we have translated the levels into numerical values as shown in the FINAL column in yellow. The tables below include the level assessment obtained in the collection of data and the different steps to get the average per indicator set and pillar. The level A, B and C corresponds to three different steps to obtain the media of the set of indicators. See annex (maturity level short version)

Greece: Most of the indicators in Greece have advanced and optimised values which reflects a remarkable maturity on Greece in the RoI.

FYROM: Most of the indicators in FYROM have basic values which reflects an essential maturity.

Table 18: Assessment from Greece

		Level	Level A	AA	AAA (ranged)	AAAA (rounded)	AA	AAA	AAAA	AA (ranged)	AA (rounded)	AAA (ranged)	AAA (rounded)	AAAA (ranged)	AAAA (rounded)	Level B	BB	BBB (ranged)	BBB (rounded)	Level C	CC	CCC (ranged)	CCC (ranged)
																				112	3,5	3	4
CAPACITIES																48	3,2	3	3				
1.1.	**National Infrastructure**	3	21	3	3	3	3,25	3	3,33333	3	3	3	3	3	3								
1.1.1.	Space agency or designated Space Authority	3																					
1.1.2.	Own space-borne capacity	1																					
1.1.3.	Access to 3rd party missions (own ground stations)	3																					
1.1.4.	Ground-based facilities	4																					
1.1.5.	In-situ monitoring networks	3																					
1.1.6.	Modelling and computing capacities	3																					
1.1.7.	EO data exploitation platforms (provision of VA services and products)	4																					
1.2	**Critical Mass of EO researchers**	4	16	4	4	4																	
1.2.1.	Number of public organizations	4																					
1.2.2.	Number of researchers (in Univ. & R&D labs)	4																					
1.2.3.	Courses being offered in universities, its diversity and maturity offered	4																					
1.2.4.	Relevant Publications	4																					
1.3.	**Industry Base**	2,75	11	2,75	2	3																	
1.3.1.	Number of companies	4																					
1.3.3.	Employment numbers, levels and changes	4																					
1.3.4.	Resellers or local representatives of European companies	2																					
1.3.5.	Existence of Clusters	1																					
COLLABORATION																41	3,727272727	3	4				
2.1.	**Collaboration through GEO**	4	16	4	4	4	3,66	3,5	3,75	3	4	3	4	3	4								
2.1.1.	Participation in GEO or to projects/initiatives which are linked to GEOSS	4																					
2.1.2.	Specific actions on Sustainable Development Goals (SDG's)	4																					
2.1.3.	Designated GEO office	4																					
2.1.4.	Provision of data to GEOSS	4																					
2.2.	**Impact of Copernicus**	4	4	4	4	4																	
2.2.1.	Organisations involved in projects linked to Copernicus	4																					
2.3.	**Participation to other international efforts**	3,6	18	3,6	3	4																	
2.3.1	ESA	4																					
2.3.2.	Meteorological: WMO, EUMETSAT, ...	4																					
2.3.3.	UN system as UN-GGIM, ...	4																					
2.3.4	Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	4																					
2.3.5.	Participation in Standardisation organizations i.e. as OGC...	2																					
2.4.	**Availability of EU funding**	3	3	3	3	3																	
2.4.1.	R&D participation or other EU programmes	3																					
UPTAKE																23	3,833333333	3	4				
3.1.	**Networking initiatives**	4	8	4	4	4	3,833333333	3,6667	4	3	4	3	4	4	4								
3.1.1.	Networking initiatives (events and thematic workshops)	4																					
3.1.2.	Data Portals	4																					
3.2.	**National Policies Implementation**	3,5	7	3,5	3	4																	
3.2.1.	Policy	4																					
3.2.2.	Budget & investment (internal to the country)	3																					
3.3.	**Penetration**	4	8	4	4	4																	
3.3.1.	Use of Geo-information	4																					
3.3.2.	Capacity building EO focused actions	4																					

Table 19: Assessment from FYROM

		Level	Level A	AA	AAA (ranged)	AAAA (rounded)	AA	AAA	AAAA	AA (ranged)	AA (rounded)	AAA (ranged)	AAA (rounded)	AAAA (ranged)	AAAA (rounded)	Level B	BB	BBB (ranged)	BBB (rounded)	Level C	CC	CCC (ranged)	CCC (ranged)
																				36	1,125	1	1
CAPACITIES																18	1,2	1	1				
1.1.	**National Infrastructure**	1,142857	8	1,143	1	1	1,214285714	1	1,33333	1	1	1	1	1	1								
1.1.1.	Space agency or designated Space Authority	0																					
1.1.2.	Own space-borne capacity	0																					
1.1.3.	Access to 3rd party missions (own ground stations)	1																					
1.1.4.	Ground-based facilities	1																					
1.1.5.	In-situ monitoring networks	2																					
1.1.6.	Modelling and computing capacities	2																					
1.1.7.	EO data exploitation platforms (provision of VA services and products)	2																					
1.2	**Critical Mass of EO researchers**	1,5	6	1,5	1	2																	
1.2.1.	Number of public organizations	2																					
1.2.2.	Number of researchers (in Univ. & R&D labs)	1																					
1.2.3.	Courses being offered in universities, its diversity and maturity offered	2																					
1.2.4.	Relevant Publications	1																					
1.3.	**Industry Base**	1	4	1	1	1																	
1.3.1.	Number of companies	1																					
1.3.3.	Employment numbers, levels and changes	1																					
1.3.4.	Resellers or local representatives of European companies	1																					
1.3.5.	Existence of Clusters	1																					
COLLABORAT																12	1,090909091	1	1				
2.1.	**Collaboration through GEO**	0,5	2	0,5	0	1	0,825	0,5	1	0	1	0	1	1	1								
2.1.1.	Participation in GEO or to projects/initiatives which are linked to GEOSS	0																					
2.1.2.	Specific actions on Sustainable Development Goals (SDG's)	2																					
2.1.3.	Designated GEO office	0																					
2.1.4.	Provision of data to GEOSS	0																					
2.2.	**Impact of Copernicus**	0	0	0	0	0																	
2.2.1.	Organisations involved in projects linked to Copernicus	0																					
2.3.	**Participation to other international efforts**	1,8	9	1,8	1	2																	
2.3.1	ESA	0																					
2.3.2.	Meteorological: WMO, EUMETSAT, ...	3																					
2.3.3.	UN system as UN-GGIM, ...	2																					
2.3.4	Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	3																					
2.3.5.	Participation in Standardisation organizations i.e. as OGC...	1																					
2.4.	**Availability of EU funding**	1	1	1	1	1																	
2.4.1.	R&D participation or other EU programmes	1																					
UPTAKE																6	1	1	1				
3.1.	**Networking initiatives**	1,5	3	1,5	1	2	1	0,667	1,33333	1	1	0	1	1	1								
3.1.1.	Networking initiatives (events and thematic workshops)	1																					
3.1.2.	Data Portals	2																					
3.2.	**National Policies Implementation**	0,5	1	0,5	0	1																	
3.2.1.	Policy	1																					
3.2.2.	Budget & investment (internal to the country)	0																					
3.3.	**Penetration**	1	2	1	1	1																	
3.3.1.	Use of Geo-information	1																					
3.3.2.	Capacity building EO focused actions	1																					

Summary Methodology chapter

The methodology is the principal chapter of this report. It introduces the elements for building a maturity assessment method to measure the (G)EO readiness of the countries. It also goes through the different phases: the starting approach where diverse methods have been considered and incorporated while other (most notably the benchmarking) may be pursued in the future; the construction phase where it is fundamental to identify the relevant indicators, for which the maturity assessment is performed, the explanation of their parameters and an overview of boundaries for their application; and finally the deployment phase describing the collection of data and how the data is transformed in the maturity cards which characterise the Earth Observation capacity in the countries within the GEO-CRADLE area, providing concrete information on its EO activities. The maturity level provides a quasi-quantitative measure of how well a country is performing against a given indicator. The aim is to translate the information collected against the various indicators into a value that falls within a certain range (e.g. 0 to 4), thus ensuring the ability to compare between countries and monitor over time.

3. Visualisation

Maturity Cards

Comparison with a baseline that ranks the maturity of EO capacities

"the maturity cards offer a visualisation based on a quasi-quantitative approach that will allow us to understand how well each country is performing against a given indicator"

We proposed two models of visualisation for the maturity cards.

- **Ranged version**: a strict way to visualise the data which will represent the values in the exact range they correspond (L0 > values between 0 to 1, L1 > values between 1 to 2). This approach will give only maximum values if the indicator has been provided by the maximum level.
- **Rounded version**: means making a number simpler for visualisation but keeping its value close to what it was.

Figure 3: Example comparison ranged version vs rounded (Albania)

Maturity card Albania (ranged)

Maturity card Albania (rounded)

Experts in the industry side seemed to be more conservative. Their preference will be to present the maturity cards following the ranged visualisation, however some of the experts in the research/policy tend to have preferences showing the results on ranged visualisation.

Figure 4: Example comparison ranged version vs rounded (Greece)

Maturity card Greece (ranged)

Maturity card Greece (rounded)

The Indicators' Groups (detail evaluation) remain the same for both visualisations; the major difference applies on the score card value and the final assessment.

The model of the maturity card format is shown in the figure below. The complete set of maturity cards for each of the countries in the RoI are included in the next pages:

Albania	Egypt	Israel	Tunisia
Bulgaria	Greece	Romania	Turkey
Cyprus	FYROM	Serbia	

The following pages will introduce the maturity card model and the maturity cards per countries. We present the ranged version in the report while the rounded version could be found in annex 5. The assessment will be presented in the Insights section.

Figure 5: Maturity card model

Country

Assessment

Score card

maturity indicators	indicators	level		maturity indicators	indicators	level		maturity indicators	indicators	level
capacity	infrastructure			cooperation	collaboration GEO			uptake	networking	
	eo reserach				impact Copernicus				policy	
	industry base				international				penetration	
					funding					

Detail evaluation

capacity	indicator	level
infrastructure	space authority	
	space borne	
	access 3rd party missions	
	ground based	
	in-situ	
	modelling & computing	
	eo data exploitation	
eo research	n. public organizations	
	n. researchers	
	courses offered	
	publications	
industry base	n. companies	
	employment	
	resellers, partnerships	
	clusters	

cooperation	indicator	level
collaboration GEO	participation GEO	
	specific actions on SDG´s	
	designated GEO office	
	provision data to GEOSS	
impact Copernicus	projects	
international	ESA	
	meteorological	
	UN / Int. agreements	
	INSPIRE	
	standardization	
funding	R&D participation	

uptake	indicator	level
networking	networking	
	data portals	
policy	policy	
	budget & investment	
penetration	use	
	capacity building	

LEGEND eo maturity card 0 initial 2 basic 3 intermediate 4 advanced 5 optimized

Figure 6: Maturity card Albania

Albania

Assessment (ranged)

CAPACITY		COOPERATION		UPTAKE	

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure		cooperation	collaboration GEO		uptake	networking	
	eo reserach			impact Copernicus			policy	
	industry base			international			penetration	
				funding				

Detail evaluation

capacity	indicator	level
infrastructure	space authority	
	space borne	
	access 3rd party missions	
	ground based	
	in-situ	
	modelling & computing	
	eo data exploitation	
eo research	n. public organizations	
	n. researchers	
	courses offered	
	publications	
industry base	n. companies	
	employment	
	resellers, partnerships	
	clusters	

cooperation	indicator	level
collaboration GEO	participation GEO	
	specific actions on SDG's	
	designated GEO office	
	provision data to GEOSS	
impact Copernicus	projects	
international	ESA	
	meteorological	
	UN / Int. agreements	
	INSPIRE	
	standardization	
funding	R&D participation	

uptake	indicator	level
networking	networking	
	data portals	
policy	policy	
	budget & investment	
penetration	use	
	capacity building	

LEGEND eo maturity card ○ initial basic intermediate advanced optimized

Figure 7: Maturity card Bulgaria

Bulgaria

Assessment (ranged)

	2			2			2	

Score card

maturity indicators	indicators	level		maturity indicators	indicators	level		maturity indicators	indicators	level
capacity	infrastructure	2		cooperation	collaboration GEO	0		uptake	networking	2
	eo reserach	3			impact Copernicus	3			policy	3
	industry base	2			international	3			penetration	3
					funding	3				

Detail evaluation

capacity	indicator	level
infrastructure	space authority	3
	space borne	2
	access 3rd party missions	3
	ground based	2
	in-situ	3
	modelling & computing	3
	eo data exploitation	3
eo research	n. public organizations	3
	n. researchers	3
	courses offered	3
	publications	3
industry base	n. companies	3
	employment	3
	resellers, partnerships	3
	clusters	2

cooperation	indicator	level
collaboration GEO	participation GEO	2
	specific actions on SDG's	0
	designated GEO office	2
	provision data to GEOSS	2
impact Copernicus	projects	3
international	ESA	4
	meteorological	5
	UN / Int. agreements	2
	INSPIRE	5
	standardization	3
funding	R&D participation	3

uptake	indicator	level
networking	networking	3
	data portals	2
policy	policy	4
	budget & investment	2
penetration	use	4
	capacity building	2

LEGEND eo maturity card 0 initial 2 basic 3 intermediate 4 advanced 5 optimized

Figure 8: Maturity card Cyprus

Cyprus

Assessment (ranged)

CAPACITY	COOPERATION	UPTAKE
◣	◣	◣

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure	◣	cooperation	collaboration GEO	◣	uptake	networking	◣
	eo reserach	◣		impact Copernicus	◣		policy	○
	industry base	○		international	◠		penetration	◠
				funding	◔			

Detail evaluation

capacity	indicator	level
infrastructure	space authority	◣
	space borne	○
	access 3rd party missions	○
	ground based	○
	in-situ	◔
	modelling & computing	◠
	eo data exploitation	◠
eo research	n. public organizations	◠
	n. researchers	◠
	courses offered	◠
	publications	◣
industry base	n. companies	◣
	employment	◣
	resellers, partnerships	○
	clusters	○

cooperation	indicator	level
collaboration GEO	participation GEO	◣
	specific actions on SDG's	◔
	designated GEO office	◠
	provision data to GEOSS	○
impact Copernicus	projects	◣
international	ESA	◔
	meteorological	●
	UN / Int. agreements	○
	INSPIRE	●
	standardization	○
funding	R&D participation	◔

uptake	indicator	level
networking	networking	◣
	data portals	◠
policy	policy	◣
	budget & investment	○
penetration	use	◔
	capacity building	◠

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Figure 9: Maturity card Egypt

Egypt

Assessment (ranged)

CAPACITY	COOPERATION	UPTAKE

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure		cooperation	collaboration GEO		uptake	networking	
	eo reserach			impact Copernicus			policy	
	industry base			international			penetration	
				funding				

Detail evaluation

capacity	indicator	level
infrastructure	space authority	
	space borne	
	access 3rd party missions	
	ground based	
	in-situ	
	modelling & computing	
	eo data exploitation	
eo research	n. public organizations	
	n. researchers	
	courses offered	
	publications	
industry base	n. companies	
	employment	
	resellers, partnerships	
	clusters	

cooperation	indicator	level
collaboration GEO	participation GEO	
	specific actions on SDG´s	
	designated GEO office	
	provision data to GEOSS	
impact Copernicus	projects	
international	ESA	
	meteorological	
	UN / Int. agreements	
	INSPIRE	
	standardization	
funding	R&D participation	

uptake	indicator	level
networking	networking	
	data portals	
policy	policy	
	budget & investment	
penetration	use	
	capacity building	

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Figure 10: Maturity card FYROM

FYROM

Assessment (ranged)

CAPACITY		COOPERATION		UPTAKE	

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure		cooperation	collaboration GEO		uptake	networking	
	eo reserach			impact Copernicus			policy	
	industry base			international			penetration	
				funding				

Detail evaluation

capacity	indicator	level
infrastructure	space authority	
	space borne	
	access 3rd party missions	
	ground based	
	in-situ	
	modelling & computing	
	eo data exploitation	
eo research	n. public organizations	
	n. researchers	
	courses offered	
	publications	
industry base	n. companies	
	employment	
	resellers, partnerships	
	clusters	

cooperation	indicator	level
collaboration GEO	participation GEO	
	specific actions on SDG's	
	designated GEO office	
	provision data to GEOSS	
impact Copernicus	projects	
international	ESA	
	meteorological	
	UN / Int. agreements	
	INSPIRE	
	standardization	
funding	R&D participation	

uptake	indicator	level
networking	networking	
	data portals	
policy	policy	
	budget & investment	
penetration	use	
	capacity building	

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Figure 11: Maturity card Greece

Greece

Assessment (ranged)

CAPACITY		COOPERATION		UPTAKE	

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure		cooperation	collaboration GEO		uptake	networking	
	eo reserach			impact Copernicus			policy	
	industry base			international			penetration	
				funding				

Detail evaluation

capacity	indicator	level
infrastructure	space authority	
	space borne	
	access 3rd party missions	
	ground based	
	in-situ	
	modelling & computing	
	eo data exploitation	
eo research	n. public organizations	
	n. researchers	
	courses offered	
	publications	
industry base	n. companies	
	employment	
	resellers, partnerships	
	clusters	

cooperation	indicator	level
collaboration GEO	participation GEO	
	specific actions on SDG´s	
	designated GEO office	
	provision data to GEOSS	
impact Copernicus	projects	
international	ESA	
	meteorological	
	UN / Int. agreements	
	INSPIRE	
	standardization	
funding	R&D participation	

uptake	indicator	level
networking	networking	
	data portals	
policy	policy	
	budget & investment	
penetration	use	
	capacity building	

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Figure 12: Maturity card Israel

Israel

Assessment (ranged)

CAPACITY	COOPERATION	UPTAKE

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure		cooperation	collaboration GEO		uptake	networking	
	eo reserach			impact Copernicus			policy	
	industry base			international			penetration	
				funding				

Detail evaluation

capacity	indicator	level
infrastructure	space authority	
	space borne	
	access 3rd party missions	
	ground based	
	in-situ	
	modelling & computing	
	eo data exploitation	
eo research	n. public organizations	
	n. researchers	
	courses offered	
	publications	
industry base	n. companies	
	employment	
	resellers, partnerships	
	clusters	

cooperation	indicator	level
collaboration GEO	participation GEO	
	specific actions on SDG's	
	designated GEO office	
	provision data to GEOSS	
impact Copernicus	projects	
international	ESA	
	meteorological	
	UN / Int. agreements	
	INSPIRE	
	standardization	
funding	R&D participation	

uptake	indicator	level
networking	networking	
	data portals	
policy	policy	
	budget & investment	
penetration	use	
	capacity building	

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Figure 13: Maturity card Romania

Romania

Assessment (ranged)

CAPACITY	COOPERATION	UPTAKE

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure		cooperation	collaboration GEO		uptake	networking	
	eo reserach			impact Copernicus			policy	
	industry base			international			penetration	
				funding				

Detail evaluation

capacity	indicator	level
infrastructure	space authority	
	space borne	
	access 3rd party missions	
	ground based	
	in-situ	
	modelling & computing	
	eo data exploitation	
eo research	n. public organizations	
	n. researchers	
	courses offered	
	publications	
industry base	n. companies	
	employment	
	resellers, partnerships	
	clusters	

cooperation	indicator	level
collaboration GEO	participation GEO	
	specific actions on SDG's	
	designated GEO office	
	provision data to GEOSS	
impact Copernicus	projects	
international	ESA	
	meteorological	
	UN / Int. agreements	
	INSPIRE	
	standardization	
funding	R&D participation	

uptake	indicator	level
networking	networking	
	data portals	
policy	policy	
	budget & investment	
penetration	use	
	capacity building	

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Figure 14: Maturity card Serbia

Serbia

Assessment (ranged)

CAPACITY	COOPERATION	UPTAKE

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure		cooperation	collaboration GEO		uptake	networking	
	eo reserach			impact Copernicus			policy	
	industry base			international			penetration	
				funding				

Detail evaluation

capacity	indicator	level
infrastructure	space authority	○
	space borne	○
	access 3rd party missions	○
	ground based	
	in-situ	
	modelling & computing	
	eo data exploitation	●
eo research	n. public organizations	
	n. researchers	
	courses offered	
	publications	
industry base	n. companies	
	employment	
	resellers, partnerships	
	clusters	

cooperation	indicator	level
collaboration GEO	participation GEO	○
	specific actions on SDG´s	○
	designated GEO office	
	provision data to GEOSS	●
impact Copernicus	projects	
international	ESA	○
	meteorological	●
	UN / Int. agreements	
	INSPIRE	●
	standardization	
funding	R&D participation	

uptake	indicator	level
networking	networking	
	data portals	
policy	policy	
	budget & investment	
penetration	use	
	capacity building	

LEGEND eo maturity card ○ initial basic intermediate advanced ● optimized

Figure 15: Maturity card Tunisia

Tunisia

Assessment (ranged)

CAPACITY		COOPERATION		UPTAKE	

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure		cooperation	collaboration GEO		uptake	networking	
	eo reserach			impact Copernicus			policy	
	industry base			international			penetration	
				funding				

Detail evaluation

capacity	indicator	level
infrastructure	space authority	
	space borne	
	access 3rd party missions	
	ground based	
	in-situ	
	modelling & computing	
	eo data exploitation	
eo research	n. public organizations	
	n. researchers	
	courses offered	
	publications	
industry base	n. companies	
	employment	
	resellers, partnerships	
	clusters	

cooperation	indicator	level
collaboration GEO	participation GEO	
	specific actions on SDG's	
	designated GEO office	
	provision data to GEOSS	
impact Copernicus	projects	
international	ESA	
	meteorological	
	UN / Int. agreements	
	INSPIRE	
	standardization	
funding	R&D participation	

uptake	indicator	level
networking	networking	
	data portals	
policy	policy	
	budget & investment	
penetration	use	
	capacity building	

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Figure 16: Maturity card Turkey

Turkey

Assessment (ranged)

CAPACITY	COOPERATION	UPTAKE
intermediate	intermediate	advanced

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure	advanced	cooperation	collaboration GEO	intermediate	uptake	networking	advanced
	eo reserach	advanced		impact Copernicus	advanced		policy	advanced
	industry base	intermediate		international	advanced		penetration	advanced
				funding	intermediate			

Detail evaluation

capacity	indicator	level
infrastructure	space authority	intermediate
	space borne	advanced
	access 3rd party missions	advanced
	ground based	advanced
	in-situ	optimized
	modelling & computing	advanced
	eo data exploitation	optimized
eo research	n. public organizations	advanced
	n. researchers	advanced
	courses offered	optimized
	publications	advanced
industry base	n. companies	advanced
	employment	advanced
	resellers, partnerships	intermediate
	clusters	intermediate

cooperation	indicator	level
collaboration GEO	participation GEO	advanced
	specific actions on SDG´s	intermediate
	designated GEO office	intermediate
	provision data to GEOSS	basic
impact Copernicus	projects	advanced
international	ESA	advanced
	meteorological	optimized
	UN / Int. agreements	advanced
	INSPIRE	advanced
	standardization	intermediate
funding	R&D participation	advanced

uptake	indicator	level
networking	networking	advanced
	data portals	advanced
policy	policy	advanced
	budget & investment	advanced
penetration	use	advanced
	capacity building	advanced

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Summary Visualisation chapter

This section explored a visualisation card which can facilitate the understanding of the country maturity indicators. The proposed “symbology” should be able to represent the maturity cards effectively.

4. Insights

4.1. Methodology Validation

The implementation of the maturity indicators methodology allows a country to **gain insight into the current situation of the implementation of (G)EO-related activities** and how it should pursue the desirable situation (i.e. a higher maturity level). The methodology provides a tool to highlight the critical factors to lead to successful (G)EO strategy implementation and explores why some countries effectively implement their strategic plans. The maturity indicators are meant to help countries to mobilise resources, with their position on the card pointing towards the sort of measures that could be taken. Such measures will be also reflected in the form of proposed actions in the context of D5.7 "**Roadmap for future implementation of GEOSS and Copernicus**"[8]. This will weigh the readiness and maturity of each country to address the identified gaps and propose – where applicable – the means to cover the needs and exploit the appropriate practices. The roadmap will be identifying regional challenges as they result from the collaboration with the regional stakeholders during the implementation of the GEO-CRADLE project and will be setting the priorities for GEOSS and a potential regional initiative to cope with these challenges in an effective and collective manner.

The validation process requires the engagement of different stakeholders in order to consistently obtain repeatable results and to build a valid information feeding the roadmap. Below a generic description:

- **Indicators** were defined/developed relying upon EARSC experience in data models.
- Detailed **information** was collected by country partners and experts in the Region of Interest.
- **1st Assessment** using the maturity indicators was conducted and contrasted with the information provided by each GEO-CRADLE country partner, thus helping to identify gaps or contradictions.
- EARSC assigned the **level of country performance – maturity cards** (based on interviews, data analysis, comparisons) and presented the scorecards to stakeholders.
- **Validation country assessments** has been repeated three to four times during the project and refined with information of recognised experts in the RoI, especially professionals outside the consortium. Country experts were requested, during a conference call in most cases, to supervise and validate the visualisation of the assessment of the maturity of the (G)EO activities in their countries. Discussion provided experts views on the different maturity levels (L0 to L4) for which indicators & sub-indicators were assigned. These experts (industry, academia, government organisations, research) provided an **independent enhancement** of the information and small adjustments have been made on the indicators to reflect new data.

Interaction with experts, especially during the **networking events** were essential to succeed on the maturity exercise. Face to face meetings facilitated during the GEOCRADLE country workshops provided with answers to some of the remaining issues. During the different discussions with partners and throughout the duration of the project, we noted that indicators under the uptake pillar progressed to a higher maturity status; this can be attributed to the extensive efforts in the region on networking activities and awareness at decision making level.

General insights were drawn from the review of the methodology with the experts and other external stakeholders, including:

Benefits:

- The maturity indicators are considered an essential tool, providing **quality insights to direct the implementation of EO activities in each country** and to assess if the investment in the (G)EO sector is working. These insights are backed by an extensive collection of quantitative data.

[8] Generic elements for a roadmap: (i) status quo analysis (ii) strategic options generation (iii) options assessment and evaluation, (iv) articulation of a strategic roadmap, and (v) development of strategy.

- The maturity indicators can also support decision-making for future actions and help to focus attention on what matters most, serving as **risk triggers and early warning signs**.
- Relatively **simple indicators offer a useful 'initial step'** as they provide a common language of communication and help to understand performance in an immediate and visual way.

Limitations:

- **Comparison of countries is challenging**. A single set of indicators is not and cannot be used to uniquely decide the maturity of a country. Rather, the assessment provides the basis to decide upon a "defensible" level of maturity and provides a chain of semi quantitative evidence that can be used to support the assignment of given "scores" against the different indicators.
- In many respects, the **feasibility of collecting adequate information is a prerequisite for success**. In that regard, there is a need to push for sustained cooperation and networking engagement to have data updated and validated over time.
- There is a **steep learning curve for the implementation of the methodology**. This is directly tied to the availability of data, the capacity of the analysts/researchers to collect and analyse it and the ease of access to literature or experts to provide consistent validation. These elements may be a barrier to deployment of complex indicators. In the case of GEO-CRADLE partners, several noted that resources estimated to collect data for the maturity card were significant especially since the requested information is not centralised neither updated regularly. The volume of data collected was an issue in some of the countries and might contribute to the "bias" of some of the indicators).
- At the definition level, there **might be some subjective elements and room for interpretation**, therefore criteria for indicators might be reviewed in the future. The additional insight offered by more complex indicators will need to be considered in connection to a country's institutional capacity and data availability.
- The decision on the exact levels of maturity against a given indicator could be **made more robust through complementary approaches** such as benchmarking. However, as already discussed within the resources and scope of GEO-CRADLE this has not been possible to implement.

Overall, country partners and experts remarked that assessments of the maturity card per country, to their knowledge, looked quite realistic and reflected adequately the current situation in their countries.

Some experts were concerned that the indicators explored in this analysis were too (G)EO focussed and also questioned the exhaustiveness of the criteria collected. Others liked the idea of simplicity and considered the selection of indicators to be appropriate. A number of specialists suggested that this methodology could act as a lever and boost the adoption of the (G)EO in the countries especially at the governmental level. Concerns on the availability of funding to apply the methodology were discussed.

Generally, it has been appreciated that EARSC, an organisation representing the industry sector in Europe, was acting as independent analyst.

4.2. Assessment

Preliminary assessment

During this opening assessment based on an aggregate of all 32 indicators of the data collected but also checking with the gap analysis (D 3.1), we observed countries placed in different maturity levels. The visualisation of the maturity cards shows high level of maturity in **Greece** and **Israel** and the lowest level in **Albania** and **FRYOM**. A more extensive analysis was subsequently done.

There is a big heterogeneity with regards to the investment in the sector across the different countries. For example, in **Israel** there are robust institutional capacities with a strong space agency and government

taking care of the sector especially for defence and military use and at the same time shows an advanced commercial exploitation of EO in the country.

The lowest level of maturity is for **FYROM** which do not have a designated space authority and in **Albania** where recently a governmental agency is helping to coordinate the space activities in the country; this is the "State Authority for Geospatial Information (ASIG)" which is committed to taking the lead in developing the strategy and associated implementation plan. In generic terms, the Western Balkan countries; **Albania, FYROM and Serbia** have basic space-borne capacities and the countries are focussing more on meteorology and receiving stations; yet, the in-situ networks are in need of further development. The industrial component is basic to intermediate. **Serbia** has advanced on its capacities with the agreement to join the European Union (in the md term), it is increasing its interest in the Earth Observation sector, whilst the engagement of public institutions and research organisations with EO is growing, driven by financial and technical support from European actors.

Greece has the most developed capacities in those GEO-CRADLE countries which are part of EU. It has invested in the space sector in the last decades and the cooperation between ESA and the Hellenic National Space Committee led to regular exchange of information, workshops and studies in the space programme. These activities have, however, been paralyzed in recent years due the economic crisis period. Normally a greater maturity might push the commercial sector to differentiate from primarily serving the needs of the public sector to establishing new EO based products and this is also reflected in the capacities maturity of **Greece, Israel, Turkey**.

Bulgaria and Romania have capacity gaps but the EO sector is developing. While **Romania** has formed strong ties with defined space-programs internationally but also moving the private sector, the EO activities in **Bulgaria** are predominantly based on the requirements guided by public sector.

Cyprus is developing its activities under research and development activities and very few commercial companies have been identified in the sector. At present, the engagement of public institutions and research organisations with EO is growing, driven by financial and technical support from the EU.

While discerning about countries in North Africa, all of those have independent space programmes, but **Egypt** has been more conservative and oriented to research than **Turkey** where the R&D spending is growing much, and new SMEs emerged in each year with innovative ideas in RS, GIS, GNSS, sensor, application areas. In **Egypt** most of the use of EO is for their Governmental internal use and collected data is not shared in the form of products/services to other organisations. Both countries have launched their own EO satellites into space as part of a space program. On the other hand, **Tunisia** actively receives satellite data through ground-based segments but there has been a growing interest in integrating the use of EO data and information for helping decision makers.

