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D7.1 Roadmap for digitalisation via EO/ Copernicus data

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Summary

This is the fourth draft and final version of the CoRdiNet's Roadmap to digitalisation via Earth observation/Copernicus data based on the work of the 18 members of the "Copernicus European Regional Strategy Panel (CERSP). The majority of its members are regional, sub-national representatives, who are part of working groups within this panel in order to set-up a roadmap adapted to the local needs and offers in digitalisation via Earth observation (EO)/Copernicus data.

The panel's opinion is that a regional-/sub-national view is close to the needs and offers of the Copernicus programme and allows to support business and pilot creation in an effective way, thus complementing a national approach. In addition, the regional/sub-national view enables synergies with regional/sub-national funds and policy priorities. The previous draft V1.4 has been in a form, which was brought into a consultation process as described in its Chapter 5 with its target group, the regional/sub-national policy makers and key players. The feedback received has been integrated by the CoRdiNet consortium to reach the final version of this deliverable, V1.5.

Executive summary for policy makers

How can you/your companies/institutions benefit from digitalisation via EO/Copernicus data across Europe's regions?
How can your "regional voice" be heard at national and EU level? How can you get your local regional user feedback integrated into the new EU space strategy and the next generation of the European Earth observation programme?

The Horizon 2020 Copernicus Relay project CoRdiNet (2018-2020) suggest the following based on the general goal of the work of its Copernicus European Regional Strategy Panel (CERSP):

- *Promote and Increase use of* Earth observation data and EO markets on regional level
- Support strategic exchange of gathered regional/sub-national expertise
- Support business development and generation based on EO data
- Formulate guidelines for other Copernicus Relays and establish a basis for collaboration with the Copernicus Academy.

Here are some of the arguments from Chapter 3 why to use Earth observation data in your region:

- EO/Copernicus introduces data access free of cost, thus providing sets of "standardised data" to monitor or to detect changes of your environment, valid beyond political boarders or statistical biases and also economically viable
- EO data are long-term, high frequency, non administratively restricted datas
- Information based on local Copernicus Services allows to be regularly and authomatically updated via processing chains
- The diagnostic power of Earth observation / Copernicus data supports policy makers to identify the programmatic lines of development while at the same time it empowers citizens with an effective control tool
- Copernicus data are the base for innovative services in precision farming, health care, protection of cultural heritage, monitoring of environmental risks and pollutions, incrementing economic sectors like tourism or climate protection.

Chapter 4 recommends how to use concrete measures at the regional/(sub-)national level to:

- Enable, promote & support Copernicus-related digitalisation in EO related businesses
- Better link Europe's regional Copernicus communities with the EU and its member states
- Support public authorities in the adoption and use of EO/Copernicus data & services
- Bottom-up: Mobilising regions to advocate their Copernicus needs
- Facilitating opportunities: Harmonizing framework conditions set by European & national space policies with regional priorities.

Chapter 6 focusses on the work and capabilities of Copernicus Relays, giving examples how to support digitalisation in Europe via Earth observation data and its related services at regional and subnational level.

Among the main activities to be achieved and implemented by a Copernicus Relay are:

- Recognition at regional, but also at the level of larger municipalities, i.e., by public authorities
- Interaction with and vast embedding in local networks
- Capailities to open up of funding sources.

The essence in the Copernicus data does not come from Copernicus Relays, who act mostly as regional or (sub)national contact point, but from the Copernicus Academy members: They do research related to EO data and their applications, but also provide training. Thus, a local and intimate partnership between the two entities is an essential factor of success, the more since the Copernicus Relays facilitate their access to public authorities as well as to SMEs.

List of Acronyms

Acronym	Meaning
CAP	EU Common Agriculture Policy
CDTI	Centro para el Desarrollo Tecnológico Industrial
CRs	Copernicus Relays
CSC	Copernicus Space Component
CA	Copernicus Academy
Climate-KIC	Climate Knowledge & Innovation Community, see also EIT
CoR	Committee of Regions
CSO	Copernicus Support Office
CUF	Copernicus User orum
DIAS	Copernicus Data and Information Access Services
EARSC	European Association of Remote Sensing Companies
ECMWF	European Centre for Medium-Range Weather Forecasts
EEA	European Environmental Agency
EEEs	Copernicus Entrusted Entities
EIT	European Institute of Innovation & Technology
EGNOS	European Geostationary Navigation Overlay Service
EMSA	European Maritime Safety Agency
EO	Earth Observation
ESA	European Space Agency
EU	European Union
FRONTEX	The European Border and Coast Guard Agency
FWC	Framework contract
JRC	EU Joint Research Centre
LRA	Local and Regional Authorities
NEREUS	Network of European Regions using space technologies
PWC	PricewaterhouseCoopers
RUS	Copernicus Research and User Support
SME	Small and medium sized enterprises
TBD	To be determined

Members (full or observer) of the Copernicus European Regional Strategy Panel (CERSP)

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Content

Introduction

The present document corresponds to Deliverable D7.1, A short roadmap for digitalisation via EO/Copernicus data, of the Horizon 2020 Copernicus Relay project CoRdiNet, www.CoRdiNet.net, which started activities in October 2018 for about two years.

