Summary of the report on the analysis of stakeholder feedbacks and strategy to cope with needs and "barriers"

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1 Introduction

This document has been issued in the framework of the CoRdiNet project (Copernicus Relays for digitalization spanning a Network). The project aims at supporting, promoting and stimulating digitalisation and new business solutions based on Earth Observation (EO) data/services from Copernicus program and bundling the local expertise in the civil use of EO close to the needs and offers of citizens, administrations and businesses.

The project builds on the past and present experience of the Copernicus Relay (CR) partners of the project which, during the last years, have been working on the identification, engagement, interaction, information and training of regional stakeholders in order to promote the Copernicus program and space-based solutions able to address societal challenges and improve the quality of life of EU citizens.

The regional dimension is crucial for this action. In fact, most of the barriers that limited or slowed down a more extensive use of EO data and Copernicus services can be understood and better evaluated only if the peculiarities in each single territory are properly accounted for. For this reason, one of the objective of the project is to interact with the regional stakeholders (users, potential users and providers) analysing their needs and capabilities and evaluating which barriers have prevented a more systematic use of Copernicus solutions so far, and promote the link between users/potential users and supplier of services based on EO data.

The activities aimed at better knowing and understanding the regional dimension (in term of demands, challeges and needs that can been addressed/supported by the Copernicus data and program) are part of *WP 2 - Regional challenges and needs to be supported by EO/Copernicus*, leaded by TeRN-CNR that includes the following task:

- Task 2.1 – Stakeholders identification and engagement
- Task 2.2 – Identify challenges, needs and present barriers
- Task 2.3 – Analysis of feedbacks and reporting

2 Scope and structure of the document

Among the afore mentioned tasks, this document reports the activities and the achievements in the framework of **Task 2.3** (Analysis of feedbacks and reporting) related to the identification of:

a) the level of knowledge of regional stakeholder about the existence of Copernicus space-based products/services useful for their specific institutional activities;

b) the existence of specific needs that could be profitably addressed by exploiting Copernicus/EO data.

The report is organised in the following main sections:

- Feedback collection (chapter 3)
- Feedback analysis (chapter 4)
- Strategy to cope with needs and barriers (chapter 5)

3 Feedback collection

In the framework of Task 2.2, a specific questionnaire aimed at surveying the level of knowledge about Copernicus program and solutions as well as at identifying Copernicus stakeholders' needs, challenges and barriers has been designed, shared among the CoRdiNet partners and finalized (Deliverable 2.2). In its final version, the questionnaire includes four main thematic sections: the first section is devoted to collect the general information about the stakeholder who is filling the survey (Section A). The following sections are addressed to different stakeholders, according to their awareness about the Copernicus Program, data and solutions. Section B is for those "Knowing and using/providing Copernicus data/services", Section C is for those stakeholders "Knowing but not using Copernicus data/services", while the last one (Section D) is for who has never heard about the Copernicus Program.

In each section, the final questions were specifically addressed to ask for any **needs and challenges** stakeholders think relevant for their own thematic sector or that they believe can be profitably addressed by means of Copernicus data and services, as well as for identifying any **barriers** that they have encountered using/looking for EO Copernicus data/solutions. The questionnaire has been also implemented in Google Forms to facilitate its spreading and dissemination. The digital version takes about 10 minutes to be completed. The English version of the questionnaire was published on the CoRdiNet website (https://cordinet.net/resources/questionnaire_cordinet.pdf) and was translated, with the help of the CoRdiNet partners, also in Italian, German, French and Spanish languages in order to be used by other Copernicus Relays in Europe and beyond. Additionally, the questionnaire has been passed to the Copernicus Support Office in order to be spread and tested within the whole network of CR and CA. Unfortunately, the change in the lead management of the CSO has probably slowed down the process of spreading and disseminating the survey and collecting some feedbacks from the network.

The questionnaire has been also provided to the associated CRs engaged in the project by a public call for expression of interest issued in the framework of WP5. In more detail, the "Istituto Europeo per lo Sviluppo Tecnologico" (IEST) in Italy and the Institut Scientifique de Service Public – ISSeP in Belgium, were selected by an independent commission of experts who evaluated the plan of activities they proposed adequate and well in line with the WP2 aims and objectives. The analysis of the feedback provided by those associated partners has been also reported in this document.

The following paragraph, namely the Feedback analysis, has been splitted in two sub-sections, one related to the CoRdiNet consortium partners (4.1), and one dedicated to the associated partners outcomes analysis (4.2).