Below is represented the list of each indicator and its value per country

Table 20: Countries placed in the maturity line from (+) to (-)

OVERALL MATURITY	**Greece**	**Israel**	**Turkey**	**Romania**	**Serbia**	**Bulgaria Tunisia**	**Cyprus**	**Egypt**	**Albania**	**FYROM**
CAPACITIES										
National Infrastructure	**Israel**	**Turkey**	**Greece**	**Romania**	**Egypt**	**Bulgaria Serbia**	**Tunisia**	**Cyprus**	**Albania**	**FRYOM**
Space Authority	Israel	Romania	Greece	Turkey Tunisia Egypt Bulgaria Albania				Cyprus	Serbia	FYROM
Own space-borne capacity	Israel	Turkey Egypt		Romania	Greece Tunisia Bulgaria		Serbia Cyprus Albania FYROM			
Access 3rd party missions	Israel	Greece Turkey		Romania Tunisia Bulgaria		Egypt FYROM		Serbia Cyprus Albania		
Ground-based facilities	Israel Greece		Turkey Serbia		Romania Egypt Albania		Tunisia Bulgaria		Cyprus FYROM	
In-situ monitoring networks	Turkey	Israel Greece Romania Cyprus				Bulgaria Egypt Serbia FYROM			Tunisia Albania	
Modelling / computing capacities	Israel	Greece Turkey Serbia			Romania Bulgaria Egypt Cyprus			Tunisia Albania FYROM		
(G) EO data exploitation platforms	Israel Greece Turkey Serbia				Romania Bulgaria Tunisia Egypt Cyprus FYROM				Albania	
Critical Mass of EO researchers	**Greece**	**Israel**	**Turkey**	**Romania**	**Tunisia**	**Bulgaria Egypt Serbia**		**Cyprus**	**Albania FYROM**	
N. of public organisations	Greece	Israel Turkey Romania Tunisia Albania				Bulgaria Cyprus Egypt FYROM Serbia				
N. of researchers	Greece Israel		Romania Turkey		Bulgaria Albania Cyprus Egypt Serbia Tunisia				FYROM	
Courses	Greece Israel Turkey			Bulgaria Cyprus Egypt FYROM Romania Serbia Tunisia					Albania	
Publications	Greece	Israel Turkey		Bulgaria Egypt Romania Serbia Tunisia				Cyprus FYROM	Albania	
Industry Base	**Israel**	**Greece**	**Turkey**	**Romania Serbia**	**Bulgaria**	**Tunisia**	**Egypt**	**Albania**	**Cyprus**	**FYROM**
N. of companies	Greece	Israel Turkey		Bulgaria Romania Serbia Tunisia			Albania Cyprus Egypt FYROM			
Employment	Greece Israel		Turkey Romania		Bulgaria Serbia		Albania Cyprus Egypt Tunisia			FYROM
Resellers	Israel Serbia		Bulgaria Egypt Greece Romania Tunisia Turkey				Albania		Cyprus FYROM	
Clusters	Israel	Turkey Romania Serbia			Bulgaria Egypt Greece Tunisia			Albania Cyprus FYROM		
COLLABORATION										

Collaboration through GEO	**Greece**	**Romania**	**Israel Turkey**	**Cyprus Tunisia Serbia**	**Albania**	**Bulgaria**	**Egypt FYROM**
Participation in GEO	Greece Romania		Israel Turkey	Tunisia	Albania Bulgaria Cyprus Egypt		Serbia FYROM
Sustainable Development Goals	Greece Romania		Cyprus Israel	FYROM Tunisia Turkey	Albania	Bulgaria Egypt Serbia	
Designated GEO office	Greece	Romania	Cyprus Israel Serbia Turkey	Bulgaria Egypt Tunisia			Albania FYROM
Provision data to GEOSS	Greece Serbia		Romania	Albania Bulgaria Tunisia Turkey	Cyprus Egypt FYROM Israel		
Impact of Copernicus	**Greece**	**Turkey**	**Bulgaria Romania Serbia Tunisia**	**Cyprus Egypt Israel**	**Albania FYROM**		
Involvement Copernicus projects	Greece	Turkey	Bulgaria Romania Serbia Tunisia	Cyprus Egypt Israel	Albania FYROM		

international efforts	**Greece Romania**	**Turkey**	**Bulgaria**	**Serbia**	**Israel**	**Cyprus**	**Tunisia**	**Albania**	**FYROM**	**Egypt**
ESA	Greece Romania		Bulgaria Cyprus Turkey		Israel	Egypt Tunisia		Albania FYROM Serbia		
Meteorological	Albania Bulgaria Cyprus Greece Israel Romania Serbia Tunisia Turkey								Egypt	FYROM
UN system	Greece Romania		Serbia Tunisia Turkey		Israel FYROM		Bulgaria Egypt		Albania Cyprus	
Infrastructure for Spatial Information	Bulgaria Cyprus Greece Romania Serbia				Turkey	Albania FYROM		Israel	Egypt Tunisia	
Participation Standardisation	Israel	Albania Bulgaria Greece Romania Serbia Tunisia Turkey						Cyprus Egypt FYROM		
Availability of EU funding	**Israel Romania**		**Cyprus Greece Turkey**		**Albania Bulgaria Egypt FYROM Serbia Tunisia**					
R&D EU programmes	Israel Romania		Cyprus Greece Turkey		Albania Bulgaria Egypt FYROM Serbia Tunisia					

UPTAKE

Networking initiatives	**Greece**	**Turkey**	**Israel Romania Serbia**	**Albania Bulgaria Cyprus Egypt FYROM Tunisia**
Networking	Greece	Romania Turkey	Bulgaria Egypt	Israel Serbia Tunisia / Albania Cyprus FYROM
Data Portals	Greece	Israel Serbia Turkey	Albania Cyprus FYROM Romania	Bulgaria Egypt Tunisia

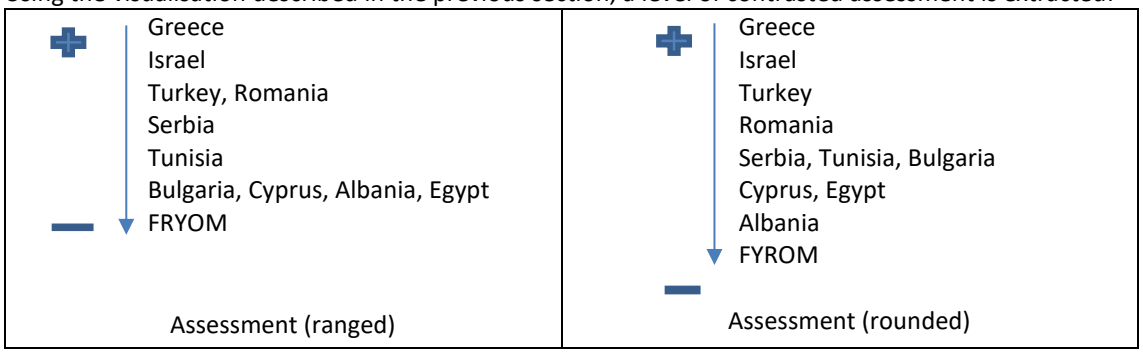
National Policies Implementation	**Greece Romania**	**Turkey**	**Israel**	**Bulgaria Serbia Tunisia**	**Albania**	**Egypt**	**Cyprus FYROM**
Policy	Greece Romania		Bulgaria Serbia Turkey		Albania Israel Tunisia		Cyprus Egypt FYROM
Budget & investment	Greece			Tunisia	Albania		Cyprus

	Israel Romania Turkey					Bulgaria Egypt Serbia			FYROM	
Penetration	**Greece Israel**		**Turkey**	**Albania Cyprus Romania Tunisia**			**Bulgaria Egypt Serbia**			**FYROM**
Use of Geo-information	Greece Israel		Bulgaria Cyprus Romania Turkey			Albania Egypt Serbia Tunisia				FYROM
Capacity building	Greece Israel		Albania Tunisia Turkey			Cyprus Egypt Romania Serbia			Bulgaria	FYROM
OVERALL MATURITY	**Greece**	**Israel**	**Turkey**	**Romania**	**Serbia**	**Bulgaria Tunisia**	**Cyprus**	**Egypt**	**Albania**	**FYROM**

Other type of analysis production has been considered and included in annex

1) **Σ of all indicators & media:** [Σ 1,2,3,…, 32 / 32]
2) **Σ of indicators per three main pillars (3) & media of each main section:** [capacities (Σ 1,2,3,…, 15/ 15) + collaboration(Σ 1,2,3,…, 11/ 11) + uptake (Σ 1,2,3,…, 6/ 6)]
3) **Σ of indicators per three main pillars & media each of subsections:** [CAPACITIES [infrastructure (Σ 1,2,3,…, 7/ 7)+ research (Σ 1,2,3,4/ 4) + industry (Σ 1,2,3,4/ 4)] + COLLABORATION [GEO (Σ 1,2,3,4/ 4)+Copernicus (Σ 1)+ Int. efforts (Σ 1,2,…,5/ 5)+ funding (Σ 1)] + UPTAKE [networking (Σ 1,2 /2) + national policy (Σ 1,2 /2) + penetration (Σ 1,2 /2)]]

Using the visualisation described in the previous section, a level of contrasted assessment is extracted:

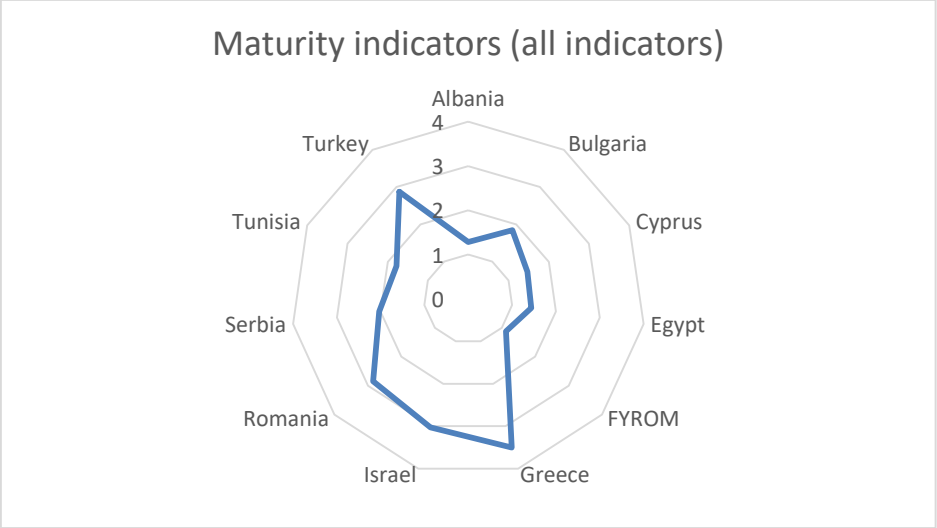


Representation (Σ of all 32 indicators): The table below represents the values for each of the countries taking the sum of all 32 indicators and establishing the media.

Table 21: Maturity cards (Σ of all 32 indicators)

	Maturity indicators (level c)	RANGED	ROUNDED
Albania	1,28	basic	basic
Bulgaria	1,84	basic	intermediate
Cyprus	1,47	basic	basic
Egypt	1,44	basic	basic
FYROM	1,13	basic	basic
Greece	3,50	advanced	optimized
Israel	3,03	advanced	advanced
Romania	2,84	intermediate	advanced
Serbia	2,03	intermediate	intermediate
Tunisia	1,78	basic	intermediate
Turkey	2,88	intermediate	advanced

Figure 17: Spider chart (all indicators)



In the previous table, red means action needed and dark green major level of maturity; therefore, FYROM is showed as the country less developed in the region while Greece is the one more advanced when taking into account all parameters. The spider chart is representing the same result than the conditional formatting showing the different levels of colours assigned.

Other representations are the **(Σ of all indicators per three main pillars)** which will be taking the mayor 3 pillars (capacities, collaboration and uptake) and sum the indicators in each of the category and establishing the media. While for capacities there are 15 indicators, cooperation and uptake have 11 and 6 respectively.

Table 22: Maturity cards (Σ of indicators representing each of the pillars > representation)

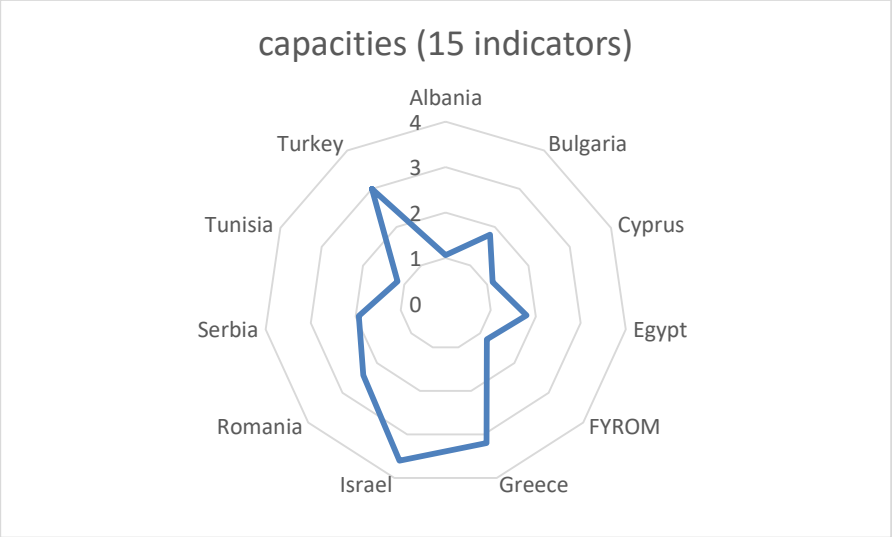
	capacities	RANGED	ROUNDED	cooperation	RANGED	ROUNDED	uptake	RANGED	ROUNDED
Albania	1,07			1,27			1,83		
Bulgaria	1,80			1,91			1,83		
Cyprus	1,13			1,91			1,50		
Egypt	1,80			0,91			1,50		
FYROM	1,20			1,09			1,00		
Greece	3,20			3,73			3,83		
Israel	3,60			2,73			3,00		
Romania	2,40			3,45			2,83		
Serbia	1,93			2,09			2,17		
Tunisia	1,17			1,82			2,00		
Turkey	3,00			2,64			3,00		

LEGEND eo maturity card ○ initial basic intermediate advanced optimized

The table representing each of the pillars is very illustrative, flagging that **FYROM** will need some action to be upgraded in the three main pillars, while others such **Greece, Israel, Romania or Turkey** are in the green domain for the majority of indicators. Other countries such as **Tunisia** are suggested to mobilise more resources into the capacities as the other indicators in cooperation and uptake seems more advance at country level; **Egypt** needs more efforts in cooperation or uptake. **Serbia** and **Bulgaria** appear to stand at an intermediate development of the (G) EO maturity while **Cyprus** and **Albania** need more efforts to upgrade their capacities.

Capacities Assessment

Figure 18: Maturity representation in Radar chart (3 pillars > capacities)



For most of the countries it is important to stress that most of EO is covered by the public sector. **Israel** is the most advanced country, as highlighted by the existence of the Israel Space Agency (ISA), responsible for the coordination and supervision of all activities of the civilian space program supporting scientific research and development with real economic potential, such as the development of unique and innovative technologies. It has cutting-edge space-borne capacities. All organisations have sufficient computing and processing capacities for their needs using different models and algorithms depend on their needs.

As indicated before, **Greece** is the longest serving member of ESA in the region. The effect of its involvement in ESA's programs includes the realisation of opportunities to support the development of Greek capacities in the (G)EO sector as well as policies supporting the industry development and the research and development activities in the EO domain.

Turkey has made big investments in monitoring and supporting revisions for infrastructure, civil protection, agri-food or internal security using spatial policies. It is vital for the country to develop existing space related technology to ensure the continuity of the technological infrastructure needed to implement and pursue national space policies, and to catch up with developed nations.

EO capacities have also grown significantly in the last years in **Romania** supported by their Space Agency (ROSA), its space programme and R&D Innovation sources which also help to mobilise the private sector.

Bulgaria has increased its development potential for SMEs and has improved the prospects for investing in the space industry as a result of signing the European Cooperative Country Agreement and participation in the European Cooperative Country Plan 2015.

The EO sector in **Tunisia** is dominated by governmental services who are still working on the production and use of geospatial information in decision making. Currently, Tunisia has a lack of coordination between different institutions, leading often to duplicated research efforts in some areas.

Egypt has been placed at the middle level, with its own capabilities for processing and analysing images that are obtainable from international commercial satellite systems. The National Authority for Remote Sensing & Space Sciences [NARSS] is the pioneering Egyptian institution in the field of satellite remote sensing, which is also concerned with the development of sensors for earth observation to be mounted on satellites.

In **Cyprus** the ability of the public sector to develop EO capacities has been clearly limited. Recently, Cyprus has signed the European Cooperating State Agreement, strengthening its relations with ESA and there are

clear expectations to improve the capacities; since then however, there are large barriers to development of EO in the country.

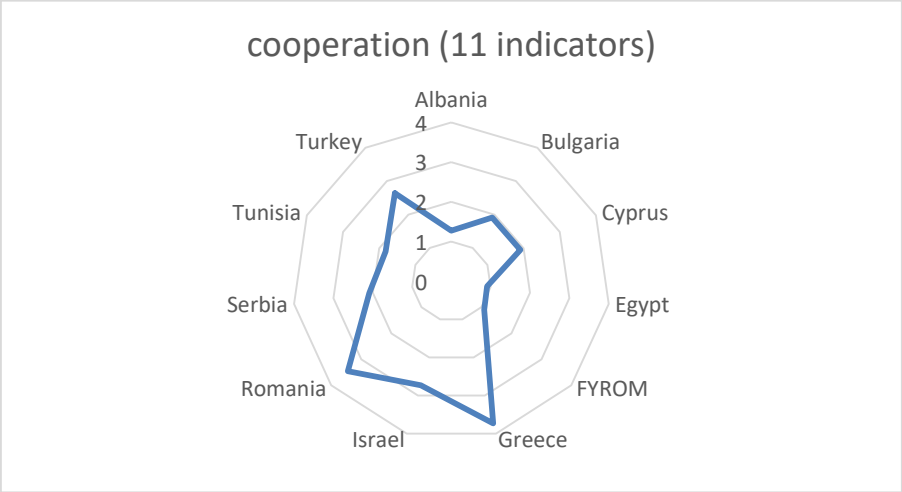
Serbia is lacking in the major capacities indicators, space authority, own space borne and access to 3rd party missions while other indicators in the capacities are stronger, in-situ monitoring networks, modelling or (G)EO exploitation, therefore the intermediate level in capacities which is also compensated with the research and private sector which is emerging.

Recently, in **Albania** there have been some more developments in the engagement of public institutions and research organisations with EO, driven by modest financial and technical support from European actors.

FYROM in the basic level of capacities has very limited infrastructure but evolving in ground segment, modelling or the provision of VA services and products. Without a strategy nor authority with the mandate to lead the geospatial sector a risk of continuity is clear.

Cooperation Assessment

Figure 19: Maturity representation in Radar chart (3 pillars > collaboration



Greece and **Romania** have very good cooperation in all levels. Space agencies or authorities are fundamental in leading coordination regarding EO activities including the active participation to GEO sessions or active representation in other international fora. They also have active participation in Copernicus projects or a National authority which assures the INSPIRE Directive implementation into national legislation and operability of GeoPortals. The active participation with UN entities such UN-SPIDER; reporting to UN-GGIM, member or active involvement in UNFCCC, FAO, UNEP, UNESCO, UN HABITAT, … are just examples of good international cooperation. ROSA, for example, as a government institution, has completed international agreements on behalf of the Romanian Government.

Regarding the engagement with GEO, only **Albania and FYROM** have not yet joined the GEO membership. The rest of the countries are improving the connections within the GEO secretariat to address priorities and some countries have a clear focus on SDG's.

Israel has a long EO tradition and has developed its own infrastructure needed for research and development in geoinformation. The Israel Space Agency is coordinating all Israeli space research programmes for scientific and commercial goals. Researchers in the country have been cooperating for many years in several European space science projects. Some efforts can be found on implementation of spatial infrastructure, collaboration with UN system or sharing of data produces medium ranking of Israel in cooperation.

In **Turkey** and with the coordination of TUBITAK, many EO bilateral relations have been signed. Just to name a few; (DLR-German Aerospace Center), BNSC (British National Space Agency) but also other cooperation's with UN, APSCO (Asia-Pacific Space Cooperation Organisation.

Serbia has medium level in cooperation with Copernicus; the country recently signed a Cooperation Arrangement with the European Commission. The agreement will enable the Republic of Serbia to benefit from the European Earth Observation and Monitoring programme and it will strengthen the collaboration between various Serbian institutions in the public sectors and with academia and private enterprises.

Most of the governmental structures in **Bulgaria** use EO derived information mainly provided on project basis. PECS signed with ESA is improving the collaboration, however some big steps need to be taken under cooperation with GEO but also with the UN system.

At the present, **Cyprus** has limited collaboration with GEO; the country is however making strong efforts in projects that help to monitor the SDGs. The cooperation with Copernicus is low, however due to recent agreement with ESA and a series of workshops on Copernicus, the expectation for collaboration will increase.

Albania, Egypt and FYROM are at basic levels for cooperation. It should be noted that Albania is making big efforts including robust projects supported by the World Bank and covering areas in capacity building but also infrastructure development. Egypt became recently a participating organization of GEO and has a very active participation under AfriGEOSS, however still to be prominent the cooperation with other entities at UN or European framework.

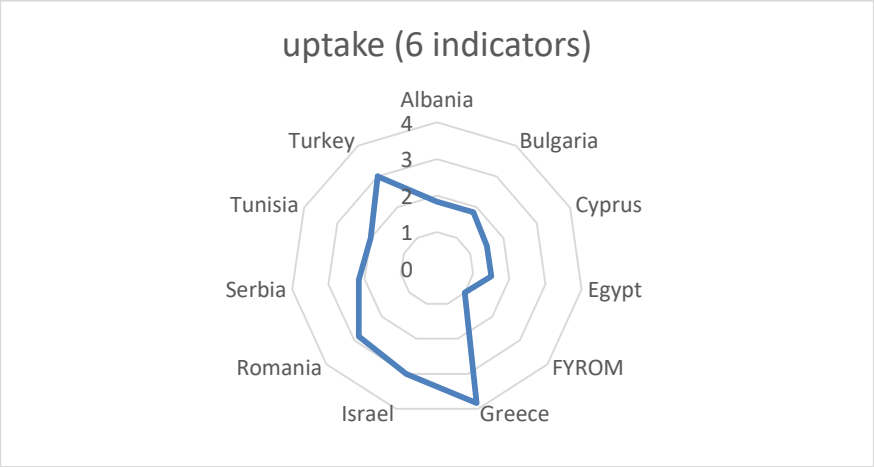
The coordination of the space activities in **Albania** and collaboration in international space programs is achieved through the establishment of the State Authority for Geospatial Information, within the Ministry of Innovation and Public Administration. ASIG, as a government institution, has completed international agreements on behalf of the Albanian Government. ASIG is responsible for creation of geodetic framework to European standards to enable the support of a unique map of the entire territory of the Republic of Albania.

Generally, there is an increased intention of the governments on implementing activities conforming the INSPIRE directive of EU. Normally all countries have assigned a representative responsible for the design, construction, maintenance and updating of the Geodetic Framework.

The level of engagement in standardisation is intermediate and the use of standards regarding EO data as well as the sharing of the regional datasets could be improved in the region.

Uptake Assessment

Figure 20: Maturity representation in Radar chart (3 pillars > uptake)



Being a member state of ESA increases the occurrence of networking events, as ESA organises dedicated EO workshops annually – often oriented to the country interests. Most regular events are in Agriculture, land/ forestry, crisis management domains, but could also focus on regional thematic areas.

In **western Balkan countries** there is a tendency from some private companies as well as NGOs to use satellite images in their studies and projects. GIS is becoming everyday more familiar in both private, public and government sector as well as to support some of the projects in the Environmental area.

On data sharing portals, many countries are making good progress; **FYROM** with its Biodiversity information system, the **Turkish** spatial data information system is also a good source for cooperation, the NSDI portal in **Serbia** or the cadastral portal in **Greece**.

All the countries progress with their "Institutional capacity building" fostering an environment for the use of Earth observations to enhance decision making. This engagement is more prominent in mature countries while education and training of individuals to be aware of, access, use and develop EO data and products are the main focus of less mature countries in the region. "Infrastructure capacity building" related to technology to access and use EO data and products are equally ingested in mature and not mature countries.

Still one of the major problems seems to be the lack of awareness of the larger EO picture. Basically, it has been noted that partnership of research institutions / private sector and decision makers for EO data development and implementation could be improved in the region and that indirectly reflected on the uptake of the EO services.

In most of the countries governmental budget does not include dedicated budget lines for the generation of EO data or their exploitation within operational services; instead, these activities are covered, to the extent outlined above, under other lines. Copernicus is seen as a game changer in that perspective and many countries seem enthusiastic for the potential uptake of EO services.

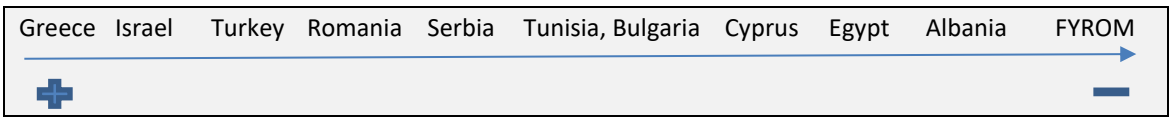
Largely, research fields of Earth observation are considered now matured and the capitalisation of existing knowledge and technologies is expected to allow progress in many different areas of application such as health, tourism, agriculture, cultural heritage, transportations, sustainable development, etc. The geospatial background of the public institutes in the region can promote and support public sectors uptake where EO application has clear benefits.

Maturity Indicators / Country

Table 23: Country indicators summary table

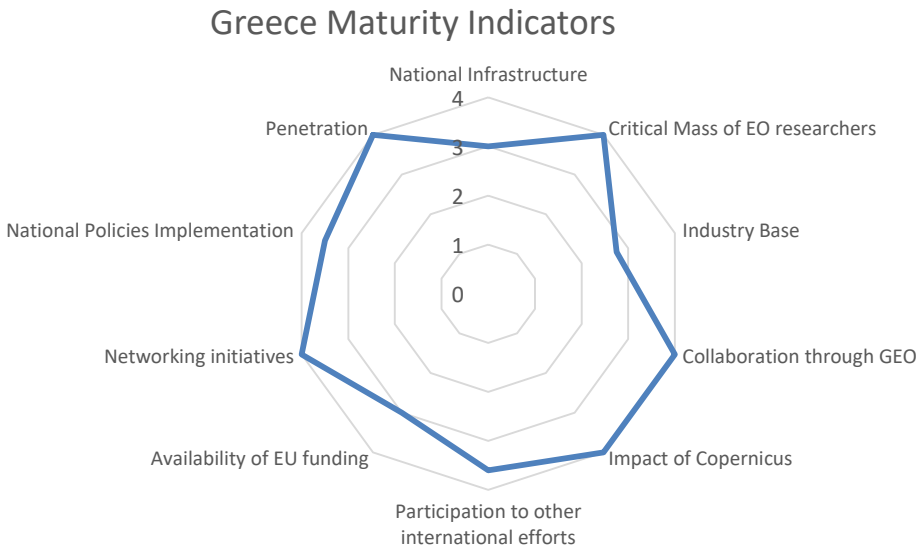
	Albania	Bulgaria	Cyprus	Egypt	FYROM	Greece	Israel	Romania	Serbia	Tunisia	Turkey
CAPACITIES											
National Infrastructure	1,00	1,71	1,14	2,00	0,86	3,00	3,86	2,43	1,71	1,43	3,14
Space agency or designated Space Authority	2	2	1	2	0	3	4	4	0	2	2
Own space-borne capacity	0	1	0	3	0	1	4	2	0	1	3
Access to 3rd party missions (own ground stations)	0	2	0	1	1	3	4	2	0	2	3
Ground-based facilities	2	1	0	2	0	4	4	2	3	1	3
In-situ monitoring networks	1	2	3	2	2	3	3	3	2	1	4
Modelling and computing capacities	1	2	2	2	1	3	4	2	3	1	3
(G) EO data exploitation platforms (provision of VA services and products)	1	2	2	2	2	4	4	2	4	2	4
Critical Mass of EO researchers	1,5	2	1,75	2	1,5	4	3,5	2,5	2	2,25	3,25
Number of public organizations	3	2	2	2	2	4	3	3	2	3	3
Number of researchers (in Univ. & R&D labs)	2	2	2	2	1	4	4	3	2	2	3
Courses being offered in universities, its diversity and maturity offered	1	2	2	2	2	4	4	2	2	2	4
Relevant Publications	0	2	1	2	1	4	3	2	2	2	3
Industry Base	0,75	1,75	0,5	1,25	0,25	2,75	3,25	2,25	2,25	1,5	2,5
Number of companies	1	2	1	1	1	4	3	2	2	2	3
Employment numbers, levels and changes	1	2	1	1	0	4	4	3	2	1	3
Resellers or local representatives of European companies	1	2	0	2	0	2	3	2	3	2	2
Existence of Clusters	0	1	0	1	0	1	3	2	2	1	2
COLLABORATION	**Albania**	**Bulgaria**	**Cyprus**	**Egypt**	**FYROM**	**Greece**	**Israel**	**Romania**	**Serbia**	**Tunisia**	**Turkey**
Collaboration through GEO	1	0,75	1,5	0,5	0,5	4	2	3,5	1,5	1,5	2
Participation in GEO or to projects/initiatives which are linked to GEOSS	1	1	1	1	0	4	3	4	0	2	3
Specific actions on Sustainable Development Goals (SDG´s)	1	0	3	0	2	4	3	4	0	2	2
Designated GEO office	0	1	2	1	0	4	2	3	2	1	2
Provision of data to GEOSS	2	1	0	0	0	4	0	3	4	1	1
Impact of Copernicus	0	2	1	1	0	4	1	2	2	2	3
Organisations involved in projects linked to Copernicus	0	2	1	1	0	4	1	2	2	2	3
Participation to other international efforts	1,6	2,8	2,2	1	1,2	3,6	2,4	3,6	2,6	2	3
ESA	0	3	3	1	0	4	2	4	0	1	3
Meteorological: WMO, EUMETSAT,…	4	4	4	3	2	4	4	4	4	4	4
UN system as UN-GGIM,…	0	1	0	1	2	4	2	4	3	3	3
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	2	4	4	0	2	4	1	4	4	0	3
Participation in Standardization organizations i.e. as OGC…	2	2	0	0	0	2	3	2	2	2	2
Availability of EU funding	2	2	3	2	2	3	4	4	2	2	3
R&D participation or other EU programmes	2	2	3	2	2	3	4	4	2	2	3
UPTAKE	**Albania**	**Bulgaria**	**Cyprus**	**Egypt**	**FYROM**	**Greece**	**Israel**	**Romania**	**Serbia**	**Tunisia**	**Turkey**
Networking initiatives	1,5	1,5	1,5	1,5	1,5	4	2,5	2,5	2,5	1,5	3
Networking initiatives (events and thematic workshops)	1	2	1	2	1	4	2	3	2	2	3
Data Portals	2	1	2	1	2	4	3	2	3	1	3
National Policies Implementation	1,5	2	0,5	1	0,5	3,5	2,5	3,5	2	2	3
Policy	2	3	1	1	1	4	2	4	3	2	3
Budget & investment (internal to the country)	1	1	0	1	0	3	3	3	1	2	3
Penetration	2,5	2	2,5	2	1	4	4	2,5	2	2,5	3
Use of Geo-information	2	3	3	2	1	4	4	3	2	2	3
Capacity building EO focused actions	3	1	2	2	1	4	4	2	2	3	3
MATURITY INDICATORS	1,29	1,85	1,49	1,43	0,91	3,52	3,00	2,85	2,04	1,80	2,88

The assessment done using the conditional formatting offers the following levels:



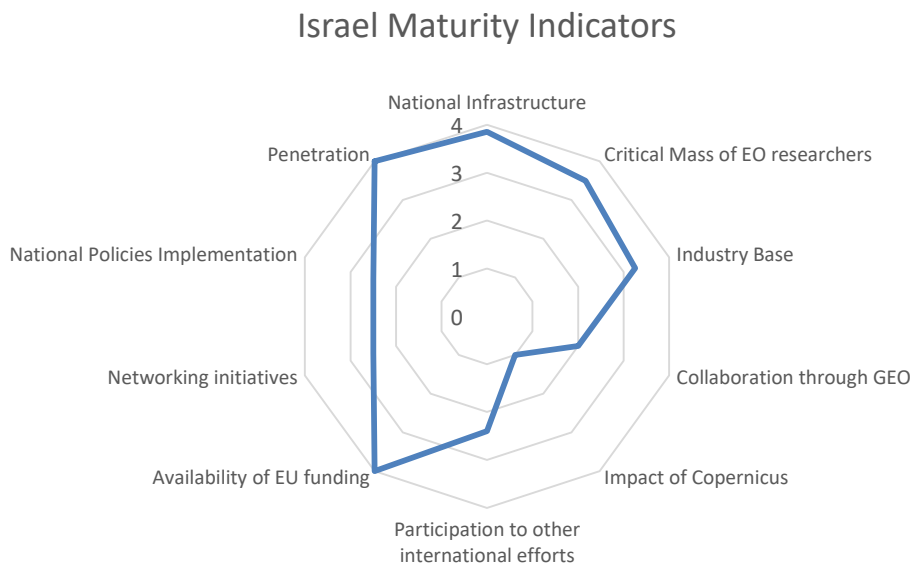
Maturity Indicators Country summary reflexion

Figure 21: Greece Maturity Indicators



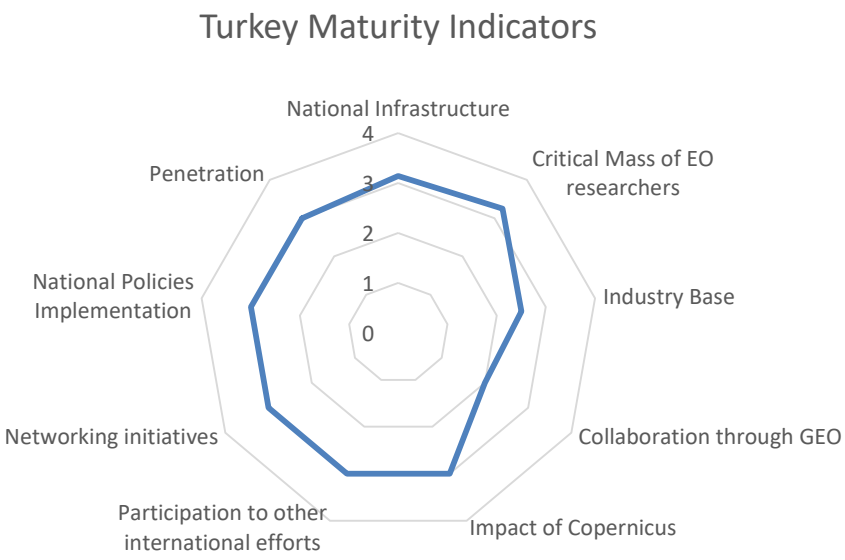
Greece shows the highest level of maturity in the GEO-CRADLE region. The lowest indicators are included at the capacities pillar where own space-borne under national infrastructure and existence of clusters are flagged as areas to be improved. Under collaboration, the indicator reflecting standardisation could be also improved. In terms of uptake Greece has an admirable performance.

Figure 22: Israel Maturity Indicators



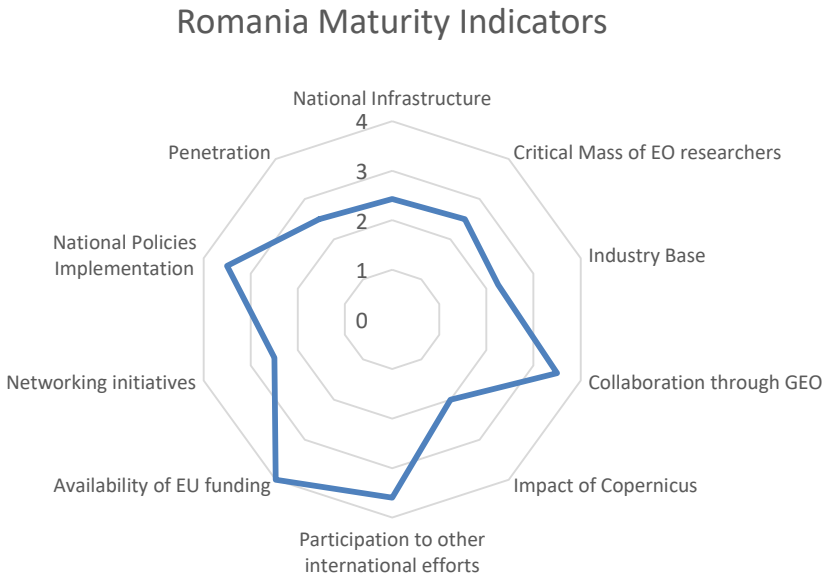
Israel displays an excellent maturity in terms of capacities, maybe the industrial base merits more resources but overall has been performing outstandingly. Collaboration is recommended to be enhanced, however still quite robust. The lowest indicator is referring to the impact of Copernicus and establishing an infrastructure for spatial information. Referring to the uptake, perhaps more events will help on the uptake and connected with increasing the policy support for the Earth Observation.

Figure 23: Turkey Maturity Indicators



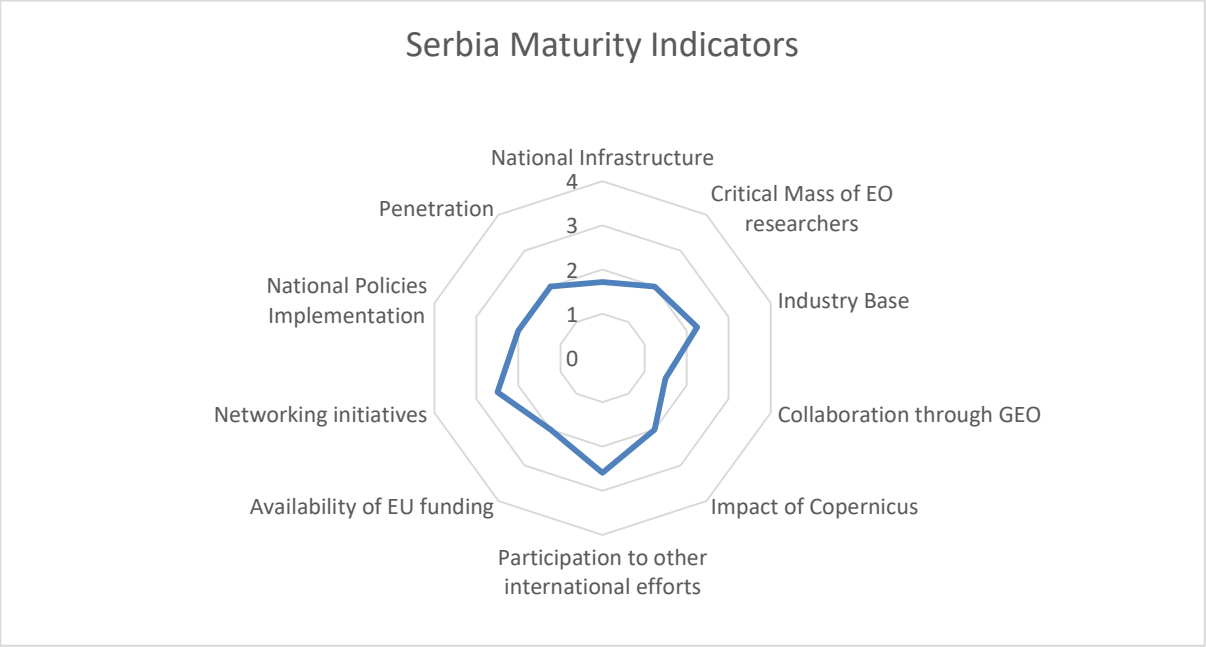
Turkey presents quite mature and regular performance in the three main pillars (capacities, collaboration and uptake), especially in the latest performs with brilliant and continuous achievements. The collaboration with GEO is recommended to be improved, however playing already a significant role. Issues with harmonisation and standardisation might also deserve more attention. While moving to the industry component, and perceiving that is improving, still an indicator that might increase through more resources into cluster collaborations.