The objective of this deliverable is framed within the general goal of the work of the Copernicus European Regional Strategy Panel (CERSP):

- *Increase use of* Earth observation data and EO markets on regional level
- Support strategic exchange of gathered regional/sub-national expertise
- Promote the use of Earth observation / Copernicus data
- Support business development and generation based on EO data
- Formulate guidelines for other Copernicus Relays and establish a basis for collaboration with the Copernicus Academy on regional/sub-national level.

The document has been initiated by the six task groups of the CERSP panel, the members' names and affiliations is listed above and can also be found on the CoRdiNet project website.

1 Context

Mankind has always set its eyes on space. Nowadays, space is at hand; space achievements are part of our daily life: telecommunications, positioning systems, routing, on-line finances, real time emergency response or rescue systems notably enhance our living standards.

The European Space Strategy, Policy and Programmes, however challenging these may be, are an excellent roadmap to achieve true digitalisation in regional markets. Moreover, satellite data applications cross-cut and propel other economy sectors: automation industries, sustainable forest management and wood markets, precision agriculture, biomass energy supply, coordinated social services for depopulated areas or air quality monitoring, to mention only a few.

European Space achievements attained at institutional, technical and industrial levels are a landmark and an open door to new markets of applications, through the flagship programmes EGNOS, Galileo-GNSS, Copernicus and Horizon 2020.The Earth observation (EO) Copernicus programme, *Europe's eyes on Earth*, is a reality, and there is more to come.

The first seven Copernicus Sentinel satellites record petabytes of high-quality data daily, while 13 other spacecraft await to be launched (as of beginning of 2020). Data and information products reach thousands of users in the public sector, research and scientific communities, SMEs and start-ups to create satellite-enabled products and services: more than 185.000 Sentinel data users are registered on the ESA/EU Copernicus data portal.

Over the decade 2020-2030, services will evolve to meet emerging monitoring needs. i.e., climate change, CO_2 and greenhouse gas emissions, changes in the Arctic, precision agriculture, land use changes and forestry, borders control and maritime surveillance.

Imminently, new Copernicus High Priority Missions are being built for launch from 2025, following confirmation in 2021. These will measure key natural elements, poorly covered so far, which will enlarge further the possibilities for the sector industries: Anthropogenic CO_2, relevant for urban and high intensity carbon and methane emissions; High-resolution Land Surface Temperature, which will add substantial information to conventional LULC, agricultural systems and urban heat; Hyperspectral Imaging, essential for cataloguing mineral resources or soil types; Polar Ice and Snow Topography, a "must-have" for high latitudes safe navigation and for monitoring of ice loss; Passive Microwave Radiometer, to measure atmospheric profiles, water and ozone content in the atmosphere; and L-Band SAR imaging, needed for soil moisture, forest biomass and carbon sequestration counts, which are imperious to meet United Nations Framework Convention on Climate Change (UNFCCC).

European regions are key to the deployment of Copernicus; "space digitalisation" should root down to the regions or it will not materialise evenly across the Member States.

The EARSC 2019 survey into the state and health of the European EO services industry reports that 96% of sector companies are SMEs, notably with a strong local identity. Nothing is said, however, relative to the capacity of space SMEs to activate the this specialised workforce and help to transform the region they are in. CoRdiNet seeks to increase the EO/Copernicus exploitation at regional level, from the regional hubs to higher national and EU levels.

It is necessary to ponder over the main regional steering actors (Regional Government Offices, consolidated industrial sectors), the target groups, markets and costs of implementation for those regional spin-offs. Moreover, it is necessary to evaluate the links between the Copernicus offer and the type of actors. The outcomes of "Space as an enabler", a EU-Council/ESA meeting held on 28 May 2019, call for a more regional dimension: "The penetration of the use of the applications of space systems needs a balanced distribution between geographic areas, EU and ESA Member States, user categories and economic sectors, and emphasises that there are significant opportunities for fostering economic growth and innovation from the more widespread use of space-based applications". The success of Copernicus downstream applications across European regions has been illustrated by NEREUS (see publication mentioned in Fig. 1 below) through a selection of success stories achieved by local and regional authorities.

CoRdiNet explores here a roadmap to consolidate more evenly the use of Copernicus data across Europe's regions. The roadmap vision follows a double logic flow. First, a bottom-up relation between the regional and space policies, approaching regions' needs and capacities to the EU actors, including the CSO, in such way that regions may increase Copernicus exploitation capacity for further expansion. Second, and even more important, a top-down approach to enable, promote and support EO related business, with consolidated industrial linkages to support regional public authorities in the use of data and services.in order to develop better policies when supporting their decision making processes. At the same time the public authoritiy's needs catalyse research.

2 Issue and vision

2.1 Importance of a Copernicus European Regional Strategy

The Space Strategy for Europe recognized the importance of networks operating at local/regional level (e.g., Copernicus Relays and Academy) to encourage and enhance the uptake of Copernicus services, data and solutions. The networks are now in place

and are working to promote Copernicus Programme at local level. This is a notable outcome of a "top-down" approach (i.e. spreading the EU information locally) which is still useful and necessary.

Similarly, a "bottom-up" approach (i.e. bringing the regional issues/requirements at EU level) is also important but, presently, it is not equally supported and promoted. In fact, there is a lack of the "regional voice" at national and EU level. The regional expertise is a wonderful heritage that is not fully integrated and gathered so far at higher levels. Similarly, local/regional user feedback have not been fully investigated and taken into account in designing the new EU space strategy and the new generation Earth observation programme.

