

**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**



Deliverable D3.2

Maturity Indicators and country (G)EO Profile (I)

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Executive Summary

The objective of this deliverable (**D3.2**) is to present the Maturity Indicators (T3.2), a novel proposal by GEO-CRADLE, that will allow to capture the level and measure the progress of each country's involvement in the implementation of GEO and Copernicus vision. This involvement ranges from strategic planning, leading initiatives and direct financial support to GEO activities (and Copernicus for EU Member States), to simple observation of the discussions made with no "take home", follow up actions.

In order for GEO to be able to attract more member states, not just on paper but also in practical terms (e.g. create national focal points, formulate commitment and platforms for national support, increase relevant scientific human resources and capacity building), and encourage regional coordination, mapping the "GEO maturity" of each country seems an imperative and a first step to establish the right channels for know-how and best practices exchange between countries.

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 become recognised also 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.

GEO-CRADLE will help to construct an accurate picture of the public organisations and industry in the Region of Interest (Middle East, North Africa and the Balkans) that use EO data and services, documenting key aspects such as their involvement in and awareness of Copernicus and their engagement with external EO providers. This will help to provide inputs to the European Commission in view of the upcoming Mid Term Review of Copernicus, whilst also contributing towards better engagement of public organisations using EO data and services.

The deliverable will be elaborated in two phases: the first one (month 9) focusses on the establishment of a robust methodology and some preliminary assessment of few countries as model for the maturity indicators. The second phase (month 26) will be devoted to the analysis of all the countries and its presentation in the form of maturity cards. It will also include a presentation of lessons learned from the application of the proposed methodology and proposals for further improvements in the future.

First thoughts of the methodology were presented to and discussed with the team at the second project meeting which took place in Novisad in July 2016. Another important iteration took place in Limassol in November 2016. Recommendations and comments were very supportive for the proper understanding of the object of research and the specific methodological design. The resulting methodology is presented herein and will be enhanced towards M26.



Project Information

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Acronyms and Abbreviations

Acronym	Description
D	Deliverable
DoW	Description of Work
EARSC	European Association of Remote Sensing Companies
EC	European Commission
EO	Earth Observation
EU	European Union
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
IP	Intellectual Property
RoI	Region of Interest
WP	Work Package



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D3.2: This interim document (in month 9) is devoted to the formulation of appropriate indicators of (G)EO maturity at the country level. These indicators will be completed for all participant countries in the Region of Interest (RoI¹). The main outcome at the final deliverable (in month 26) will be the identification and decoding of each country's current status w.r.t the implementation of GEOSS and the uptake of Copernicus services, allowing the definition of steps that help the country's maturation within and beyond the project.

This first part of the deliverable outlines the methodology and its boundaries, and presents a preliminary assessment of the maturity indicators for a few countries.

The second part (in month 26) will validate the methodology providing a standardised structure (score card / maturity card) focussing on the main indicators applied and possible assessment outcomes. The report will also highlight the critical factors that will lead to a successful EO strategy implementation.

¹ RoI: Middle East, North Africa and the Balkans



1. Introduction

1.1. Context

Country priorities in the Earth Observation (EO) sector are experiencing profound change worldwide. The project's aspiration is to constitute the "cradle" of sustainable, coordinated EO activities and capacities in the Region of Interest (RoI), through the maximisation of synergies amongst key EO partners and the creation of an ecosystem and a toolbox that allows to effectively address the regional needs within and beyond the project's lifetime, supporting the implementation of GEOSS and Copernicus in the RoI.

1.2. Project objectives

The overarching objective of the GEO-CRADLE project is to create a multi-regional (Balkans, N. Africa and Middle East) coordination network, supporting the effective integration of EO capacities, providing the interface for the engagement of the complete ecosystem of EO stakeholders, promoting the uptake of EO services and data in response to regional needs and, finally, contributing to the implementation of GEOSS and Copernicus in the RoI.

GEO-CRADLE has defined four objectives that will govern 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. Contribution to 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.



2. Methodology

The proposed methodology introduces the definition of **maturity indicators, an explanation of their parameters and an overview of boundaries for their application.**

The validation phase will explore common challenges in defining EO-related priorities.

To support the definition of the indicators, we have prepared additional reasoning for the analysis that will be undertaken (see indicator definitions). This information has been sent to all country partners to request inputs for each of the maturity indicators. 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 various indicators. This first assessment is established by **indicator ranges** which will relate 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 (characterized by maturity levels) assign scores to each indicator. The current proposal follows the scale score from 0-4 but it is still in discussion and its appropriateness and applicability will need to be evaluated by task leaders & project management as the work of this task progresses.

This first assessment of countries' maturity will only include the information provided in a first round with country partners. During the course of the project more information will be available so we should need to re-evaluate the maturity scores and better define the guidelines.

The methods we have applied (and some that are currently evaluated for the next phase) are:

- **Integration of information from other project tasks:** This step will evaluate and interpret the country capacities from the inventory (T2.1-2.4) and review the gap analysis (T3.1) to help tie the maturity indicators with the rest of the GEO-CRADLE project. This will contribute to the determination of the appropriate benchmarking approach for the assignment of value to the indicators (*status: next phase*)
- **Desk research by country partners:** it is based on available literature and publications. Other main sources consulted are the websites of institutions and companies; finally the country partners own insights and expertise into the topics to feed into the report (*status: ongoing*)
- **Comparative assessment:** it will be based on the desk research and comparative assessments per country level (country level analysis and report). The report will produce an interpretation of own findings (*status: next phase*)



- **Benchmarking:** An appropriate benchmarking approach is currently under consideration. This is critical as the assignment of values to the various indicators for a given country should follow an – as much as possible – objective approach and allow scrutiny/comparison against countries with well mapped capacities. At present **two approaches are being considered**. The **first** involves the application of the maturity indicator methodology on a country with well-known and, ideally, high performance in EO-related activities, thus constituting a “reference” country. In this approach, all countries considered in the RoI will be compared against this reference country. **Alternatively**, for each of the indicators, we will attempt to identify the best practice/performance, studying the capacities of various countries with well-known capacities. This would 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?”.

Overall, the objectives for using benchmarking are: (i) Assess performance of EO objectively: compare and evaluate performance in a more objective way (ii) Create an interest for improvement to effectively see the evolution of other countries in the RoI (iii) Expose areas where improvement is needed and reveal underlying problems of the country (iv) Identification of best practices (v) Test whether improvement will be successful in future revisions of country strategic plans. (*status: next phase*)

- **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. Further, countries are all on a different position of development in terms of economy, environmental, population, health as measured for example by the Social progress index or UN Human Development Index². This may affect the metrics used to evaluate the Earth Observation performance but which are not taken into account in performance assessments. This raises the question as to whether some form of normalisation would be useful by for example checking the ranking performance of two countries that have nothing to do with each other and expecting the same outcome. For example, we could consider the possibility to build more complex models to run effective country comparisons - such as GDP and economic performances - to produce a more realistic view of rankings. During the second phase of work, we plan to investigate this further and evaluate whether there is merit in a normalisation process, and what this process shall entail. (*status: next phase*)

² The Human Development Index (HDI) is a composite statistic of life expectancy, education, and income per capita indicators.

Source: https://en.wikipedia.org/wiki/List_of_countries_by_Human_Development_Index
2016 Social Progress Index. <http://www.socialprogressimperative.org/>



- **Semi-structured interviews with country partners & organizations:** In order to collect first-hand data and information on perceived impacts, trends and challenges, semi-structured interviews should be carried out with country partners. For the interviews a flexible approach should be used (*status: ongoing*)
- **Validation of findings by experts:** To assure the overall quality of the report and to avoid the inclusion of incorrect findings a feedback round will take place. Firstly, country partners will provide feedback on the methodology of the report. Secondly, some recognised organizations, National Contact Points (NCPs) and companies could validate the findings (corrections and improvements). The consolidation of these enhancements will be undertaken by EARSC (as task leader of T3.1) and the project management team. (*status: next phase*)
- **Analysis will also be required concerning incomplete data or N/A.** This can arise if there are insufficient responses from country partners against a particular category; for example, the number of EO institutions per country, or in some cases where we shall wish to provide a complete response even if this has not been possible with the information gathered; for example, the total number of employees in public but also private organisations. The extrapolation potential of this analysis shall be assessed. (*status: next phase*)

During the next project months, the methodology will be validated providing solid basis to assess the maturity indicators of each of the GEO-CRADLE countries.

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.

2.1. Indicator definitions

The indicators are the parameters by which the maturity of the country related to Earth Observation and geo-information capabilities will be measured and monitored in 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).