Figure 24: Romania Maturity Indicators



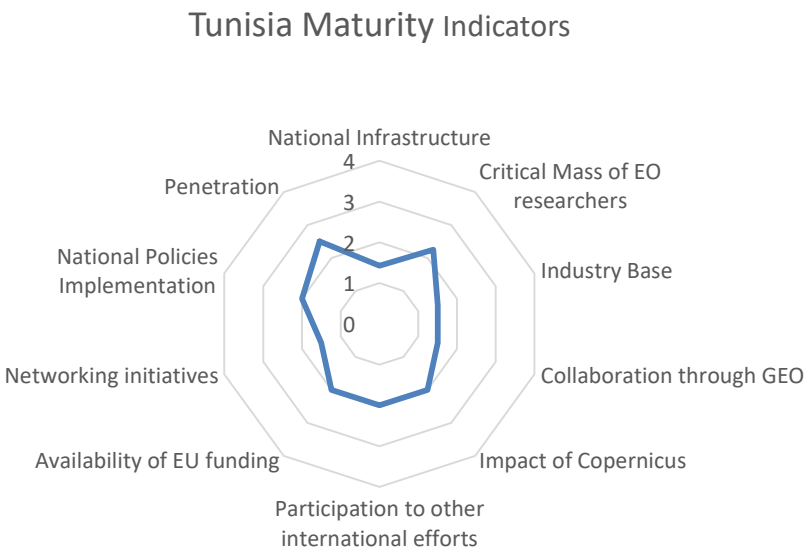
Romania belongs to an advance country in the region. Collaboration is strong in all components, perhaps, the impact of Copernicus deserves more attention, but the country has big expectations for improvement in that area of exploitation. The lowest block of indicators falls into the capacities pillar, though on the intermediate area. National infrastructure will merit more responsiveness from the government and ROSA might help to mobilize resources in that direction, in addition to the industry indicators.

Figure 25: Serbia Maturity Indicators



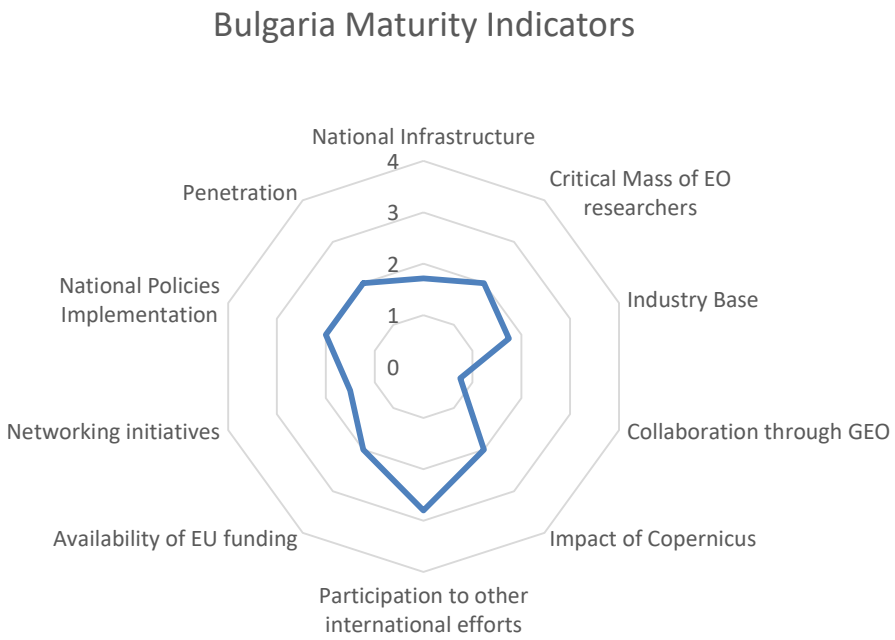
Serbia fits in the intermediate maturity level. It has some very strong indicators but also others at the initial phase. The red flag corresponds to the national infrastructure (space authority, own-space borne and access to 3rd party missions) under capacities while the rest of indicators in this pillar are basic/intermediate. Serbia should improve through engagement with GEO or ESA and the recently formulated cooperation with EC under Copernicus programme.

Figure 26: Tunisia Maturity Indicators



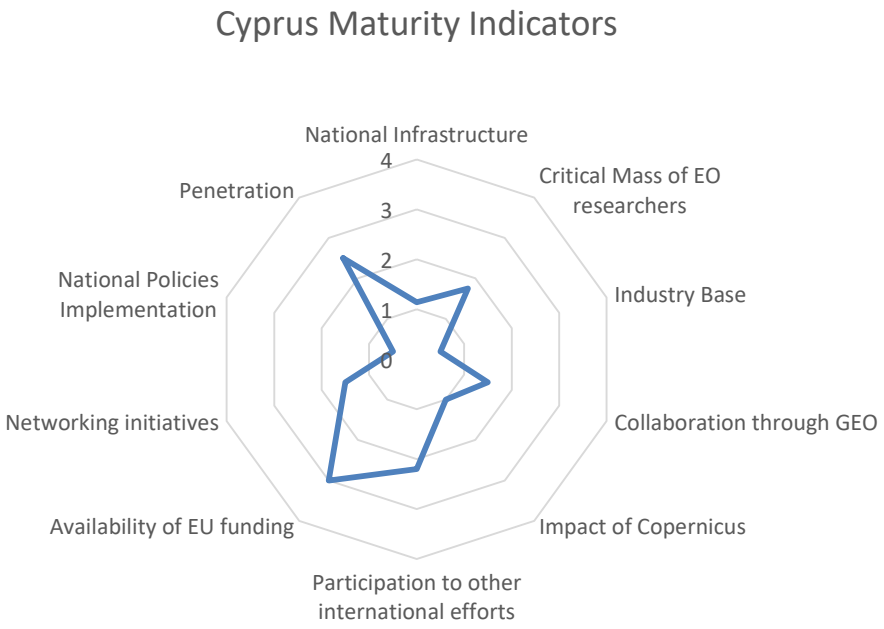
Tunisia gives also has an overall medium position. Probably the stronger indicators are the ones referring to the engagement with the meteorology sector but also with the UN system, as well as capacity building or the EO activities in research institutions. Low values are concentrated in the Capacities pillar, specifically under the national infrastructure: ground-based facilities, in-situ monitoring networks or modelling and computing capacities. Likewise, Tunisia shall mobilise resources for the development of the industry sector in the country.

Figure 27: Bulgaria Maturity Indicators



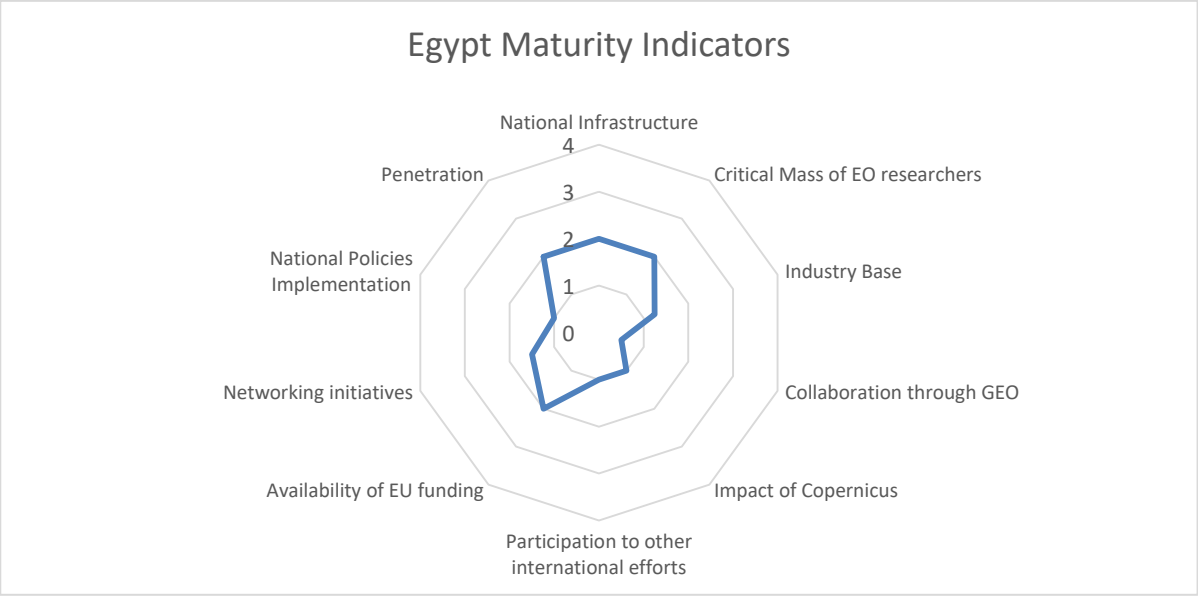
Bulgaria has a basic maturity, nevertheless, it is intensely improving in recent months through various actions motivated by the EU presidency but also thanks to increased engagement with PECS under ESA cooperation. The policy engagement seems quite strong and suggested at least to keep that level in the future and to mobilise resources in weak directions such as the area on collaboration (especially with GEO), which justifies more attention as the indicators feeding that group are rated quite low. The stronger position falls into the capacities pillar, probably thanks to past experiences in the space sector.

Figure 28: Cyprus Maturity Indicators



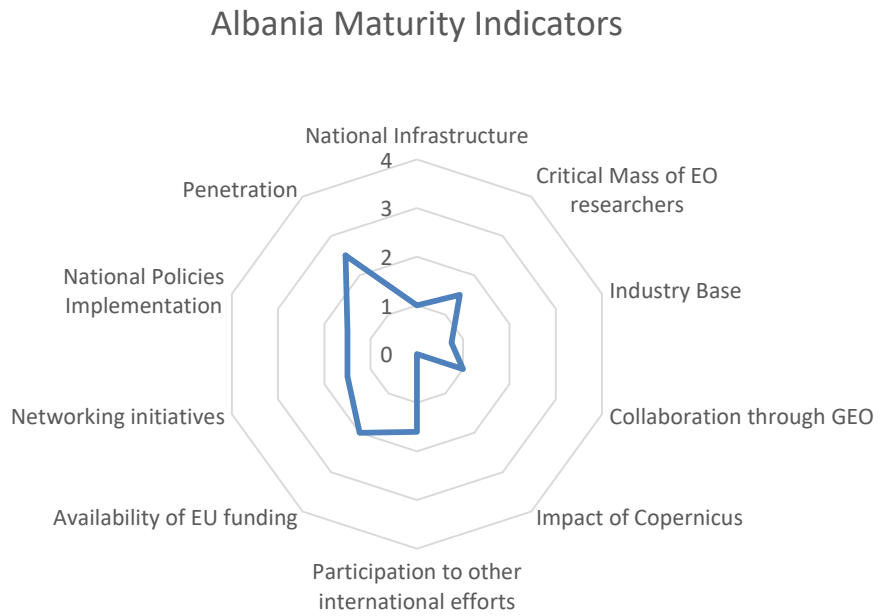
Cyprus merits attention in the capacities pillar where an important group of indicators is labelled as initial stage, incl. on the national infrastructure (own space-borne, access to 3rd party missions, in-situ monitoring networks) and the industrial component. The strongest values are for the collaboration, especially on the meteorology sector but also on the establishing the infrastructure for spatial information. It is also noted the engagement with the monitoring and reporting with some SDGs or the use of resources in the penetration indicators.

Figure 29: Egypt Maturity Indicators



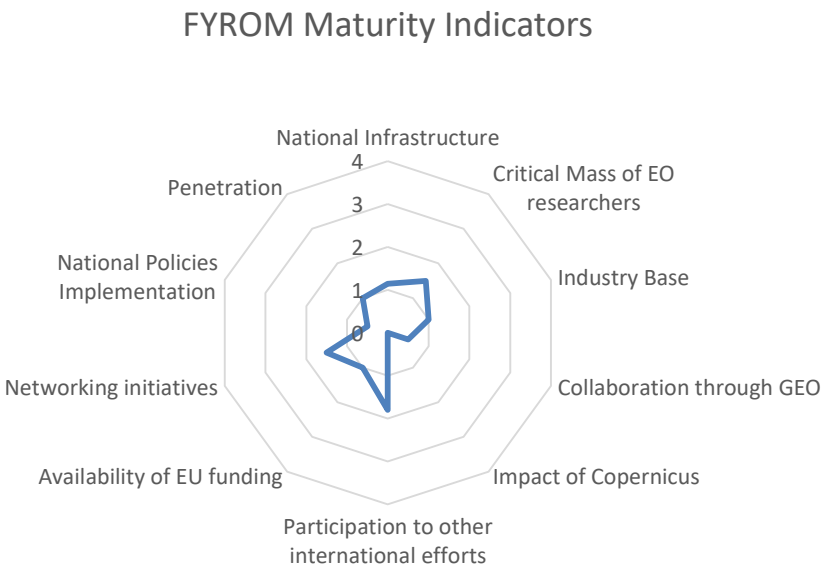
Egypt deserves attention in the collaboration pillar, where it has reached an intermediate level. This is thanks to have an independent space programme; in contrast, the lowest value falls into collaboration with GEO, Copernicus, UN while with meteorological organisations the cooperation is stronger. The industry section also deserves support of the private sector. The uptake pillar falls into the basic level with particular attention required for data sharing and the national policies implementation.

Figure 30: Albania Maturity Indicators



Albania is at the basic level. Comparing the three main pillars, Albania scores relatively high in the uptake where penetration (capacity building) has a high rate when it is plotted against the rest of indicators; contrary to that the country is quite weak on capacities where national infrastructure (especially on space-borne and third-party missions), research (publications indicator) and industry base are initial or basic. In collaboration, the impact of Copernicus ideally should be significantly improved, as well as the cooperation with GEO or the UN system.

Figure 31: FYROM Maturity Indicators



FYROM is placed as the lowest maturity level in the region. Most of the indicators highlight the need of sources to help the country to move from initial to basic. The best pillar is the uptake but some individual indicators in collaboration are standing out: cooperation with meteorological organisations, participation with UN system entities or establishing the infrastructure for spatial information. Some small mobilisation of resources will bring important impact on the evolution of its maturity.

Detailed information on the individual plots are in annex 3

4.3. Recommendations

A systematic review during the discussion with country experts identified a large number of qualitative indicators that were used in the evaluations of the country capacities. The indicators are used in sets to create a multifaceted understanding of the institutional/private environment and its interactions with policy. These are drawn from various indicator sets and grouped according to the specific pillar that they are intended to represent. The list of indicators was not planned to be exhaustive, nor is it suggested that an evaluation of the capacities of the country should address only these indicators; rather it highlights the diversity of issues considered pertinent to capacities, cooperation and uptake.

The status of an indicator has important implications regarding the form of corrective actions required to be addressed by the countries. This exercise is expected to help towards gauging the necessity for more detailed investigation in the implementation of (G)EO, and thus could be valuable for countries facing decisions about how best to allocate resources for policy assessment. Generally, qualitative methods are well-suited because they allow detailed assessment, taking account multiple perspectives (assessment / country indicators or other countries RoI) to contextualise process deployment, however, such methods can be sensitive to subjectivity requiring an additional level of validation to minimise bias.

Below is a summary of the steps that will help the country's process to establishing the maturity indicators revision within the GEO-CRADLE region:

1. Outline:
   - Characterisation: Overview of the GEO-CRADLE framework project
   - Introduction to the maturity indicators methodology as model for assessment of the maturity
   - Preliminary fieldwork and in-depth analysis is required to validate the use of indicators

2. Maturity design and population:
   - Maturity indicators are defined against three main pillars (activities on capacities, cooperation, uptake). For each indicator, the maturity levels are agreed (i.e. what does a certain value correspond to). At the end, following extensive gathering of data to substantiate the state-of-play of a country against these indicators, the levels will give a snapshot of current country capabilities.
   - Check incomplete data and analysis for the relevant data by indicators.

Those conducting the evaluation need to be aware that certain indicators should be introduced gradually over time as data availability improves. It is suggested that data availability would be improved partly as a result of the introduction of policy evaluation indicators.

3. Deployment:
   - Validation of country data by partners & experts (interviews assure overall quality). Experts from a number of academic, government and industry were interviewed to gain additional insights. Semi-structured interviews were used for this exercise
   - Indicators level assignation and maturity card representation
   - Visual assessment of indicators values
   - Support policies should be reviewed biannually. In many cases evaluations are made too late for any meaningful revisions to take place. Governments may not have sufficient funds to generate, monitor and evaluate these indicators. These need to be linked to institutional feasibility considerations.

Summary Insights chapter

This chapter highlights the critical indicators for each country to lead to successful (G)EO strategy implementation. The findings presented herein will feed into and be analysed in the GEO-CRADLE Roadmap for future implementation of GEOSS and Copernicus (D5.7).

The chapter also summarises validation elements for the application of the methodology which have proven to reflect quite adequately the current situation in countries where this has been tested.

It also provides a preliminary assessment in the three major pillars and outlines the actual status of the indicators in the countries. Finally, it covers some recommendations for future upgrades of the methodology.

The assessment can be used in the roadmap for the Countries in the Region providing a structured "guide" on how to improve the country's (G)EO readiness. Therefore, the maturity assessment has to be considered as a step of an overall approach describing in detail the actions to undertake in each country in order to improve maturity.

4.4. Conclusion

Conclusion

The implementation of the maturity indicators methodology allows a country to gain solid insights into the current situation of the implementation of (G)EO activities and how it should pursue the desirable a higher maturity level.

Report structure

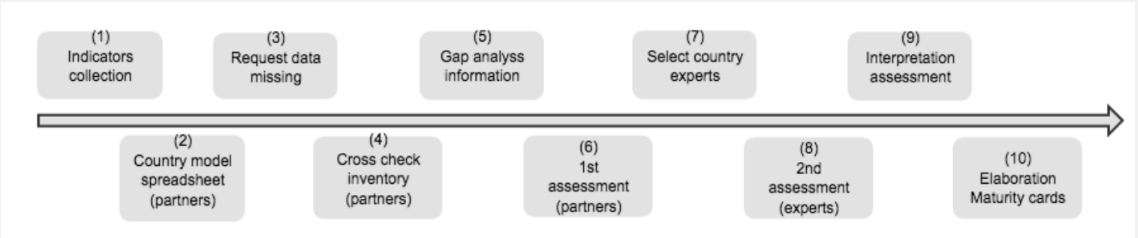
1) context of the methodology and its objectives
2) process to perform the assessment of the (G)EO maturity and construction of a consolidated list of indicators to be measured by participant countries
3) description and visualisation of indicators
4) main findings
5) graphs support for future analysis and interpretation

Statement as Project Outcome

The vision of GEO-CRADLE is to pave the way for the sustainable and continuous uptake and exploitation of Earth Observation services in North Africa, Middle East and the Balkans. Through the elaboration of novel maturity indicators, the project aspires to build adequate knowledge of the level and progress of GEO and Copernicus involvement in each country. It highlights the critical indicators for each country to lead to successful (G)EO strategy implementation. It will feed with valid and instrumental information the GEOCRADLE long-term roadmap (D5.7: Roadmap for future implementation of GEOSS and Copernicus) that reflects on the concrete regional priorities.

Summary of the steps that will help the country's process to establishing the maturity indicators revision under GEO-CRADLE region:

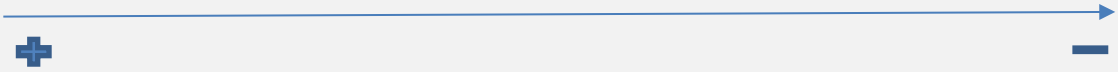
---|Outline | ------ |Maturity Design & population |---------- |Deployment|----------



Findings for users

The assessment done using the conditional formatting offers the following levels:

Greece > Israel > Turkey > Romania > Serbia > Tunisia | Bulgaria > Cyprus > Egypt > Albania > FYROM



- **Greece** shows the highest level of maturity in the GEO-CRADLE region. The lowest indicators are included under the capacities pillar.
- **Israel** displays an excellent maturity in terms of capacities. Collaboration is recommended to be enhanced.

- **Turkey** presents quite mature and regular performance. Issues with harmonisation and standardisation might also deserve more attention.
- **Romania** is a relatively advanced country in the region. The lowest block of indicators falls into the capacities pillar.
- **Serbia** fits in the intermediate maturity level. The red flag corresponds to the national infrastructure pillar.
- **Tunisia** holds a medium position. Low values are concentrated in the Capacities pillar, specifically under the national infrastructure.
- **Bulgaria** has a basic maturity. Collaboration indicators justify more attention.
- **Cyprus** merits attention in the capacities pillar where an important group of indicators on the national infrastructure is labelled as initial stage.
- Despite having an intermediate maturity at the capacities pillar, **Egypt** could place stronger attention to the collaboration pillar.
- **Albania** is at the basic level. It seems quite weak on capacities especially w.r.t. national infrastructure.
- **FYROM** is placed at the lowest maturity in the region. Most of the indicators highlight the need of sources to help the country to move from initial to basic.

Equipped with information, stakeholders in the region are more empowered to maximise the impact of EO activities, be it for informed decision making or boost of EO businesses. The status of an indicator has important implications regarding the form of corrective actions required to be addressed by countries. This exercise could help in gauging the necessity for more detailed investigation in the implementation of (G)EO, and thus could be valuable for countries facing decisions about how best to allocate resources for policy assessment.

Annex 1: Maturity levels – short version

Table 24: Maturity levels (short version)

CAPACITIES	level 0	level 1	level 2	level 3	level 4
National Infrastructure: It will understand the Earth Observation Strategy by country.					
Space agency or designated Space Authority	[no authority]	[1 ministry]	[1-various ministries]	[1 authority]	[1 operational authority/agency]
Own space-borne capacity	[no missions]	[generic space-borne interest]	[1 EO mission]	[2-5 missions]	[> 5 missions]
Access to 3rd party missions (with own ground stations)	[no access missions]	[access 1one 3rd party mission]	[access 2 to 5 3rd party missions]	[access between 5-10 3rd party missions]	[access > 10 3rd party missions]
Ground-based facilities	[no ground-based capacity]	[1 station]	[2 to 5 ground stations]	[6-10 stations]	[> 11 ground stations]
In-situ monitoring networks	[no in-situ capacity]	[at least one in-situ network]	[between 5 to 10 in-situ networks]	[between 10-20 in-situ networks]	[more than 20 networks]
Modelling and computing capacities	[no modelling capacities]	[one HPC]	[between 2 to 10 modelling capacities]	[between 10-20 modelling capacities]	[more than 20 modelling capacities]
(G) EO data exploitation platforms (provision of VA services and products)	[no exploitation platforms]	[one exploitation platform]	[2-5 exploitation platforms]	[5-10 exploitation platforms]	[> 10 exploitation platforms]
Critical Mass of EO researchers: Identification of the different groups of researchers both in research institutions & universities/academia and how big these groups are.					
Number of public organisations	[no (G) EO research/Univ. departments centers]	[one (G)EO organisation]	[between 2-10 (G)EO organisations]	[between 11-25 (G)EO organisations]	[more than 25 (G)EO organisations]
Number of researchers (in Univ. & R&D labs)	[no significant (G)EO staff]	[less than 50 (G)EO employees]	[between 50-250 (G)EO employees]	[between 250-500 (G)EO employees]	[> than 500 (G)EO employees]
Courses being offered in universities, its diversity and maturity offered	[no (G)EO courses]	[between 1-10 (G)EO courses offered]	[between 10-50 (G)EO courses]	[between 50-100 specialized (G)EO courses]	[> 100 specialized (G)EO courses]
Relevant Publications	[no (G)EO publications]	[1-25 papers]	[25-100 papers]	[100-500 papers]	[> 500 papers]
Industry Base: The goal here is to get a wide picture of the number and geographical distribution of EO companies per country.					

Number of companies	[no companies on (G)EO]	[between 1-5 companies]	[between 6-25 companies]	[between 26-50 companies]	[> 51 companies]
Scale of companies (large/medium/small/micro)	[no comparable]	[micro]	[small]	[SMEs]	[all types industry]
Employment numbers, levels and changes	[up to 10 employees]	[10-50 employees]	[51-150 employees]	[151-300 employees]	[> 300 employees]
Resellers or local representatives of European companies	[no resellers]	[1 reseller]	[2-5 resellers]	[6-10 resellers]	[> 10 resellers]
Existence of Clusters	[no clusters]	[1 cluster]	[2-5 clusters]	[6-10 clusters]	[>10 clusters]
COLLABORATION	level 0	level 1	level 2	level 3	level 4
Collaboration through GEO: Information on the country relations with international GEO Secretariat Geneva, GEO Plenary Meetings & Ministerial Summits.					
Participation in GEO or to projects/initiatives which are linked to GEOSS	[no participation GEO]	[participation 1 project]	[participation >2 project initiatives]	[designated representative active in GEO plenaries]	[designated representative active in GEO plenaries & contributing to budget lines]
Specific actions on Sustainable Development Goals (SDG´s)	[no SDGs actions]	[1 SDGs action]	[2-5 SDGs actions]	[5-10 SDGs actions]	[5-10 SDGs actions last 3 years]
Designated GEO office	[no office]	[plans for office 1 staff coordinating GEO act.]	[1 organisation supervising GEO activities]	[Truly dedicated office no staff]	[Truly dedicated office with own staff/5 years]
Provision of data to GEOSS	[no data to GEOSS]	[plans for data to GEOSS]	[1-5 datasets to GEOSS]	[6-15 datasets to GEOSS]	[provision >15 datasets to GEOSS]
Impact of Copernicus: This section will evaluate the type of engagement with Copernicus projects and actions (projects involvement) with Entrusted Entities					
Organisations involved in projects linked to Copernicus	[no projects using Copernicus services]	[1-5 projects using Copernicus services]	[6-25 projects using Copernicus services]	[25-50 projects using Copernicus services]	[< 50 projects using Copernicus services]
Participation to other international efforts: Level of international collaboration to ensure country access to essential global EO information.					
ESA	[no cooperation agreements with ESA]	[plans cooperation agreements with ESA]	[participation under some ESA activities]	[ESA European Cooperating State Agreement]	[ESA full member]

Meteorological: WMO, EUMETSAT, ...	[no cooperation meteo]	[participation national Meteo]	[participation National Meteo & sporadic Int. cooperation]	[participation National Meteo & Int. Cooperation & one international membership: i.e: EUMETSAT, or WMO, etc]	[participation National Meteo & Int. Cooperation & more than one membership , i.e EUMETSAT & WMO]
UN system as UN-GGIM, ...	[no participation UN bodies]	[at least 1 active participation in UN agency/organization]	[participation in 2-5 UN agencies/organzations]	[participation in >6 UN agencies/organzations]	[participation >6 UN agencies/organzations/10 years]
Establishing an Infrastructure for Spatial Information [ie. European Community (INSPIRE)]	[no directive for Spatial Information]	[plans to establish a directive for Spatial Information]	[one requirement for a directive for Spatial Information]	[2-3 requirements for a directive for Spatial Information]	[full implementation for a directive for Spatial Information]
Participation in Standardisation organisations i.e. as OGC...	[no engagement with Standardisation discussions]	[one organisation engage with Standardisation discussions]	[2-5 organisations engage with Standardisation discussions]	[6-10 organisations engage with Standardisation discussions]	[> 10 organisations engage with Standardisation discussions]
Availability of EU funding					
R&D participation or other EU programmes	[no EU R&D participation]	[one EU R&D participation]	[2-10 EU R&D participation]	[11-20 EU R&D participation/sustained 5 years]	[11-20 EU R&D participation/sustained 10 years]
UPTAKE & AWARENESS	level 0	level 1	level 2	level 3	level 4
Networking initiatives: Events which examine and discuss the many different aspects and applications of the Earth Observation and geo-information field from the thematic or market point of view					
Networking initiatives (events and thematic workshops)	[no networking]	[1-5 networking activities/year]	[6-15 networking activities/year]	[> 25 sustained networking activities/year]	[sustained 16-25 networking activities/year]
Data Portals	[no data portals]	[plans data portals]	[one data portal]	[> one data portals in various thematics]	[> one data portals in various thematics and fully integrated]
National Policies Implementation					
Policy	[no national policy on (G)EO aspects]	[one national authority/minister engage with on (G)EO aspects]	[2-5 national authorities/ministers engage with on (G)EO aspects &	[>5 national authorities/ministers engage with on (G)EO aspects &	[dedicated national institution engage with on (G)EO aspects &

			collaboration at international level]	collaboration at international level]	collaboration at international level]
Budget & investment (internal to the country)	[no budget line designated to (G)EO activities]	[one budget line designated in other domains where (G) EO is used]	[one dedicated budget line designated to (G)EO activities]	[2-5 budget lines designated to (G)EO activities]	[2-5 budget lines designated to (G)EO activities 7 last 10 years]
Penetration					
Use of Geo-information	[no use (G)EO /penetration]	[sporadic activities in (G)EO / low penetration]	[one dedicated activity in (G)EO / medium penetration]	[2-5 dedicated activities in (G)EO / advance penetration]	[> 5 dedicated activities in (G)EO / fully optimised penetration]
Capacity building EO focused actions	[no capacity building actions]	[one capacity building action]	[2-5 capacity building actions]	[6-10 capacity building actions]	[>10 capacity building actions / 10 years]

Annex 2: Contacts in the RoI

The study entails data collection provided by country partners, but also data collection from direct interaction, GEO-CRADLE survey and questionnaires.

Partners

Table 25: List of main partners contacts

Country	Name	Contact
Albania	Institute for Nature Conservation in Albania. INCA (Daniela Godo, Emirjeta Adhami)	-daniela.godo@yahoo.com -Emirjeta Adhami <emi_adhami@hotmail.com> -enti Kromidha <gkromidha@yahoo.it>
Bulgaria	Space Research and Technology Institute. SRTI-BAS (Hristo Nikolov)	-hristo@stil.bas.bg
Cyprus	Cyprus University of Technology. CUT (Rodanthi-Elisavet Mamouri)	-rodanthi.mamouri@cut.ac.cy -athos.agapiou@cut.ac.cy -d.hadjimitsis@cut.ac.cy
Egypt	Center for Environment and Development of the Arab Region and Europe. CEDARE (Hesham El-Askary)	-elaskary@chapman.edu -elbadawy@cedare.int
Greece	National Observatory of Athens. NOA (Haris Kontoes)	-kontoes@noa.gr -alexiatsouni@noa.gr -egera@noa.gr -ellikalopesa@gmail.com, kstila@i-bec.org, zalidis@agro.auth.gr
FRYOM	University of Saints Cyril and Methodius. USCM (Ordan Cukaliev)	-cukaliev@gmail.com -dragi_dimitrievski@yahoo.com
Israel	Tel Aviv University. TAU (Eval Ben Dor, Yaron Ogen)	-bendor@post.tau.ac.il -Yaron Ogen <yaronogen@gmail.com>
Romania	National Institute of R&D for Optoelectronics. INOE (Doina Nicolae)	-nnicol@inoe.ro -luminita.marmureanu@gmail.com
Serbia	InoSens ltd. and Institute of Physics Belgrade. INOSENS (Grigoris Chatzikostas, Vladimir Mrkajic)	-gchatzikostas@gmail.com -Zoran Mijic <zoran.mijic@ipb.ac.rs> -nickovic@gmail.com
Tunisia	CERT (Hend Ben Hadji)	-hend.benhji@cert.mincom.tn
Turkey	TUBITAK UZAY Space Technologies Research Institute (Aziz Koru)	-aziz.koru@tubitak.gov.tr -kaan.kalkan@tubitak.gov.tr

The study has been complemented with data further supplemented and validated by experts in the Region (table 10) which ensure authenticity of the data assessed and evaluated

Experts contacted

Table 26: Stakeholders in the respective countries

Country	Name
Albania	-Albana Zotaj - National Agency for Territory Development, director of GIS directory (albana.zotaj@azht.gov.al) - Spartak Likaj - GjeoVjosa, manager (spartak@gjeovjosa.com)
Bulgaria	-CASTRA) Cluster for Aerospace Techjnologies, Research and applications Vesselin Vassilev (vesselin.vassilev@castra.org) -TAKT. Kamen Iliev (k.iliev@rst-tto.com)
Cyprus	-Department of Meteorology, Cyprus. Filippos Tymvios (ftymvios@dom.moa.gov.cy) -Cyprus Geological Survey Deparment. Niki Koulermou (nkoulermou@gsd.moa.gov.cy) -Agricultural Research Institute, Rural Development Section, Dr. George Papadavid, Research Officer (papadavid@ari.gov.cy)

Egypt	-University Alexandria, Department of Environmental Studies. Mohamed El Raey (melraey@gmail.com)
Greece	-Greek Research & Technology Network (GRST) Dr. Xenophon Tsilibaris, (www.grnet.gr) -Draxis- Evangelos Kosmidis (kosmidis@draxis.gr) -Terraspatium. Georgia Kalousi -University Patras: Andreas Kazantzidis (akaza@upatras.gr)
FRYOM	-Sts. Cyril and Methodius University Faculty for Civil Engineering - Skopje Prof. Vanco Gjorgjiev (vanco@t-home.mk & tijanasekuloska@gmail.com -Head of Department of Water and Erosion Protection. Faculty of Agricultural Sciences and Food-Skopje. Ss. Cyril and Methodius University in Skopje Marija Vukelic Shutoska <marija.vukelic.sutoska@gmail.com>
Israel	-IS Mapping - Ido Livne (livneido75@gmail.com) -Daniel Barok – EO Consultant (danielbarok@gmail.com)
Romania	-Terrasigna- Florin Serban (Florin.Serban@terrasigna.com) -ESRI Romania-Andreea Anghel (aanghel@esri.ro)
Serbia	-Prof. dr Lazar Lazic, Head of the Institute of Meteorology, Faculty of Physics, University of Belgrade, Serbia (lazar@ff.bg.ac.rs) -Dr Ana Vukovic, Faculty of Agriculture, University of Belgrade, Serbia (pazisadana@yahoo.com) -HIDMET, Prof Jogoslav Nikolic (office@hidmet.gov.rs)
Tunisia	-Prof. Zohra Lili Chabaane, Specialist at Remote Sensing, GIS and Water resources management at Institut National d'Agronomie de Tunisie (INAT) Director of LR17AGR01 / GREEN-TEAM (Integrated Management of Natural Resources: Remote Sensing, Spatial Analysis and Modeling) - German Geoconsultants Group- Karem Ben Khaled - Centre National de la Cartographie et de la Télédétection-Adel Jehane (www.cnct.defense.tn) -Tunisia GEO Principal: Prof. Fethi Lebdi
Turkey	-Mrs. A. Yücel ERBAY, Director NiK SİSTEM, Remote Sensing and Satellite Image (-sistem@nik.com.tr, yucel@nik.com.tr) -Mr. Hayati Koyuncu, PhD, Managing & Research Director, JeoDijital Bilisim Teknoloji Madencilik Ltd. Sti. (hayatik@jeodijital.com) -Özgür Acir, Association of Geological Researches-JADE, (ozgur.acir@jade.org.tr)

Information on the assessment and methodology was also distributed to experts in the BAMENA GEO members countries, mainly via the GEO principals. Some of them such Israel, Turkey were involved in the discussions. The purpose was to make awareness on the methodology.