This is presently a missed opportunity, as the regional level is very relevant because it is close to local issues, actors and business, it knows very well the peculiarities and needs of the different territories and it allows resources to be pooled. Moreover, Local and Regional Authorities (LRAs) are the main potential drivers of the demand for space-based services and products.

A wider awareness of Copernicus at local level, in fact, will drive to a more diffuse uptake of EO/Copernicus data, services and solutions in regional offices that, in turn, would allow for a wider and faster digitalization process and for developing and implementing improved and innovative services citizens may increasingly use in their everyday life.

2.2 Bringing the regional views towards national/ European levels

There is an urgent need to bring in the regional view, both at national and at European levels. In order to facilitate this process, new ways and approaches can be explored and tested. Here, it is suggested:

- *Allow for NEREUS a stable participation to the Copernicus User Forum* and facilitate a better coordination with CoR

NEREUS is the network of European Regions Using Space Technologies, presently counting 25 full members (i.e. European regions) and 38 associate members. Thus, NEREUS can actually advocate the key role of regions in developing the space market and relay the regional dimension (i.e. the regional view) of European space policies and programs towards the European Copernicus User Forum where, presently, only the Member States (i.e. the national view) are sitting and the Committee of Regions (CoR) has been invited as observer, only.

- Associate national and regional networks to the Copernicus user forum to link end-users on European level

Many networks and working groups at national levels have been established in recent years. They are of different forms and natures, but all aim to enable the local and regional authorities to use Copernicus data. In France, for example, the Theia cluster is organized by drawing on regional strengths to promote EO images and products and share experiences. Also the "French Boosters" could be cited, as they are regional entities devoted to promote the use of satellite data and technologies.

Where they exist, national and regional networks should be identified and associated as relevant intermediaries to link end-users to European levels.

2.3 Improving CSO-CR-EC collaboration and exchange

Speeding and facilitating the digitalization process via EO/Copernicus data at local level will also require to improve and strengthen the collaboration and the exchanges among all the relevant actors working at different levels: the European Commission, the Copernicus Support Office (CSO) and the CR/CA networks.

For example, CR/CA nodes expertise's should be better explored and possibly integrated, trying to maximize their complementarities and synergies. This would allow for a better quality and effectiveness of training materials, communication methods, information modules, etc. For this, a major role of the CSO has to be expected and should be aimed at; in fact, CSO should promote and facilitate a much more continuous and systematic dialogue among the CR/CA network members, pushing for more frequent and structured collaborations and partnerships within specific Copernicus-related initiatives (e.g., pilot projects, jointly tailored EO solutions).

Putting in place these actions will require additional financial efforts from the side of the EC; it should improve and reinforce its support to CSO and CR/CA members, e.g., planning additional and dedicated funding instruments and mechanisms/opportunities for their ecosystems (for example by means of regular calls dedicated to CR/CA members), removing language barriers (i.e. Copernicus material should be available in all languages of the EC Member States).

2.4 Increasing EO/Copernicus exploitation at regional level

Although the Commission has put in place several actions so far to encourage the uptake of Copernicus data and services, their actual usage at local/regional level is still far from being fully satisfactory. Examples of systematic use and "full integration" of Copernicus data in the regional offices' procedures and protocols are still too rare and occasional.

Copernicus exploitation at regional level needs to be strengthened and several actions can be promoted and implemented in this direction with the active involvement of all relevant regional and local stakeholders and users. Here chapter 4 has broken down this report's recommendations to concrete measures at the regional level. Chapter 6 focusses on the work and capabilities of Copernicus Relays, giving examples how to support the user uptake. The CERSP members hope to initiate a fruitful discussion on how to support digitalisation in Europe via Earth observation data and its related services at regional and subnational level.

3 Actors, benefits for target group, efforts

There is a high demand for detailed information in our complex, connected and global world. Potential fields of applications for Copernicus data and services are widespread. EO/Copernicus data and services can benefit actors at the international, regional (subnational) and local level facilitating and improving public services and developing business opportunities in Europe, including land and water management, urban planning, sustainable development and environmental protection, security and safety. The successful exploration of the potential provided by EO data and services requires expertise throughout the process chain starting with collecting and pre-processing of the data, producing user-specific information and rational usage of the information. Moreover, it takes time to establish structures, develop capacities and change habits. This change should and must be fostered by awareness-raising activities, user-specific offers and evidence of the advantages of using EO data compared to current routines or habits. In the following sections, the main actors, benefits and efforts required to successfully exploit the data, will be illustrated. Furthermore, requirements and needs are addressed.

The main user groups are the public and commercial sectors as well as academia on the international, national and regional level. For Copernicus, there are many user uptake papers and measures from the side of EC and ESA, however, neither of them differentiate in user requirements nor specify their core users. Nonetheless, there have already been successful user uptake structures (user fora) developed fostering the usage of the data and services, particularly on the international and partly on the national or regional level. Examples for the international level are the Entrusted Entities, Copernicus Relays and Academies, the Copernicus Support Office, the European Association of Remote Sensing Companies (EARSC) or the EU-funded Framework Partnership Agreement on Copernicus User Uptake (FPCUP).