4 Feedback analysis

4.1 CoRdiNet partners analysis

Each CoRdiNet partner has tested the questionnaire collecting the feedback from the Copernicus stakeholders identified and engaged in their specific geographic area of activity. To this aim, different instruments have been used: i) general or thematic workshops; ii) local/regional meetings; iii) face-to-face meetings; iv) interviews, etc. Additionally, the digital version of the questionnaire has been disseminated by using the Google Forms service.

Table 1 summarizes the number of feedback collected from each CR. The numbers are not so high in all the regions, highlighting, also for comparison with the ones achieved during the stakeholders identification (i.e., Deliverable 2.1), a common problem at local scale, namely, a general difficulty in stimulating stakeholders to participate to the survey. However, in this project face-to-face meetings, direct interviews and specific networking instruments during regional events have been preferred to better understanding and interpreting the stakeholders' view. Therefore, more than the quantity, the quality of the feedback has been particularly aimed at.

Table 1: feedback summary

CoRdiNet Partner	**Feedback received**
bavAIRia	9
GMV	9
TeRN	11
ULEIC	12
IMR	5

Among the different stakeholder types engaged, the largest categories that participated to the survey were SMEs (26%), Research centres (26%) and Public Authorities (22%) (Figure 1).

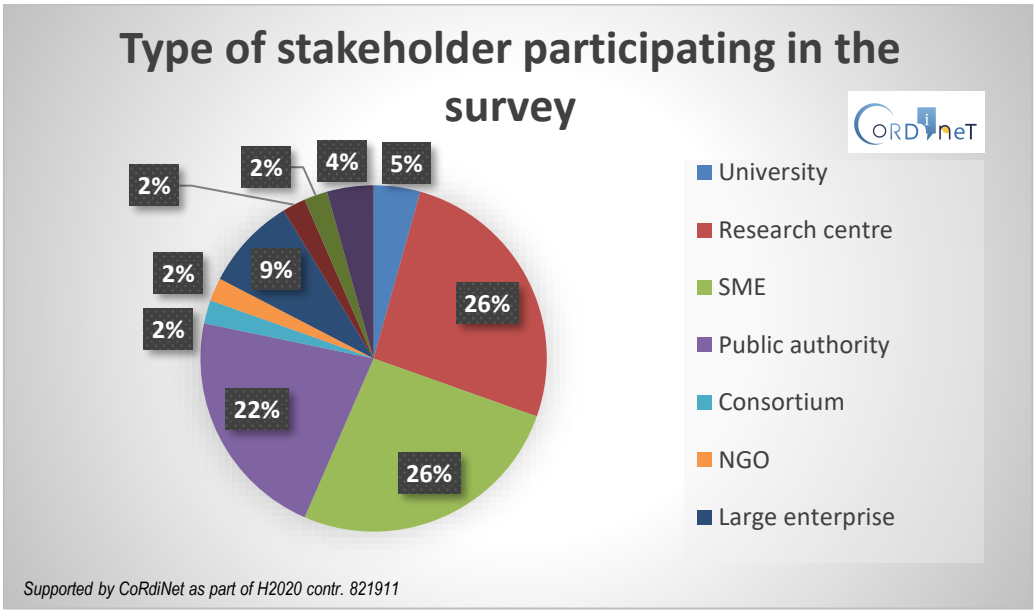

Figure 1. Type of stakeholder parteciping in the survey

The 46 stakeholders participating to the survey can be divided in three main groups, based on their Copernicus Programme awareness: 37 (i.e., 80%) are the stakeholders who know and use Copernicus data/service (Group A), 6 (i.e., 13%) know but do not use yet Copernicus/EO data (Group B), with the remaining 3 (i.e., 7%) addressed stakeholders having any knowledge about the Copernicus program (Group C) (summary in Figure 2).