Annex 3: Spider diagram per country

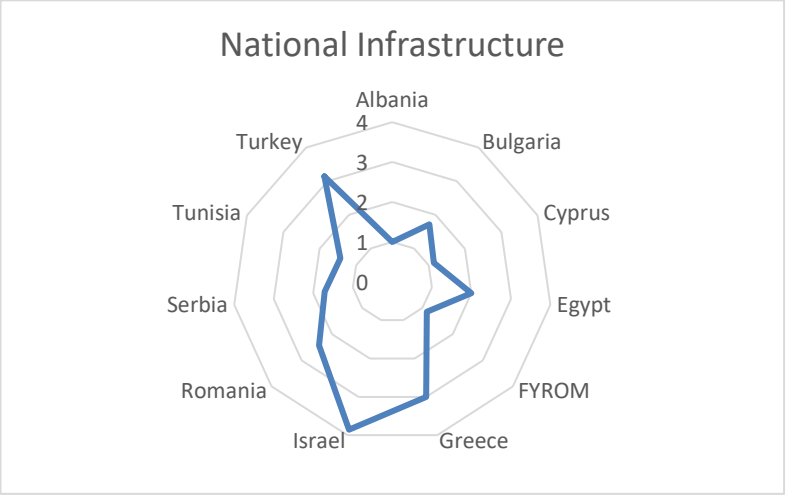
The 'maturity level' per country is also synthesized in a spider diagram in the following pages. This section illustrates the current situation of each country in the region with the help of spider charts.

Grouping of countries

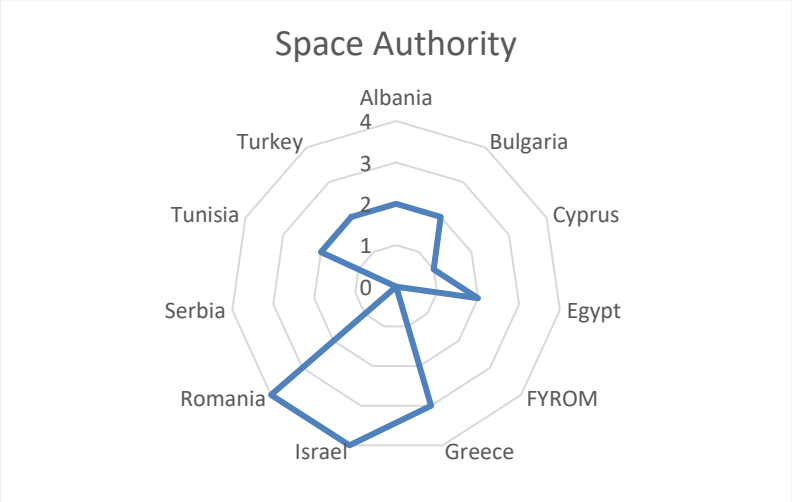
Country-specific results vary widely among the countries in the RoI. Cross country comparisons among indicators must be made with caution. Although several countries report their maturity indicators under the same name, their methodology is based on in-country qualitative assessments. Accordingly, it is not possible to establish a direct comparison between indicators of different countries, even if these indicators have the exact same name. Despite this limitation, this methodology provides a good first step in assessing each country w.r.t. the selected indicators.

CAPACITIES

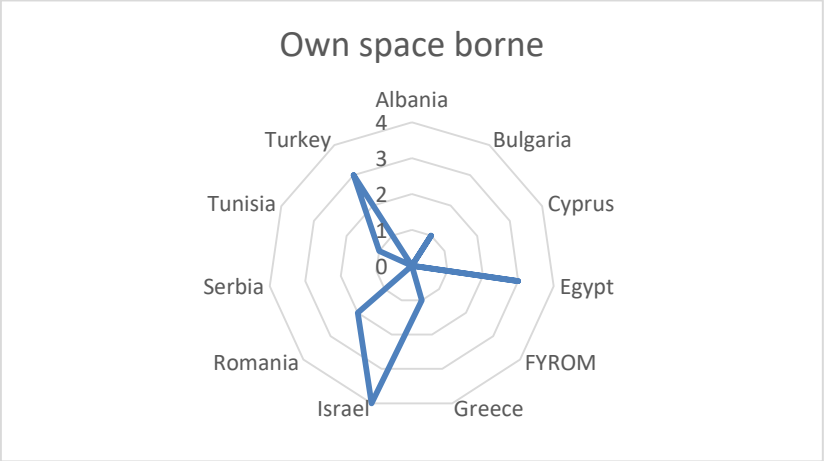
National Infrastructure



(a) Space Agency / Space Authority

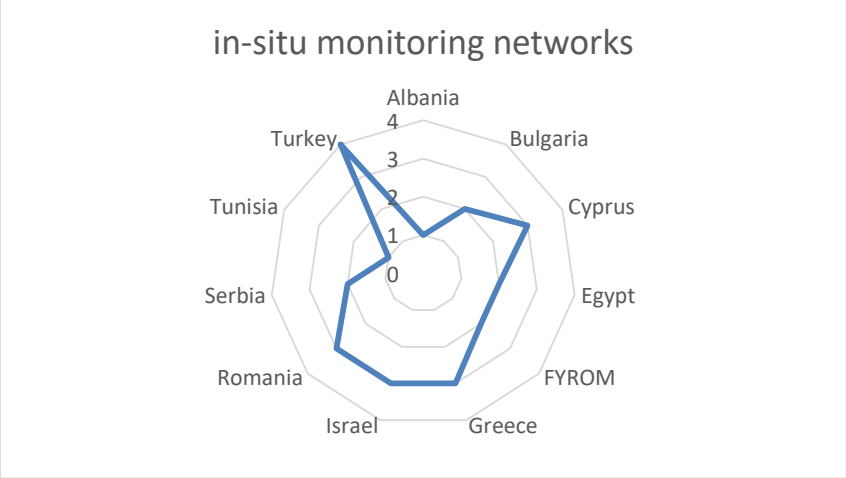


(b) Own space-borne capacity

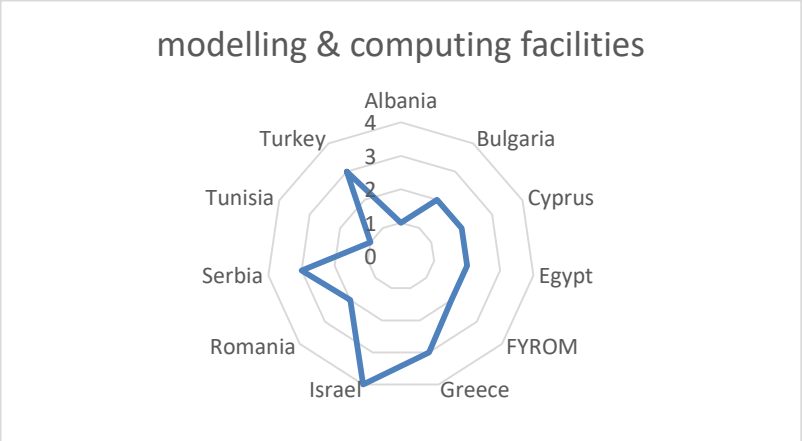


(c) Ground-based facilities

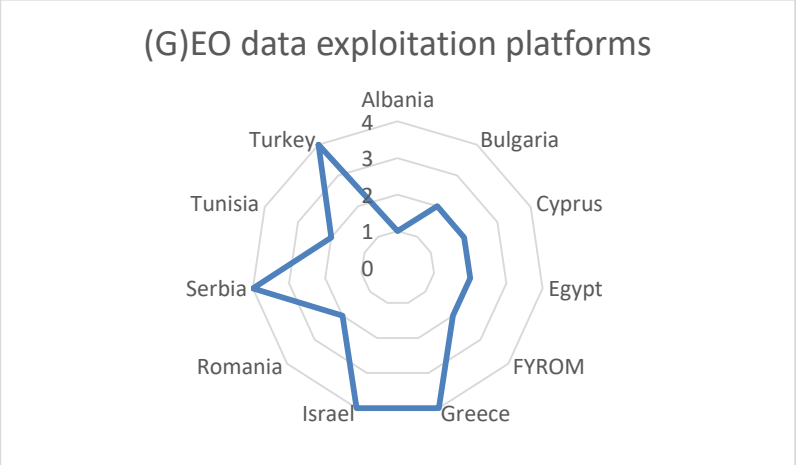
(d) In-situ monitoring networks



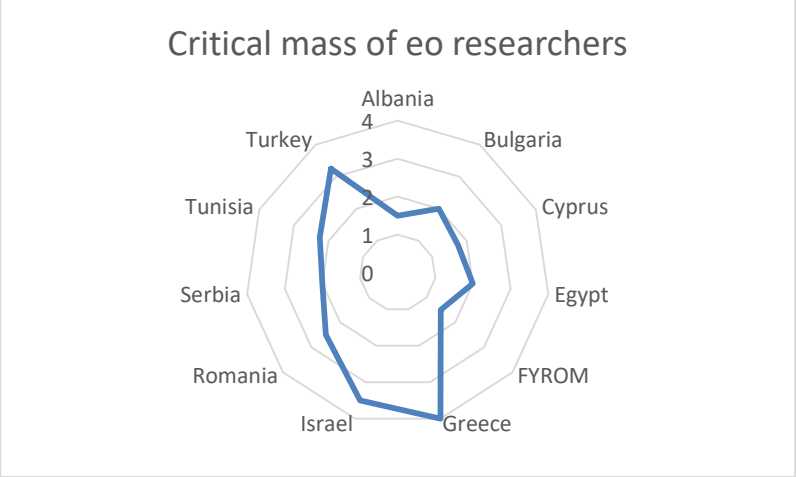
(e) Modelling / Computing capacities



(f) (G) EO data exploitation platforms



Critical mass of EO researchers



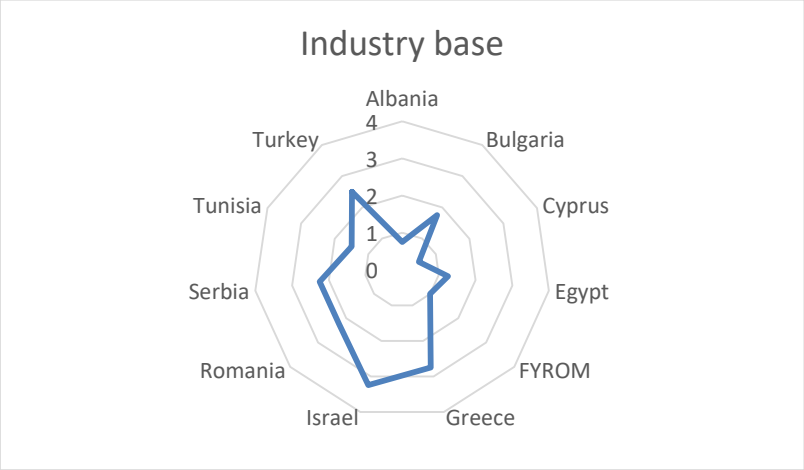
(g) Number of public organisations

(h) Number of researchers

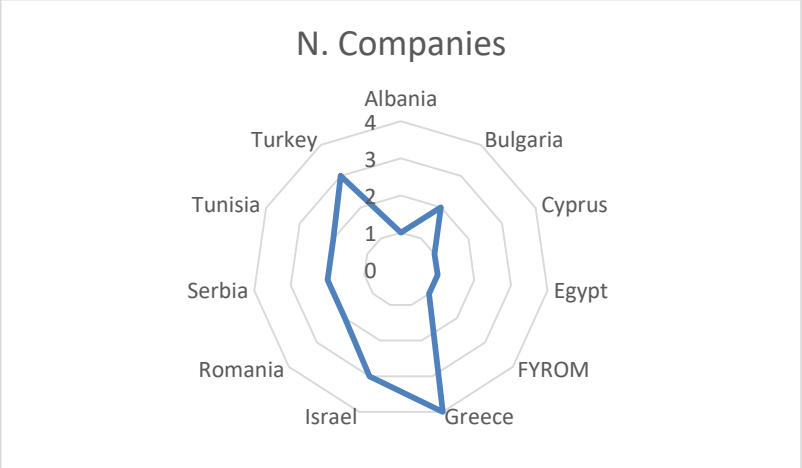
(i) Courses offered

(j) Relevant publications

Industry base

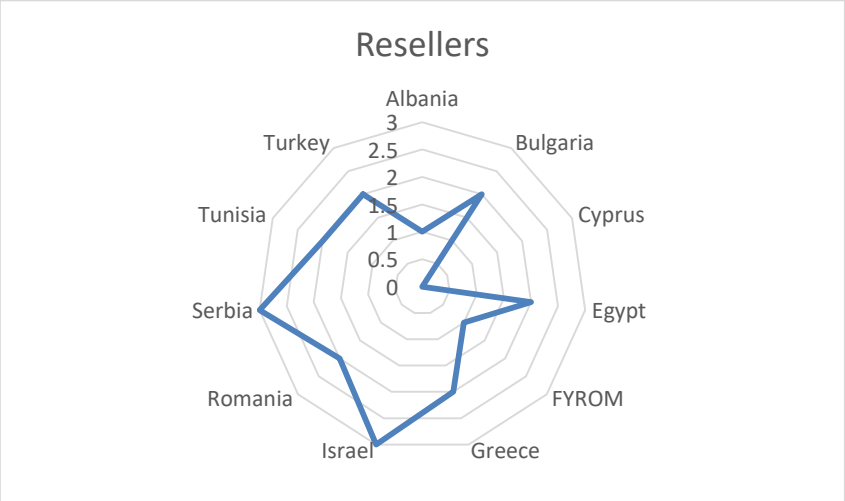


(k) Number of companies

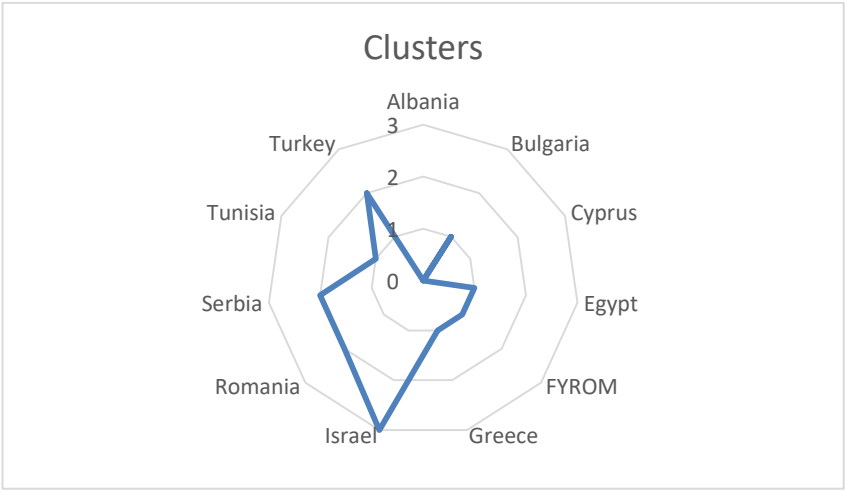


(l) Employment numbers

(m) Resellers / Representatives



(n) Clusters

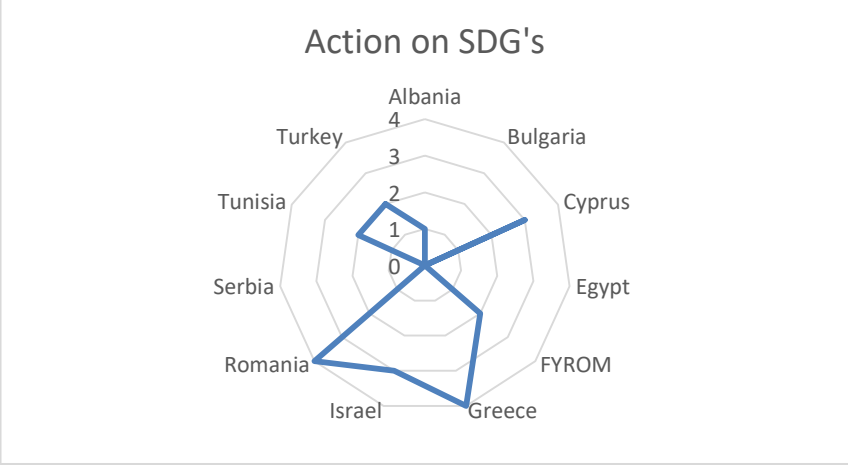


COLLABORATION

Collaboration through GEO

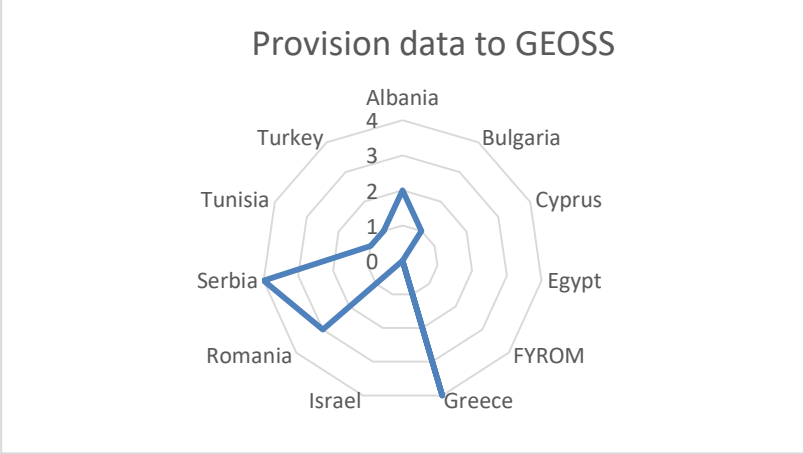
(o) Participation in GEO/GEOSS initiatives

(p) Specific actions on SDGs



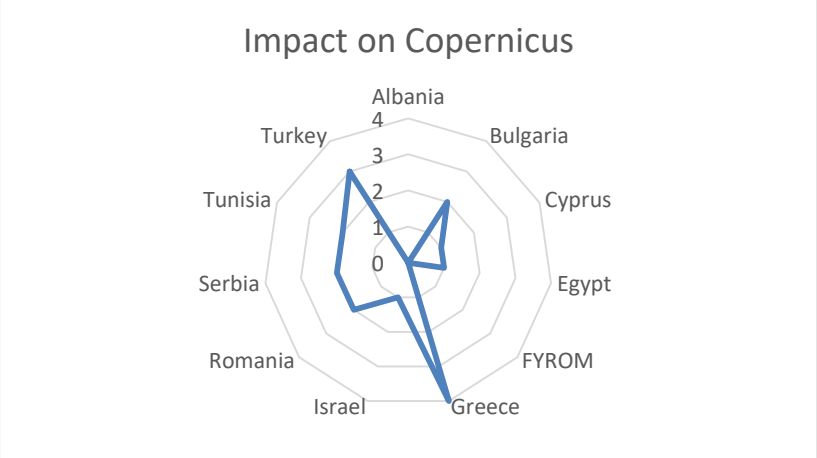
(q) Designated GEO office

(r) Provision of data to GEOSS

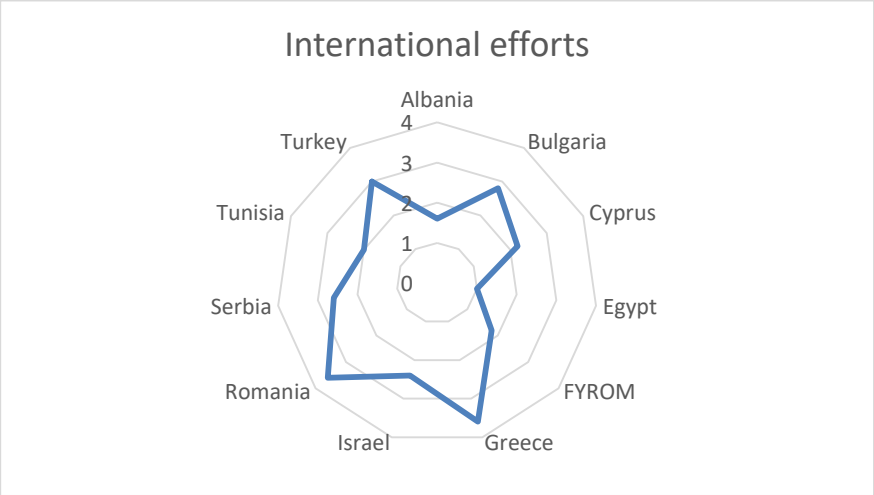


Impact of Copernicus

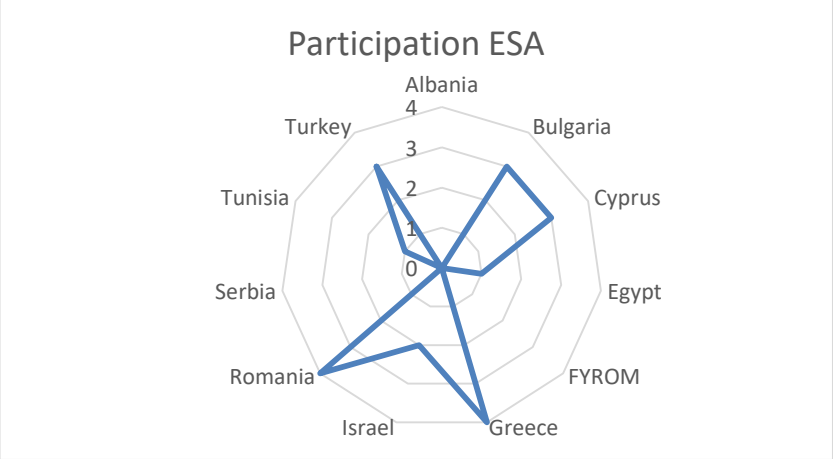
(s) Organisations involved in Copernicus projects



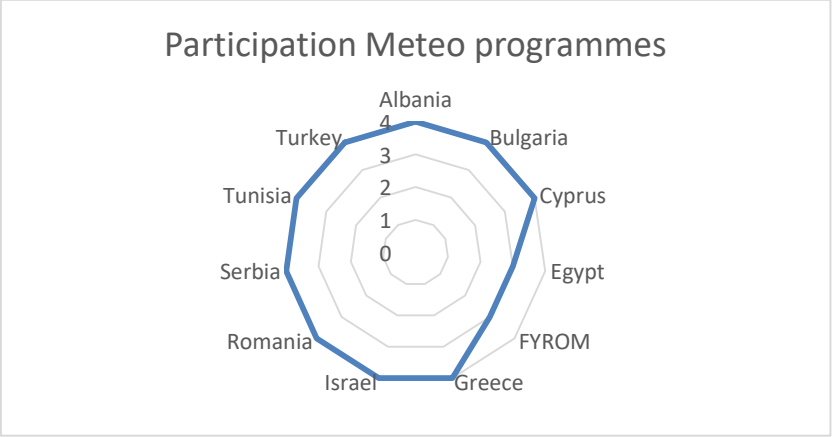
Participation to other international efforts



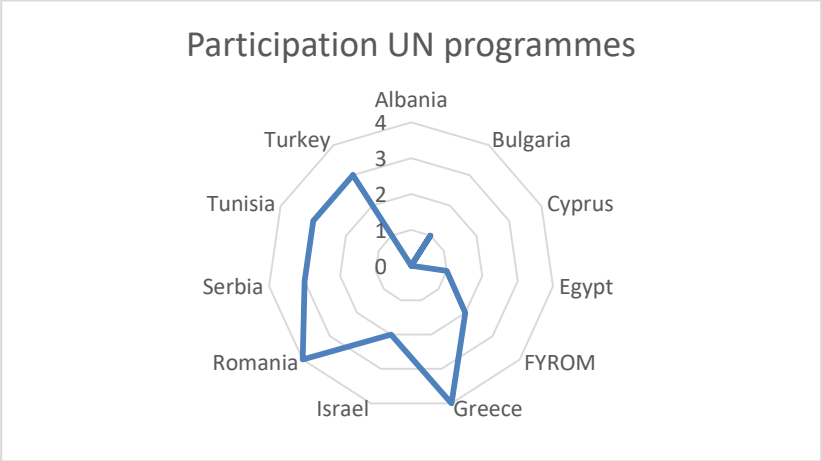
(t) ESA



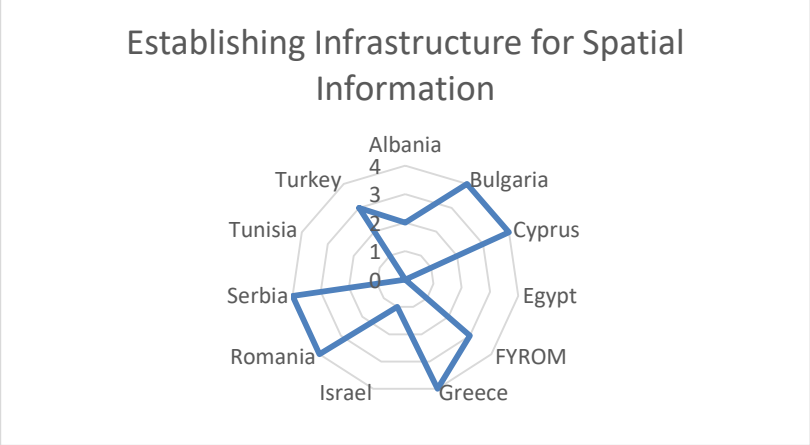
(u) Meteorological (WMO, EUMETSAT…)



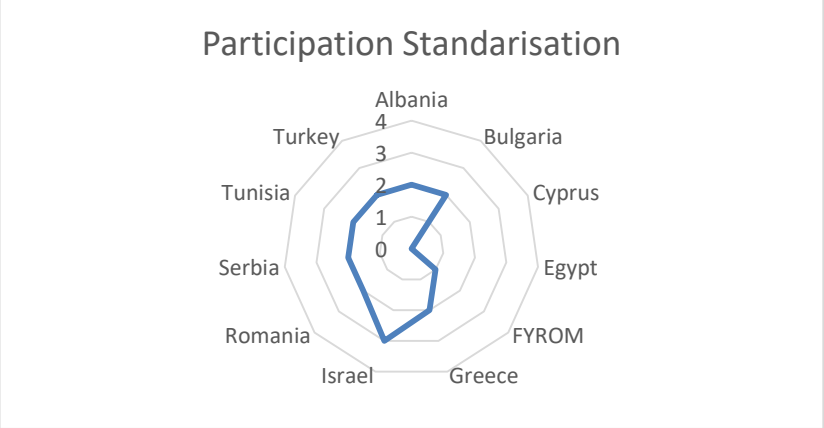
(v) UN system (UN-GGIM, …)