The EU-funded FPCUP project consists of 48 entities from 23 European countries with profound knowledge of national and regional user requirements. They implement, in a bottom-up approach, different user-uptake measures. Through exchange and joint activities synergies are created and the international outreach is increased. Examples on the national level are for instance the “Fachkoordinatoren” in Germany or the national user forum in Italy. The German Fachkoordinatoren inform and advice national Copernicus users including the national government. The regional (subnational) or local level, also in a transboundary manner, has, however, not been sufficiently taken into account. That is why only few structures have been established so far, such as NEREUS. Nonetheless, they have shown high interest in using the data for knowledge-based and improved decision making. Thus, there is a need to foster actors and structures on the regional/sub-national level.

An interesting gap was addressed by Envirolens, the Copernicus project for law enforcement support, which points out that the link between EO and legal community is still missing. Insurances may not play a role of support to other actors but be the user of EO data. For risk and damage assessment, EO imagery offers an alternative tool for verifying whether substantial damage or destruction has been caused by an insured risk. In addition, consultancy companies can help in the better understanding of the issues faced by all the stakeholders within a specific domain. Some consultancy companies already build on expertise in Earth observation like e.g., for offshore oil seepage studies by using a large amount of synthetic aperture radar images.

Another benefit of EO is improved farm management. Fields can be monitored in a time and cost-efficient way. Farmers can use EO to oversee their soil health status through different parameters that cannot be measured from a crop monitor device located on the ground. Farm input manufacturers may use EO to measure the efficiency of their farm inputs. Both, the farmers and the

environment benefit by an improved usage of fertilizer and water. The information can also be used by food industrialists to communicate about soil conservation and crop health status, leading to a better transparency for consumers, while further follow-up with EO data can support public bodies in their reporting duties.

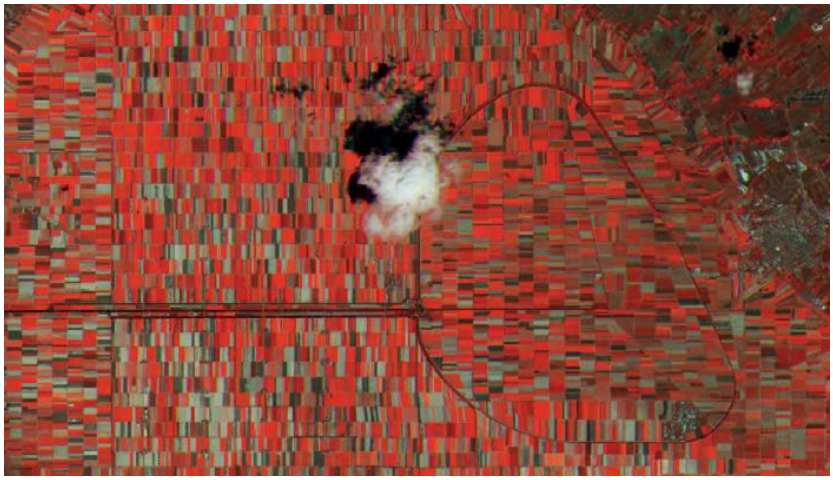

Figure 1 : Cultivated fields in Avezzano. The varying shades of red indicate differences in vegetation cover and chlorophyll content, picture Credit: Copernicus Sentinel Data/ESA (From: The ever growing use of Copernicus across Europe's regions)

Similar to agriculture, EO can support forest management by saving time and costs for the maintenance and management. For example, the Forest Stewardship Council (FSC) or any type of label or public forest manager can improve their service as satellite analysis help to identify areas, where public forest managers favour the preservation of forest or reports under-pressure areas[7]. In addition, a geographic information system (GIS) allows labels to do a part of their job remotely by accessing in real-time logging activities. In the same manner, forest owners can benefit from a GIS because it offers a cost-effective way to verify ecosystem services and generates revenue from a sustainable forest management. Indeed, small forest holders struggle to obtain an FSC certification because it is expensive and challenging.

Within the marine and aquatic realms, EO can provide better information and understanding of water pollution and thereby support water managers to implement an improved water resources management, e.g., remote sensing of ocean color can help in early warning systems for harmful algae blooms. Fishing industries rely on sustainable stock management. In particular, fisherman and fishmonger benefit from a better understanding and predictability of fish stocks, aided by EO. Furthermore, EO provides overview of fishing activities, including illegal third-party loading-at-sea activities. In coastal areas, marine spatial planning integrating aquaculture, fisheries, energy, transportation, and recreation rely on EO data for its sustainable management. For example, the Food and Agriculture Organization of the United Nations (FAO) helped Bangladeshi regional authorities to list and classify aquaculture exploitations and measure precisely their impact on the environment. EO via Synthetic Aperture Radar (SAR) images did also dramatically reduce oil spills from maritime traffic, see the clean sea net programme coordinated by EMSA.

Beyond living marine resources management, EO facilitates feasibility studies for renewable energy resources both offshore and onshore and, thus, can foster the sustainable development goals. Examples include site feasibility assessments, collecting offshore wind information, and identifying eligible capture carbon sequestration sites (EO for Energy - ESA Website).