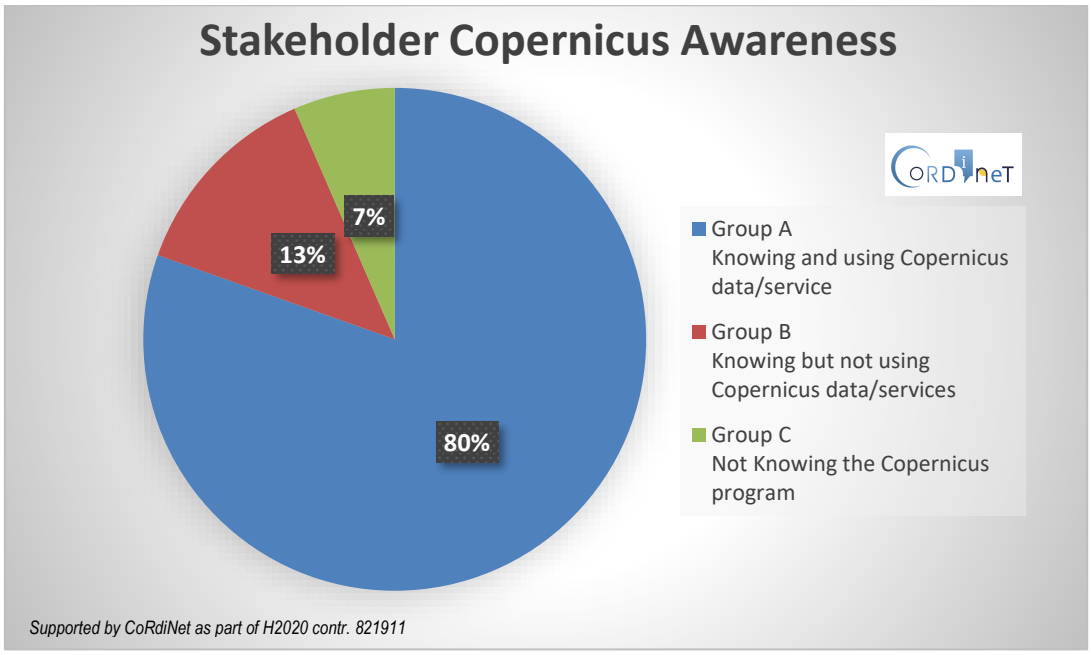

Figure 2. Stakeholder Copernicus Program Awareness

The following analysis has been mainly focused on the group A which is the most populated. These "expert" stakeholders are users and/or providers of data/services that can be classified in 4 main types: Mapping and Monitoring, Planning and Management, Early warning, and Support to decision (Figure 3).

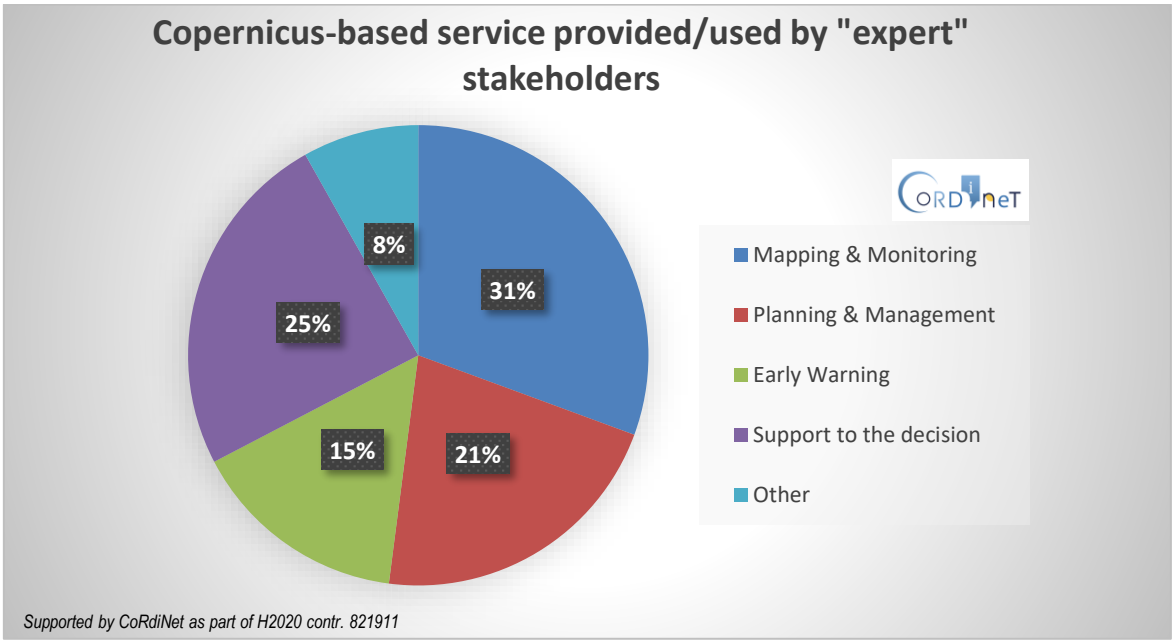

Figure 3. Copernicus service types provided/used by stakeholders belonging to Group A (i.e. knowing and using Copernicus data/service)

Only a small number of them, 7 (less than 20%) have encountered issues or problems in finding and/or using Copernicus EO data for their activities, confirming that the efforts made at different levels to promote the program and facilitate the data access and usage are on the right way

Besides, there is a general awareness among stakeholders about the relevance of Copernicus data/services for their own activities, with only a residual (i.e., 3%) amount of them stating that they are of limited assistance (Figure 4). This result highlights the good satisfaction level of those stakeholders already handling these data/services, confirming their actual potential once ingested within the daily operational routines. In particular, 60% of the sample considers the Copernicus information “essential” and 37% “helpfully supportive” for their work.