(w) Infrastructure for Spatial Information

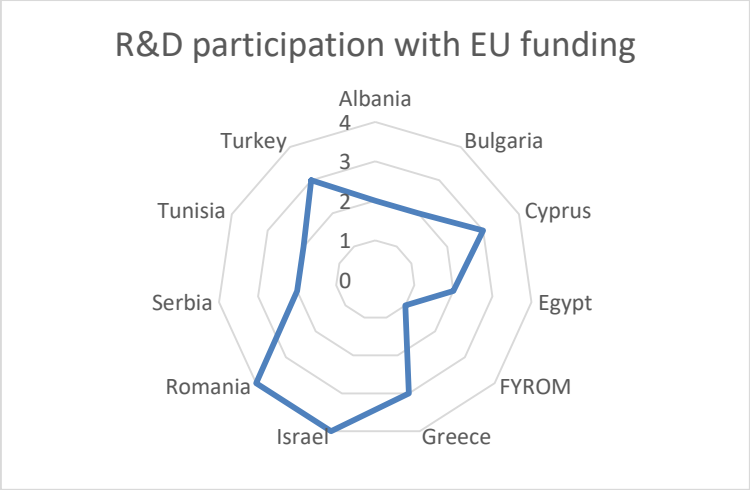


(x) Standardisation activities



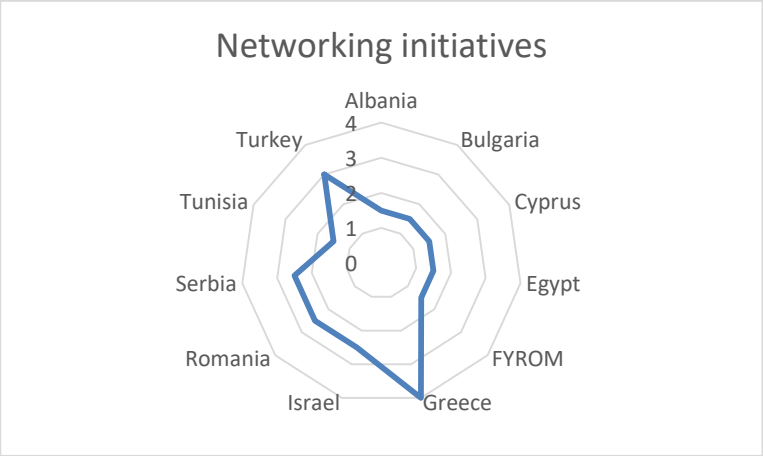
Availability of EU funding

(y) EU R&D participation

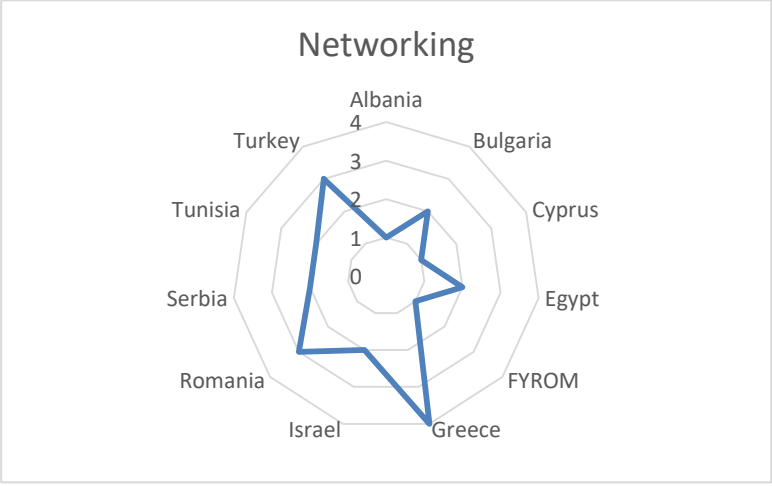


UPTAKE

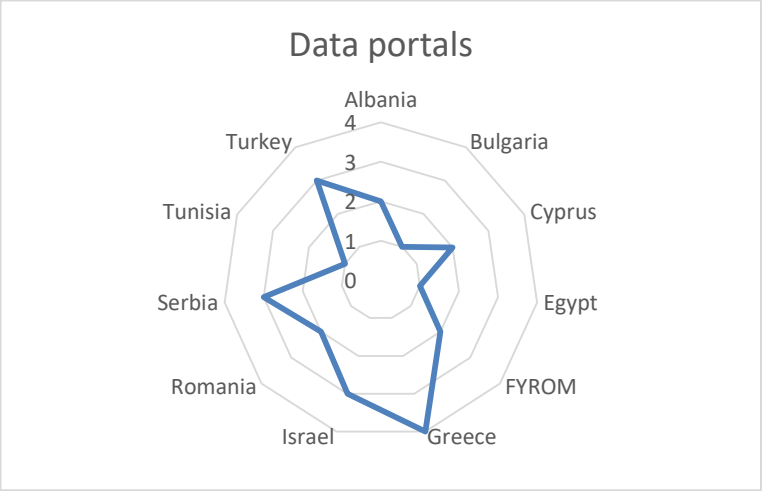
Networking initiatives



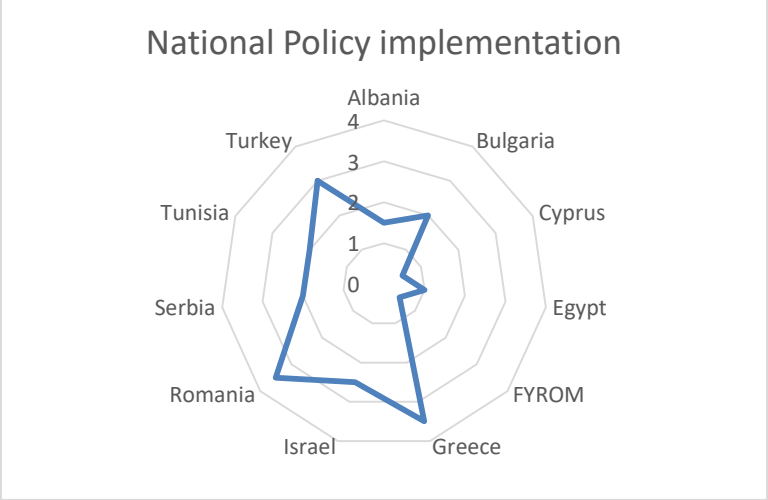
(z) Networking initiatives



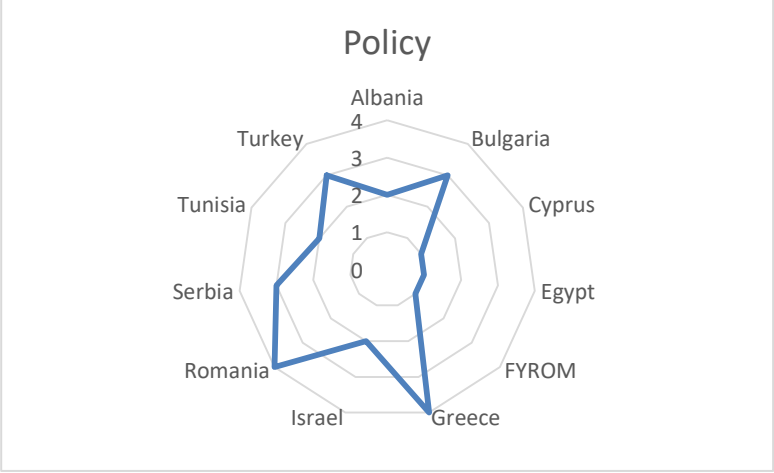
(aa) Data Portals



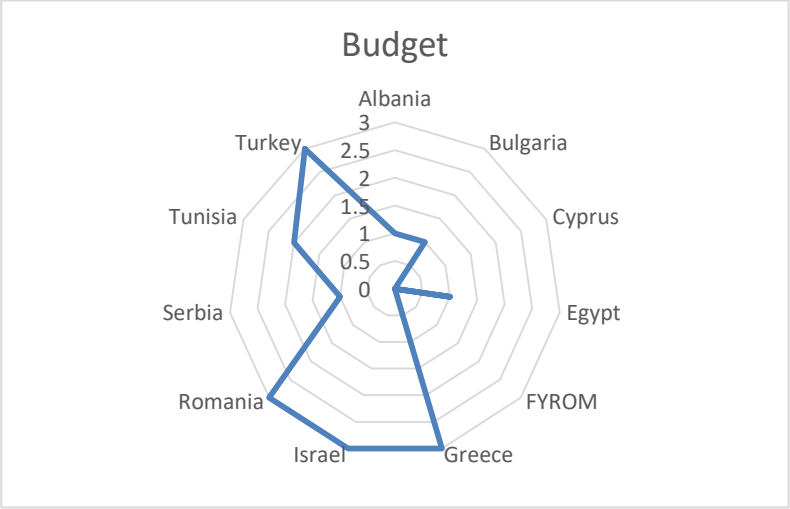
National Policies Implementation



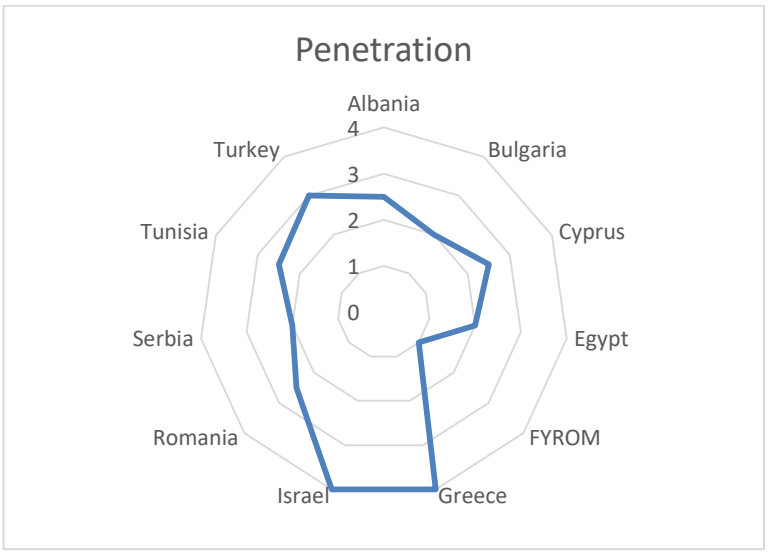
(bb) Policy



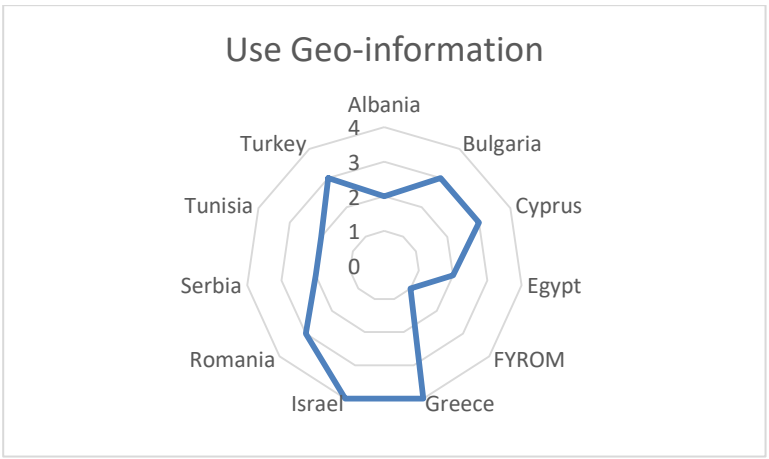
(cc) Internal Budget & Investment



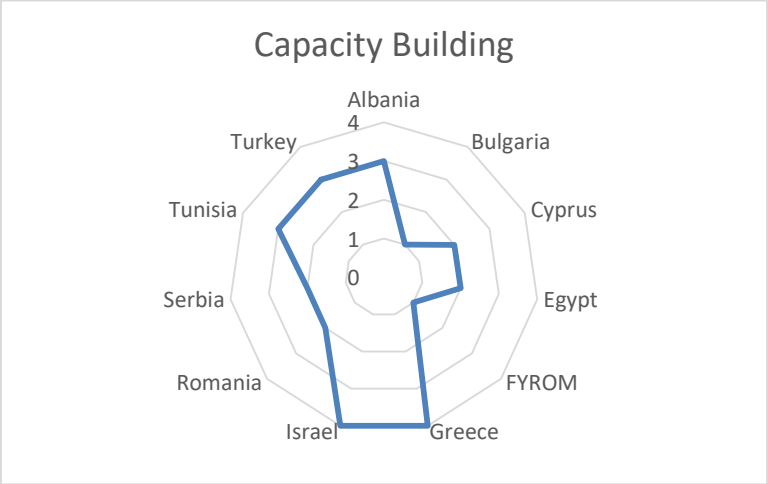
Penetration



(dd) Use of Geo-information



(ee) Capacity building EO focused actions



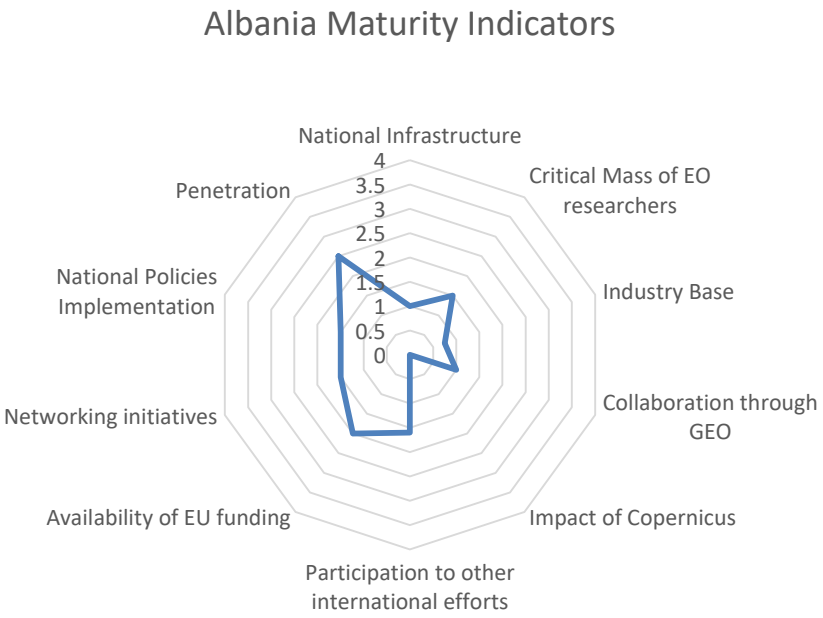
Annex 4: Example of Spider graphs and Conditional formatting per country

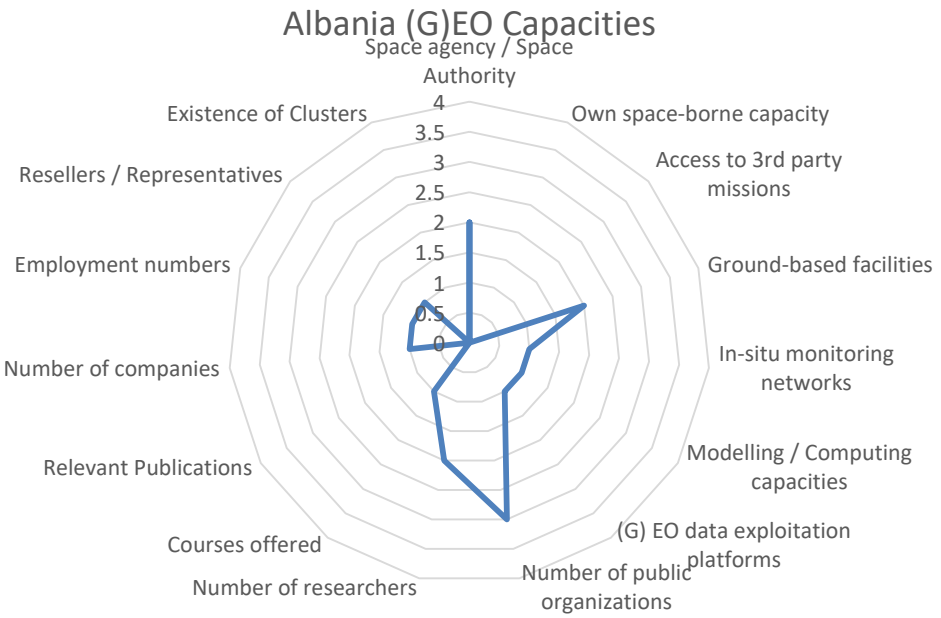
Multi-dimensional charts of quantitative variables will present the country maturity per indicator

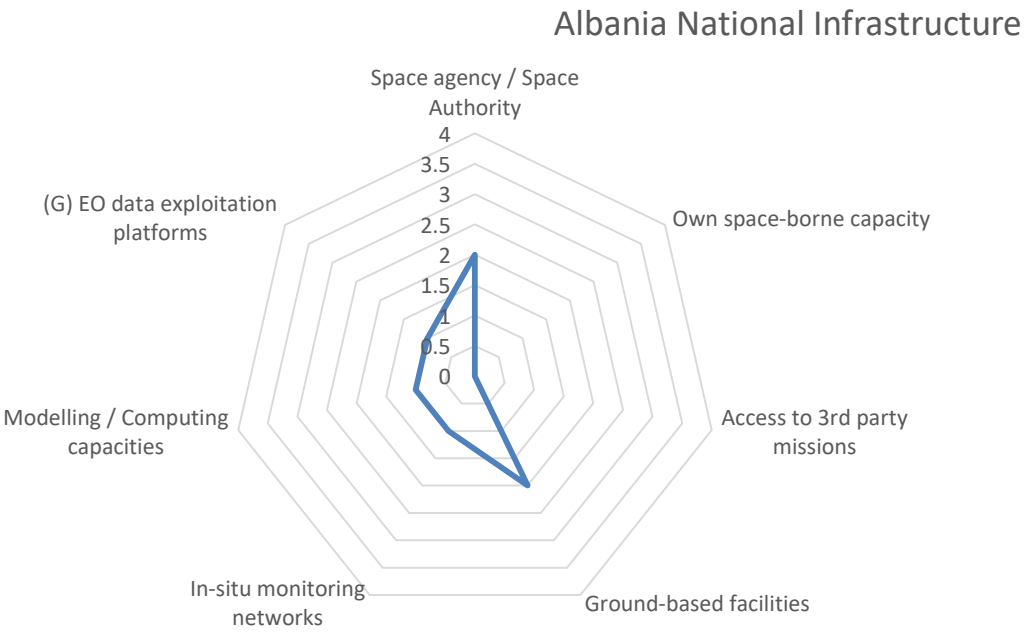
a) Albania Spider graphs and conditional formatting

Albania assessment (conditional formatting)	Albania
CAPACITIES	
National Infrastructure	**1**
Space agency or designated Space Authority	2
Own space-borne capacity	0
Access to 3rd party missions (own ground stations)	0
Ground-based facilities	2
In-situ monitoring networks	1
Modelling and computing capacities	1
(G) EO data exploitation platforms (provision of VA services and products)	1
Critical Mass of EO researchers	**1,5**
Number of public organisations	3
Number of researchers (in Univ. & R&D labs)	2
Courses being offered in universities, its diversity and maturity offered	1
Relevant Publications	0
Industry Base	**0,75**
Number of companies	1
Employment numbers, levels and changes	1
Resellers or local representatives of European companies	1
Existence of Clusters	0
COLLABORATION	Albania
Collaboration through GEO	**1**
Participation in GEO or to projects/initiatives which are linked to GEOSS	1
Specific actions on Sustainable Development Goals (SDG´s)	1
Designated GEO office	0
Provision of data to GEOSS	2
Impact of Copernicus	**0**
Organisations involved in projects linked to Copernicus	0
Participation to other international efforts	**1,6**
ESA	0
Meteorological: WMO, EUMETSAT, ...	4
UN system as UN-GGIM, ...	0

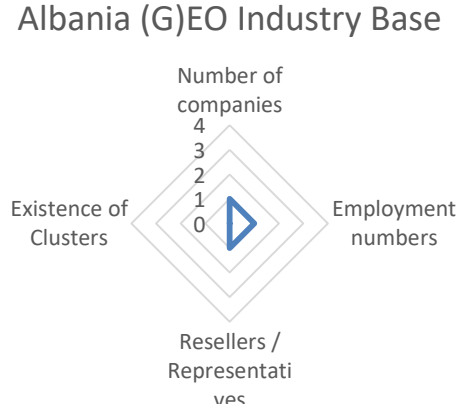
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	2
Participation in Standardisation organisations i.e. as OGC...	2
Availability of EU funding	**2**
R&D participation or other EU programmes	2
UPTAKE	Albania
Networking initiatives	**1,5**
Networking initiatives (events and thematic workshops)	1
Data Portals	2
National Policies Implementation	**1,5**
Policy	2
Budget & investment (internal to the country)	1
Penetration	**2,5**
Use of Geo-information	2
Capacity building EO focused actions	3



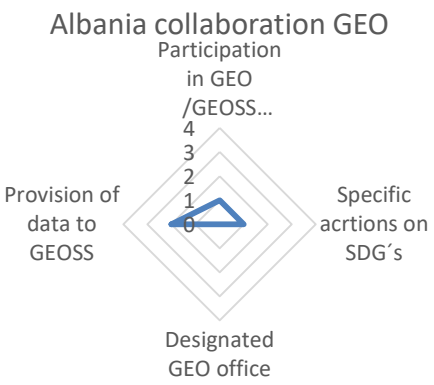

Albania (G)EO Capacities
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
Number of public organizations
Courses offered
Number of researchers
Relevant Publications
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
4
3.5
3
2.5
2
1.5
1
0.5
0

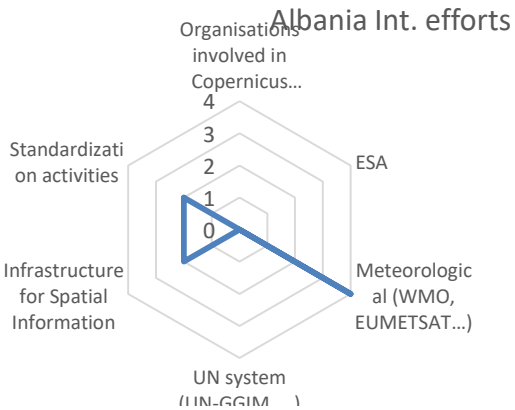

Albania National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
4
3.5
3
2.5
2
1.5
1
0.5
0

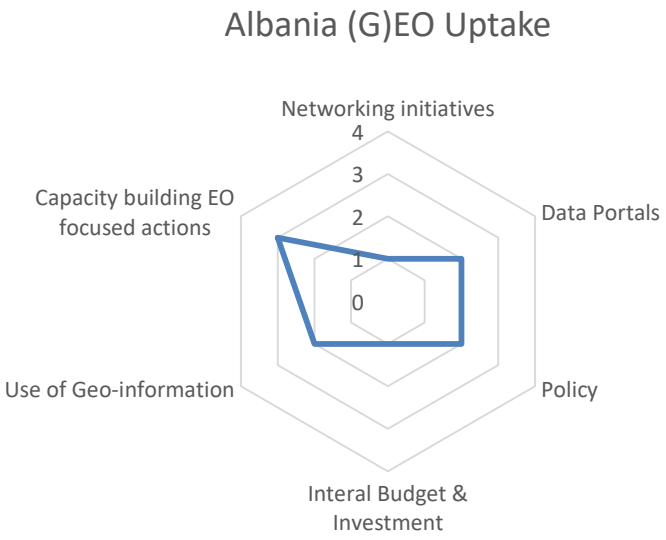

(G)EO Researchers
Number of public organizations
Number of researchers
Courses offered
Relevant Publications
4
2
0


Albania (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
4
3
2
1
0


Albania Collaboration
Participation in GEO…
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
Organisations involved in…
ESA
Meteorological (WMO,…
UN system (UN-GGIM, …)
Infrastructure for Spatial…
Standardization activities
EU R&D participation
4
3.5
3
2.5
2
1.5
1
0.5
0


Albania collaboration GEO
Participation in GEO /GEOSS…
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
4
3
2
1
0

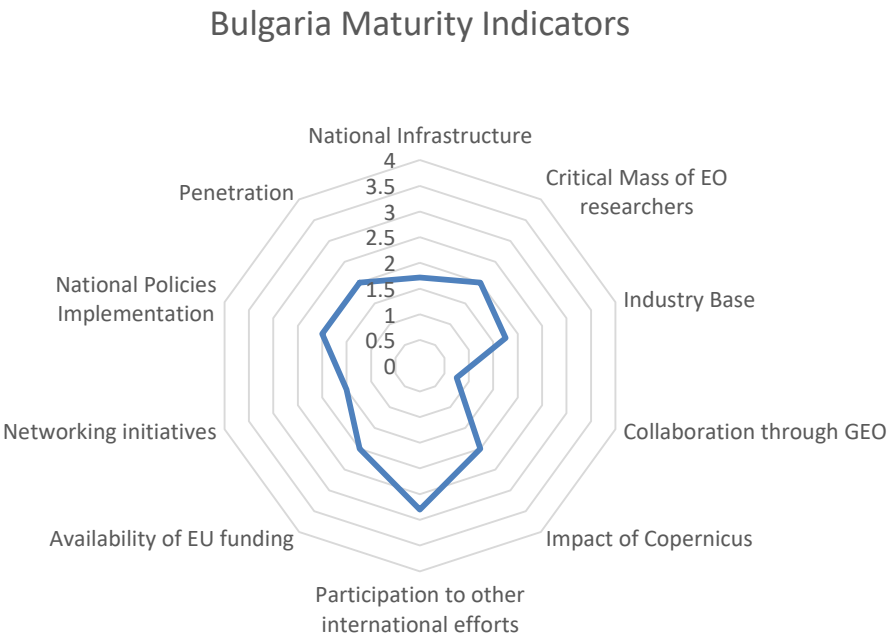

Albania Int. efforts
Organisations involved in Copernicus…
ESA
Meteorological (WMO, EUMETSAT…)
UN system
Infrastructure for Spatial Information
Standardizati on activities
4
3
2
1
0

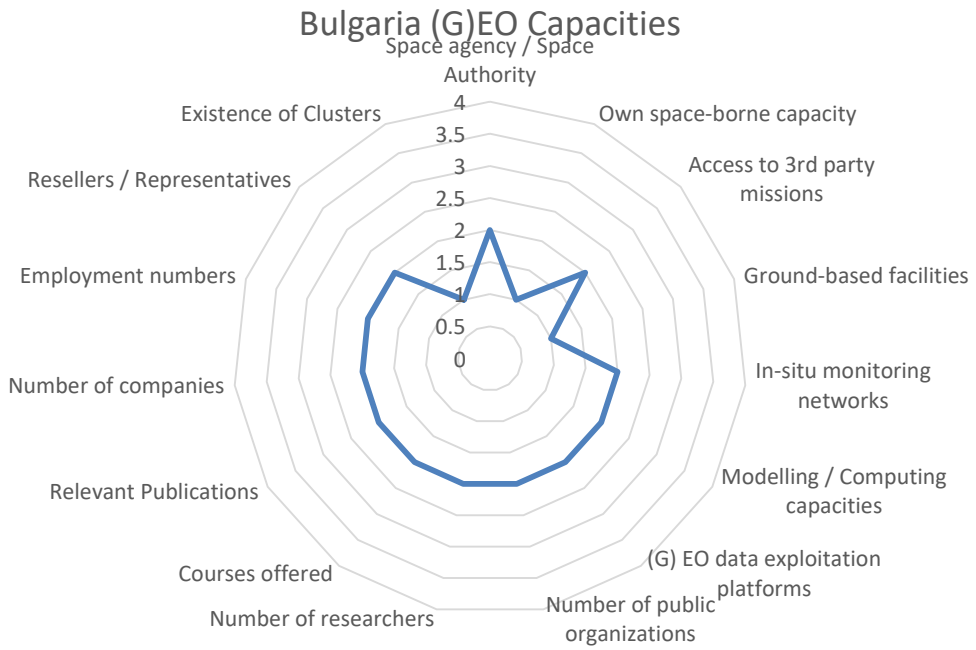

Albania (G)EO Uptake
Networking initiatives
Data Portals
Policy
Interal Budget & Investment
Use of Geo-information
Capacity building EO focused actions
4
3
2
1
0

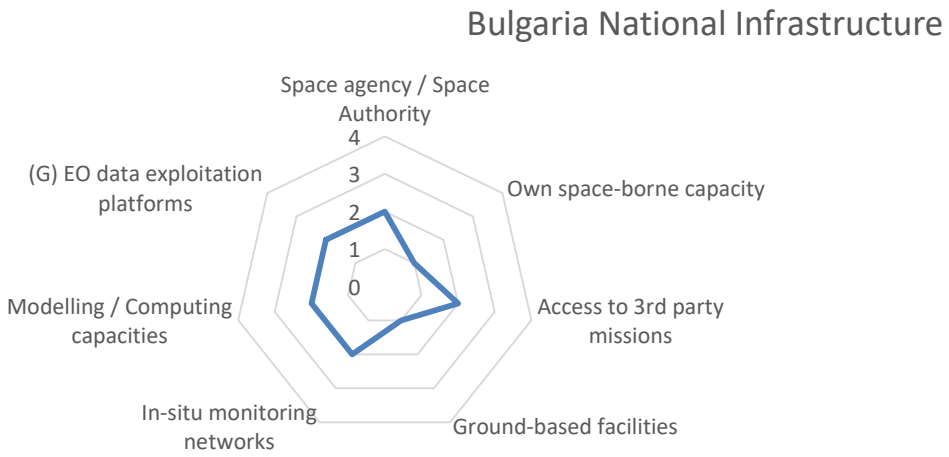
b) Bulgaria Spider graphs and conditional formatting

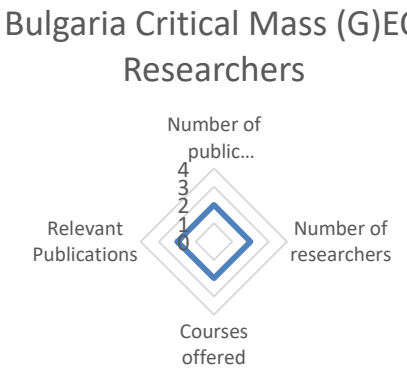
Bulgaria assessment (conditional formatting)	Bulgaria
CAPACITIES	
National Infrastructure	1,714285714
Space agency or designated Space Authority	2
Own space-borne capacity	1
Access to 3rd party missions (own ground stations)	2
Ground-based facilities	1
In-situ monitoring networks	2
Modelling and computing capacities	2
(G) EO data exploitation platforms (provision of VA services and products)	2
Critical Mass of EO researchers	2
Number of public organisations	2
Number of researchers (in Univ. & R&D labs)	2
Courses being offered in universities, its diversity and maturity offered	2
Relevant Publications	2
Industry Base	1,75
Number of companies	2
Employment numbers, levels and changes	2
Resellers or local representatives of European companies	2
Existence of Clusters	1
COLLABORATION	Bulgaria
Collaboration through GEO	0,75
Participation in GEO or to projects/initiatives which are linked to GEOSS	1
Specific actions on Sustainable Development Goals (SDG´s)	0
Designated GEO office	1
Provision of data to GEOSS	1
Impact of Copernicus	2
Organisations involved in projects linked to Copernicus	2
Participation to other international efforts	2,8
ESA	3
Meteorological: WMO, EUMETSAT, ...	4
UN system as UN-GGIM, ...	1
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	4
Participation in Standardisation organisations i.e. as OGC...	2

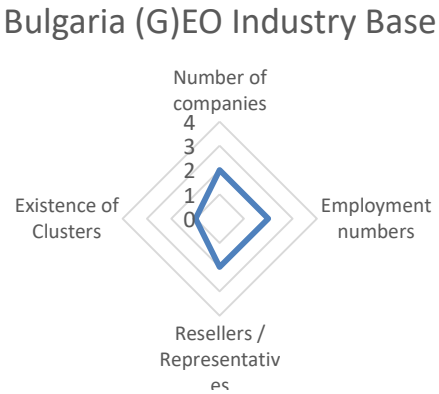
Availability of EU funding	**2**
R&D participation or other EU programmes	2
UPTAKE	Bulgaria
Networking initiatives	**1,5**
Networking initiatives (events and thematic workshops)	2
Data Portals	1
National Policies Implementation	**2**
Policy	3
Budget & investment (internal to the country)	1
Penetration	**2**
Use of Geo-information	3
Capacity building EO focused actions	1

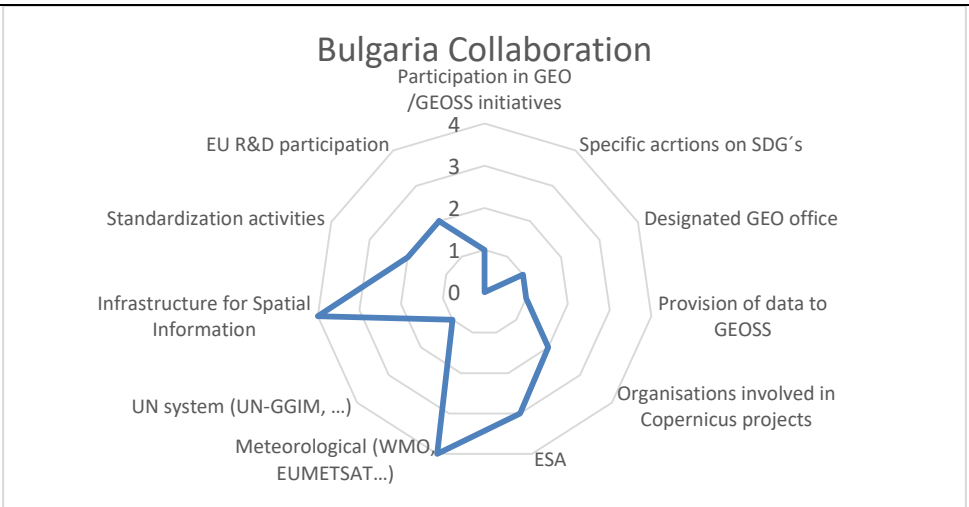


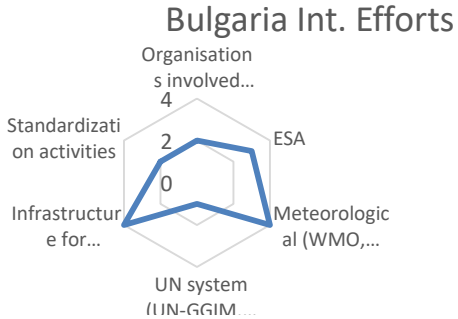

Bulgaria (G)EO Capacities
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
Number of public organizations
Number of researchers
Courses offered
Relevant Publications
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
4
3.5
3
2.5
2
1.5
1
0.5
0

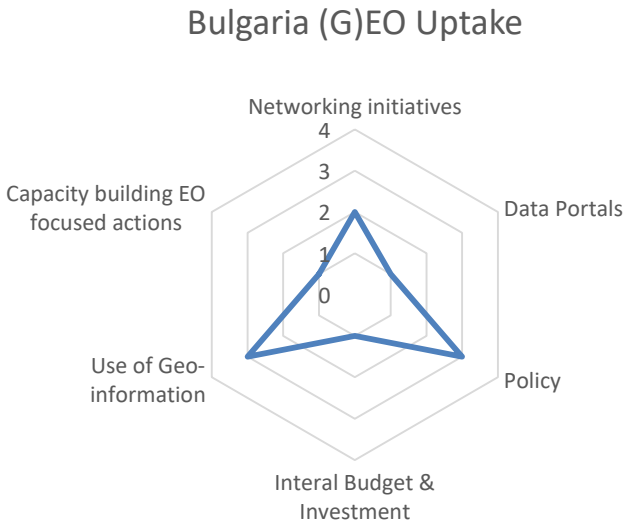

Bulgaria National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
4
3
2
1
0


Bulgaria Critical Mass (G)EO Researchers
Number of public...
Number of researchers
Courses offered
Relevant Publications
4
3
2
1
0


Bulgaria (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Representativ es
Existence of Clusters
4
3
2
1
0





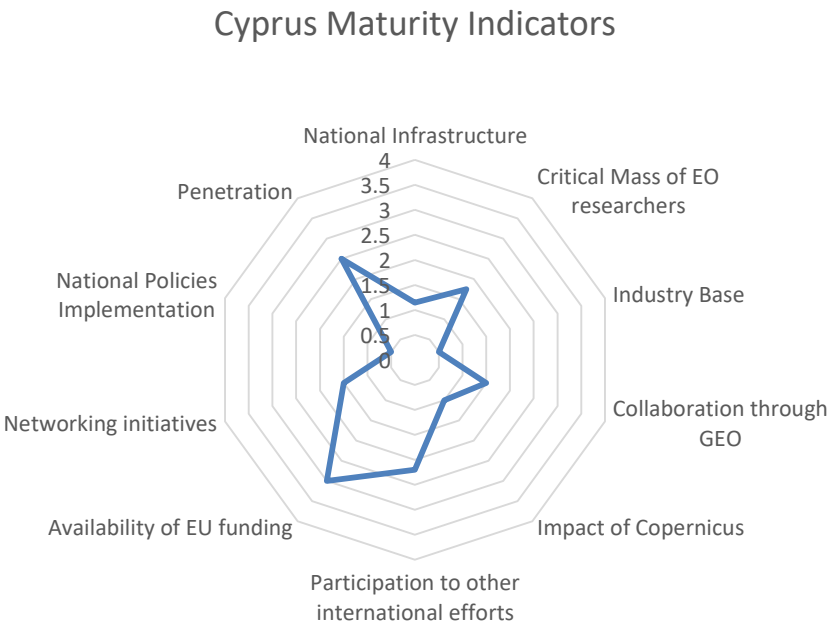


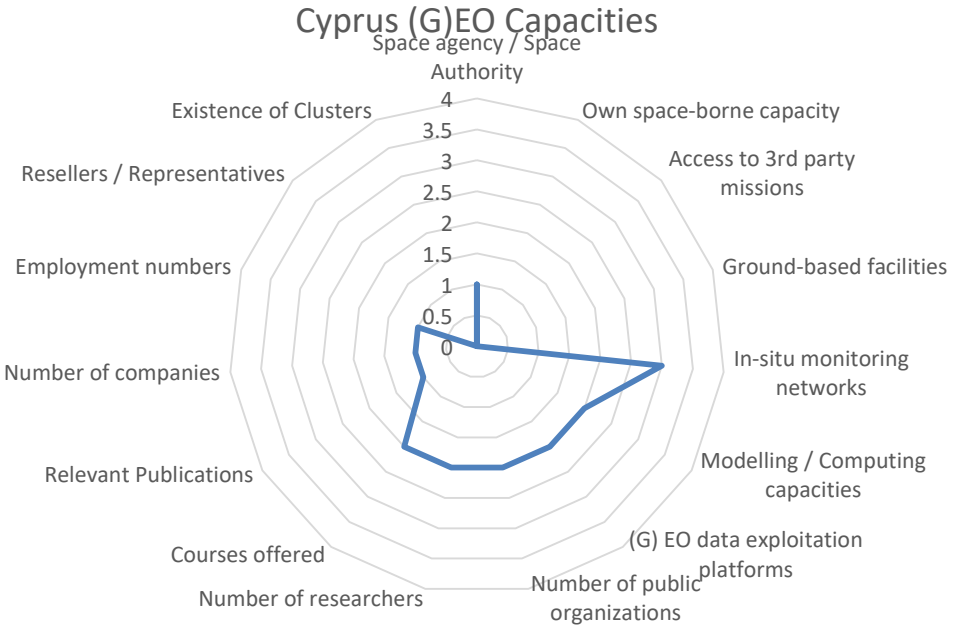
c) Cyprus Spider graphs and conditional formatting

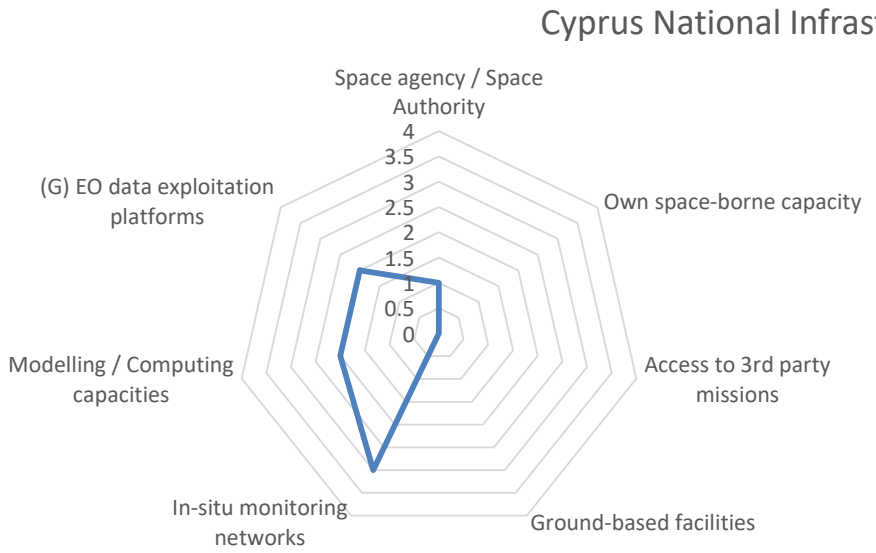
Cyprus assessment (conditional formatting)	**Cyprus**
CAPACITIES	
National Infrastructure	1,142857143
Space agency or designated Space Authority	1
Own space-borne capacity	0
Access to 3rd party missions (own ground stations)	0

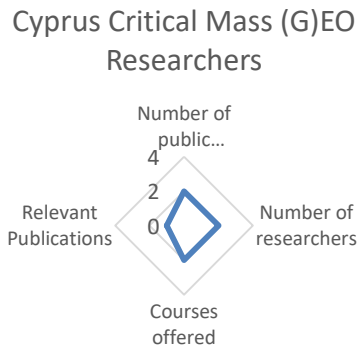
Ground-based facilities	0
In-situ monitoring networks	3
Modelling and computing capacities	2
(G) EO data exploitation platforms (provision of VA services and products)	2
Critical Mass of EO researchers	**1,75**
Number of public organisations	2
Number of researchers (in Univ. & R&D labs)	2
Courses being offered in universities, its diversity and maturity offered	2
Relevant Publications	1
Industry Base	**0,5**
Number of companies	1
Employment numbers, levels and changes	1
Resellers or local representatives of European companies	0
Existence of Clusters	0
COLLABORATION	Cyprus
Collaboration through GEO	**1,5**
Participation in GEO or to projects/initiatives which are linked to GEOSS	1
Specific actions on Sustainable Development Goals (SDG´s)	3
Designated GEO office	2
Provision of data to GEOSS	0
Impact of Copernicus	**1**
Organisations involved in projects linked to Copernicus	1
Participation to other international efforts	**2,2**
ESA	3
Meteorological: WMO, EUMETSAT, ...	4
UN system as UN-GGIM, ...	0
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	4
Participation in Standardisation organisations i.e. as OGC...	0
Availability of EU funding	**3**
R&D participation or other EU programmes	3
UPTAKE	Cyprus
Networking initiatives	**1,5**
Networking initiatives (events and thematic workshops)	1
Data Portals	2
National Policies Implementation	**0,5**

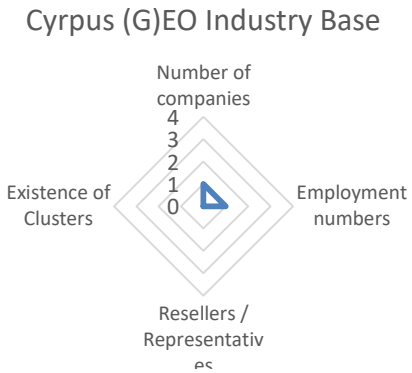
Policy	1
Budget & investment (internal to the country)	0
Penetration	2,5
Use of Geo-information	3
Capacity building EO focused actions	2