EO provides substantial benefits in planning and monitoring of, e.g., settlements or infrastructure, including improved disaster management. Benefits from improved monitoring of damages or threats of infrastructure (such as floods or fire) include time and cost savings for maintenance, management, and civil protection.

Finally, EO data have played a pivotal role in improving our knowledge and understanding of climate change and disentangling anthropogenic climate change from natural climate variability, spanning from earth energy imbalance measurements, to atmosphere gas composition and sources of, e.g., CO_2 emissions, to impact on, e.g., phenology. This latter information, provided through an app, is very valuable for farmers and environmental management as it supports adaptation measures. Based on improved information on air quality early warning systems can be developed or improved reducing negative impacts on public health.

Although the applications fields and benefits of EO are wide and substantial, it takes time and investigations to fully exploit this potential. Structures must be established, capacities including infrastructure developed and habits changed. Required costs of investigations vary widely depending on the case. With Copernicus, potential stakeholders have received open and free data facilitating decisions to develop required infrastructure including personal resources. Nonetheless, it requires specific proofs that EO improves procedures, information and solution compared to current ones to convince potential users and the private actors to invest. In many cases, it has been started with pilot projects for demonstration and assessing cost-benefits. If the results are positive, existing capacities are further developed through training activities or experts are subcontracted to produce the required information. Such initiatives should be further supported, and new potential users addressed, making them a standard and not just an example. Finally, it should be stressed that there are also costs associated with NOT moving.

A summary table in the Annex shows examples of concrete application areas, stakeholders and their potential involvements. Some more examples and benefits of Copernicus applications can be found here.

4 Main policy objectives

4.1 Enable, promote & support Copernicus-related digitalisation in EO related businesses

Digitalisation of Europe's business & public sector must be accelerated. Copernicus EO data and services play a fundamental role due to speed, amount of data and precision, also and i.e. at regional level. To facilitate user up-take, it is recommended to:

- Strengthen the digital infrastructure on all levels in Europe: European, national and regional
- Ease data access: EO Data are free, but by no way easy to access. In addition, access should be systemised for economic players and institutions of different sectors. This calls for local hubs run by existing organisations & multiplyers, supported by the infrastructure's owner, offering expertise & coaching, (self-)explaining in easy words. Such hubs are essential as support structures and linkage between key actors.
- Enhance interdisciplinary exchange and cooperation, cross-border and cross-regional approaches as they contribute to pool experiences, expertise, knowledge and resources
- Promote EO/Copernicus data in the context of regional challenges and policies: How can the local digital environment and capabilities be improved best? Analyse the regional ecosystems in terms of strengths and smart specialisations, how EO/Copernicus feeds into local economies? Set close linkages to regional Smart Specialisation Strategies and to local/regional natural disaster scenarios, taking account of environmental preservation aspects
- Foster the development of a specific regional profile: Integrate EO/Copernicus as part of a larger portfolio of locally relevant data allowing to extract information for specific regional customer solutions (e.g., open data by administrations, drone data). Design a strategy for digital platforms oriented along regional needs and strengths
- Stimulate new forms of data integration: Foster regional academic hubs and laboratories to experiment with new data sources and different integration approaches. Address enablers like IT & big data service providers (for e.g., cloud processing or storage provision) to strengthen the abilities of intermediate users to better incorporate external sourcing of Copernicus data into intelligent workflows
- Support efforts to improve user feedback mechanisms: Strengthen regional structures like clusters, Copernicus Relays, start-up facilitators/accelerators, which are an important intermediary to provide valuable feedback and support trainings on local users and their needs. Expand the use of digitalised tools that allow a more precise statistical analysis to better understand user needs and feedback.

4.2 Better link Europe's regional Copernicus communities with the EU and its member states

- Improve local/regional access to EO/Copernicus data and knowledge: Generate knowledge and data transmission services of high connectivity across the EU. Create more local capacities for non-expert users to have data & knowledge at their disposal in order to generate their own information out of the data, i.e. via low-cost technologies such as mobile phones, tablets and notebooks. Prepare for mass market proliferation linking regions
- Improve technical infrastructures to achieve better connectivity from central (European, national) to local platforms
- The currently availale data access platform need a consolidation in numbers, sector focuses, usability & data access information provided

- Align and target relevant public funds (EU, national and regional level) for regions to boost a more effective up-take and advance digitalisation at local/regional level: Improve information and digitised flows of data related to Copernicus from EC (national) to the regional level. Market Copernicus products and services directly to regional user groups
- Foster user opportunities triggered by EU-environmental legislation (such as reporting obligations by member states and their regional authorities towards European institutions, e.g., climate or environmental conditions like air or water quality), involving the regional level in designing the policies that promote digitalisation within such domains
- Closely coordinate and link between member states (national level) and regions to up-scale knowledge sharing and good practices. Collect statistics, map activities and capabilities of relevant players. Align initiatives and innovation drivers such as incubation and accelerator programmes for a better overview on the impact, especially for business.
- Minimum is to ensure full compatibility with the INSPIRE cloud, already irritating local authorities.