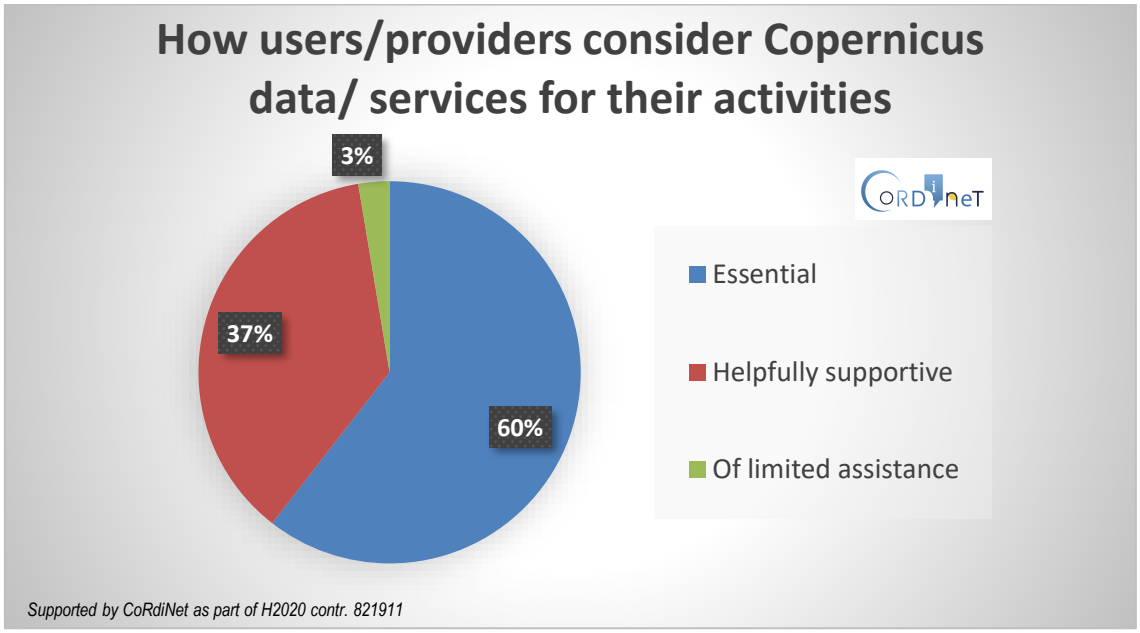

Figure 4. EO Copernicus data/services consideration among "expert" stakeholders.

Regarding the different kind of data used (figure 5), the ones coming from Sentinel Missions and other Earth Observation Satellites are the most used (i.e, 38% and 35% respectively), followed by multi-mission satellite data (i.e., 19%), while records from other space-based data are less used (i.e, 8%).