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

1. Providing quality feedback to drive direction of involvement in the EO per country;
2. Supporting future decision-making and focusing attention on what matters most;



3. Providing a common language for communication and helping understand performance;
4. Providing a way to see if the investment in the EO sector is working;
5. Serving as risk triggers and early warning signs.

Constraints need to be also quoted:

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

We have grouped the indicators into 3 main strategic groups or categories, each of them having its own sections.

1. Capacities (including national or regional capacities)
2. Cooperation (including international cooperation)
3. Uptake (including national uptake and awareness)

Where appropriate the corresponding indicators will have different parameters (information resources/variables) which will describe the necessary elements to assess the maturity (i.e. the actual state, the impact, response..., etc.). For some indicators, the parameters and the relationship to the indicator is clear. For others, some explanation and analysis is needed to ensure a consistency of the analysis and that the indicators can be successfully compiled.

To support the definition of the indicators we are providing additional reasoning for the analysis that will be undertaken. This provides assurance that the indicator is valid. It will also help to ensure that country partners will obtain the necessary information which guarantee the basis for the assessment of the maturity analysis. The set of indicators will provide the major tool to get a compact, illustrated overview of country trends 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. 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.), highlighted in red, 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.



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

Table 1 Model of table sent to country partners as guideline for the Indicators

2.1.1. Capacities

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



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							
	<p>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 organizations 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 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.</p> <p>Until recently, EO satellites used to be built and operated by the governmental organizations. However, launching of the 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. The new generation of small satellites is also part of the scene.</p> <p>Developing a space programme including EO satellites</p>							
1.1.1.	Own space-borne capacity	Get a wide picture if countries are operating their 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	Request to country representative space borne capacity operated by the country.	It will provide information on the space -borne infrastructure: number of organizations but most important the type of satellites and how those are operated up to date.



						(vii) data policy applied		
1.1.2.	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	
1.1.3.	Ground-based / in-situ monitoring networks and facilities	It will give information on the number of organizations operating the equipment necessary to control and to acquire data from EO satellites and in-situ (active or passive remote sensors, meteo/atmospheric/ water sensors, etc.) EO satellite acquisition stations & antennas, mirror sites of GSs, Core GSs, etc.)	-Total number of Organizations with ground based/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		-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



						<p>composition/profiling, hydrometric/water quality, soil attributes/spectra, energy/radiation, other)?</p> <p>(iv) Is METADATA available?</p>		<p>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</p> <p>-Are these users willing to be data providers, therefore helping to fill gaps with in situ & satellite data records?</p>
1.1.4.	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	<p>-Total number of Organizations with modelling & processing capacities</p> <p>-Total number of models</p>	Lack of response at country level	Q	<p>-Does your organization have sufficient available computing resources for the processing and exploitation of EO data and the models running (Server clusters, HPC clusters, Cloud infrastructure, Virtualization</p>	<p>-If organizations do have the modelling and computing capacity then they are asked to provide a short description of what it is used</p>	<p>The questionnaire also provides information on (i) Total number of algorithms (ii) Models for meteo/climatic (iii) Models for atmospheric composition (iv) Models for</p>



		external memory units.				<p>infrastructure, Processing power capacity – CPU, RAM, Storage Capacity)?</p> <p>-What is the source of EO data used in the model (geospatial data, e.g. DTM; remote sensing data, e.g. raw satellite high-level images; in-situ data, e.g. temperature, pressure, humidity; other)?</p>	<p>for.</p> <p>-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</p>	<p>hydrometric/water quality (v) Models for soil attributes (vi) Models for energy/radiation</p> <p>-Interest to have thematic areas of interest per country</p>
1.1.5.	EO data exploitation platforms (provision of VA services and products)	Coordinated monitoring networks, integrated analysis & modelling capacity	<p>-Names of Organizations with data exploitation products</p> <p>-Type of organization according to classification system</p>	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	<p>Critical Mass of EO researchers</p> <p>Identification of the different groups of researchers both in research institutions & universities/academia and how big these groups are.</p> <p>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 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)</p>							



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1.2.1.	Number of public organizations	It will show the number of public organizations in a given country and it will illustrate the geographical distribution of organization	-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 -Difficult to establish threshold groups or department sizes	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 organization (climate change, food security, access to raw materials, energy, other)?	-The goal here is to get a wide picture of the number and geographical distribution of EO organizations per country. -Country partners should be able to provide the names of the organisations and what they do (the classification) -Note: it is assumed that these organizations do not go beyond in the value chain. So any public organization that represents more than end-users, will appear in section 1.1.	-Additional Information on type of organization by activity: (i) raw data producers surveyed (ii) value-adders surveyed (iii) GIS/mapping service providers surveyed (iv) End-users with in-house 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.	Courses being offered in universities	Information about the quantity of courses	-Number of	-Hard to accurately	R		-Request to country	Maybe we could get an idea on how



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		<p>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.</p>	<p>courses offered</p>	<p>determine, both because of a lack of knowledge and general sensitivity around funding questions</p> <p>-Difficult to measure the academic performance (e.g. number of high-impact papers published, # of PhDs, etc.) or to industry/economic performance of students after graduation</p>			<p>representative & desk research on the number of courses offered</p> <p>-Interview process needed</p> <p>-The country partner should provide a table including information on the courses related to EO / country. It will include the following parameters:</p> <p>(I) title (ii) type (master/post-graduate...) (iii) duration (iv) graduation requirements (v) start year (vi) estimate n. of students/course (vii) organization partners (lecturing or sponsoring) (viii)</p>	<p>resources are being concentrated in academia? will be possible to do some correspondence with the large research institutes?</p> <p>- Consolidation: we might have some information on the investment in the future?</p> <p>-Specific courses are expected to provide a better basis for recognition on the research work</p> <p>-To what extent 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</p>
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							academic performance(impact of the project)...	
1.2.3.	Diversity and maturity for courses offered	Most universities will also offer courses through a combination of lectures and specialized seminars. This indicator will understand where country priorities are .	-Subject of Geo-information Science and <i>Earth Observation</i> , Courses as for example: Remote Sensing, Photogrammetry, Digital processing, GIS or specific courses as monitoring climate from space, Observing Earth from Space, ...etc -Years where courses have been first established -Qualitative perspective	-Difficult to identify quality and when was the first year where the course has been in place (where do you draw the line on the courses?) -How to score relevance & level of the courses	R		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, photogrammetry ,	-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 technology as measure -Diversity courses & how relevant are those courses. -Levels of evaluation: Results, transfer, learning, reactions



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1.2.4.	Number of researchers (in Univ. & R&D labs)	Distribution of researchers by country. It might indicate the level of training and expertise deployed	<ul style="list-style-type: none"> -Estimated number of researchers employed or granted -Organization location -Grouped according to doctorate, masters, degree ? 	<ul style="list-style-type: none"> -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. -Grades could offer a dedicated subject in EO as satellite oceanography, EO for mining engineering, ecosystems. 	Q / R	Hard to find out the number of researchers in using any EO and geo-information data. It will depend of departments, taking into account staff in Earth observation: researchers, doctorates, graduates doing some training, etc... (% employees in EO and geo-information)	<ul style="list-style-type: none"> -Request to country representative more information on the number of departments & size of the research group (the number of people involved in it) 	<ul style="list-style-type: none"> -How many researchers are employed in each country -Nice to have gender percentage (participation woman in the workforce) -To be included at the score card - Try to understand consolidation of a research area – at the national & international level
1.2.5.	Papers published (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 resulting from EU-funded projects and initiatives...or relevant magazines.		<ul style="list-style-type: none"> -Difficult to obtain and also check the relevance of papers that have been published in a large variety of magazines -Difficult to define 	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) /	<ul style="list-style-type: none"> -Items to take into account: facilitation of communication (via papers) should form an important part of the research institutes - Maybe interesting to have the number of citations of papers- the impact