4.3 Support public authorities in the adoption and use of EO/Copernicus data & services

Adopting new technologies and digitalisation via EO and Copernicus data & services is a complicated and resource consuming process for public authorities. An active animation structure is needed capable of organising basic events and trainings. To facilitate the user uptake by the public sector, undertake the following regional activities:

- Analysis of user profiles: Find out about potential needs via interviews, studies and personal talks
- Matchmaking: Support information events and create opportunities to make offers and needs meet
- Skills development/capacity building: Support trainings of public authorities in the use of EO/Copernicus data in close cooperation with service providers and Copernicus Academy members
- Dedicate Pre-commercial Procurement (PCP)/Public Procurement of Innovative Solutions (PPI) calls to local and regional authorities to boost EO/Copernicus data use.

4.4 Bottom-up: Mobilising regions to advocate their Copernicus needs

Communication is a two-sided engagement; it is also the European regions, which are to express their needs and feedback towards European institutions, service providers and organisations relevant for EO/Copernicus data and services. Opportunities are via:

- *Awareness raising activities through European-centred regional space application support networks, e.g.,* EARSC, NEREUS, *or more general innovation support networks such as* ERRIN or EBN
- Sensitizing Members of the European Parliament (MEP) with constituencies in regions or members of specific Parliamentarian committees or Intergroups, or European Interparliamentarian Space Conference (EISC) for the concerns of regional space users.

A “re-appropriation” of Copernicus services by regional policies would be desirable, a political validation: The regions should draw-up a synthesis on their issues, how Copernicus could best respond to them and how it could help public policies, e.g., spatial planning, land use, risk mitigations, etc.

4.5 Facilitating opportunities: Harmonizing framework conditions set by European & national space policies with regional priorities

Regional business support programmes, especially those supporting digitalisation, are to be adapted in a way to allow for leveraging by national and EU service offers and funding. Therefore, facilitate digitalisation processes by including Copernicus data and services/Copernicus-software:

- Stimulate leading industry software & visualisation companies to include Copernicus plug-ins, i.e. for non-experts
- Support Copernicus knowledge feeds in apps and easy-to-use additional layers (e.g., provided by private service providers) within official regional surveying and online maps and its providers, e.g., regularly updated info layers on regional forest fire risks; and use this as a chance to modernize regional governmental & public administrations
- Communicate Copernicus success stories to highlight the potential as part of a wider plan to foster demand of EO-valued services
- Finance research and training, support expertise in Earth observation/Copernicus data and its use in order to facilitate delivery of relevant monitoring services to LRAs
- LRAs' employ work & operating procedures which are often certified and thus accepted; new EO/Copernicus data and related services building on top, are not. Help to mediate - via national and EU institutions - that new procedures will be accepted via conclusions of agreements on their acceptance
- Support the set-up of more local Copernicus data hubs to easier manage data collection without time-consuming downloading.

5 Consultation process of draft roadmap with regional/sub-national committees

5.1 Identify clear perimeter for the consultation

- Roadmap feedback and needs to be clarified, expectations from this consultation regarding its content (benefits, policy objectives, guidelines)
- Define what the various committees are to comment on, i.e. all roadmap sections, main objectives, etc.
- Review what has been done on the topic up to now in order to have a more efficient contribution of this work.

5.2 Define the methodology and tools to implement this consultation

Suggestions are semi-structured

- Interviews per Task Group (primary stakeholders)
- Interview (TelCos) per Task Group (TG) member with common questions (next level stakeholder)
- Online survey/questionnaire (Other stakeholders)

5.3 Define relevant stakeholders

- Selection of regions (e.g., via NEREUS or regions active in EO/Copernicus initiative) / define number
- Each Task Group member brings its knowledge and identifies contacts, including the CSO
- Prioritise stakeholders for consultation (designation of primary, secondary, other stakeholders)

5.4 Analyse the data

- Deskwork of gathering the consultation content

5.5 Synthesize

- Draft consultation's outcome and report to CERSP

*5.6 **Timing** - Consulting from ready draft, define timeline for follow-up steps*

First step:

- Define consultation questions and implement tools (online survey)
- Stakeholder identification, prioritisation
- Roadmap draft release

Second step:

- Interviews carried out

Third step:

- Deskwork / consultation outcome
- Draft consultation outcome

Fourth step:

- Contribution to the deliverable (consultation outcome final version).

6 Guidelines for Copernicus Relays

Membership in the network of Copernicus Relays grants the member entity to present itself with the European Commission's Copernicus logo and to act as a local, often regional, ambassador for an important EU program. On the other hand, it needs an operational and financial commitment and perspective to be given from the side of the creator of this label, if the goal is to reach the declared targets for Copernicus Relay.

Most of the current Copernicus Relays are public institutions, such as ministries or a regional agency reporting to a ministry, only a minority is linked to entities like innovation hubs, clusters or incubators, which are, by mission, more suitable to implement activities fulfilling the economic expectations of Copernicus data and services.

Regions and subnational entities need an entity like a Copernicus Relay as a part of a necessary support structure and as a link between otherwise uncoordinated activities in efforts to push digitalisation, EO itself through its Big Data contribution is contributing in an essential way.

Taking up an active role as Copernicus Relay means a significant commitment from an operational point of view and requires not only a close relationship with the right local business networks, but also with public administrative structures. In addition, this type of Copernicus Relay network is relatively new, just having been created back in 2016.