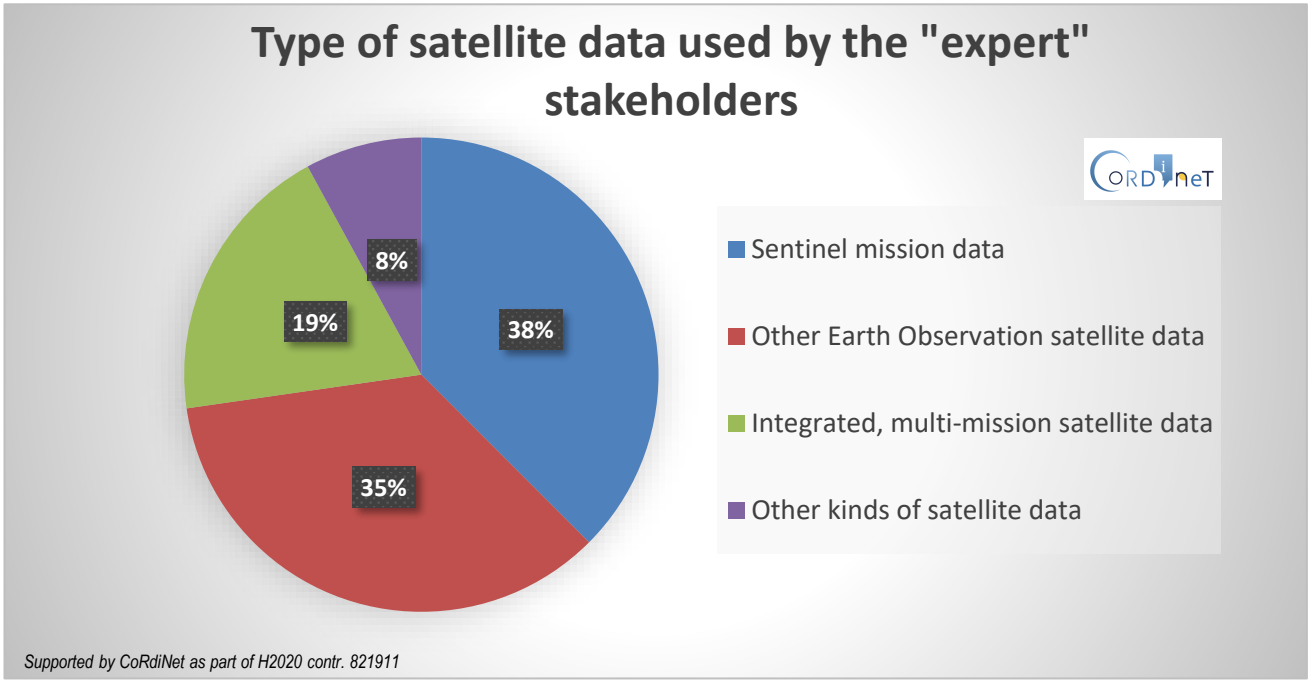

Figure 5. Type of satellite data used by the "expert" stakeholders

For what concern the needs, challenges and barriers of this group of stakeholders, several consideration based on the feedback analysis, can be done and are described in the following.

4.1.1 Needs

Needs are generally very specific and strictly linked to the type of data/service used/provided and to the stakeholder thematic sector (Table 2), hence it is quite difficult to categorize them in different main types.

Anyway, at least two general and quite common needs have been identified: one is mostly related to the data/product quality (yellow rows in table 2), and the other one refers to data accessibility (orange rows).

Table 2: Summary of Needs identified by Group A (Knowing and using Copernicus data/service)

NEEDS	***TYPE***
High resolution optical satellite imagery (summer, winter)	General need (Data/product Quality)
Determining with satellite data wood density and characterization that influences its commercial value and industrial processing.	Specific need
Higher frequency update of Corine Land Cover and other products.	General need (Data/product Quality)
Improve the complementarity to ortho production	General need (Data/product Quality)
Advise on sea-ice thickness and icebergs for Arctic shipping or tourism industry (Using Sentinel-3 and Sentinel-1).	Specific need
Provide tidal charts for the Arctic (Using Sentinel-3 and CryoSAT2).	Specific need
Advise to ship routing using ocean currents and wave forecasts.	Specific need
It is difficult to find the list with the catalogue of products with the reference to the variable to download and its associated parameters.	General need (Data accessibility)
Significant interest in CAMS products, but provided they are easily accessible.	General need (Data accessibility)
Mappatura della suscettività al rischio incendi	Specific need
Assured long-term availability, high spatial resolution, high temporal resolution	General need (Data/product Quality)
Monitor the seasonal evolution of croplands and livestock grasslands as an indicator of forced migrations due to climate change.	Specific need
Analysis of natural resources availability, which is a cornerstone to such resilience; specifically the access to energy (fuelwood) and water.	Specific need
Detection of possible IDP population with satellite data.	Specific need
Rapid access to usable, analysis-ready data	General need (Data accessibility)
Coastal erosion monitoring, marine debris tracking, coral bleaching extent.	Specific need
Land economy management including agricultural production, natural capital management and urban planning	Specific need
L2 Atmospheric corrected images	Specific need
Satellite products supplied to customers with high frequency thanks to the excellent temporal resolution of the Sentinel 2A / 2B constellation	General need (Data accessibility)
Change detection and Land cover classification	Specific need
Monitoring of changes in the type of land cover; Monitoring of humidity / stress characteristics of vegetation; Monitoring of millimetric displacements of the territory, infrastructures and buildings.	Specific need
High-resolution sea-ice thickness and drift prediction and reanalysis. 2. High-quality global reanalysis products (like ERA5)	General need (Data/product Quality)
Improved Biodiversity monitoring services (GEO BON EBVs)	Specific need
Methods to improve the planning, management, and monitoring of natural forests, specifically for mountainous areas.	Specific need
Improvement of theirs decision making to provide sustainable forest management.	Specific need
Frequency of observation, multispectral data, operationality	General need (Data/product Quality)
Too many to describe, Copernicus could be useful almost anywhere; get some apps out for younger people / students, they'll be the users of tomorrow.	Specific need
air pollution and quality	Specific need