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				relationship between research quality and group quantity.		Publication (magazine, website) / N. citations / N. downloads	<p>factor: Publishing in a journal, such as Nature or Science, which has a high impact factor is considered very prestigious for a marine biologist. However, if a paper is focussed on algorithm research or electronics and communications, it is more relevant to publish in IEEE journals as they have a high impact factor and their reviewing procedure is very tough.</p> <p>-Could we count the "online page hits"? Could we track the number of visitors to the publications website from each research, academia, etc?.</p> <p>-Development of</p>
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								innovative research -Strengthening of a research performing institution
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 trends in the size distribution of companies	-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 these companies? - Are the country partners aware on the quality management? or standard processes within these companies?	- 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 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)	<p>Classification Small and medium-sized enterprises: -Micro: 0-9 employees < €2 million</p> <p>-Small: 10-49 employees (includes micro) < €10 million</p> <p>-Medium-sized: 50-249 employees < €50 million</p> <p>-Large: over 250 employees €50 million+</p>	<p>-Type of companies.</p> <p>-Split by size</p>	Lack of information from companies responding the survey	Q / R		<p>EARSC request to country representative & desk research. Maybe information could be under companies websites.</p>	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 through the years. Difficult to identify the total population	Q / R		<p>EARSC request to country representative & desk research</p> <p>-estimated employees per company companies (company website)</p>	<p>-We could not be certain on the total number of companies by country.</p> <p>-It will be nice to know about the gender percentage</p>
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	<p>-Number of partners or resellers</p> <p>-Country</p>		Q / R		EARSC request to country representative & desk research on data providers	Will provide some idea of companies working as resellers in the region.



		existed.					resellers & partners	-It could be extended to other companies
1.3.4.	Existence of Clusters	It provides a measure of the concentration of business, suppliers, and associated institutions in the geo-information field.	-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 output of a knowledge-based economy - Might help to understand innovation & competitiveness.
1.4.	Space Agency or designated Space Authority							
	This dimension will look at the key players involved in space activities at the national level.							
1.4.1.	Space policy organization	Name of any organisation responsible for space policy in each country			Q	Is there a national space policy or strategy, a space agency?		
1.4.2.	Organization chart	It shows the organisational structure (Who is			Q		EARSC request to country representative	



		who) in a given organisation					for an idea of the hierarchy, organization chart, position in the value chain and links with other institutions. This indicator is being proved difficult to answer by country partners.	
1.5.	Initiatives for 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.							
1.5.1.	National R&D investment (internal to the country)	Relevant to National R&D investment: while the EU Research and Innovation programmes have been pivotal in building the GEOSS, this questions 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	-Budget information related to national funds	It should be ensured to be separate from external R&D.	Q / R	Difficult to have this piece of information: 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	- How important it the investment in R&D in your country?



		innovation cycle. Innovation builds on R&D and also includes commercialization phases. Specially those ones related to EO systems will be relevant					companies were investing in satellites/ground stations etc) ask also for the percentage.	
1.5.2.	EO focused actions	Other EO actions on capacity building on the human, institutional or infrastructure level	-EO related projects	Open indicator	Q	Has the organization participated in EO-related projects? How would you rate your organization'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

Table 2 Capacities

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.



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
2.1.	Impact of GEO	<p>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.</p>						
2.1.1.	Participation in GEO or in projects which are linked to GEOSS	<p>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</p> <p>It will also reply to Qs as if the country preparing positions in GEO Plenary Meetings</p>	<p>-Country member of GEO</p> <p>-Number of projects</p>	Provide limited selection of projects	Q/R	<p>-Has your organization participated in GEO/GEOSS SBA tasks, community activities or initiatives?</p> <p>-Would the organization be interested in contributing to a regional initiative of GEO (perhaps under specific</p>	Country partner could dig out on which is the organization 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 organization 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



		& Ministerial Summits. Has the country established strong ties with GEO countries?				conditions)?		actions 2) articulation of goals for more than one stakeholders 3) identification of adaptive measurement techniques and evaluative process for the projects, what was the project life after the financial proposal
2.1.2.	Designated GEO office	The GEO office will help to identify all national activities for possible integration into GEO. Information if the country have such office or department which links with GEO	-N. organizations with direct or at least indirect relevance to GEO/GEOSS -GEO office in a country -GEO focal point organization		R		EARSC request to country representative about a country point of contact for GEO aspects and the number and name of organizations related to GEO activities per country. -Are there any other participating organizations members of the GEO community from each country?	Provide an assessment from the results of the Q: Would the organization be interested to provide feedback to the GEO CRADLE consortium for establishing a roadmap for GEO and Copernicus implementation in the region?
2.1.3.	Actions on SBA's	The Societal Benefit Areas (SBAs) are nine environmental fields of interest around which the Global Earth Observation System of Systems (GEOSS) project is exerting its	-Number of participation in specific actions		Q/R	Has your organization participated in GEO/GEOSS SBA tasks, community activities or initiatives?		The nine Societal Benefit Areas are environmental issues that the Global Earth Observation System of Systems (GEOSS) is aiding: Disaster, Health, Energy, Climate, Water,



		<p>efforts. These include: Agriculture, Biodiversity, Climate, Disasters, Ecosystems, Energy, Health, Water, and Weather around which a preliminary hierarchical vocabulary has been created.</p> <p>This indicator will provide a view on the involvement of country organisations in the implementation of SBAs (at various levels) [it could also include additional points for countries whose orgs have contributed to the definition of SBAs]</p>						Weather, Ecosystems, Agriculture, Biodiversity
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) to GEOSS	<p>-Data linked to GEOSS portal (registered any datasets for GEOSS)</p> <p>-Contribution</p>		Q		<p>-Info on data sharing: Country partners will provide an overview on the open exchange of data, metadata and products shared within GEOSS</p>	<p>-Access to data and information by GEOSS users is an integral part of GEO</p> <p>-part of the Data Sharing Working Group</p>



			to shared data, metadata and products					(DSWG) -Reference to the term "Open Data" ³ 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 Principles in line with the relevant international, regional, national and organizational developments
2.2.	<p>Impact of Copernicus</p> <p>There are 6 core services identified under the Copernicus programme. The 6 services are: 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.</p> <p>The service provision of Copernicus services has been delegated by the European Commission to a number "Entrusted Entities", which act or will act as "service providers"</p> <ul style="list-style-type: none"> • 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); 							

³ "Open data" is not a measure of maturity. It is a useful information obtained gaps analysis and will be used accordingly.



<ul style="list-style-type: none"> • 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 will be 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. <p>Copernicus will bridge the gap between the commercial very high-resolution satellite programmes and the existing national government satellite programmes.</p>								
2.2.1.	Projects using data from Copernicus	It will provide to a certain extent the involvement in supply of the Copernicus services	-Number of actions with Entrusted entities	- List only of four key thematic areas (adaptation to climate change, food security, access to raw materials and energy). There is a limitation on the selection. -Countries has not the same level of involvement in Copernicus.	Q	-Has the organization participated in Copernicus service provision, Copernicus user requirements or Copernicus research and innovation action? -Would the organization be interested in contributing to a regional initiative of Copernicus (perhaps under specific conditions)?	- Country partner to inform which is the organization/ministry dealing with Copernicus in the country and projects related - Request to country representatives their activity with Entrusted entities	



2.2.2.	Organisations involved in projects linked to Copernicus	It will provide information on to which extent organizations have been users of products from Copernicus and maybe the type of Copernicus services they use	-N. Organizations -N. Copernicus Services/ organization	Country partners to provide information on the projects involvement under Copernicus. This country information could be contrasted via CORDIS	Q			
2.3.	<p>Participation to other international efforts</p> <p>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.</p>							
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 .	Participation in Meteorological Organizations such as World Meteorological Organization (WMO) and European Organization for the Exploitation of	-Member		Q/R		Contrast with country partners the information obtained by desk research	How much project involvement coming from organisations in a given country.



		Meteorological Satellites (EUMETSAT)						
2.3.3.	CEOS	Participation at Committee on Earth Observation Satellite's Earth Observation	-Member		Q/R		Contrast with country partners the information obtained by desk research	
2.3.4.	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	
2.3.5	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.



								<p>- MS reports: Bulgaria, Croatia, Cyprus, Greece, Slovakia, Slovenia, Romania,</p> <p>Candidate: Serbia, Turkey, FYROM</p>
2.3.5.	<p>Other International agreements, e.g. OGC...</p> <p>Standard organization, OGC</p>	<p>Membership to 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.</p>	-Member		Q/R		<p>Request to country partner an idea of country participation in other international organizations</p>	
2.4.	<p>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.</p>							
2.4.1.	<p>R&D participation or other EU programmes</p> <p>Country partner</p>	<p>Sources of funds. It will provide a general indication on the areas of funding programmes.</p>	<p>-ESA, EC budget contributions to EO programme</p>	<p>Some organizations do not make a distinction between contracts and</p>	Q		<p>-We shall try to obtain figures for R&D funds for EO services from ESA, EC, and National Institutes</p>	<p>Find out Statistics: EC figures of participation in H2020 projects for Earth Observation (REA, DG-RTD)</p>



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to search through CORDIS for the finite number of Copernicus related projects by country"		-Budget received from the Copernicus framework.	R&D sponsorship				
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Table 3 Cooperation



2.1.3. National Uptake & Awareness

Within 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?