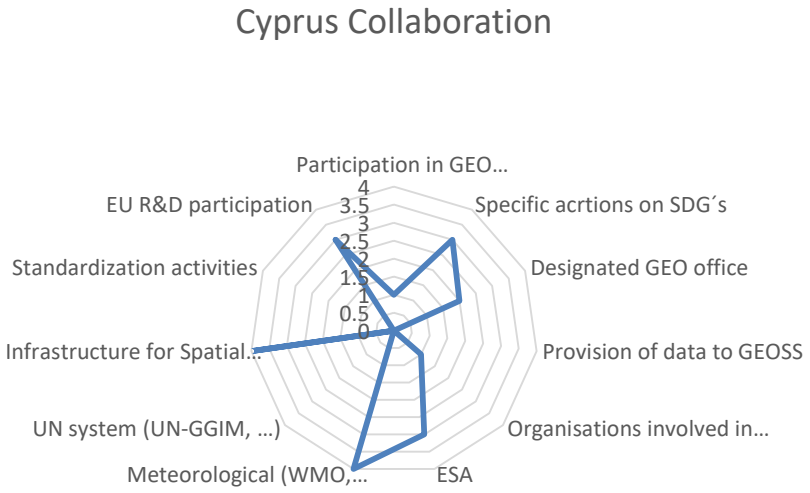


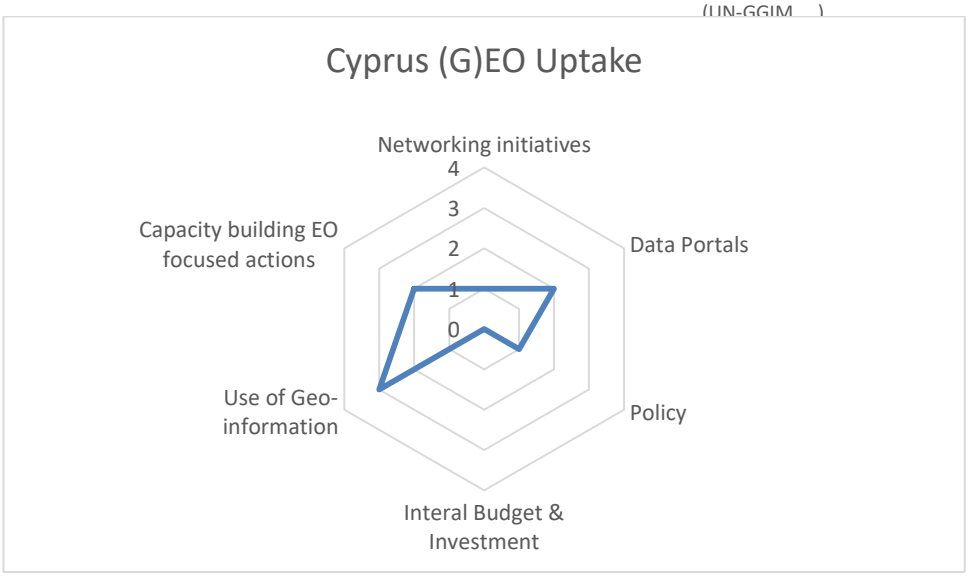



Cyprus National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
4
3.5
3
2.5
2
1.5
1
0.5
0


Cyprus Critical Mass (G)EO Researchers
Number of public...
Number of researchers
Courses offered
Relevant Publications
4
2
0


Cyrpus (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Representativ es
Existence of Clusters
4
3
2
1
0

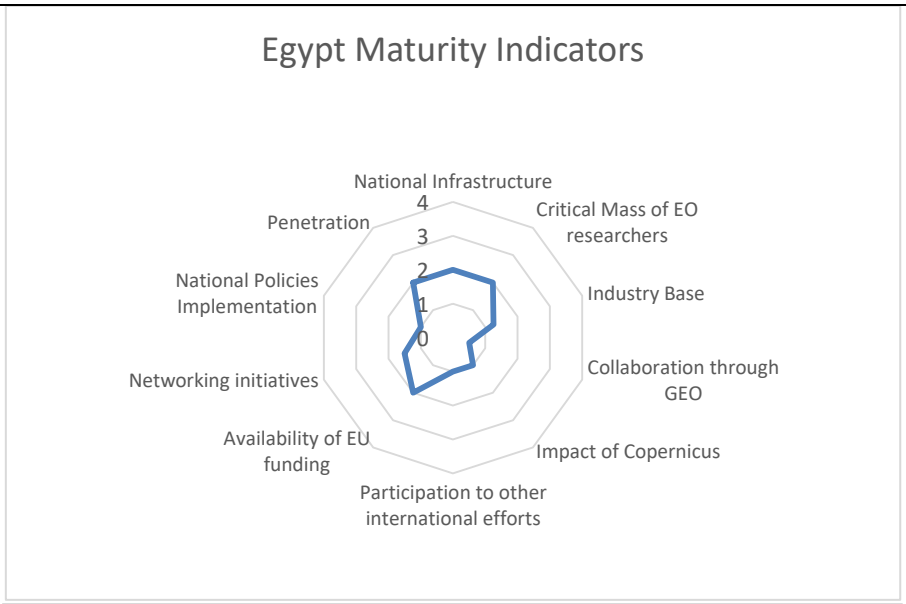

Cyprus Collaboration
Participation in GEO...
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
Organisations involved in...
ESA
Meteorological (WMO,...
UN system (UN-GGIM, ...)
Infrastructure for Spatial...
Standardization activities
EU R&D participation
4
3.5
3
2.5
2
1.5
1
0.5
0



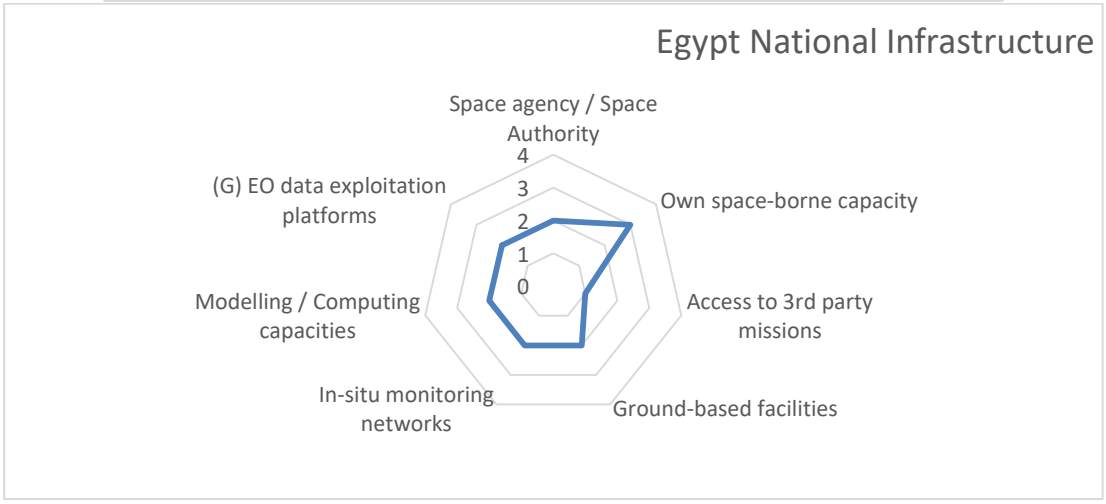
d) Egypt Spider graphs and conditional formatting

Egypt assessment (conditional formatting)	**Egypt**
CAPACITIES	
National Infrastructure	**2**
Space agency or designated Space Authority	2
Own space-borne capacity	3
Access to 3rd party missions (own ground stations)	1
Ground-based facilities	2
In-situ monitoring networks	2
Modelling and computing capacities	2
(G) EO data exploitation platforms (provision of VA services and products)	2
Critical Mass of EO researchers	**2**
Number of public organisations	2
Number of researchers (in Univ. & R&D labs)	2
Courses being offered in universities, its diversity and maturity offered	2
Relevant Publications	2

Industry Base	**1,25**
Number of companies	1
Employment numbers, levels and changes	1
Resellers or local representatives of European companies	2
Existence of Clusters	1
COLLABORATION	Egypt
Collaboration through GEO	**0,5**
Participation in GEO or to projects/initiatives which are linked to GEOSS	1
Specific actions on Sustainable Development Goals (SDG´s)	0
Designated GEO office	1
Provision of data to GEOSS	0
Impact of Copernicus	**1**
Organisations involved in projects linked to Copernicus	1
Participation to other international efforts	**1**
ESA	1
Meteorological: WMO, EUMETSAT, ...	3
UN system as UN-GGIM, ...	1
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	0
Participation in Standardisation organisations i.e. as OGC...	0
Availability of EU funding	**2**
R&D participation or other EU programmes	2
UPTAKE	Egypt
Networking initiatives	**1,5**
Networking initiatives (events and thematic workshops)	2
Data Portals	1
National Policies Implementation	**1**
Policy	1
Budget & investment (internal to the country)	1
Penetration	**2**
Use of Geo-information	2
Capacity building EO focused actions	2


Egypt Maturity Indicators
National Infrastructure
Critical Mass of EO researchers
Industry Base
Collaboration through GEO
Impact of Copernicus
Participation to other international efforts
Availability of EU funding
Networking initiatives
National Policies Implementation
Penetration
4
3
2
1
0


Egypt (G)EO Capacities
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
Number of public organizations
Number of researchers
Courses offered
Relevant Publications
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
4
3
2
1
0

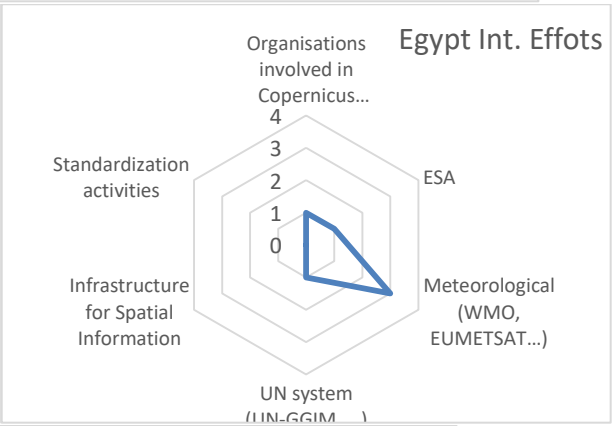

Egypt National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
4
3
2
1
0

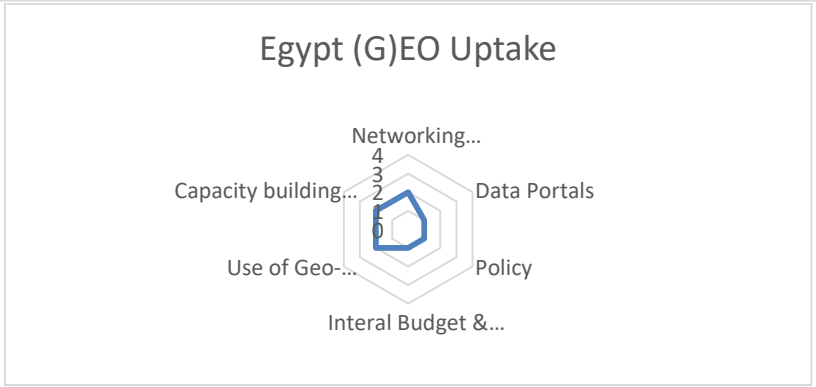

Egypt Critical Mass (G)EO Researchers
Researchers in public organizations
Number of researchers
Courses offered
Relevant Publications
4
2
0


Egypt (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Representat...
Existence of Clusters
2
1.5
1
0.5
0


Egypt Collaboration
Participation in GEO /GEOSS initiatives
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
Organisations involved in Copernicus projects
ESA
Meteorological (WMO, EUMETSAT...)
UN system (UN-GGIM, ...)
Infrastructure for Spatial Information
Standardization activities
EU R&D participation
4
3
2
1
0


Egypt Collaboration with GEO
Participation in GEO /GEOSS...
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
4
3
2
1
0

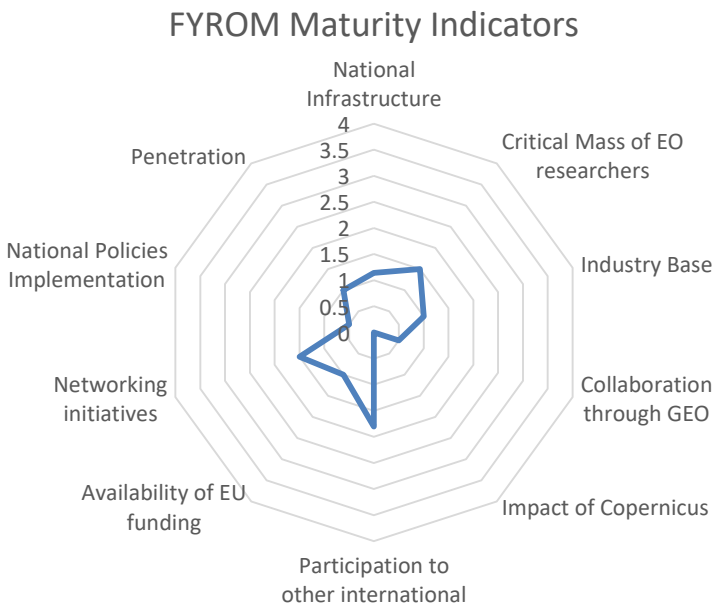

Egypt Int. Effots
Organisations involved in Copernicus...
ESA
Meteorological (WMO, EUMETSAT...)
UN system
Infrastructure for Spatial Information
Standardization activities
4
3
2
1
0

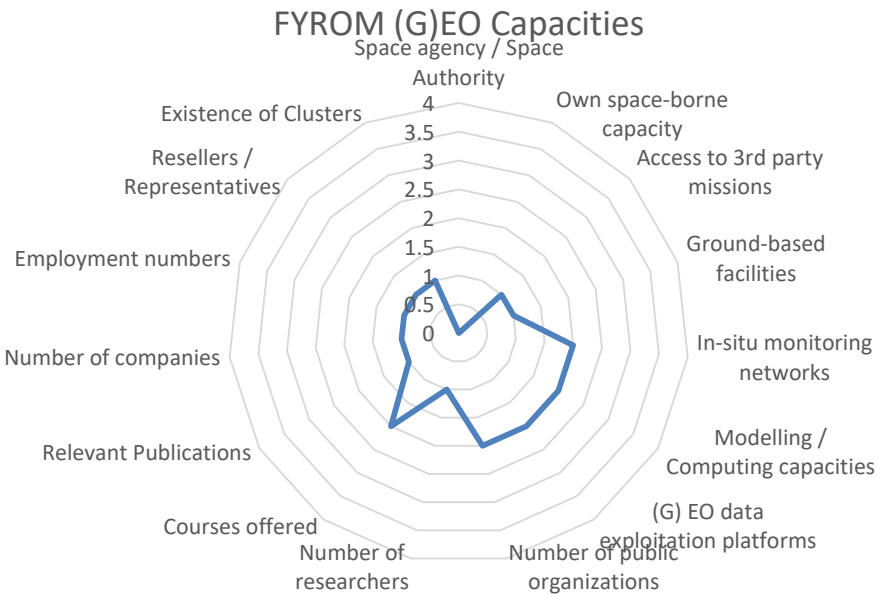

Egypt (G)EO Uptake
Networking...
Data Portals
Policy
Interal Budget &...
Use of Geo-...
Capacity building...
4
3
2
1
0

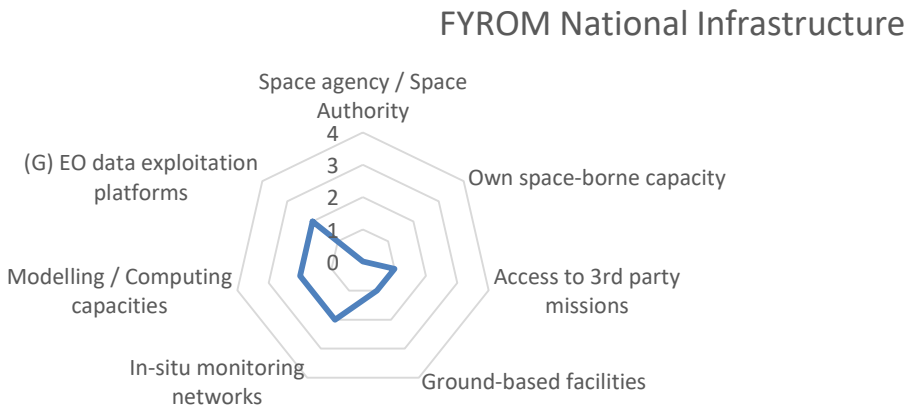
e) FYROM Spider graphs and conditional formatting

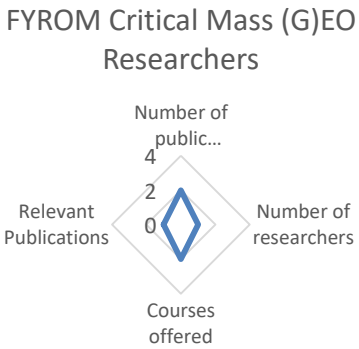
FYROM assessment (conditional formatting)	FYROM
CAPACITIES	
National Infrastructure	0,857142857
Space agency or designated Space Authority	0
Own space-borne capacity	0
Access to 3rd party missions (own ground stations)	1
Ground-based facilities	0
In-situ monitoring networks	2
Modelling and computing capacities	1
(G) EO data exploitation platforms (provision of VA services and products)	2
Critical Mass of EO researchers	1,5
Number of public organisations	2
Number of researchers (in Univ. & R&D labs)	1
Courses being offered in universities, its diversity and maturity offered	2
Relevant Publications	1
Industry Base	0,25
Number of companies	1
Employment numbers, levels and changes	0
Resellers or local representatives of European companies	0
Existence of Clusters	0
COLLABORATION	FYROM
Collaboration through GEO	0,5
Participation in GEO or to projects/initiatives which are linked to GEOSS	0
Specific actions on Sustainable Development Goals (SDG´s)	2
Designated GEO office	0
Provision of data to GEOSS	0
Impact of Copernicus	0
Organisations involved in projects linked to Copernicus	0
Participation to other international efforts	1,2
ESA	0
Meteorological: WMO, EUMETSAT, ...	2
UN system as UN-GGIM, ...	2
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	2
Participation in Standardisation organisations i.e. as OGC...	0

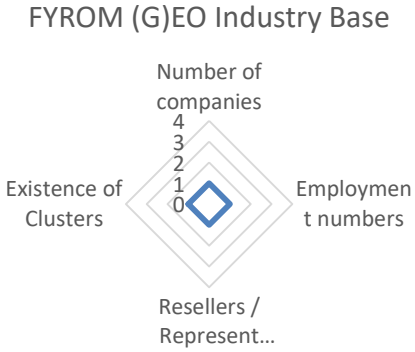
Availability of EU funding	2
R&D participation or other EU programmes	2
UPTAKE	FYROM
Networking initiatives	1,5
Networking initiatives (events and thematic workshops)	1
Data Portals	2
National Policies Implementation	0,5
Policy	1
Budget & investment (internal to the country)	0
Penetration	1
Use of Geo-information	1
Capacity building EO focused actions	1

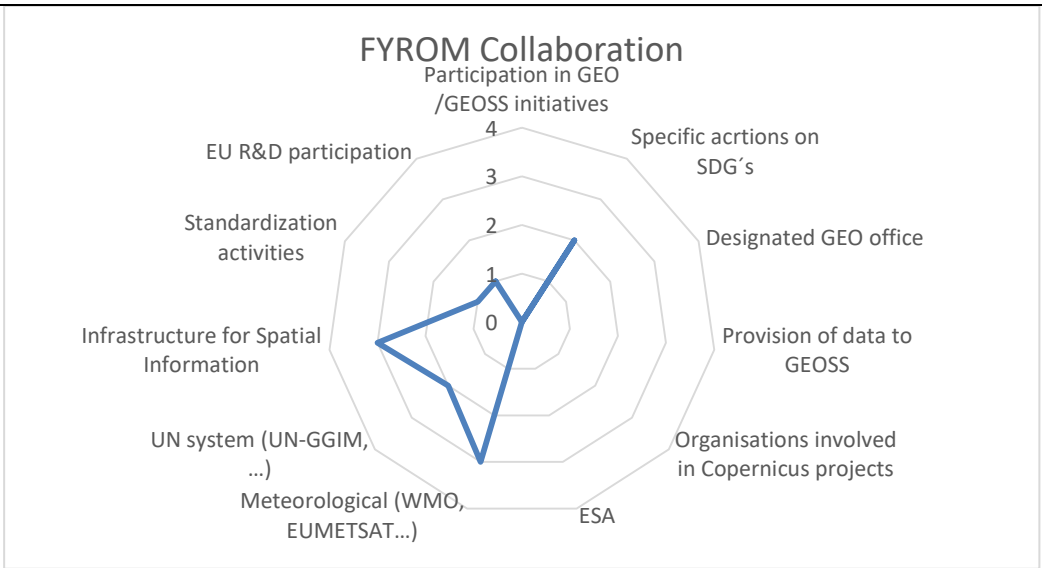


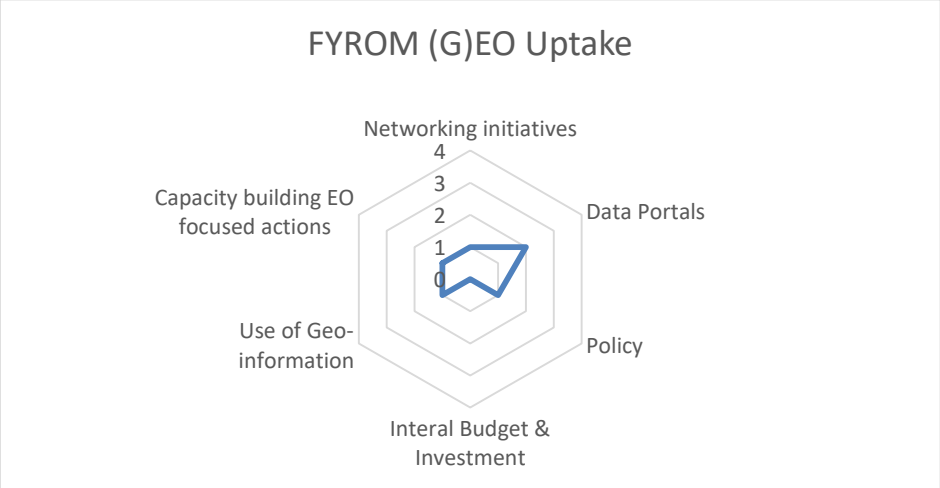

FYROM (G)EO Capacities
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
Number of public organizations
Number of researchers
Courses offered
Relevant Publications
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
4
3.5
3
2.5
2
1.5
1
0.5
0


FYROM National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
4
3
2
1
0


FYROM Critical Mass (G)EO Researchers
Number of public...
Number of researchers
Courses offered
Relevant Publications
4
2
0


FYROM (G)EO Industry Base
Number of companies
Employmen t numbers
Resellers / Represent...
Existence of Clusters
4
3
2
1
0

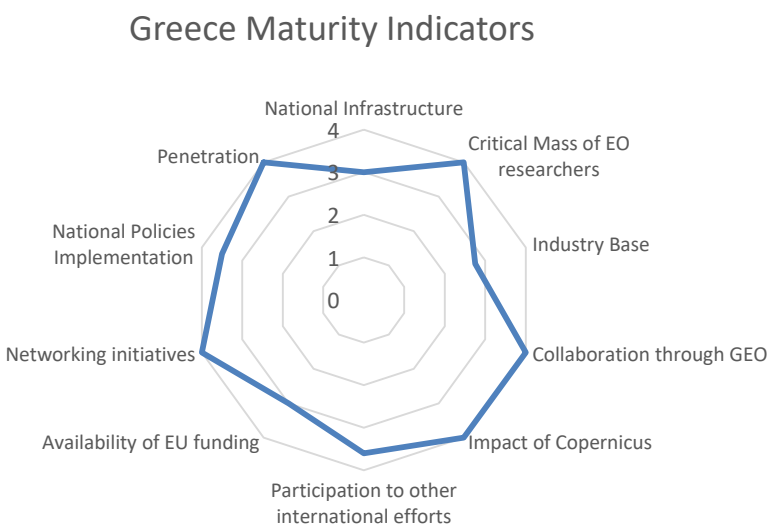


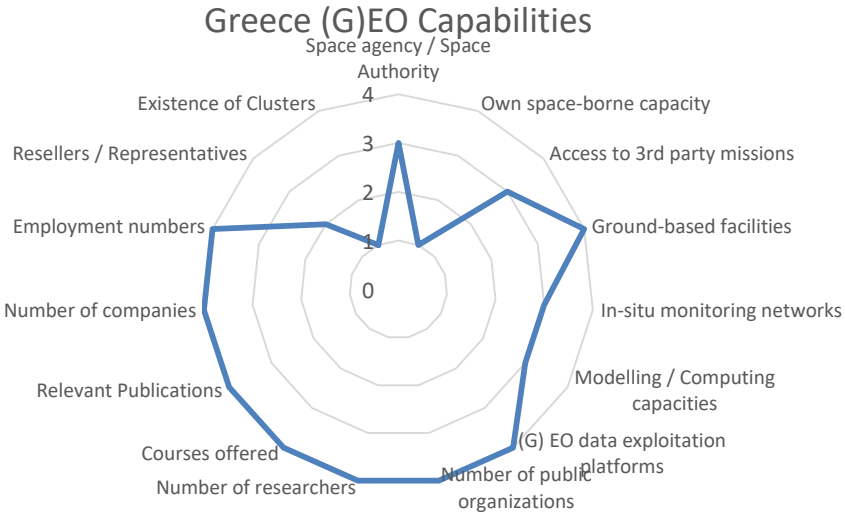


f) Greece Spider graphs and conditional formatting

Greece assessment (conditional formatting)	Greece
CAPACITIES	
National Infrastructure	**3**
Space agency or designated Space Authority	3
Own space-borne capacity	1
Access to 3rd party missions (own ground stations)	3
Ground-based facilities	4
In-situ monitoring networks	3
Modelling and computing capacities	3
(G) EO data exploitation platforms (provision of VA services and products)	4
Critical Mass of EO researchers	**4**
Number of public organisations	4
Number of researchers (in Univ. & R&D labs)	4

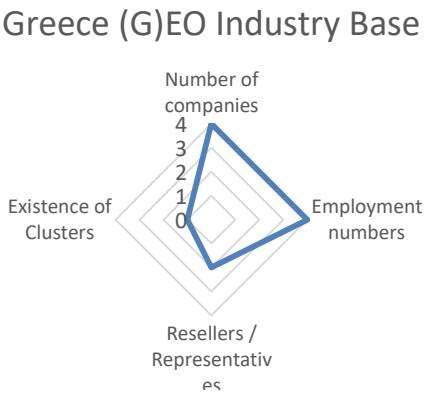
Courses being offered in universities, its diversity and maturity offered	4
Relevant Publications	4
Industry Base	**2,75**
Number of companies	4
Employment numbers, levels and changes	4
Resellers or local representatives of European companies	2
Existence of Clusters	1
COLLABORATION	Greece
Collaboration through GEO	**4**
Participation in GEO or to projects/initiatives which are linked to GEOSS	4
Specific actions on Sustainable Development Goals (SDG´s)	4
Designated GEO office	4
Provision of data to GEOSS	4
Impact of Copernicus	**4**
Organisations involved in projects linked to Copernicus	4
Participation to other international efforts	**3,6**
ESA	4
Meteorological: WMO, EUMETSAT, ...	4
UN system as UN-GGIM, ...	4
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	4
Participation in Standardisation organisations i.e. as OGC...	2
Availability of EU funding	**3**
R&D participation or other EU programmes	3
UPTAKE	Greece
Networking initiatives	**4**
Networking initiatives (events and thematic workshops)	4
Data Portals	4
National Policies Implementation	**3,5**
Policy	4
Budget & investment (internal to the country)	3
Penetration	**4**
Use of Geo-information	4
Capacity building EO focused actions	4


Greece Maturity Indicators
National Infrastructure
Critical Mass of EO researchers
Industry Base
Collaboration through GEO
Impact of Copernicus
Participation to other international efforts
Availability of EU funding
Networking initiatives
National Policies Implementation
Penetration
4
3
2
1
0

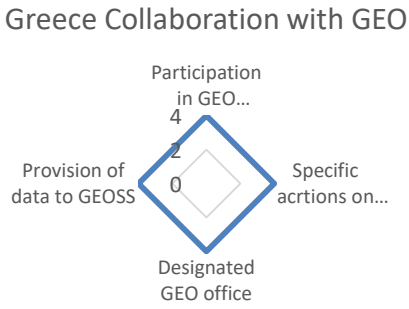

Greece (G)EO Capabilities
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
Number of public organizations
Number of researchers
Courses offered
Relevant Publications
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
4
3
2
1
0

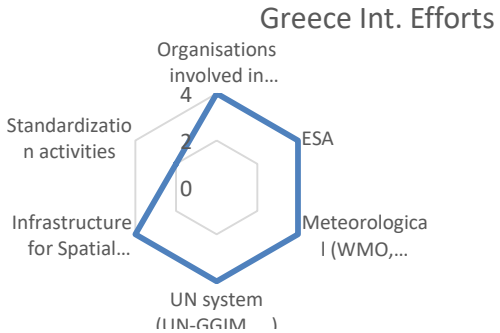

Greece National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
4
3
2
1
0


Greece Critical Mass (G)EO Researchers
Number of public...
Number of researchers
Courses offered
Relevant Publications
0
1
2
3
4


Greece (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Representativ es
Existence of Clusters
0
1
2
3
4


Greece Collaboration
Participation in GEO /GEOSS initiatives
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
Organisations involved in Copernicus projects
ESA
Meteorological (WMO, EUMETSAT...)
UN system (UN-GGIM, ...)
Infrastructure for Spatial Information
Standardization activities
EU R&D participation
0
1
2
3
4


Greece Collaboration with GEO
Participation in GEO...
Specific acrtions on...
Designated GEO office
Provision of data to GEOSS
0
2
4

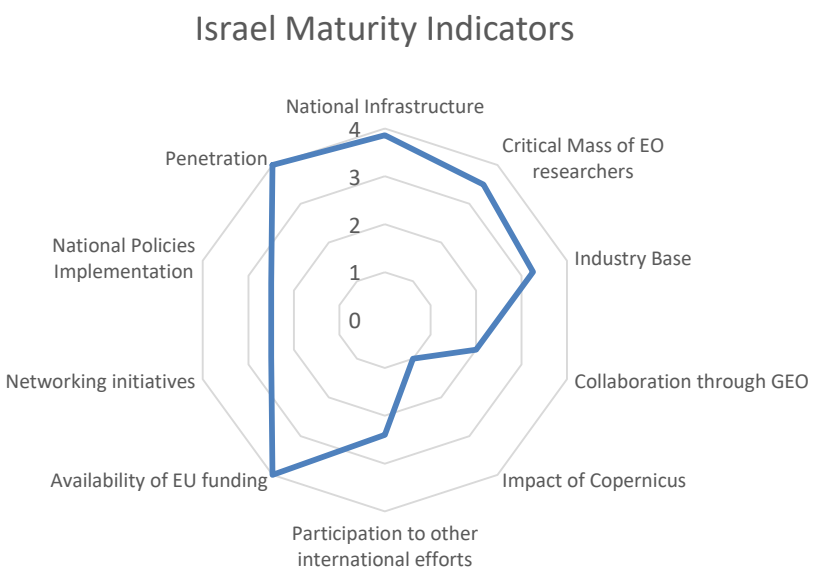

Greece Int. Efforts
Organisations involved in...
ESA
Meteorologica l (WMO,...
UN system (UN-GGIM...)
Infrastructure for Spatial...
Standardizatio n activities
0
2
4

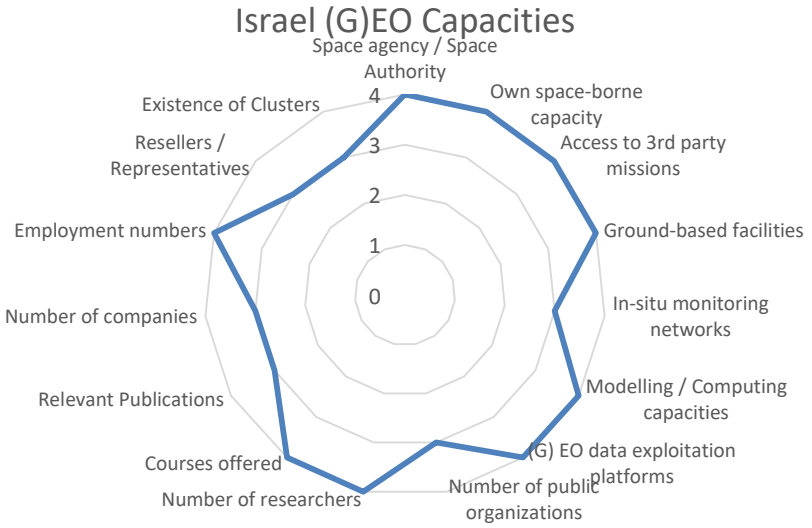

Greece (G)EO Uptake
Networking initiatives
Data Portals
Policy
Interal Budget & Investment
Use of Geo-information
Capacity building EO focused actions
0
1
2
3
4

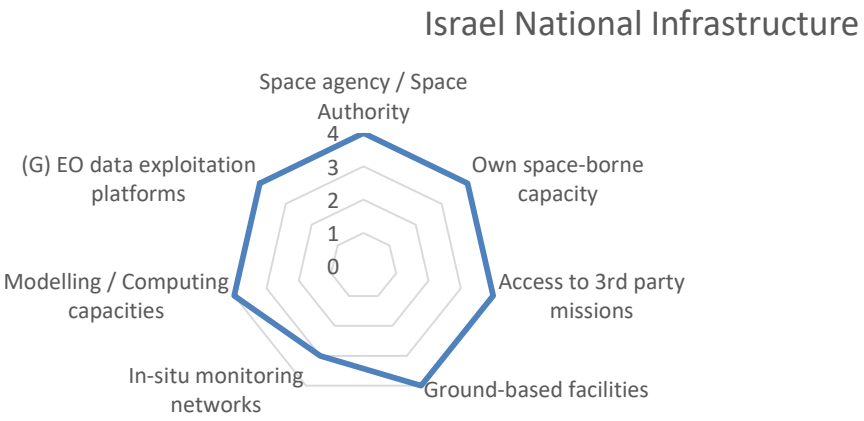
g) Israel Spider graphs and conditional formatting

Israel assessment (conditional formatting)	Israel
National Infrastructure	3,857142857
Space agency or designated Space Authority	4
Own space-borne capacity	4
Access to 3rd party missions (own ground stations)	4
Ground-based facilities	4
In-situ monitoring networks	3
Modelling and computing capacities	4
(G) EO data exploitation platforms (provision of VA services and products)	4
Critical Mass of EO researchers	3,5
Number of public organisations	3
Number of researchers (in Univ. & R&D labs)	4
Courses being offered in universities, its diversity and maturity offered	4
Relevant Publications	3
Industry Base	3,25
Number of companies	3
Employment numbers, levels and changes	4
Resellers or local representatives of European companies	3
Existence of Clusters	3
COLLABORATION	Israel
Collaboration through GEO	2
Participation in GEO or to projects/initiatives which are linked to GEOSS	3
Specific actions on Sustainable Development Goals (SDG´s)	3
Designated GEO office	2
Provision of data to GEOSS	0
Impact of Copernicus	1
Organisations involved in projects linked to Copernicus	1
Participation to other international efforts	2,4
ESA	2
Meteorological: WMO, EUMETSAT, ...	4
UN system as UN-GGIM, ...	2
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	1
Participation in Standardisation organisations i.e. as OGC...	3

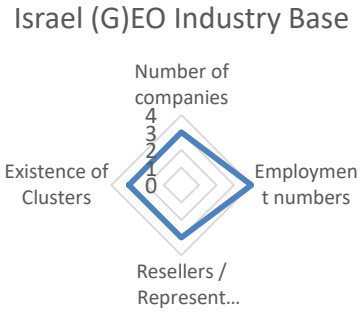
Availability of EU funding	4
R&D participation or other EU programmes	4
UPTAKE	Israel
Networking initiatives	2,5
Networking initiatives (events and thematic workshops)	2
Data Portals	3
National Policies Implementation	2,5
Policy	2
Budget & investment (internal to the country)	3
Penetration	4
Use of Geo-information	4
Capacity building EO focused actions	4