A subsetting tool for copernicus data to allow quick and easy extraction of all data for a location The processing of all L1 S2 outside of europe for before 2018. Huge data potential which isnt being exploited The release of all copernicus data on google earth engine to facilitate analysis.	General need (Data accessibility)
Sentinel-1 data distributed as Analysis Ready Data	General need (Data accessibility)
We only recently started our forest service	Specific need
Time and space high resolution data	General need (Data/product Quality)
spatial resolution, frequency, spectral signature	General need (Data/product Quality)
Optimization of forest monitoring	Specific need
Updating global coastlines, monitoring port development projects, oceanographic data	Specific need
Improvement of spatial resolution. Improvement of availability of temperature measurements of crops for determination of water status. It would be necessary to incorporate a thermal sensor of about 30 m allowing to assess the use of water in agriculture and the natural environment, as well as mapping the heat islands.	General need (Data/product Quality)
Improvement of application in remote sensing for phytosanitary use control, phenological markers, CAP indicators for (e.g. soil), indexes or biophysical variables, etc.	Specific need
More cross-checking of products atmospherically corrected in different situations is needed. It is important to ensure a good correction to accurately determine changes in the development of crops, and current products do not offer a sufficient guarantee.	Specific need
Improvement of detection and forecast with remote sensing of special events: water deficit, biotic damages, plagues, weather damages etc.	Specific need
Improvement of spatial and tamporal resolution.	General need (Data/product Quality)
Agricultural monitoring based on very high satellite images to control of data collected for CAP direct payments. Integrated in SIGPAC Visor.	Specific need
1-2 m Land Cover maps every week for vegetation phenological cycle monitoring	General need (Data/product Quality)
Daily measurements of soil moisture at high resolution	General need (Data/product Quality)

4.1.2 Challenges

A similar consideration can be done for **challenges** and also in this case general challenges related to the data quality (yellow rows, e.g. higher spatial and temporal resolution is a common request) can be identified (Table 3). Besides, it is worth saying that a significant number of stakeholders is not able to indicate any challenges.

Table 3: Summary of Challenges identified by Group A (Knowing and using Copernicus data/service)

CHALLENGES	***TYPE***
Full-coverage, high-resolution terrain or surface models and optical satellite image data - current and summer / winter	General challenge (Quality of data)
1. Improvement of spatial resolution	General challenge (Quality of data)
1. improve the spatial and temporal resolutions.	General challenge (Quality of data)
1. Observe ocean surface currents (like from a HF coastal radar but on satellite) - necessary for emergency response in high seas.	Specific Challenge

2. High-resolution and complete coverage of sea ice concentrations and sea-ice thickness. 3. Monitor primary production for marine ecosystem management	General challenge (Quality of data)
1. Need of NO2, SO2 and CO2 concentrations at very high spatial and temporal resolutions.	General challenge (Quality of data)
avvistamento precoce	Specific Challenge
Non so specificare (I don't know)	
Smart farming, snow monitoring in remote areas	Specific Challenge
Non so specificare (I don't know)	
1. Retrieve natural resources scarcity indicators for the early warning of humanitarian crisis.	Specific Challenge
Plant health and invasive diseases	Specific Challenge
Higher resolution is a constant request in optical sensors, however this must retain the same level of QA/QC so that time comparisons and change detection can work optimally. Smaller (ie less wide) spectral bands, a suite of atmospheric correction models and greater marine coverage.	General challenge (Quality of data)
Independent single source of truth in sustainable finance	Specific Challenge
Thermal bands compatible with L8 TIRS to calculate surface temperature to implement hydrological models (water cycle models)	General challenge (Quality of data)
1-2 meters panchromatic image in order to achieve geometric resolution to identify crop extension and other field elements to comply geometric requirements on common agriculture policy	General challenge (Quality of data)
Un uso più diffuso e comune delle tecnologie spaziali per migliorare qualitativamente e quantitativamente le coltivazioni e ridurre le pressioni ambientali	Specific Challenge
Feature extraction	Specific Challenge
Non so specificare (I don't know)	
Non so specificare (I don't know)	
Detection of calved icebergs near glacier fronts.	Specific Challenge
Detection of drifting icebergs (maybe addressed elsewhere)	Specific Challenge
Biodiveristy Monitoring.	Specific Challenge
Shared national and international data and processing infrastructures	Specific Challenge
Improve spatial resolution	General challenge (Quality of data)
Missing infrared sensor for monitoring vob high temperature events (fire, gas flares, etc.)	General challenge (Quality of data)
Too many to describe, Copernicus could be useful almost anywhere; get some apps out for younger people / students, they'll be the users of tomorrow.	Specific Challenge
future farming, water quality	Specific Challenge
Non so specificare	
Integration between satellites to have a wider coverage of EO data.	Specific Challenge
More efficient crop production through the use of EO data. Continued monitoring of land surface processes to assess the impact of climate change in different regions in real time.	Specific Challenge
Non so specificare (I don't know)	
Non so specificare (I don't know)	
Non so specificare (I don't know)	
Observation of the atmosphere, climate change	Specific Challenge
Non so specificare (I don't know)	
cloudless cover, thermal data, hyperspectral	Specific Challenge