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.	Events	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...						
3.1.1.	Networking Events	Regular (annual?) events organised at national level -What is the focus of these events? – R&D, thematic, ICT -Are there regional events relevant to the sector?	-N. events -Focus for the events -Sector related	Period under examination (last 5 years)	Q Q/R Q/R	Can the organization name high-impact, EO - dedicated workshops organized in the country in the last five years?	-Country partner to provide more information on the related events and who organizes them	Could provide insights on duplication of Earth observation capacity building efforts.
3.1.2.	Thematic Workshops	Regular Workshops on specific topics related to EO? e.g. disasters, agriculture, GIS, ICT etc	-Number of workshops	Timeline	Q/R		-More information on these dedicated workshops	Ongoing comprehensive training via thematic workshops related to using and developing new Earth observation products



3.2. Dedicated dissemination activities								
3.2.1.	Networking initiatives	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 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)	-Number activities	Timeline for the activities	Q/R	Provide limited number of initiatives	Research on networking activities	
3.2.2.	Data Portals	Portal to distribute Earth observation data from diverse EO Missions or samples and auxiliary data from a number of missions and	-Portal		Q/R	Provide an assessment following the Q: Would the organization like their profile	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



		instruments				presented on the 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)...
3.3.	National Policies Implementation							
	It will attempt to highlight the importance given to EO as part of the political agenda and the engagement with Ministries.							
3.3.1.	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.
3.3.2.	Budget	Budgets linked to these policies	-Budget designated	No budget figures	Q/R	Is there funding for EO activities available in your country	Country partners will provide information on the budget linked to these possible policies: i.e. EC-	



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						(infrastructure development, EO market development, R&D)?	<p>CAP (Common Agricultural Policy).</p> <p>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 -Cultural Heritage authorities</p> <p>-Environmental bodies -Forestry and resource management bodies - Meteorological bodies -Maritime authorities -Transport bodies -IT and communication organisations</p> <p>-Research Institutes</p>	
3.4.	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?							
3.4.1.	Use	-Awareness of the	-Name of	Difficult to get	Q/R		Country partners should	-It will give information



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	<p>capabilities of EO</p> <p>-Use of satellite imagery by government agencies</p> <p>-R&D Uptake activity</p>	<p>agencies and domains which they operate</p> <p>-Maturity of the use of satellite data and how the information is used</p> <p>-Volume and regularity of use</p> <p>-Activation of international observation resources (eg. EMS, charter)</p>	<p>the exact definition on the type of data needed for this indicators</p>			<p>get information (i) if public organizations 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.</p> <p>-EARSC has done some preliminary research on the charter activation</p>	<p>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 observations among decision makers</p> <p>-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)</p> <p>-Educational outreach to decision makers reinforces the value of such a system as an environmental decision support tool</p>
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Table 4 National Uptake & Awareness



3. Maturity Card

The maturity card will characterize the Earth Observation capacity in the countries within the GEO-CRADLE area, providing concrete information on its EO activities.

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

3.1. 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.

Within this process, this first assessment of the country data is undertaken. The assessment is based upon a series of indicators which can be used to characterize the critical aspects of measurements of country maturity in Earth Observation.

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 to country partners in thinking about the status of the indicator and its performance.

L1 - Basic: The value describes country practices that are in early pilot use and are demonstrating some successful results.

L2 - Intermediate: The value describes country practices that are in limited use in industry or government organizations for the EO sector.

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.

L4 - Optimized: The value describes practices that have been fully integrated and optimized by the country.



Maturity level	0	1	2	3	4
overall definition	initial	basic	intermediate	advanced	optimized

Table 5 Overall maturity level

For each indicator we create a mapping between the overall range of values (0 to 5) and a reasonable scale (sometimes quantitative others qualitative)⁴.

⁴ Initial: ad-hoc practices,
Basic: formally defined steps
Intermediate: managed result metrics
Advanced: advanced process
Optimized: fully consolidated activities in EO



3.1.1. Capacities

		level 0	level 1	level 2	level 3	level 4
1.1.	National Infrastructure					
1.1.1.	Own space-borne capacity	no commitment towards space-borne capacity	Existing technical ability to possess this capacity but no actual activities	at least one satellite operated by the country	more than one mission, future mission planning with improvement degree	Well-developed capacity in a full integrated structure
1.1.2.	Access to 3rd party missions (own ground stations)	no access to other missions	<p>access to one 3rd party mission (not owned nor operated by the country)</p> <p>Ground stations for EO satellites</p> <p>example of party missions: ie. Deimos, QuickBird, GeoEye, Worlwide, Oceansat, WorldView, IKONOS, TerraSAR, 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</p> <p>overview: https://earth.esa.int/web/guest/missions/3rd-party-missions/overview</p>	<p>access to more than one 3rd party missions with capability for downlinked data from various Remote Sensing Satellites with medium, high and very high resolution imagery</p> <p>n. of institutions operating the party mission</p>	access to several ground stations for EO satellites with capability for downlinked data from various Remote Sensing Satellites with medium, high and very high resolution imagery (meteo, active or passive sensors)	<p>strategic access to own stations for country missions but also access to other third party missions</p> <p>advanced capability of reception antennas for RS. satellite telemetry & image archiving in the last 10 years</p>
1.1.3.	Ground-based / in-situ monitoring networks and facilities	no capacity for EO satellite acquisition	demonstrated capacity in one of the following facilities: meteorological, water, atmospheric, hydrometry, soil, energy/radiation	demonstrated capacity in more than one of the following facilities:	besides owning or providing raw data also	provide a established system of monitoring



		antennas, nor in-situ monitoring networks to determine the spatio-temporal distribution of certain parameters in thematic areas		meteorological, atmospheric, hydrometry, energy/radiation	water, soil,	process/model data (it covers full value chain). It could have open access of the in-situ data	networks and ground based stations defining a large range of parameters. Gap data records are filled including improvement processes of performance which comply with international standards as INSPIRE, ISO, OGC...etc
1.1.4.	Modelling and computing capacities	no modelling capacities (high-performance computer (HPC) facilities)	at least one institution with high-performance computer (HPC) facilities for their executions with multiprocessing systems and large external memory units	multiple resources for the processing and exploitation of EO data for one or more institutions		Models covering all thematics: 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.	fully operational models (high performance computing, distributed computing and scientific data warehouse) integrated into the policy making processes. consolidated, many years tracing modelling and computing



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1.1.5.	EO data exploitation platforms (provision of VA services and products)	<p>no involvement in exploitation platforms (collaborative, virtual work environment providing access to EO data and the tools, processors, information and communication technology resources)</p> <p>These need to be more linked to whether they have capacity to develop and offer VA products to others. Firstly internally to the country and finally outside of it.</p>	<p>at least one organization has the capacity to develop and offer VA products to others.</p> <p>some dissemination and promotion the commercial exploitation results</p>	<p>more than one organizations have the capacity to develop and offer VA products to others (mainly in one capacity)</p>	<p>more than one organization in the country have leading capacities to develop and offer VA products such as training, tools, processes, measurements... in few thematic areas</p>	<p>More than one organization have a fully-fledged portfolio of EO data exploitation platforms capacities</p>
1.2	Critical Mass of EO researchers					
1.2.1.	Number of public organizations	no public organization	at least one public organization providing any of these activities (i) raw data producers (ii) value-adders (iii) GIS/mapping service	at least the country has more than one organization in	Apart from having different types of organizations, the	the country is well covered in all types and



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		involved in EO related activities	providers (iv) End-users with in-house GIS (v) End-users	<p>government, PSB, institute, academia/university that besides owning or providing raw data, also process/model data, provide GIS/mapping services, etc</p> <p>about 2-10 organizations</p>	<p>country has organizations active in a wide range of thematic areas of activity (geocradle is focus on: climate change, food security, access to raw materials, energy...etc) but could be much more. With ref. employment: usually the remote sensing departments or laboratories dealing with EO activities are rather small, having around 10 employees as media.</p> <p>about 10-25 organizations</p>	<p>thematic areas but also spread in country regions and sizes of the organizations (example: cartographic agencies, civil protection agencies, defence and security actors, cultural heritage authorities, environmental bodies, forestry and resource management bodies, meteo bodies, marine authorities, transport bodies, IT and communication organisations and research institutes).</p> <p>Note: Usually the departments or laboratories dealing with EO activities have an average of 10</p>
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						employees
1.2.2.	Courses being offered in universities	no courses being offered in the EO domain	range of courses being offered in the areas of remote sensing, photogrammetry, digital processing, GIS some training focused on specifics of EO data management	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	continuous courses being offered which will show some organizational training activity and investment plans at universities.	most relevant country universities should have large number of thematic courses with licensed EO software / data processing packages. it will show some organizational & national investment plans on education & training on potential work force
1.2.3.	Diversity of courses offered	no diversity of courses offered in the EO domain	between 1-5 courses offered <i>note: courses / GDP</i>	more than 10 courses as for example: photogrammetry, digital processing, G.I.S., .. or specific courses as monitoring climate from space, observing Earth from Space, ...etc <i>note: courses / GDP (county's Gross Domestic Product) tbc</i>	more than 20 specialized courses in applications as agriculture monitoring, crop water demands, surface water and flash floods. <i>note: courses / GDP (county's Gross Domestic Product) tbc</i>	large variety & diversity of courses related to EO (more than 25 courses)(thematic but also on degree domain) offered by universities but also other organizations. It is also expected some consolidation of the course by