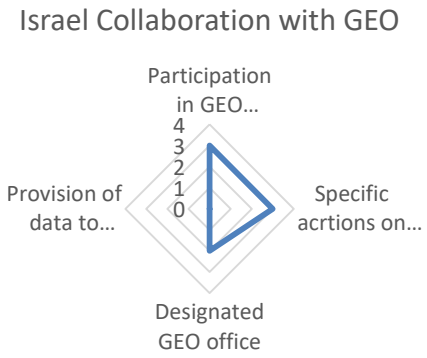


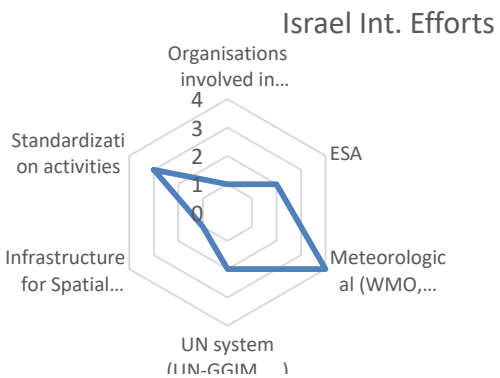

Israel National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
0
1
2
3
4

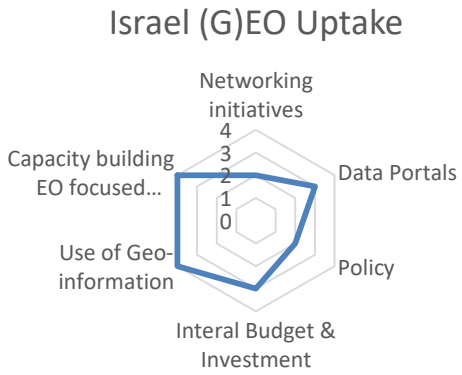

Israel Critical Mass (G)EO Researchers
Number of public...
Number of researchers
Courses offered
Relevant Publications
0
2
4


Israel (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Represent...
Existence of Clusters
0
1
2
3
4


Israel Collaboration
Participation in GEO /GEOSS initiatives
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
Organisations involved in Copernicus projects
ESA
Meteorological (WMO, EUMETSAT...)
UN system (UN-GGIM, ...)
Infrastructure for Spatial Information
Standardization activities
EU R&D participation
0
1
2
3
4





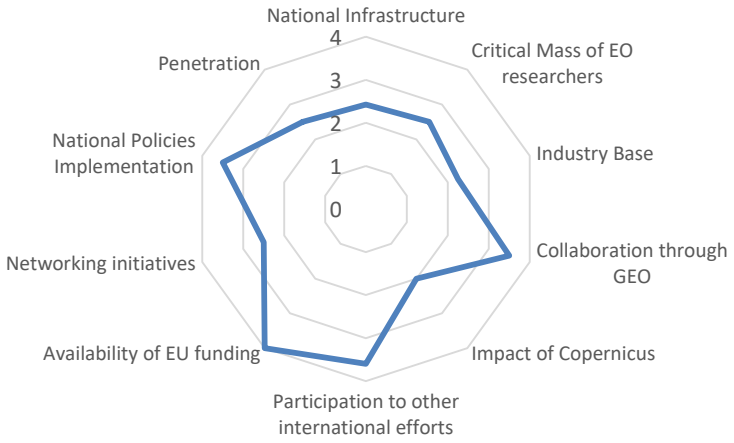


h) Romania Spider graphs and conditional formatting

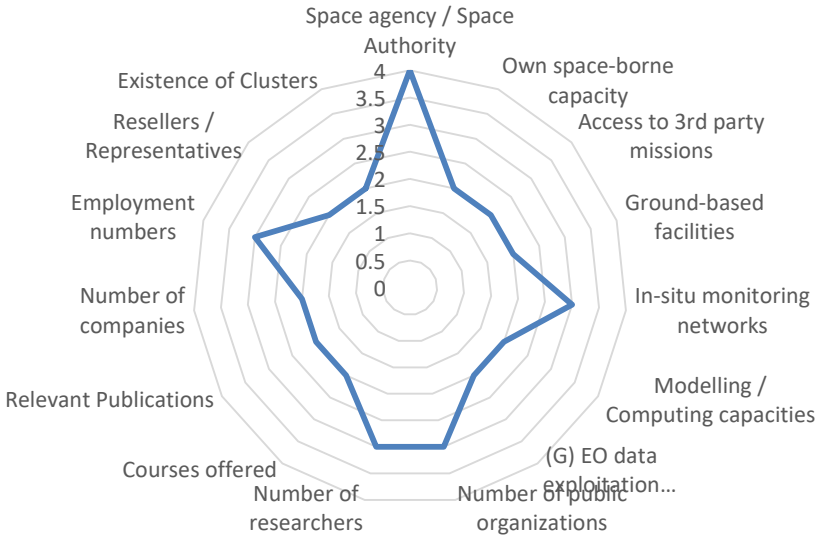
Romania assessment (conditional formatting)	Romania
CAPACITIES	
National Infrastructure	2,428571429
Space agency or designated Space Authority	4
Own space-borne capacity	2
Access to 3rd party missions (own ground stations)	2
Ground-based facilities	2
In-situ monitoring networks	3
Modelling and computing capacities	2
(G) EO data exploitation platforms (provision of VA services and products)	2
Critical Mass of EO researchers	2,5
Number of public organisations	3
Number of researchers (in Univ. & R&D labs)	3
Courses being offered in universities, its diversity and maturity offered	2
Relevant Publications	2
Industry Base	2,25
Number of companies	2
Employment numbers, levels and changes	3
Resellers or local representatives of European companies	2

Existence of Clusters	2
COLLABORATION	Romania
Collaboration through GEO	**3,5**
Participation in GEO or to projects/initiatives which are linked to GEOSS	4
Specific actions on Sustainable Development Goals (SDG´s)	4
Designated GEO office	3
Provision of data to GEOSS	3
Impact of Copernicus	**2**
Organisations involved in projects linked to Copernicus	2
Participation to other international efforts	**3,6**
ESA	4
Meteorological: WMO, EUMETSAT, ...	4
UN system as UN-GGIM, ...	4
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	4
Participation in Standardisation organisations i.e. as OGC...	2
Availability of EU funding	**4**
R&D participation or other EU programmes	4
UPTAKE	Romania
Networking initiatives	**2,5**
Networking initiatives (events and thematic workshops)	3
Data Portals	2
National Policies Implementation	**3,5**
Policy	4
Budget & investment (internal to the country)	3
Penetration	**2,5**
Use of Geo-information	3
Capacity building EO focused actions	2

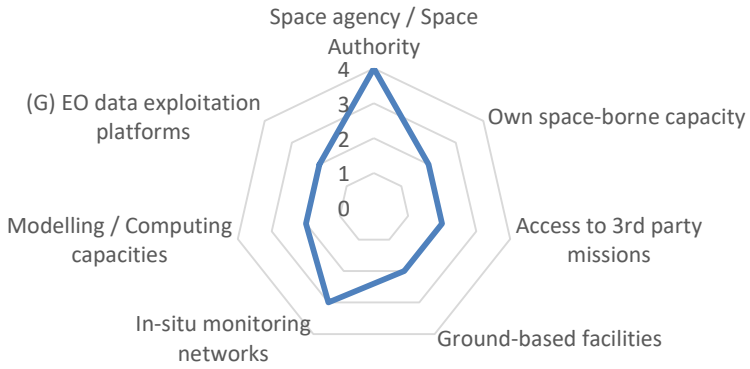
Romania Maturity Indicators



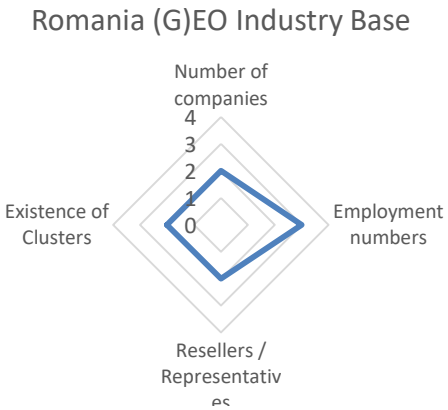
Romania (G)EO Capacities

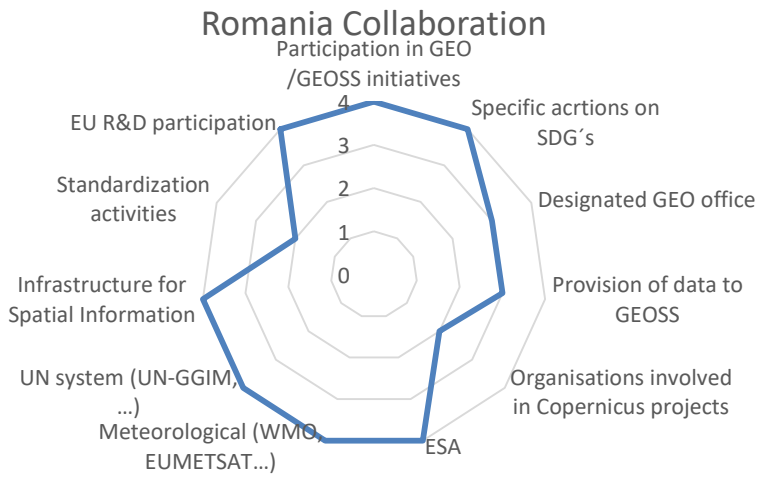


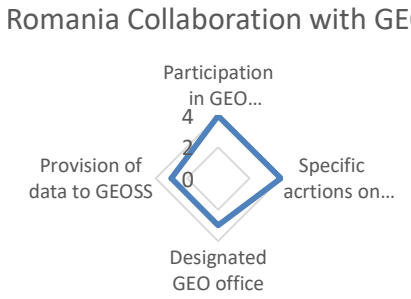
Romania National Infrastructure

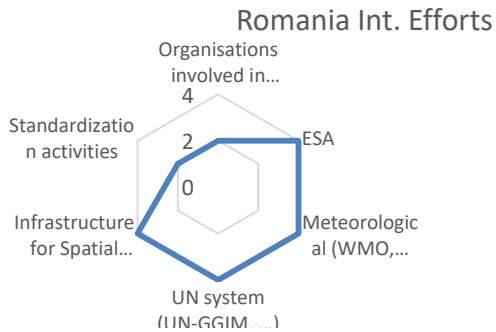


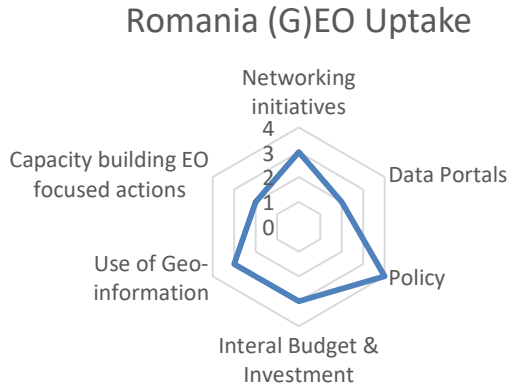

Romania Critical Mass (G)EO Researchers
Number of public organizations
Number of researchers
Courses offered
Relevant Publications
0
1
2
3
4


Romania (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Representativ es
Existence of Clusters
0
1
2
3
4


Romania Collaboration
Participation in GEO /GEOSS initiatives
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
Organisations involved in Copernicus projects
ESA
Meteorological (WMO, EUMETSAT…)
UN system (UN-GGIM, …)
Infrastructure for Spatial Information
Standardization activities
EU R&D participation
0
1
2
3
4


Romania Collaboration with GEO
Participation in GEO…
Specific acrtions on…
Designated GEO office
Provision of data to GEOSS
0
2
4

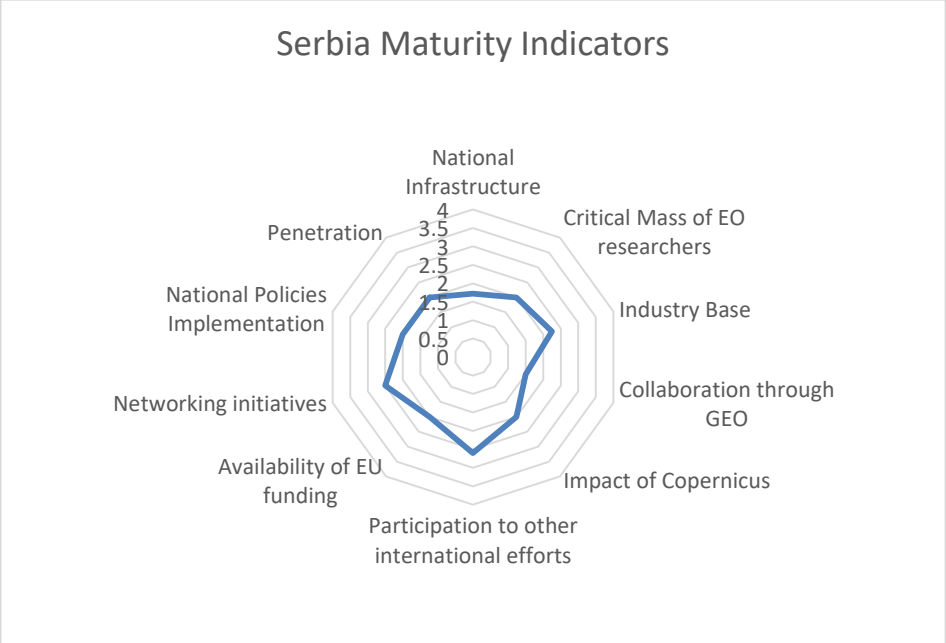

Romania Int. Efforts
Organisations involved in…
ESA
Meteorologic al (WMO,…
UN system (UN-GGIM, …)
Infrastructure for Spatial…
Standardizatio n activities
0
2
4

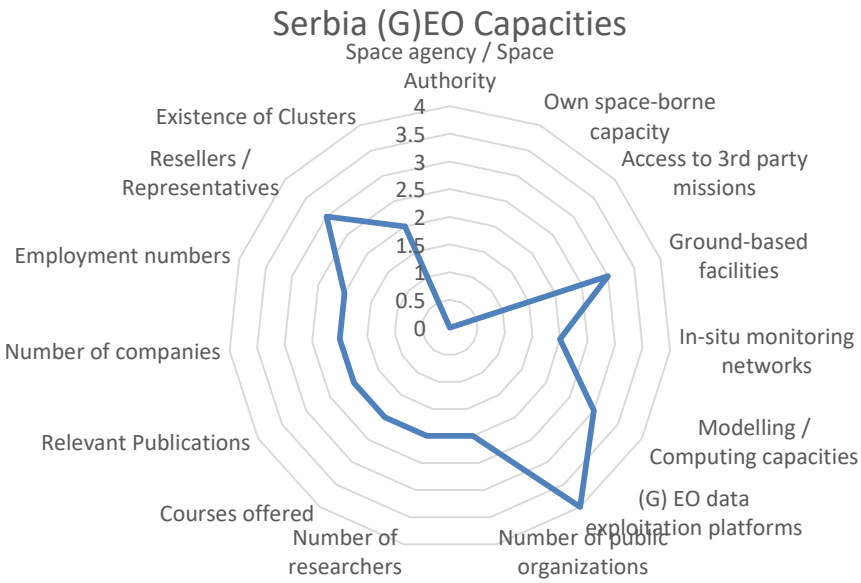

Romania (G)EO Uptake
Networking initiatives
Data Portals
Policy
Interal Budget & Investment
Use of Geo-information
Capacity building EO focused actions
0
1
2
3
4

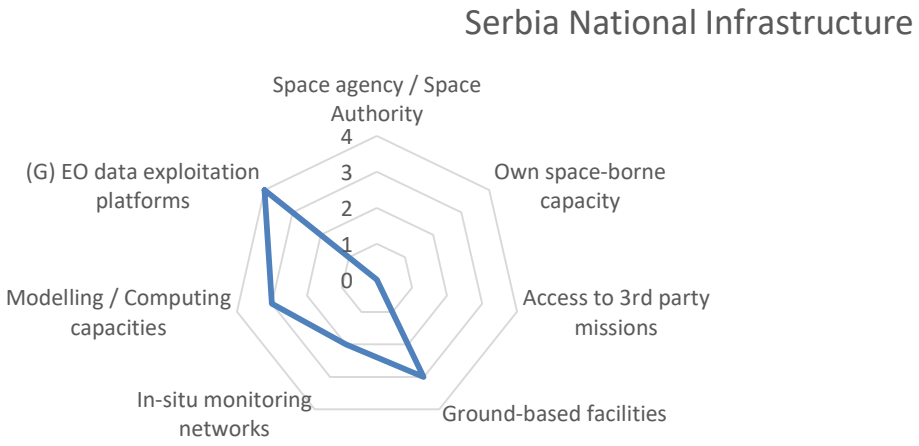
i) Serbia Spider graphs and conditional formatting

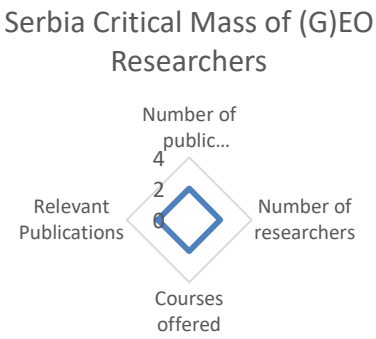
Serbia assessment (conditional formatting)	Serbia
CAPACITIES	
National Infrastructure	1,714285714
Space agency or designated Space Authority	0
Own space-borne capacity	0
Access to 3rd party missions (own ground stations)	0
Ground-based facilities	3
In-situ monitoring networks	2
Modelling and computing capacities	3
(G) EO data exploitation platforms (provision of VA services and products)	4
Critical Mass of EO researchers	2
Number of public organisations	2
Number of researchers (in Univ. & R&D labs)	2
Courses being offered in universities, its diversity and maturity offered	2
Relevant Publications	2
Industry Base	2,25
Number of companies	2
Employment numbers, levels and changes	2
Resellers or local representatives of European companies	3
Existence of Clusters	2
COLLABORATION	Serbia
Collaboration through GEO	1,5
Participation in GEO or to projects/initiatives which are linked to GEOSS	0
Specific actions on Sustainable Development Goals (SDG´s)	0
Designated GEO office	2
Provision of data to GEOSS	4
Impact of Copernicus	2
Organisations involved in projects linked to Copernicus	2
Participation to other international efforts	2,6
ESA	0
Meteorological: WMO, EUMETSAT, ...	4
UN system as UN-GGIM, ...	3
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	4
Participation in Standardisation organisations i.e. as OGC...	2

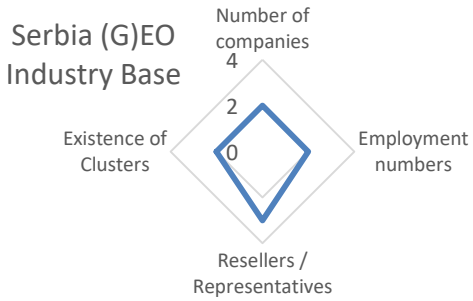
Availability of EU funding	**2**
R&D participation or other EU programmes	2
UPTAKE	Serbia
Networking initiatives	**2,5**
Networking initiatives (events and thematic workshops)	2
Data Portals	3
National Policies Implementation	**2**
Policy	3
Budget & investment (internal to the country)	1
Penetration	**2**
Use of Geo-information	2
Capacity building EO focused actions	2

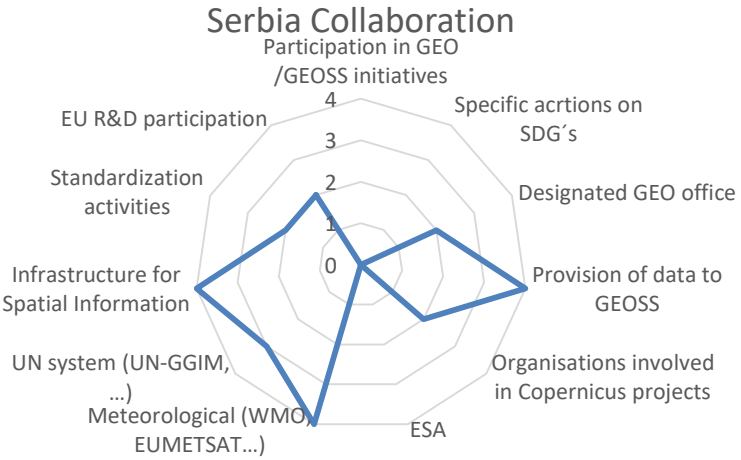


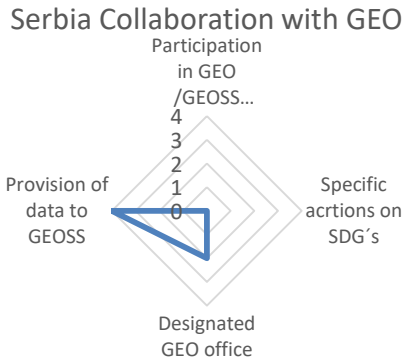

Serbia (G)EO Capacities
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
Number of public organizations
Number of researchers
Courses offered
Relevant Publications
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
4
3.5
3
2.5
2
1.5
1
0.5
0

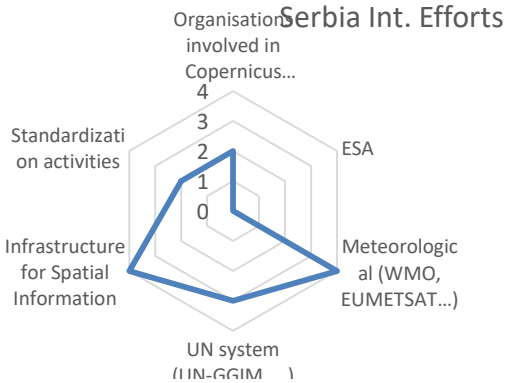

Serbia National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
4
3
2
1
0


Serbia Critical Mass of (G)EO Researchers
Number of public...
Number of researchers
Courses offered
Relevant Publications
4
2
0


Serbia (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
4
2
0





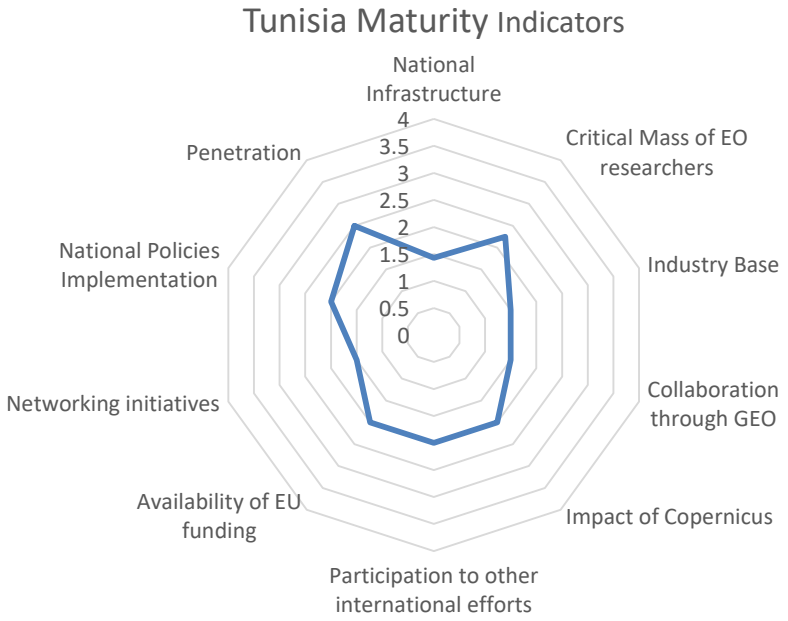


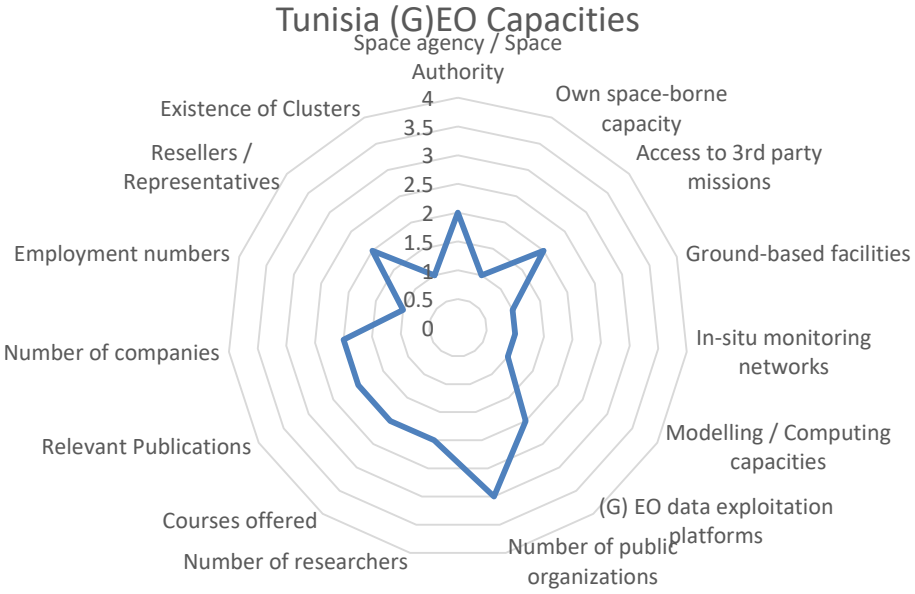
j) Tunisia Spider graphs and conditional formatting

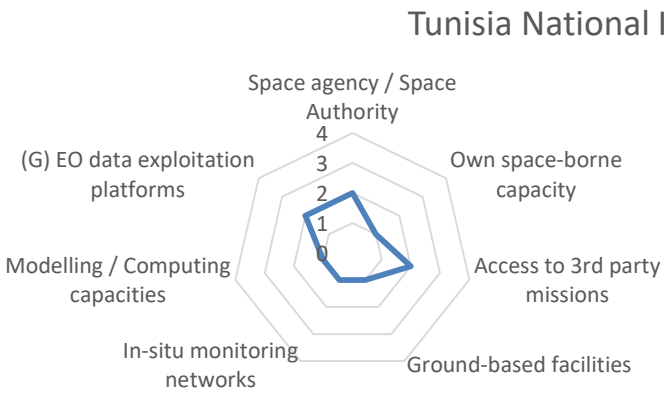
Tunisia assessment (conditional formatting)	**Tunisia**
CAPACITIES	
National Infrastructure	1,428571429
Space agency or designated Space Authority	2
Own space-borne capacity	1
Access to 3rd party missions (own ground stations)	2
Ground-based facilities	1

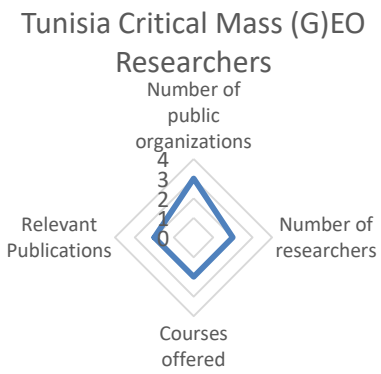
In-situ monitoring networks	1
Modelling and computing capacities	1
(G) EO data exploitation platforms (provision of VA services and products)	2
Critical Mass of EO researchers	**2,25**
Number of public organisations	3
Number of researchers (in Univ. & R&D labs)	2
Courses being offered in universities, its diversity and maturity offered	2
Relevant Publications	2
Industry Base	**1,5**
Number of companies	2
Employment numbers, levels and changes	1
Resellers or local representatives of European companies	2
Existence of Clusters	1
COLLABORATION	Tunisia
Collaboration through GEO	**1,5**
Participation in GEO or to projects/initiatives which are linked to GEOSS	2
Specific actions on Sustainable Development Goals (SDG´s)	2
Designated GEO office	1
Provision of data to GEOSS	1
Impact of Copernicus	**2**
Organisations involved in projects linked to Copernicus	2
Participation to other international efforts	**2**
ESA	1
Meteorological: WMO, EUMETSAT, ...	4
UN system as UN-GGIM, ...	3
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	0
Participation in Standardisation organisations i.e. as OGC...	2
Availability of EU funding	**2**
R&D participation or other EU programmes	2
UPTAKE	Tunisia
Networking initiatives	**1,5**
Networking initiatives (events and thematic workshops)	2
Data Portals	1
National Policies Implementation	**2**
Policy	2

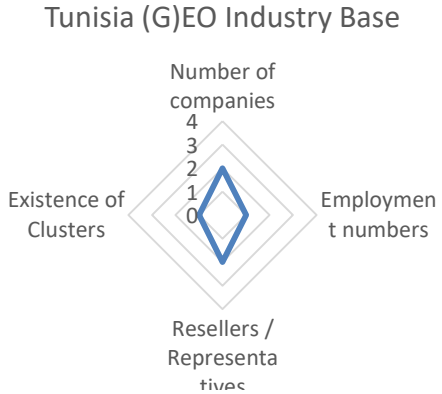
Budget & investment (internal to the country)	2
Penetration	2,5
Use of Geo-information	2
Capacity building EO focused actions	3

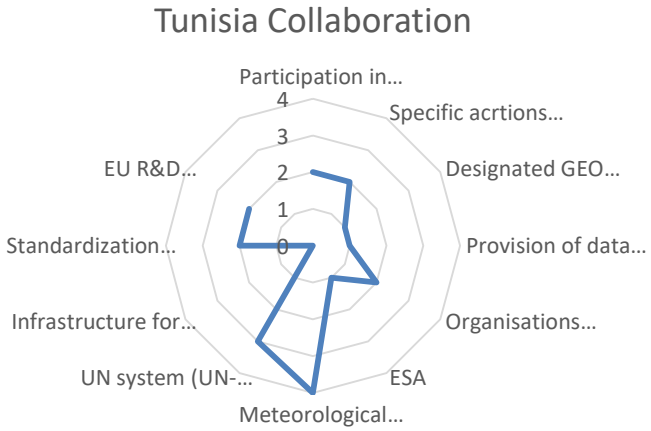


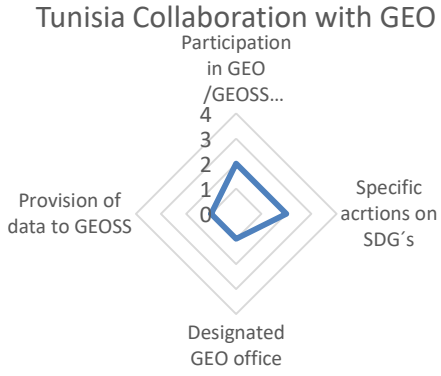


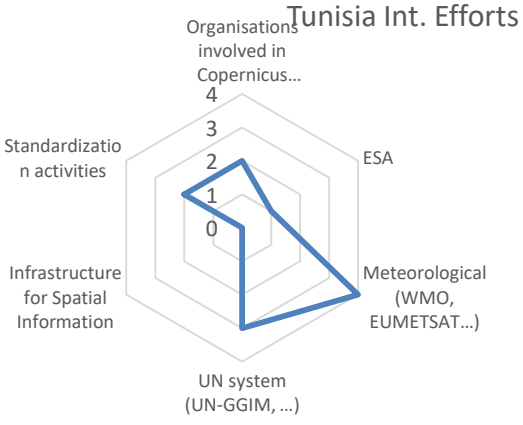

Tunisia National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
0
1
2
3
4

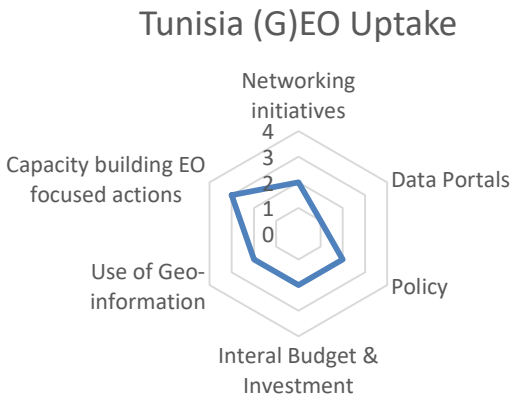

Tunisia Critical Mass (G)EO Researchers
Number of public organizations
Number of researchers
Courses offered
Relevant Publications
0
1
2
3
4


Tunisia (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
0
1
2
3
4


Tunisia Collaboration
Participation in...
Specific acrtions...
Designated GEO...
Provision of data...
Organisations...
ESA
Meteorological...
UN system (UN-...
Infrastructure for...
Standardization...
EU R&D...
0
1
2
3
4


Tunisia Collaboration with GEO
Participation in GEO /GEOSS...
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
0
1
2
3
4

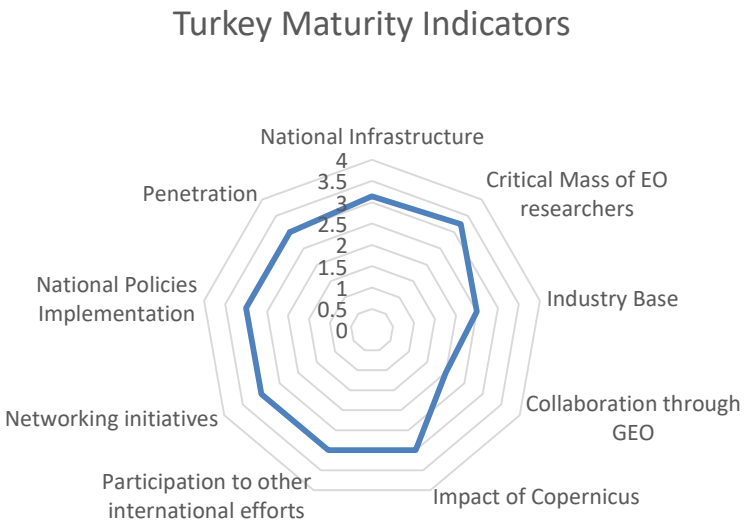

Tunisia Int. Efforts
Organisations involved in Copernicus...
ESA
Meteorological (WMO, EUMETSAT...)
UN system (UN-GGIM, ...)
Infrastructure for Spatial Information
Standardizatio n activities
0
1
2
3
4



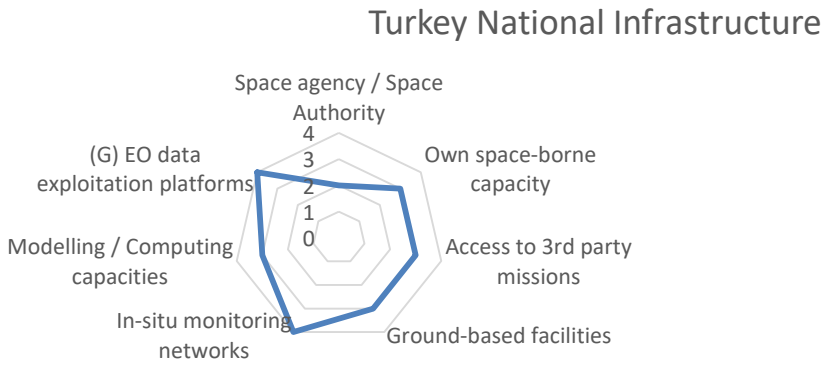
k) Turkey Spider graphs and conditional formatting