Another important point to consider is the fact that often regions - when having participated in various European or National Development programs (e.g., the regional innovation strategy for smart specialisation, RIS3) – have committed themselves to take directly or indirectly part in this type of geo-information topic. Without the support of a regional policy or strategy on the topic of digitalisation or geoinformation, practical implementation work for Copernicus Relays is difficult. This is because to date the ability to finance the initiative is linked to the availability of regional resources, which will be more and more directed towards regional strategic choices and specific foci. Even financing mechanisms such as the Climate-KIC or certain programs of the European Institute of Technology (EIT) can be studied and implemented in the Copernicus Relay activities, and act as a stimulus and an integrative and financing action, parallel to local resources. But there are also many opportunities via the Copernicus Framework Partnership Agreement, Horizon 2020 and its successor, Horizon Europe or INTERREG programs - apart from national sources.

Among the main activities to be achieved and implemented by a Copernicus Relay are:

- Recognition at regional, but also at municipal (>250.000 inhabitants) level
- Interaction with local networks
- Opening up of funding sources.

Therefore, it is necessary to work with local networks i.e. local administrations, start-ups and small & medium-sized enterprises to identify potential synergies that could be useful and jointly activated. The main asset of Copernicus is its freely accessible data, from the programme itself and from third party commercial providers. Still, this is an entrance barrier not to be underestimated: The use of these freely accessible data is by far not self-explaining, quite some technical understanding and equipment is pre-requisite to process the data for interpretation. This goes beyond the expected one-stop shop contact, Relays are supposed to represent as communication channel for the end user or even a potential mass market.

Among the types of activities Copernicus Relays are to implement, the following should be pursued:

- Awareness raising, animation and promotion
- Training activities
- Support to user uptake.

Each time, for different types of target groups, it is necessary to define specific actions.

For Copernicus Relays and regional/sub-national authorities as well as for larger municipal communities, it is

- Political engagement
- Technical engagement.

The role of a Copernicus Relay could be to prepare a culture in public administrations to use Copernicus data and also to speak in the name of business in a way as a mediator between businesses and LRA, via regular meetings and events, also companies can participate in. LRAs, like for e.g; various federal authorities in Germany, should have a contact person/expert on EO/Copernicus data and services.

For Copernicus Relays and SMEs, it is

- Business incubation
- Business acceleration
- Business development.

Encourage SMEs to use EO/Copernicus data, tell them about other companies with the expertise to use them, keep them informed about focused EO/Copernicus support programs and opportunities based on their core business and to support and work with its key actors/clients to develop operational & sustainable services. It is important to show viable and successful business models based on EO data usage helping to convince policy makers to support such endeavors.

For Copernicus Relays and Copernicus Academy members it is

- Development of research and science
- Development of training modules.

These types of activities cannot be committed without resources or on a voluntary basis or within a short period of time. It is necessary to define mechanisms, even if only indirectly, that allow the development and support of the Copernicus ecosystem on the local level. If funding is not possible on the level of regional or structural funds, new mechanism could be activated such as e.g., implemented by the Climate-KIC program, which - after the introduction of a new type of partnerships with “Regional Centres” - offer some re-distribution of funds to the local level. For the development and implementation of the use of Copernicus data inside local and regional authorities and SMEs, many of the possible funding and marketing mechanisms can be used, such as participation in European or national competitions and/or company-research exchanges.

Another fundamental opportunity for the regions and thus the regionally/subnationally operating Relays is to expand the areas of applications of the Copernicus program beyond its original scope towards applications related to other European space infrastructures and application fields, notably global navigation (e.g., Galileo), information and communication technologies in general as well as other novel market sectors - such as insurances, energy or food control.

In particular, the concept of a **Copernicus Hub** or a general **Space Application Hub** needs to be further consolidated, a hub that ideally integrates regional and local actors from the academic, non-academic as well as from the public administrative sector to:

- Perform a systematic collection and analysis of regional / local user needs and feedbacks (e.g., training needs, service costs, funding sources, barriers to business, suggestions to improvements of legislation as well as innovation & pre-commercial procurement, both in the field of EO, navigation and positioning)
- Focus on local expertise / demand (e.g., many local and regional authorities already use geospatial data, INSPIRE SDIs and complex ICT infrastructures, private companies with expertise in ICT, navigation and positioning solutions and GIS)
- Describe in portfolios and catalogues - best visualised in geo-catalogues – availability of EO data and navigations/positioning/timing products in the easy terms of an application user and in the local language.

Synergies between Copernicus Relays and Copernicus Academy members

Only a close partnership between the two networks oriented along concrete application cases and solutions tailored to each challenge guarantees essential steps towards a further digitalisation via Earth observation and Copernicus data i.e.

- "Regionalise" the Copernicus-relevant expertise in Europe in order to allow for regional / local search functions: For "thematic expertise" (application domains, i.e. core services and below) or "methodological competence". In the Copernicus Academy's "Knowledge Landscape", (see www.cophub-ac.eu) this expertise is presented in an extended WebGIS solution, searchable via the Citizen App. This could serve as an important tool for the local and regional authorities and Copernicus Relays
- Copernicus Relays can provide access and door opening for Copernicus Academy members to regional public authorities and small & medium-sized businesses dealing with Earth observation services & applications
- Copernicus Relay and Copernicus Academy members on the regional/sub-national level should both, team-up and contribute to the work of the regional/sub-national "Copernicus Hub".
- Educational training courses or learning materials should be made available enabling students to become familiar with the subject matter: It is desirable to win young people for the field of space activities; as digital natives they have a bigger interest, anyway.
- Encourage and promote regular meetings between the EO scientific community, companies and EO stakeholders and users.
- Lobby to invest in research and education related to EO in order to increase the schooling rate of citizens and train classes of qualified technicians.