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					continuous courses offered in the last years	repetition of more than 10 years ago which will show some quality of the courses offered. <i>note: courses / GDP (county's Gross Domestic Product) tbc</i>
1.2.4.	Number of researchers (in Univ. & R&D labs)	no significant number of researches in the EO domain	less than 5 groups of research communities in whole country less than 50 employees	between 5-10 groups of research communities which have between 1-5 staff / each between 50-100 employees	more than 10 groups of researchers which employ large group of staff more than 100 employees	big number of groups of research communities (medium to large size) in different public-private universities more than 300 employees
1.2.5.	Papers published	no papers published	at least 10 papers published at department level and which will facilitate the communication in other scientific communities	between 10-25 papers published that will provide some excellence of the research resulting from national projects related to EO funded by Government or other EU funding	more than 25 scientific papers (+ thesis research) produced by research organizations and universities on innovative topics (as the focus of Geo-cradle: adaptation to	large number of theses and scientific papers produced by research organizations and universities which have an impact factor in prestigious magazines or



					climate change, access to raw materials, water resource management, food security and access to energy	presented in high level conferences; (i.e; publications in journals ranked in JRC among the top 30% of journals in its field)
1.3.	Industry Base					
1.3.1.	Number of companies	no private companies in the EO domain	between 1-5 companies in the country serving any category in the EO value chain (Definitions in Annex 1.1)	the country has between 5-10 companies serving at least 3 categories covering the EO value chain	the country has between 10-20 companies serving at least 3 categories covering the EO value chain	the country has more than 20 companies representing all the categories covering the EO value chain.
1.3.2.	Scale of companies (large/medium/small/micro)	no comparable	the country has micro companies (Classification in Annex 1.2)	the country has micro and small companies	the country has micro, small and medium companies	the country has all types of companies spread all over the country note= usually the EO companies are the small size ones. They have around 2-10 employees
1.3.3.	Employment numbers, levels and changes	private sector employment 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.	Private task force between 50-100 employees	Private task force between 100-200 employees	Private task force more than 200 employees



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1.3.4.	<u>Resellers or local representatives of European companies</u>	no reseller activity, nor companies that are members of international specialized groups.	one company who is resellers (for software or data reseller) in the region. Examples of missions whose data are resold are listed Annex 1.3	2-5 companies who are working as resellers in the region	5-10 companies who are working as resellers in the region	more than 10 companies who are working as resellers in the region
1.3.4.	Existence of Clusters	no concentration of business activities around ICT or geo-information	at least one ICT cluster which could promote innovation and technological development	between 1-5 professional cluster organizations involved in technological transfer and innovation.	5-10 cluster in more than one thematic	more than 10 clusters in more than one thematic ⁵
1.4.	Space Agency or designated Space Authority					
1.4.1.	Space policy organization	no organization, nor government ministry leading the space activity	at least one ministry leading and coordinating with space activities	one ministry leading and few ministries interconnected to the space activities in the country	at least one ministry leading and coordinating with space activities: however the governmental space agency is in charge of coordinating the space activities in	a governmental space agency coordinating the space activities in the country and different ministries involved in EO activities as: education,

⁵ We need to evaluate the dynamic impact of ITC clusters on the country with the innovation capacity and we should relate this indicator with a country of reference (benchmark)

Definition of cluster: While the organizations and industry of the cluster establish closer relationships, their innovation and improved productivity will promote the local economy. The prosperous regional economy will bring huge profits, which will further attract external enterprises to gather around the cluster. This interaction is well known due to much research. Reference to Audretsch, D. B. (1998). Agglomeration and the location of innovation activity.



					the country and other stakeholders relations which are equally active in the EO domain	defence & intelligence, foreign affairs, agriculture and rural development, interior affairs (ie. research institutes and private companies which are contributing to ESA missions)
1.4.2.	Organization chart	no		more than one link with stakeholders		full links with ministries and other stakeholders
1.5.	Initiatives for Capacity Building					
1.5.1.	National R&D investment (internal to the country)	no funds available for EO R&D	at least one line of research projects funds in the domains of Earth sciences, or funding for an applications where EO could be used. <i>Evaluate the % of GDP</i>	a dedicated budget line or programme for EO / geo-information research projects funds funded by government. <i>Evaluate the % of GDP</i>	EO research projects funded but more than one line of budget funded by government but also regional funds. <i>Evaluate the % of GDP</i>	EO research projects funded but more than one line of budget and it is sustained in the last 10 years. <i>Evaluate the % of GDP</i>
1.5.2.	EO focused actions	no current EO actions	some national program for capacity development in EO and geoinformatics	EU funded projects in the region	EU funded projects in the region sustained in the	EU funded projects in the region and



					last 10 years	bilateral agreements with other countries sustained in the last 10 years
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Table 6 Maturity Level: Capacities

3.1.2. Cooperation

		level 0	level 1	level 2	level 3	level 4
2.1.	Impact of GEO					
2.1.1.	Participation in GEO or to projects which are linked to GEOSS	no participation in GEO	participation at least in one GEO project	participation in GEO and participation to more than one projects which are linked to GEOSS	designated representative in GEO actions and active contribution to GEO networks	participate to sessions (as plenary meetings) and ministerial summits and representative in GEO High Level Working Group. preparing positions in GEO Plenary Meetings & Ministerial Summits
2.1.2.	Designated GEO office	no designated office	plans for office coordinating GEO activities in the country	organization which is taking care of GEO activities	organization which already nominated staff to take care of GEO activities	fully active office taking proactive participation at GEO activities in the last 5 years
2.1.3.	Actions on SBA's	no actions related to SBA's	action at least in one SBA <ul style="list-style-type: none"> • 1.1 Disasters • 1.2 Health • 1.3 Energy • 1.4 Climate • 1.5 Water • 1.6 Weather • 1.7 Ecosystems 	more than one action in SBA's	active contribution to different actions in SBA's	active contribution to different actions in SBA's in the last 5 years



			<ul style="list-style-type: none"> • <u>1.8 Agriculture</u> • <u>1.9 Biodiversity</u> 			
2.1.4.	Provision of data to GEOSS	no data transferred to GEOSS	plans for provision of data to GEOSS. some planning of data sharing at country level	provision of data to GEOSS under one of the possible Networks	provision of data to GEOSS under more than one of the possible Networks.	provision of data to GEOSS under more than one of the possible Networks. Implemented the open exchange of data, metadata and products shared within GEOSS.
2.2.	Impact of Copernicus					
2.2.1.	Projects using data from Copernicus	no projects using data from Copernicus	plans for projects using data from Copernicus	at least one project related to Copernicus programme	outcome for at least one project related to Copernicus programme	consolidated impact of the project related to Copernicus programme and plans for future integration
2.2.2.	Organisations involved in projects linked to Copernicus	no involvement in Copernicus	plans for involvement in Copernicus for at least one organisation	strengthening of projects and products have been related to Copernicus programme	outcome for at least one project related to Copernicus programme involvement of more than one organization	consolidated impact of the projects and products which have been related to Copernicus programme in the last years
2.3.	Participation to other international efforts					
2.3.1	ESA	no cooperation agreements with ESA	plans to join ESA	participation of public organizations and industry under the ESA programmes	ESA European Cooperating State Agreement (cooperation agreement), strengthening its relations with ESA	ESA full member funding several ESA activities (obligatory or subscription programmes)
2.3.2.	Meteorological: WMO, <u>EUMETSAT</u> ,	no cooperation agreements with meteo organizations	National meteorological administration	participation to international organizations through the National agency	continuous participation to international organizations through	country membership of meteorological organizations