Calibrazione tra dati satellitari e dati rilevati in campo	General challenge (Quality of data)
Increased global coverage of Sentinel-1 & -2 data. Some significant gaps in coverage, e.g. Bermuda, much of Pacific ocean Micronesia/Polynesia.	General challenge (Quality of data)
A quicker image processing with better quality assurance.	General challenge (Quality of data)
Generate higher quality images for agriculture, crop adjustment and thermal images.	General challenge (Quality of data)
Monitoring, early warning and risk assessment techniques for croplands	Specific Challenge
Better technical specifications of satellite data, mainly temporal and spatial resolution	General challenge (Quality of data)

4.1.3 Barriers

For what concerns the **barriers** identified in the framework of group A, reported in Table 4, they can be classified in five main categories , summarized as follows: Training, Information, Technical, Data/product quality, Cost. They essentially reveal:

i) a lack of information (violet rows) and education/training (green rows) for the human resources working at LRAs or SMEs, who are not always well skilled for this aim;

ii) the perception of technical barriers and issues (orange rows), e.g. in searching/exploring/accessing Copernicus data or about their full interoperability;

iii) a general need for data at improved temporal and spatial resolution as well as for more accurate and reliable products (yellow rows);

iv) a slight warning about costs (blue rows) to be sustained for dedicated ICT infrastructures and for ad-hoc education/training initiatives for the internal staff.

Table 4: Summary of Barriers identified from Group A (Knowing and using Copernicus data/service)

BARRIERS	TYPE
Resolution of the freely available data is still too low	Data/product quality
Training is still sparse, would be good to highlight best practice & coll innovations more prominently.	Training
Difficulty to access the data from scattered in-situ infrastructure (belonging to member states or industry).	Technical
Lack of resolution and accuracy for sea ice variables (concentration, drift, and thickness).	Data/product quality
Technical difficulty to search, explore, overlap different Copernicus EO data from the different ground segments.	Technical
A big constraints is the lack of tehcnial and human resources.	Training
Need of improve the accesibility to Copernicus data.	Technical
Reliability of application based on Copernicus data	Data/product quality
Awareness of products and services;	Information
Training in data access	Training
Barriers to additional, regionally managed geodata from government agencies, which are often poorly or not digitally retrievable even though they fall under the Inspire Directive	Technical

Costs for commercial access to the data for those without access to the full range of free Copernicus datasets (i.e. non-Sentinel) is sufficiently high to constrain innovation and uptake.	Cost
knowledge of potential usage by non academic and non scientific sector. In the UK it is not clear	Information
L2A data production, NRT data supply, interoperability of datasets e.g S2 and L8	Technical
Lack of resources.	Cost
Training.	Training
the downloaded requires significant investments in infrastructure (internet and PC / calculation server) and highly qualified personnel	Cost
the downloaded requires significant investments in infrastructure (internet and PC / calculation server) and highly qualified personnel	Training
Number of simultaneous tiles that can be downloaded. Download speeds.	Technical
potenzialità applicative dei dati satellitari, in particolare da parte delle Pubbliche Amministrazioni)	Information
Training is still sparse, would be good to highlight best practice & coll innovations more prominently.	Training
understanding of what satellite data can and cannot do	Information

More specifically, the lack in training/education actions is identified as the most relevant barrier (i.e., more than 40% of the interviewed mentioned this barrier), followed by technical issues (slightly higher than 20%), while the remaining ones are all in the 10-20% interval ranges (Figure 6).