7 Annex (Arguments to use Copernicus, actors, benefits, efforts)

Ad Chapter 1: Some arguments in favour of using Copernicus data and services:

- EO/Copernicus introduces data access free of cost, thus providing sets of "standardised data" to monitor or to detect change, valid beyond political boarders or statistical biases and also economically viable
- EO data are long-term, high frequency, non administratively restricted datas
- Information based on local Copernicus Services allows to be regularly and authomatically updated via processing chains
- The diagnostic power of Earth observation / Copernicus data supports policy makers to identify the programmatic lines of development while at the same time it empowers citizens with an effective control tool
- Copernicus data are the base for innovative services in a variety of fields & can be used on local, sub-national level for:
  - Precision Farming and indicators for sustainable and ecological agriculture
  - Health care, e.g., support to the modelling of the spreading of diseases
  - Protection of cultural heritage
  - Monitoring of environmental risks and pollutions
  - Incrementing economic sectors, e.g., tourism when monitoring marine pollution
  - Monitoring of traffic movements e.g., for traffic control, also with regard to e.g., nitrogen oxide pollution
  - Data collection on climate protection to support public relations activities.

Ad Chapter 3: Actors, benefits for target group, efforts:

The table below shows some application areas, relevant stakeholders as well as their roles and benefits:

Application	Stakeholder	Role	Comment
ALL	Lawyer	support	These entities can help regions to have a better understanding of the issues faced by all the stakeholder within a specific domain (agriculture, energy, water, etc.)
	Insurance companies	support	
	Consultancy companies	support	
AGRICULTURE, FOOD	Farmer	be involved	Farmers can use Earth observation to oversee their soil health status through different parameters that cannot be measured from a crop monitor device located on the ground.
	Farm input manufacturer	be involved	Earth observation can lead to a precise spray of agricultural operating fluids in order to improve the field yield.
	Farm equipment manufacturer	be involved	Support to autonomous vehicle operations
	Food industrialist	be involved	Food industrialist can access information about soil and crop health status. This data can be used for a better transparency for consumers.
FORESTRY	Private forest owner	be involved	Surveillance, safety and management of stock by EO
	Public forest manager	be informed	As well as in the agricultural application, Earth observation can be used to ensure a better forest management and avoid over-exploitation some piece of forest.
	Public local managers/owner	be involved	Stock management by EO

	Equipment manufacturer for forestry	be involved	Surveillance of operations and stock
	Local entity for forest ownership registration	in involved	Support to preservation of wild life and detection of forest fires and other damages
FISHERIES	Fishermen (wild and aquaculture)	be involved	Improve fish stock management by avoiding overfishing or it can be used to monitor coastal life.
	Fishmongers	be informed	Earth observation offers a better overview of the fish stock. Thanks to Earth observation they can adjust their demand to avoid overexploiting the fish stock.
	Traders	be informed	Surveillance of operations and local infrastructures of aquacultures
	Boats and equipment manufacturer	be involved	Support to local navigation by EO
	Fishfarming input manufacturer	be informed	Support to growth and well-being of aquacultures
BIODIVERSITY AND ENVIRONMENTAL PROTECTION	Biodiversity agency	be involved	Collecting data offers a better understanding of biodiversity management. For example, it can help to precisely determine borders of a nature reserve.
	NGO	be informed	
	Testing laboratory	be involved	
	Research laboratory	be involved	Earth observation can provide data that cannot be measured by a device located at the Earth surface.
CLIMATE AND ENERGY	Power plant operator	be involved	Earth observation can give information such as the water temperature of rivers, which has a great influence on the gas, coal or nuclear power plant efficiency.
	Electricity grid operator	be involved	EO support to surveillance & maintenance of critical infrastructures
	Equipment manufacturer	be involved	EO support to surveillance of critical infrastructures
	Meteorological centre	be involved	EO support to weather data and modelling
WATER	Water mangement	be involved	Water quality monitoring and adjustment within the wastewater treatment plant
	Wastewater treatment plant operator	be involved	
TERRITORIAL MANAGEMENT AND URBAN PLANNING	Construction firm	be informed	Earth observation can give information such as Earth movement or it can help to determine a flood-risk area and therefore provide a better territorial management.
	Public transport operator	be involved	Support to autonomous driving by EO
	Road traffic operator	be involved	Earth observation can be used to learn about road traffic (traffic jam, users' habits, etc.), predict the traffic depending on quite a few parameters and optimize traffic.
CIVIL PROTECTION	Police	be informed	In case of emergency, such as flooding due to heavy rainfall or wildfire, local authorities can be informed rapidly and precisely. So, taking action can be done more quickly.
	Firefighter & forest fire prevention	be informed	
PUBLIC HEALTH	Air quality measurement centre	be involved	Air quaility data for background of large cities, due to still limited resolutions of the order of 10 km, continuously improving.