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					the National agency	
2.3.3.	<u>CEOS</u>	not member of CEOS	plans for links to reference CEOS site to focus international efforts, facilitate traceability and enable the establishment of measurement “best practices.	cooperation with CEOS activities as events or wg’s	active participation at one of the sub-group of the Committee of Earth Observation Satellites (CEOS).	country member of CEOS and active participation at more than one of the sub-groups of the Committee of Earth Observation Satellites (CEOS)
2.3.4.	UN system as UN-GGIM, ...	no membership of UN bodies related to Space activities	plans for links to reference UN sites to focus international efforts, facilitate traceability and enable the establishment of measurement “best practices.	cooperation with UN activities as events or wg’s	active participation at one of the UN offices (UNITAR, UNOSAT, UN-OOSA, UN-SPIDER, UNEP, ...)	active participation or membership of more than one UN bodies / offices related to space activities: (UNITAR, UNOSAT, UN-OOSA, UN-SPIDER, UNEP, ...)
2.3.5	INSPIRE	not following INSPIRE directive	National infrastructure for spatial information	sporadic participation at INSPIRE directive events	active participation at INSPIRE directive events	National infrastructure for spatial information or National agency for cadastre and land registration assures INSPIRE Directive implementation into national legislation and operability which contains and quality geographic information.
2.3.5.	Other International agreements, i.e. as OGC... Standard organization, OGC	not following programmes on standard processes		public or private organization participating in one of other international organizations dealing with standardisation as OGC,		companies an organization active in OGC
2.4.	Availability of EU funding					
2.4.1.	R&D participation or other EU programmes	no R&D participation	participation at least one line of research projects where EO could be used	participation in more than one EU funded projects in the region	participation in more than one in the region sustained in	participation in EO research projects sustained in the last 10



					the last 5 years	years
						continuity of funding

Table 7 Maturity Level: Cooperation

3.1.3. National Uptake & Awareness

		level 0	level 1	level 2	level 3	level 4
3.1.	Events					
	Networking Events	no networking events in EO activities	planned networking events in EO activities	1-5 networking events per year in EO activities	more than 5 networking events in EO activities	consolidated number of networking events in EO, GEO or planned for different institutions in the last 5 years (ESA, Eurisy, EARSEL, GEO, UN...etc)
3.1.2.	Thematic Workshops	no thematic events	planned thematic workshops in EO activities	1-5 thematic workshops in EO activities. thematic workshops based on each institute focus and priority areas	more than 5 thematic workshops in EO activities	consolidated large number of GEO project workshops or thematic workshops planned for different institutions in the last 5 years (ESA, Eurisy, EARSEL, GEO, UN...etc)
3.2.	Dedicated dissemination activities					
3.2.1.	Networking initiatives (related to projects)	no networking events in EO activities	planned networking events in EO activities	1-5 networking events in EO activities, for example Aerosols, integrated activities, water forecast, research infrastructures, etc...	more than 5 networking events in EO activities focus on dissemination to stakeholders. activities which helped on the dissemination	consolidated number of networking events in EO, GEO or planned for different institutions in the last 5 years (ESA, Eurisy, EARSEL, GEO, UN...etc) focus on dissemination to stakeholders. activities which helped on the dissemination
3.2.2.	Data Portals	no involvement in data portals	plans to develop a focussed EO data portal, country need to develop a strategy to increase the	country data portal established which implies a certain strategy to increase the number	more than one data portal in other thematics as described in level 2& 3	data portal established at country level. it distributes EO data from diverse EO Missions or samples and auxiliary data



			number of users and types of applications in Earth Observation. i.e portals: land surveys, geospatial information, open data, air quality, meteo...etc	of users and types of applications in Earth Observation		from a number of missions and instruments. it has synergies with Copernicus Programme, GEO Activities and stakeholders activities.
3.3.	National Policies Implementation					
3.3.1.	Policy	no national policies implementation	no governmental authorities nor ministries are using EO data for the monitoring status of the National/European policies.	coordination of the space activities and collaboration in international space programs by one organization. i.e: some monitoring of the air, land and water combining eo and in situ data	list of more than one 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)	government institution which has completed international agreements on behalf of the national Government (i.e; forecasts of the flood state of the catchment, forest fire identification and monitoring systems, biodiversity inventories, development of land evaluation systems , river monitoring and pollution control systems...)
3.3.2.	Budget	no budget planned for national policies implementation	at least one line of research projects funds in the domains of Earth sciences, or funding for an applications where EO could be used	a dedicated budget line or programme for EO / geo-information research projects funds funded by government	EO research projects funded but more than one line of budget funded by government but also regional funds Ministry implementing the EO research programme	EO research projects funded but more than one line of budget and it is sustained in the last 10 years
3.4.	Penetration					
3.4.1.	Use	no use of EO in country policies	satellite imagery is not used very regularly	some uptake activities from projects, most often at a pilot level.	regular national activities integrating EO in country	EO (and satellite imagery) used to policy implications.



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				There are some national activities for possible integration of EO in country policies	policies. special awareness to the Earth Observation capabilities.	goal of strengthening public sector capacities by the EU. active dissemination to stakeholders in other communities.
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Table 8 Maturity Level: National Uptake & Awareness



3.2. Preliminary Maturity cards

This section contains preliminary cases (maturity cards) for each country to illustrate the implementation of the maturity model assessment. By assessing the maturity of different aspects, it gives some information on the country strengths and weaknesses and where improvements are needed.

With this first assessment, we could observe countries placed in different maturity categories:

- Advanced quasi optimized: Israel
- Advanced (from + to -): Romania, Turkey and Greece
- Intermediate (from + a -): Serbia, Tunisia, Cyprus and Egypt
- Basic: Bulgaria
- Initial (from + to -): FYROM and Albania

Examples of country Cards:

- Albania
- Bulgaria
- Cyprus
- Egypt
- Greece
- FYROM
- Israel
- Romania
- Serbia
- Tunisia
- Turkey



Country

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure		COOPERATION	impact GEO		UPTAKE	events	
	eo reserach			impact Copernicus			dissemination	
	industry base			international			policy	
	space authority			funding			penetration	
	capacity building							

Detail assessment

capacity	indicator	level	cooperation	indicator	level
infrastructure	space borne		impact GEO	participation GEO	
	access 3rd party missions			designated GEO office	
	ground based/ in-situ			actions on SBA's	
	modelling & computing			provision data to GEOSS	
	eo data exploitation			impact Copernicus	projects
eo research	n. public organizations		organizations involved		
	univ. courses offered		international	ESA	
	diversity/maturity courses			meteorological	
	n. researchers			CEOS	
papers published		INSPIRE			
industry base	n. companies			Int. agreements	
	scale companies		funding	R&D participation	
	employment				
	resellers, partnership				
clusters					
space authority	space organization				
capacity building	national R&D		uptake	indicator	level
	eo focus actions		events	networking	
				thematic workshops	
			dissemination	networking	
				data portals	
			policy	policy implementation	
				budget	
			penetration	use	

LEGEND eo maturity card

○ initial ▽ basic ▲ intermediate ● advanced ● optimized

Figure 1 Maturity card model



Albania

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level		
CAPACITY	N/A	infrastructure	▾	COOPERATION	▾	UPTAKE	N/A	events	▾	
		eo reserach	N/A				impact Copernicus	○	dissemination	N/A
		industry base	N/A				international	○	policy	▸
		space authority	○				funding	▸	penetration	▸
		capacity building	○							

Detail assessment

capacity	indicator	level	cooperation	indicator	level
infrastructure	space borne	○	impact GEO	participation GEO	○
	access 3rd party missions	N/A		designated GEO office	▸
	ground based/ in-situ	▸		actions on SBA's	N/A
	modelling & computing	▸	provision data to GEOSS	▸	
	eo data exploitation	N/A	impact Copernicus	projects	○
eo research	n. public organizations	N/A		organizations involved	○
	univ. courses offered	N/A	international	ESA	○
	diversity/maturity courses	N/A		meteorological	●
	n. researchers	▾		CEOS	○
	papers published	N/A		INSPIRE	▸
industry base	n. companies	N/A		Int. agreements	N/A
industry base	scale companies	N/A	funding	R&D participation	▸
	employment	N/A		uptake	events
	resellers, partnership	N/A	networking		▸
	clusters	N/A	thematic workshops	N/A	
space authority	space organization	○	dissemination	networking	N/A
capacity building	national R&D	▾		data portals	▸
	eo focus actions	○	policy	policy implementation	▸
				budget	▸
			penetration	use	▸

LEGEND eo maturity card

○ initial ▾ basic ▸ intermediate ▸ advanced ● optimized

Figure 2 Maturity card Albania



Bulgaria

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	■	COOPERATION	impact GEO	■	UPTAKE	events	■
	eo reserach	■		impact Copernicus	■		dissemination	■
	industry base	■		international	■		policy	■
	space authority	■		funding	■		penetration	■
	capacity building	■						