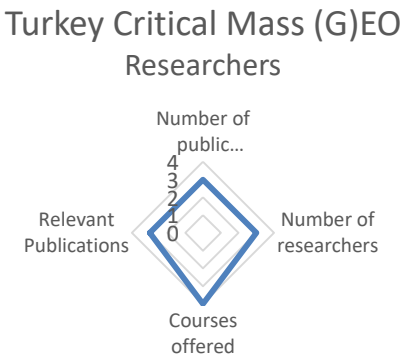
Turkey assessment (conditional formatting)	Turkey
CAPACITIES	
National Infrastructure	3,142857143
Space agency or designated Space Authority	2
Own space-borne capacity	3
Access to 3rd party missions (own ground stations)	3
Ground-based facilities	3
In-situ monitoring networks	4
Modelling and computing capacities	3
(G) EO data exploitation platforms (provision of VA services and products)	4
Critical Mass of EO researchers	3,25
Number of public organisations	3
Number of researchers (in Univ. & R&D labs)	3
Courses being offered in universities, its diversity and maturity offered	4
Relevant Publications	3
Industry Base	2,5
Number of companies	3
Employment numbers, levels and changes	3
Resellers or local representatives of European companies	2
Existence of Clusters	2
COLLABORATION	Turkey
Collaboration through GEO	2
Participation in GEO or to projects/initiatives which are linked to GEOSS	3
Specific actions on Sustainable Development Goals (SDG´s)	2
Designated GEO office	2

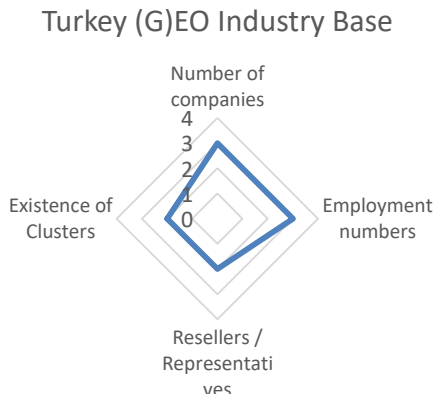
Provision of data to GEOSS	1
Impact of Copernicus	**3**
Organisations involved in projects linked to Copernicus	3
Participation to other international efforts	**3**
ESA	3
Meteorological: WMO, EUMETSAT, …	4
UN system as UN-GGIM, …	3
Establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)	3
Participation in Standardisation organisations i.e. as OGC...	2
Availability of EU funding	**3**
R&D participation or other EU programmes	3
UPTAKE	Turkey
Networking initiatives	**3**
Networking initiatives (events and thematic workshops)	3
Data Portals	3
National Policies Implementation	**3**
Policy	3
Budget & investment (internal to the country)	3
Penetration	**3**
Use of Geo-information	3
Capacity building EO focused actions	3

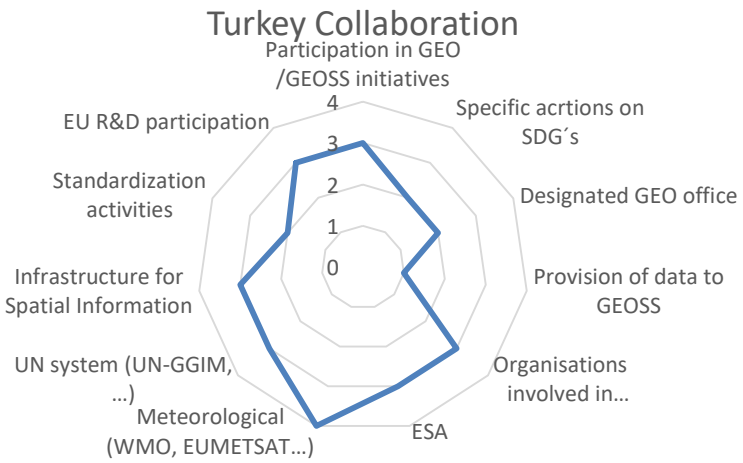



Turkey (G)EO Capacities
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
Number of public organizations
Number of researchers
Courses offered
Relevant Publications
Number of companies
Employment numbers
Resellers / Representatives
Existence of Clusters
4
3.5
3
2.5
2
1.5
1
0.5
0

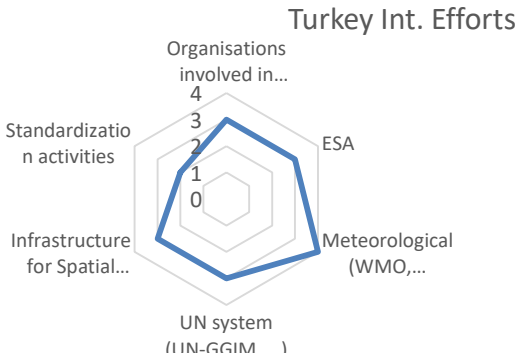

Turkey National Infrastructure
Space agency / Space Authority
Own space-borne capacity
Access to 3rd party missions
Ground-based facilities
In-situ monitoring networks
Modelling / Computing capacities
(G) EO data exploitation platforms
4
3
2
1
0

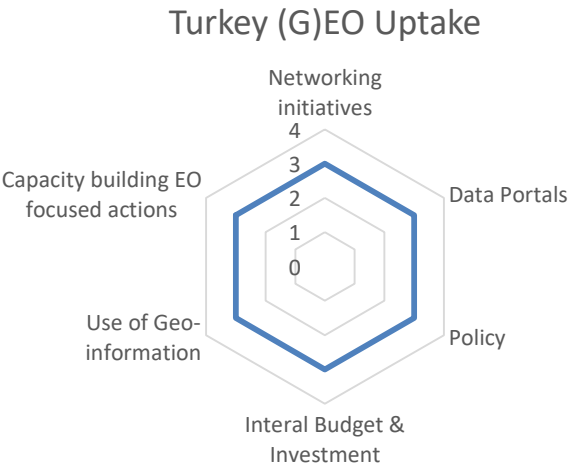

Turkey Critical Mass (G)EO Researchers
Number of public...
Number of researchers
Courses offered
Relevant Publications
4
3
2
1
0


Turkey (G)EO Industry Base
Number of companies
Employment numbers
Resellers / Representati ves
Existence of Clusters
4
3
2
1
0


Turkey Collaboration
Participation in GEO /GEOSS initiatives
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
Organisations involved in…
ESA
Meteorological (WMO, EUMETSAT…)
UN system (UN-GGIM, …)
Infrastructure for Spatial Information
Standardization activities
EU R&D participation
0
1
2
3
4


Turkey Collaboration with GEO
Participation in GEO /GEOSS…
Specific acrtions on SDG´s
Designated GEO office
Provision of data to GEOSS
0
1
2
3
4

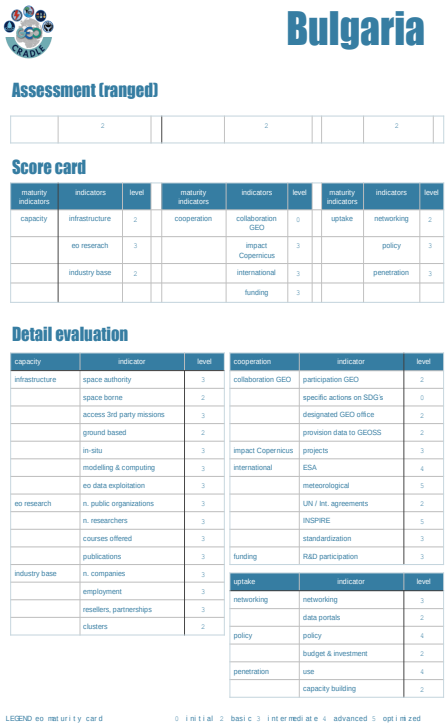

Turkey Int. Efforts
Organisations involved in…
ESA
Meteorological (WMO,…
UN system (UN-GGIM…)
Infrastructure for Spatial…
Standardizatio n activities
0
1
2
3
4


Turkey (G)EO Uptake
Networking initiatives
Data Portals
Policy
Interal Budget & Investment
Use of Geo-information
Capacity building EO focused actions
0
1
2
3
4

Annex 5: Contrasted assessment for the RoI

Maturity card Albania (ranged

Maturity card Albania (rounded)



Maturity card Bulgaria (ranged)

Maturity card Bulgaria(rounded)

Maturity card Cyprus (ranged)

Maturity card Cyprus (rounded)

Maturity card Egypt (ranged)

Maturity card Egypt (rounded)

Maturity card FYROM (ranged)

Maturity card FYROM (rounded)

Maturity card Greece (ranged)

Maturity card Greece (rounded)

Maturity card Israel (ranged)

Maturity card Israel (rounded)

Maturity card Romania (ranged)

Maturity card Romania (rounded)

Maturity card Serbia (ranged)

Maturity card Serbia (rounded)

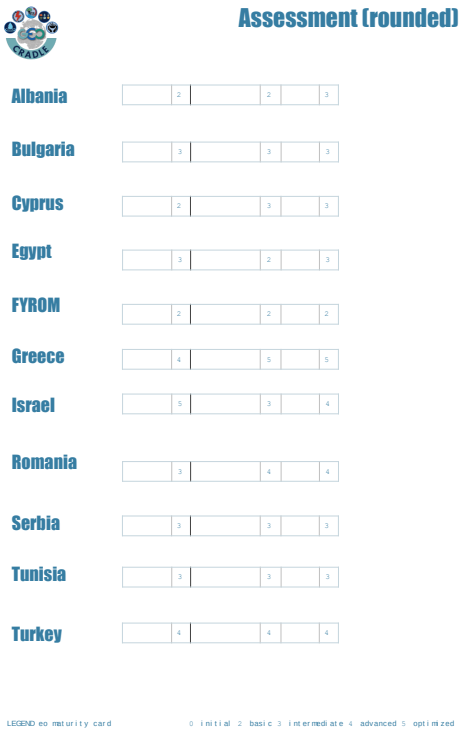
Maturity card Tunisia (ranged)

Maturity card Tunisia (rounded)

Maturity card Turkey (ranged)

Maturity card Turkey (rounded)

Global Assessment (ranged)



Global Assessment (rounded)

We have also prepared intermediate processes to get statistically the right value planned to be used. The assessment has considered the following values, being

- the values extracted being the Σ of all indicators & media is named **(C)** : [Σ 1,2,3,…, 32 / 32]
- the Σ of indicators per three main pillars (3) & media of each main section will be corresponding with **(B)** : [capacities (Σ 1,2,3,…, 15/ 15) + collaboration(Σ 1,2,3,…, 11/ 11) + uptake (Σ 1,2,3,…, 6/ 6)]
- Σ of indicators per three main pillars & media each of subsections will be the (**A**) : [CAPACITIES [infrastructure (Σ 1,2,3,…, 7/ 7)+ research (Σ 1,2,3,4/ 4) + industry (Σ 1,2,3,4/ 4)] + COLLABORATION [GEO (Σ 1,2,3,4/ 4)+Copernicus (Σ 1)+ Int. efforts (Σ 1,2,…,5/ 5)+ funding (Σ 1)] + UPTAKE [networking (Σ 1,2 /2) + national policy (Σ 1,2 /2) + penetration (Σ 1,2 /2)]]

  Level A: media group indicators: Capacities (national infrastructure, critical mass of EO researchers, industry base) // Collaboration (Collaboration through GEO, Impact of Copernicus, Participation to other international efforts, availability of funding) // Uptake (networking activities, National Policies implementation, Penetration)
  Level Aa: media three main pillars [capacities, collaboration, uptake]
  Level Aaa (ranged)
  Level Aaaa (rounded)

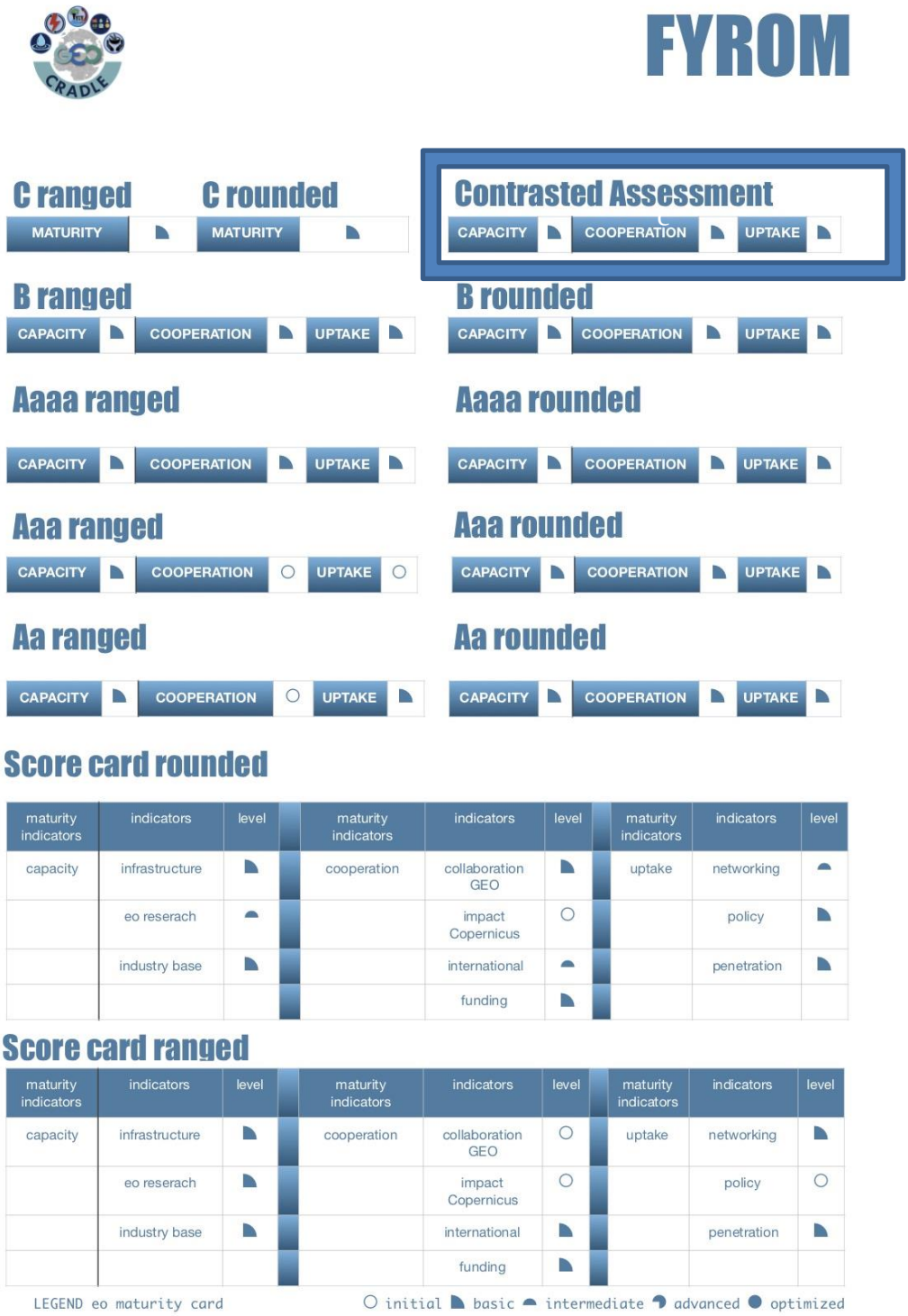
The examples below visualise from the ranged or rounded perspectives:

Maturity card Albania (comparison > contrasted assessment)

Maturity card Bulgaria (comparison > contrasted assessment)

Maturity card Cyprus (comparison > contrasted assessment)

Maturity card Egypt (comparison > contrasted assessment)



Maturity card FYROM (comparison > contrasted assessment)

Maturity card Greece (comparison > contrasted assessment)

Maturity card Israel (comparison > contrasted assessment)

Maturity card Romania (comparison > contrasted assessment)

Maturity card Serbia (comparison > contrasted assessment)

Maturity card Tunisia (comparison > contrasted assessment)

Turkey

C ranged

	3		4

C rounded

	4		4

Contrasted Assessment

	4		3		4

B ranged

	4		3		4

B rounded

	4		4		4

Aaaa ranged

	4		3		4

Aaaa rounded

	4		4		4

Aaa ranged

	3		3		4

Aaa rounded

	4		4		4

Aa ranged

	3		3		4

Aa rounded

	4		4		4

Score card rounded

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure	4	cooperation	collaboration GEO	3	uptake	networking	4
	eo reserach	4		impact Copernicus	4		policy	4
	industry base	4		international	4		penetration	4
				funding	3			

Score card ranged

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
capacity	infrastructure	4	cooperation	collaboration GEO	3	uptake	networking	4
	eo reserach	4		impact Copernicus	4		policy	4
	industry base	3		international	4		penetration	4
				funding	3			

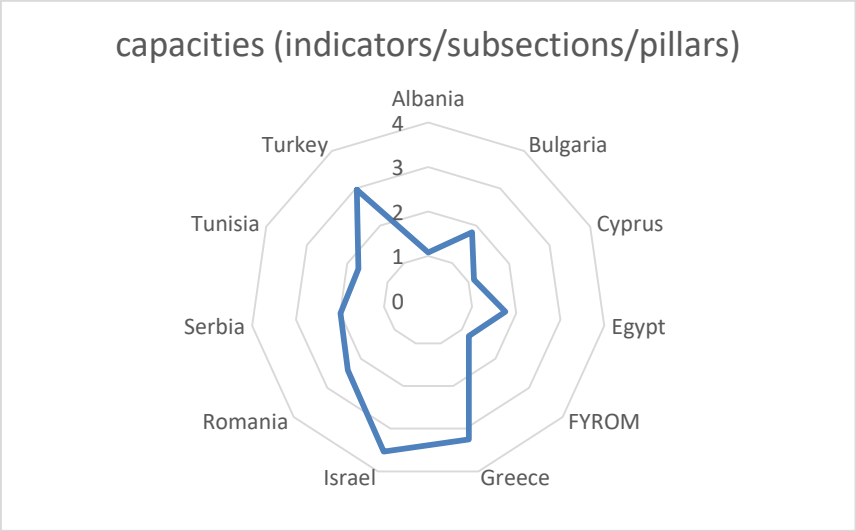
LEGEND eo maturity card 0 initial 2 basic 3 intermediate 4 advanced 5 optimized

Maturity card Turkey (comparison > contrasted assessment)

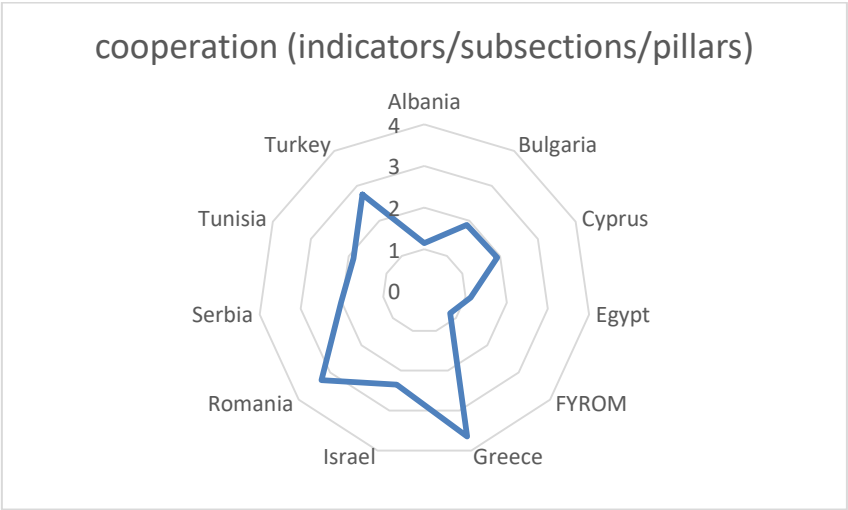
Representation (Σ of all indicators per three main pillars / media each of subsections)

	capacities	RANGED	ROUNDED	cooperation	RANGED	ROUNDED	uptake	RANGED	ROUNDED
Albania	1,08			1,15			1,83		
Bulgaria	1,82			1,89			1,83		
Cyprus	1,13			1,93			1,50		
Egypt	1,75			1,13			1,50		
FYROM	1,21			0,83			1,00		
Greece	3,25			3,65			3,83		
Israel	3,54			2,35			3,00		
Romania	2,39			3,28			2,83		
Serbia	1,99			2,03			2,17		
Tunisia	1,73			1,88			2,00		
Turkey	2,96			2,75			3,00		

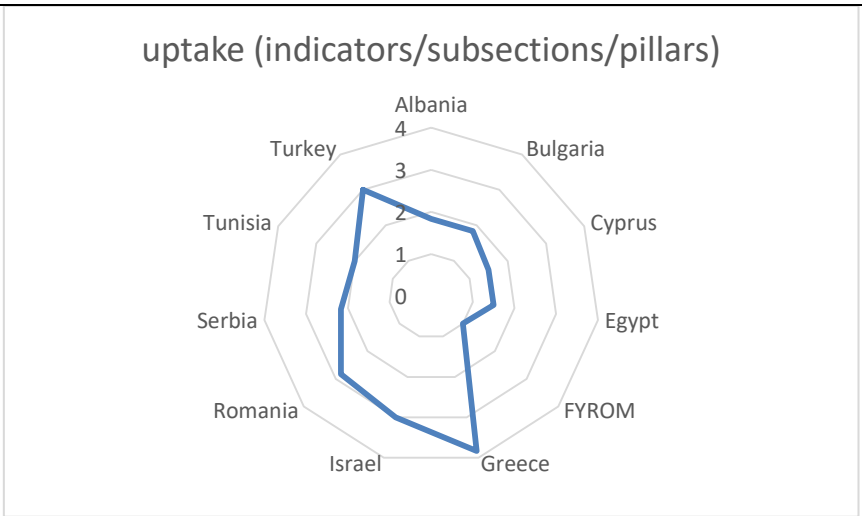
Maturity cards (Σ of indicators / subsections/ representing each of the pillars > representation)



Maturity representation in Radar chart (3 pillars > subsections> capacities)



Maturity representation in Radar chart (3 pillars > subsections> cooperation)



Maturity representation in Radar chart (3 pillars > subsections> uptake)

During the course of the visualisation exercise, different graphics have been considered to approach the most accurate level of maturity representation. The graphic on contrasted assessment illustrates the media of all representations.

Assessment (global)

Annex 6: Definitions

EARSC classification based on EO activities

(i) Satellite operator - defined as the owner of a satellite system
(ii) Data reception and distribution - owner or operator of a ground station (EO).
(iii) Data reseller - satellite or other data from non-EU sources
(iv) Value- adding services - company using EO data to produce products
(v) Downstream / GIS services - but with a satellite data element.
(vi) Consultancy - studies / analyses not VA services.
(vii) Hardware / software provision.

GEO-CRADLE classification based on EO activities by users

(i) Space strategy: Space agencies
(ii) Upstream: hardware/software manufactures, launchers, satellite operators
(iii) Downstream: Raw data providers, EO value-adders, GIS providers, consultancies
(iv) End users: In house GIS providers, managers & decision makers, citizens

Classification of companies by size

-Micro: 1-9 employees < €2 million
-Small: 10-49 employees (includes micro) < €10 million
-Medium-sized: 50-249 employees < €50 million
-Large: over 250 employees €50 million+

Examples of missions whose data are resold:

ALOS (MS+PALSAR), ALOS-2, Aqua, Bilsat, Cartosat-1(P-5), Cartosat-2, COSMO- SkyMed, DEIMOS-1, Envisat, EO-1 (ALI, Hyperion), Eros-A1, Eros-B1, ERS- 1/2,,Formosat-2, GeoEye-1, Ikonos, IRS-1 C/D, IRS-P6, (Resourcesat-1), IRS- ResourceSat 2, J-ERS, Kanopus-V/BelKA-2, KOMPSat-1, KOMPSat-2, KOMPSat-3, KOMPSat-3A,KOMPSat-5,KVR-1000,Landsat 1-7, ,Landsat 8, OrbView-3, Pléiades 1A-1B ,QuickBird-2, Radarsat-1, RADARSAT-2, RapidEye, RASAT, Resurs-DK1, Resurs-P , Spot 1-4, Spot 5, SPOT 6 & 7, Terra (ASTER- MODIS), TerraSAR-X, TH-01, THEOS, UK- DMC SLIM-6, WorldView-1, WorldView-2, WorldView-3.

Example of Courses being offered by Universities:

- Geoinformatics
- Environment and Development
- Geology and Geo-environment
- Applied Geography and Spatial Planning
- Techniques and Methods in Urban Analysis, Design and Management
- Applied and Environmental Geology
- Meteorology Climatology and Atmospheric Environment
- Agriculture
- Environmental Physics
- Environmental Engineering and Science
- Atmospheric Sciences and the Environment
- Energy and Environment
- Applied Meteorology and Environmental Physics
- Space Science Technologies and Applications
- Geography and Applied Geo-Informatics
- Environmental Sciences
- Ecological Engineering and Climate Change
- Geotechnology and the Environment
- Water Resources and Climate Change
- Environmental Management, Sustainable Energy and Climate change

Example of thematic type of courses offered (bibliography from Greece contact partner):

- Methods for precise geodetic measurements and data processing
- Geospatial data vizualization
- Geoportals and geospatial services
- Location based services
- Digital photogammetry
- Geodesy in city planning
- Real estate cadastre
- Applied geophysics in geomatics
- Application of GNSS systems
- Advanced remote sensing technologies
- Valuation of real estate
- Spatial and temporal databases
- Geosensor networks
- Optimization in geodetic surveying
- Service oriented architecture in GIS
- GIS – Geographic Information System
- Remote Sensing in Geography
- GIS in Spatial Planning
- Advanced GIS
- GIS and Tourism
- GIS and Population
- Remote Sensing Methods of Environmental Research
- Geospatial Data Bases
- Digital Mapping of the Environment
- Environmental Information Systems
- Meteorological Measurements
- Remote Sensing
- GIS Application in Geology
- Fundamentals of Gravimetry
- Gravimetry
- GIS Technologies
- Physical Principles of Remote Sensing
- Analysis of the accuracy of terrestrial laser scanning
- Integrated geodetic measurement systems in engineering fields
- Methods of precise satellite positioning
- Energy Mechanics and Natural Resources Management
- Energy Monitoring and Accreditation of Buildings
- Environmental Measurement Technologies
- Environmental and Industrial Development
- Foundations of Ecology
- Renewable Energy Sources
- Foundations of Energy
- Renewable Energy Technologies
- Environmental Impact Assessment
- Building Energy Management
- Critical Analysis and Research Preparation
- Energy Dissertation
- Economics for Renewable Energy
- Heat Transfer and Heat Exchangers
- Process Intensification
- Ventilation and Air Conditioning
- Technology Futures and Business Strategy
- Demand Management and Energy Storage
- Building Inspectors
- Inspectors Boilers and Heating Installations
- Inspectors HVAC installations
- Rational Use of Energy and the renewable forms

- Multimedia Education Material
- Solar DHW and Space Heating
- Design of Solar DHW/Space Heating Systems
- Basic Principles of Energy Savings
- Specialization of Energy and Environment
- Solar Energy Systems
- Energy and Environment
- Electrochromic devices
- Photo-electrochromic devices
- Dye-Sensitised solar cells
- Photovoltaic technology applications
- Solar Thermal applications
- Thermal Solar Collectors and Systems
- Thermal Storage Systems- Analysis and Design
- Solar cooling
- Thermal Distillation - Desalination
- Mechanical/Solar-assisted Drying Processes and Systems
- Metrology of Energy Quantities
- Computational Fluid Dynamics and Heat Transfer
- Solar and Thermal radiation - Thermodynamics of the atmosphere
- Geophysical Fluid Dynamics
- Methods and instruments in environmental measurements - Data analysis
- Numerical Methods for Geophysical Fluid
- Physics of the build environment
- Building energy design
- Principles and applications of remote sensing
- Atmospheric and Environmental Physics
- Atmospheric Technology
- Energy Resources in the Environment
- Radiative transfer models
- Renewable Energy resources
- Statistical analysis of time series
- Radiation in the atmosphere
- Environmental data analysis
- Satellite remote sensing
- Agrometeorology and Hydrometeorology
- Atmospheric pollution and climate change
- Satellite Meteorology and Climatology
- Meteorology and Climatology
- Principles of atmospheric chemistry
- Environmental chemistry
- Space environment
- Satellite communications
- Applied computer science
- Signal/image processing and pattern recognition
- Big data management
- Space applications
- Earth system science
- Satellite systems and networks
- Dependable and energy efficient computing
- Satellite positioning and navigation
- Space business aspects

Annex 7: Bibliography

The following references were supervised as preparatory activities during the course of this deliverable

Several EU projects in the regions have been searched as starting phase those are:

- ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network)
- AfriGEOSS (AfriGEOSS initiative, developed within the GEO framework)
- BalkanGEONet (Balkan Geo Network, towards inclusion Balkan countries into GEO)
- BRAGMA (Bridging Actions for GMES and Africa)
- ConnectinGEO (Coordinating an Observation Network of Networks Encompassing satellite and IN-situ to fill the Gaps in European Observations)
- IASON (International Action for the Sustainability of the Mediterranean and the Black Sea Environment)
- OBSERVE (Strengthening and development of Earth observation activities for the environment in the Balkan area)

Related to sector studies:

- Copernicus User uptake, Space -Tec partners, February 2016
- EARSC Views on the Procurement of the Copernicus Services, September 2014
- EARSC Developing the EO Services Industry, September 2013

Related to policy:

- EARSC Views on European Space Strategy, June 2016
- EARSC Survey into Public Bodies using EO data and services, April 2016

Related to maturity readiness:

- Evaluating Renewable Energy policy, UKERC (J. Watson, 2014, policy paper, presented by the International Renewable Energy Agency (IRENA)
- Maturity Model for Assessing the Digital Readiness of Manufacturing Companies (A. Carolis, © IFIP International Federation for Information Processing 2017)
- Networked Readiness Index. Geospatial readiness (Geospatial World, 2017)
- Real growth rate in 2016 (link), Wikipedia List of global indicators
- Taxonomy of Economic Activities Based on R&D Intensity, Galindo-Rueda © OECD/OCDE 2016

Related to benchmarking:

- International benchmarking from OECD countries (S. Helgason, OECD, February 2017)
- Regional benchmarking in the smart specialization process: Identification of reference regions based on structural similarity (M. Navarro et al. JRC 2014)
- The Global Energy Architecture Performance Index 2017: Methodological Addendum (World Economic Forum 2017)
- The Global Information Technology Report 2015 (World Economic Forum, 2015)

Annex 8: Benchmarking

In order to support countries defining their (G)EO maturity, the maturity assessment is proposed in this report, but countries might need to select a pure maturity assessment or a comparative assessment which would be able to semi-compare practices across countries in order to benchmark maturity within different indicators. These two methods are different steps of the maturity understanding, firstly, to identify what desired level countries have to reach and, secondly, to select some indicators, which have to be improved.

The benchmarking practice fraught with difficulty for many reasons, notably on how to contemplate differences in governmental expectations, difficulty in identifying total resources, right number of entities developing of the EO activities, particularly w.r.t. private companies, or varying levels of government transparency including public organisations and funding. The assignment of values to the various indicators for a given country should follow– as much as possible – an objective approach and allow scrutiny/comparison against countries with well-mapped capacities.

Assuming that benchmarking will help to identify and implement best practices in the country; those have to be evaluated and adjusted to the needs of the benchmarking of the country. Overall, it is interesting to highlight the following issues for using benchmarking in future projects:

i. Assess the performance of the relevant national EO sector objectively to allow comparison and evaluation in a more equitable way: Countries should be assessed on their current status in relation to the maturity indicators criteria and benchmarking guidelines. The resulting ratings should focus on the actual/current level of performance assessed against the maturity indicators, rather than any degree of improvement. It should be noted that the process to provide assessments and evaluations and maturity indicators derives from informed judgments from stakeholders. Indicators are used to assist country teams in determining country scores so national contact points will have the value of the dimensions, the rating and its justification of each of the dimensions

ii. Highlight the evolution of other countries: the application of the methodology should consider the size of the economy in the countries and its degree of sophistication in implementing the maturity indicators. Accordingly, the criteria could be developed to ensure that, to the extent possible, their contents are not influenced by the level of development in the country; but in parallel, the methodology could be applied in other regional areas.

iii. Expose areas where improvement is needed and reveal underlying problems of the country: All benchmarking activities involve performance measurements of some kind and these can become catalysts for progress beyond the scope of the specific sector being investigated. Such an activity might bring additional benefits such as an understanding of the nation's performance when compared to third countries, standardisation of methods and uptake of best practices, providing links to the budget process and other relevant decision-making activities.

iv. Best practices: Benchmarking against high performing countries allows comparison of the information gathering exercise itself. Through such a process, particularly useful methodologies for identification of EO-sector related performance information within the framework of good governance, economic and social development. The resulting improved prioritization of resources and facilitation and coordination for the benchmarking process facilitates optimisation of this process in the target country.

v. To predict whether improvement will be successful in future revisions of country strategic plans. The goal will be to highlight a set of instruments to improve the country position and future revisions by answering the overall question of what it would take for a country to catch up with the country of reference?' There could be a wide range of sub-questions to arrive at this goal e.g.: What are the main elements/priorities for evolving in geo-information? What are the necessary steps to implement future revisions? How will the country develop market-based 'next level' of services working with strategic sectors? Could the Government be considered as a customer?

As the benchmarking can be costly and time/resources consuming (establishing benchmarks that are applicable across countries with different GDPs, income levels, different populations and, of course, different EO needs); within this report, it is important to note that this methodology will just organise the process of benchmarking in order to achieve good results in later studies. We are just exploring the benchmarking as a method to compare the performance of the geo-information processes and products with the best performances of other countries in future activities. A full benchmarking approach requires an array of considerations and resources which will not be considered as part of the methodology.

Annex 9: Geospatial readiness index

There is a little documentation on how to develop a maturity readiness that is theoretically robust, tested and widely accepted, but some exercises on this direction have been taken in the last years. The activity done by Geospatial Media and Communications is one of those.

The Countries Geospatial Readiness Index (CGRI) is a comparative assessment of 50 countries spread across geographies, at different development stages, evaluated and assessed for their geospatial maturity. The index is an important tool for decision makers to comprehend the areas for developing geospatial capabilities for value-creation, economic-growth, and overall national development.

The index assesses a country´s geospatial capabilities on the following pillars (figure 15): (i) Data infrastructure, (ii) Policy framework, (iii) Institutional capacity, (iv) User adoption level, (v) Industry fabric, while GEOCRADLE methodology base the assessment in three main blocks (a) Capacities (b) Cooperation and (c) Uptake and each block is subdivided in groups of indicators.

Table 27: Comparison Geospatial CGRI / GEO-CRADLE maturity indicators methodology

Geospatial CGRI	GEO-CRADLE methodology	Capacities	Cooperation	Uptake
Data infrastructure		*		
Policy framework			*	*
Institutional capacity		*		
User adoption level				*
Industry fabric		*		

The CGRI was introduced by Geospatial Media and Communications in 2017, parallel to the activities GEO-CRADLE was conducting. The major goal was providing a framework to the decision makers in respective countries to better understand the imperative of developing and inclusive geospatial ecosystem strategy. This index can be used by stakeholders of a country to know and identify the key areas for developing effective and efficient geospatial capabilities which could then contribute to robust national growth and development.

It is also to note than while the CGRI is including key segments of the geospatial industry – GNSS and Positioning, GIS/Spatial Analytics, Earth Observation, and 3D Scanning, the GEO-CRADLE maturity indicators are focus on GEOSS and Copernicus activities with a strong component on Earth Observation.

Future activities could improve the methodology and relate the exploitation of the GEO-CRADLE methodology with the Geospatial readiness index.

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