Detail assessment

capacity	indicator	level	cooperation	indicator	level	
infrastructure	space borne	■	impact GEO	participation GEO	■	
	access 3rd party missions	■		designated GEO office	■	
	ground based/ in-situ	■		actions on SBA's	○	
	modelling & computing	■		provision data to GEOSS	○	
	eo data exploitation	■		impact Copernicus	projects	■
eo research	n. public organizations	■		organizations involved	■	
	univ. courses offered	■	international	ESA	■	
	diversity/maturity courses	■		meteorological	●	
	n. researchers	■		CEOS	○	
	papers published	■		INSPIRE	■	
industry base	n. companies	■			Int. agreements	■
	scale companies	■	funding	R&D participation	■	
	employment	■				
	resellers, partnership	■				
	clusters	■				
space authority	space organization	■				
capacity building	national R&D	■	uptake	indicator	level	
	eo focus actions	■	events	networking	■	
				thematic workshops	■	
			dissemination	networking	■	
				data portals	■	
			policy	policy implementation	■	
				budget	■	
			penetration	use	■	

LEGEND eo maturity card

○ initial ■ basic ■ intermediate ■ advanced ● optimized

Figure 3 Maturity card Bulgaria



CYPRUS

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	basic	COOPERATION	impact GEO	basic	UPTAKE	events	intermediate
	eo reserach	intermediate		impact Copernicus	basic		dissemination	intermediate
	industry base	basic		international	basic		policy	initial
	space authority	intermediate		funding	basic		penetration	intermediate
	capacity building	basic						

Detail assessment

capacity	indicator	level	cooperation	indicator	level
infrastructure	space borne	initial	impact GEO	participation GEO	intermediate
	access 3rd party missions	initial		designated GEO office	intermediate
	ground based/ in-situ	intermediate		actions on SBA's	N/A
	modelling & computing	intermediate	provision data to GEOSS	initial	
	eo data exploitation	intermediate	impact Copernicus	projects	basic
eo research	n. public organizations	intermediate		organizations involved	basic
	univ. courses offered	optimized	international	ESA	intermediate
	diversity/maturity courses	intermediate		meteorological	optimized
	n. researchers	intermediate		CEOS	initial
	papers published	intermediate		INSPIRE	basic
industry base	n. companies	intermediate		Int. agreements	initial
	scale companies	intermediate	funding	R&D participation	basic
	employment	intermediate			
	resellers, partnership	N/A			
	clusters	initial			
space authority	space organization	intermediate			
capacity building	national R&D	intermediate			
	eo focus actions	N/A			

uptake	indicator	level
events	networking	basic
	thematic workshops	intermediate
dissemination	networking	intermediate
	data portals	intermediate
policy	policy implementation	initial
	budget	N/A
penetration	use	intermediate

LEGEND eo maturity card

○ initial ▢ basic ▤ intermediate ▥ advanced ● optimized

Figure 4 Maturity card Cyprus



Egypt

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	🔴	COOPERATION	impact GEO	🔴	UPTAKE	events	🔴
	eo reserach	🔴		impact Copernicus	○		dissemination	🔴
	industry base	🔴		international	N/A		policy	🔴
	space authority	🔴		funding	N/A		penetration	🔴
	capacity building	🔵						

Detail assessment

capacity	indicator	level	cooperation	indicator	level
infrastructure	space borne	🔵	impact GEO	participation GEO	●
	access 3rd party missions	🔴		designated GEO office	🔵
	ground based/ in-situ	🔵		actions on SBA's	○
	modelling & computing	🔴		provision data to GEOSS	○
	eo data exploitation	🔵		projects	○
eo research	n. public organizations	🔵	international	organizations involved	○
	univ. courses offered	🔴		ESA	○
	diversity/maturity courses	🔴		meteorological	N/A
	n. researchers	N/A		CEOS	○
	papers published	🔴		INSPIRE	○
industry base	n. companies	🔵	funding	Int. agreements	N/A
	scale companies	🔴		R&D participation	N/A
	employment	🔵			
	resellers, partnership	🔵			
	clusters	🔴			
space authority	space organization	🔴			
capacity building	national R&D	🔵			
	eo focus actions	🔵			

uptake	indicator	level
events	networking	🔴
	thematic workshops	🔴
dissemination	networking	🔴
	data portals	○
policy	policy implementation	🔴
	budget	🔵
penetration	use	🔴

LEGEND eo maturity card

○ initial 📄 basic 🟡 intermediate 🟢 advanced ● optimized

Figure 5 Maturity card Egypt



FYROM

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	🟡	COOPERATION	impact GEO	🟡	UPTAKE	events	N/A
	eo reserach	N/A		impact Copernicus	N/A		dissemination	N/A
	industry base	N/A		international	N/A		policy	N/A
	space authority	🟡		funding	🟡		penetration	🟡
	capacity building	N/A						

Detail assessment

capacity	indicator	level	cooperation	indicator	level	
infrastructure	space borne	🟡	impact GEO	participation GEO	🟡	
	access 3rd party missions	🟡		designated GEO office	🟡	
	ground based/ in-situ	🟡		actions on SBA's	N/A	
	modelling & computing	🟡		provision data to GEOSS	🟡	
	eo data exploitation	🟡		impact Copernicus	projects	N/A
eo research	n. public organizations	🟡		organizations involved	N/A	
	univ. courses offered	🟡	international	ESA	🟡	
	diversity/maturity courses	N/A		meteorological	🟡	
	n. researchers	N/A		CEOS	🟡	
	papers published	🟡		INSPIRE	🟡	
industry base	n. companies	🟡			Int. agreements	N/A
	scale companies	🟡	funding	R&D participation	🟡	
	employment	🟡				
	resellers, partnership	N/A				
	clusters	N/A				
space authority	space organization	🟡				
capacity building	national R&D	N/A				
	eo focus actions	N/A				

uptake	indicator	level
events	networking	N/A
	thematic workshops	🟡
dissemination	networking	🟡
	data portals	N/A
policy	policy implementation	🟡
	budget	N/A
penetration	use	🟡

LEGEND eo maturity card

🟡 initial 🟡 basic 🟡 intermediate 🟡 advanced 🟡 optimized

Figure 6 Maturity card FYROM



Greece

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	🔄	COOPERATION	impact GEO	🔄	UPTAKE	events	🔄
	eo reserach	●		impact Copernicus	●		dissemination	●
	industry base	🔄		international	🔄		policy	🔄
	space authority	🔄		funding	N/A		penetration	●
	capacity building	🔴						

Detail assessment

capacity	indicator	level	cooperation	indicator	level
infrastructure	space borne	○	impact GEO	participation GEO	●
	access 3rd party missions	🔄		designated GEO office	●
	ground based/ in-situ	●		actions on SBA's	🔄
	modelling & computing	●		provision data to GEOSS	N/A
	eo data exploitation	●		impact Copernicus	projects
eo research	n. public organizations	●	organizations involved		●
	univ. courses offered	●	international	ESA	🔴
	diversity/maturity courses	●		meteorological	●
	n. researchers	●		CEOS	○
	papers published	●		INSPIRE	●
industry base	n. companies	●		Int. agreements	🔄
	scale companies	●	funding	R&D participation	N/A
	employment	●			
	resellers, partnership	🔄			
	clusters	🔄	uptake	indicator	level
space authority	space organization	🔄	events	networking	●
capacity building	national R&D	🔴		thematic workshops	🔄
			eo focus actions	🔴	dissemination
				data portals	●
			policy	policy implementation	🔄
				budget	N/A
			penetration	use	●

LEGEND eo maturity card

○ initial 🔄 basic 🔄 intermediate 🔄 advanced ● optimized

Figure 7 Maturity card Greece



Israel

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	●	COOPERATION	impact GEO	🔄	UPTAKE	events	●
	eo reserach	🔄		impact Copernicus	○		dissemination	🔄
	industry base	●		international	🔄		policy	●
	space authority	●		funding	🔄		penetration	🔄
	capacity building	●						

Detail assessment

capacity	indicator	level	cooperation	indicator	level	
infrastructure	space borne	●	impact GEO	participation GEO	●	
	access 3rd party missions	●		designated GEO office	🔄	
	ground based/ in-situ	●		actions on SBA's	●	
	modelling & computing	●		provision data to GEOSS	○	
	eo data exploitation	N/A		impact Copernicus	projects	○
eo research	n. public organizations	🔄		organizations involved	○	
	univ. courses offered	🔄	international	ESA	🔄	
	diversity/maturity courses	🔄		meteorological	●	
	n. researchers	🔄		CEOS	○	
	papers published	●		INSPIRE	○	
				Int. agreements	N/A	
industry base	n. companies	●	funding	R&D participation	🔄	
	scale companies	●				
	employment	●				
	resellers, partnership	●				
	clusters	N/A				
space authority	space organization	●				
capacity building	national R&D	●				
	eo focus actions	●				

uptake	indicator	level
events	networking	🔄
	thematic workshops	●
dissemination	networking	🔄
	data portals	○
policy	policy implementation	●
	budget	●
penetration	use	🔄

LEGEND eo maturity card

○ initial 🔄 basic 🔄 intermediate 🔄 advanced ● optimized

Figure 8 Maturity card Israel



ROMANIA

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	🔴	COOPERATION	impact GEO	🔴	UPTAKE	events	🟡
	eo reserach	🔴		impact Copernicus	🔴		dissemination	N/A
	industry base	🟡		international	🟡		policy	🔴
	space authority	🟢		funding	N/A		penetration	🟡
	capacity building	🟡						

Detail assessment

capacity	indicator	level	cooperation	indicator	level
infrastructure	space borne	🟡	impact GEO	participation GEO	🟢
	access 3rd party missions	🟡		designated GEO office	🟢
	ground based/ in-situ	🔴		actions on SBA's	N/A
	modelling & computing	🟢		provision data to GEOSS	🟢
	eo data exploitation	N/A	impact Copernicus	projects	🟢
eo research	n. public organizations	🟡		organizations involved	N/A
	univ. courses offered	🔴	international	ESA	🟢
	diversity/maturity courses	🟡		meteorological	🟢
	n. researchers	🟡		CEOS	○
	papers published	🟢		INSPIRE	🟢
industry base	n. companies	🟡		Int. agreements	🟡
	scale companies	🟡	funding	R&D participation	N/A
	employment	🟡			
	resellers, partnership	🟡			
space authority	space organization	🟢			
capacity building	national R&D	🟡	uptake	indicator	level
	eo focus actions	🟡	events	networking	🟡
				thematic workshops	🟡
			dissemination	networking	N/A
				data portals	N/A
			policy	policy implementation	🔴
				budget	🟡
			penetration	use	🟡

LEGEND eo maturity card

○ initial 🟡 basic 🟡 intermediate 🟡 advanced 🟢 optimized

Figure 9 Maturity card Romania



SERBIA

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	▲	COOPERATION	impact GEO	N/A	UPTAKE	events	N/A
	eo reserach	▶		impact Copernicus	▶		dissemination	▶
	industry base	▲		international	▶		policy	▲
	space authority	○		funding	▶		penetration	▶
	capacity building	▲						

Detail assessment

capacity	indicator	level	cooperation	indicator	level
infrastructure	space borne	○	impact GEO	participation GEO	N/A
	access 3rd party missions	▲		designated GEO office	▲
	ground based/ in-situ	▲		actions on SBA's	N/A
	modelling & computing	▶	provision data to GEOSS	●	
	eo data exploitation	●	impact Copernicus	projects	▶
eo research	n. public organizations	▶		organizations involved	▶
	univ. courses offered	●	international	ESA	N/A
	diversity/maturity courses	▶		meteorological	●
	n. researchers	▶		CEOS	▲
	papers published	●		INSPIRE	●
industry base	n. companies	▲	Int. agreements	▲	
	scale companies	▲	funding	R&D participation	▶
	employment	▶			
	resellers, partnership	▶			
	clusters	▲			
space authority	space organization	○			
capacity building	national R&D	▲	uptake	indicator	level
	eo focus actions	▲	events	networking	N/A
				thematic workshops	●
			dissemination	networking	▶
				data portals	●
			policy	policy implementation	▶
				budget	▲
			penetration	use	▶

LEGEND eo maturity card

○ initial ▲ basic ▶ intermediate ▶ advanced ● optimized

Figure 10 Maturity card Serbia



TUNISIA

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	🔴	COOPERATION	impact GEO	🟡	UPTAKE	events	🟡
	eo reserach	🟡		impact Copernicus	🟡		dissemination	🔴
	industry base	N/A		international	🔴		policy	🟡
	space authority	🟡		funding	🟡		penetration	N/A
	capacity building	🔴						

Detail assessment

capacity	indicator	level	cooperation	indicator	level	
infrastructure	space borne	○	impact GEO	participation GEO	●	
	access 3rd party missions	🔴		designated GEO office	🟡	
	ground based/ in-situ	🟡		actions on SBA's	🔴	
	modelling & computing	🔴		provision data to GEOSS	🟡	
	eo data exploitation	🔴		impact Copernicus	projects	🔴
eo research	n. public organizations	🟡	organizations involved		🔴	
	univ. courses offered	🔴	international	ESA	🟡	
	diversity/maturity courses	🟡		meteorological	●	
	n. researchers	●		CEOS	○	
	papers published	●		INSPIRE	N/A	
industry base	n. companies	🔴			Int. agreements	●
	scale companies	N/A	funding	R&D participation	🟡	
	employment	N/A				
	resellers, partnership	N/A				
	clusters	N/A				
space authority	space organization	🟡				
capacity building	national R&D	🔴	uptake	indicator	level	
	eo focus actions	🔴	events	networking	🟡	
				thematic workshops	●	
			dissemination	networking	●	
				data portals	🔴	
			policy	policy implementation	🟡	
				budget	🔴	
			penetration	use	N/A	

LEGEND eo maturity card

○ initial 🟡 basic 🟡 intermediate 🟡 advanced ● optimized

Figure 11 Maturity card Tunisia



Turkey

Score card

maturity indicators	indicators	level	maturity indicators	indicators	level	maturity indicators	indicators	level
CAPACITY	infrastructure	🔴	COOPERATION	impact GEO	🔴	UPTAKE	events	🟡
	eo reserach	N/A		impact Copernicus	🔴		dissemination	🔴
	industry base	🟡		international	🟢		policy	🔴
	space authority	🔴		funding	🟡		penetration	🟡
	capacity building	N/A						

Detail assessment

capacity	indicator	level	cooperation	indicator	level	
infrastructure	space borne	🟢	impact GEO	participation GEO	🟢	
	access 3rd party missions	🟢		designated GEO office	🔴	
	ground based/ in-situ	🔴		actions on SBA's	🟡	
	modelling & computing	🟡		provision data to GEOSS	N/A	
	eo data exploitation	N/A		impact Copernicus	projects	🟡
eo research	n. public organizations	🟢		organizations involved	🔴	
	univ. courses offered	🟡	international	ESA	🔴	
	diversity/maturity courses	🔴		meteorological	🟢	
	n. researchers	N/A		CEOS	🟢	
	papers published	N/A		INSPIRE	🟢	
industry base	n. companies	🟡		Int. agreements	🟢	
	scale companies	🟢	funding	R&D participation	🔴	
	employment	🟢				
	resellers, partnership	🟢				
	clusters	🟡				
space authority	space organization	🔴				
capacity building	national R&D	N/A				
	eo focus actions	🔴				

uptake	indicator	level
events	networking	🟡
	thematic workshops	🟡
dissemination	networking	🟢
	data portals	🔴
policy	policy implementation	🟢
	budget	N/A
penetration	use	🟡

LEGEND eo maturity card

○ initial 🟡 basic 🟡 intermediate 🟡 advanced 🟢 optimized

Figure 12 Maturity card Turkey



3.3. Validation (future steps)

The implementation of a maturity matrix will allow a country to gain insight into the current situation of the implementation of EO country capacities and how it should pursue the desirable situation (i.e. a higher maturity level). This will highlight the critical factors to lead to successful EO strategy implementation and will explore on the reasons why some countries effectively implement their strategic plans. *(next phase)*

An assessment using the maturity indicators should be conducted and contrasted with the information provided by each country partner, thus helping to identify gaps or contradictions. It is likely to be useful to have a specific teleconference to contrast the results. *(ongoing – but planned for next phase)*

The country assessments should be repeated and refined on a multi-year cycle to capture improvements in country performance thus ensuring that the appropriate data has been gathered. *(future)*



Annex 1: 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 type of courses (bibliography from Greece contact partner):

- Methods for precise geodetic measurements and data processing
- Geospatial data visualization
- Geoportals and geospatial services
- Location based services
- Digital photogrammetry
- 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 built 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 2: Bibliography

EARSC position paper on the Views on the Procurement of the Copernicus Services, September 2014

EARSC Position Paper on Developing the EO Services Industry, September 2013

EARSC Views on European Space Strategy, June 2016

EARSC Survey into Public Bodies using EO data and services, April 2016

AfriGEOSS

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