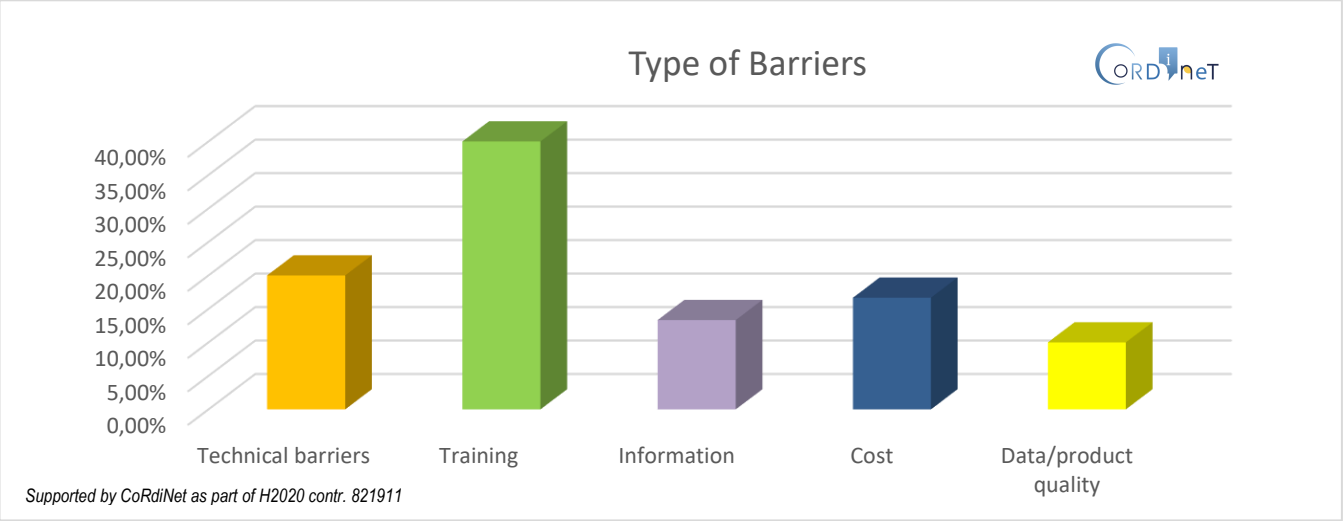

Figure 6. Barriers to a more systematic use of Copernicus data/products/services as identified by stakeholders belonging to Group A

These numbers clearly indicate the area where to improve efforts and investments aiming at reducing the distance/gap from EO Copernicus data/service and stakeholders at local/regional scale. Even if less robust from a statistical point of view, similar results arise from the analysis of Groups B and C. All the stakeholders belonging to both these groups have identified as main barrier the needs of training for their employers, indicating also that currently they believe not having all the information required to find/download/use the Coperniucs/EO data.

4.2 Associated partners analysis

In the following paraghraphs the main outcomes produced by ISSeP and IEST, on the basis of their reports, are summarized using the same scheme already used in Section 4.1. Further material provided by the two associated partners (as indicated in the two reports) is available at NEREUS and TeRN-CNR premises.

4.2.1 ISSeP Feedback Analysis

ISSeP engaged 21 stakeholders, mainly represented by research centers (48%) and Public authorities (24%) (Figure 7).

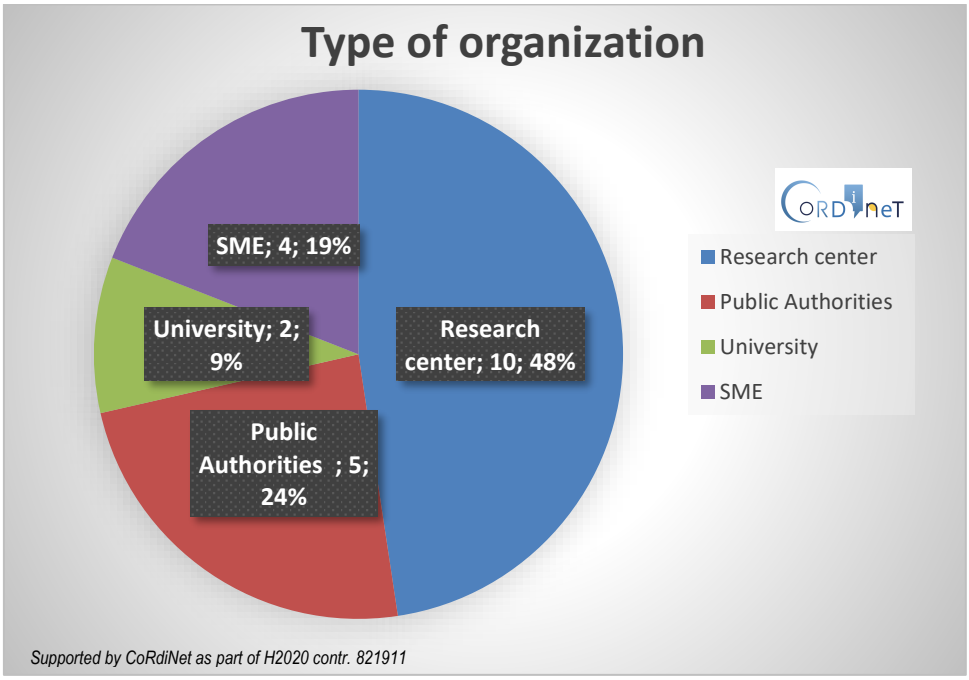

Figure 7. Type of stakeholders engaged by ISSeP

On the basis of the classification already used in section 4.1, these 21 stakeholders are mainly Expert users (Group A) of Copernicus data/service (i.e., 10, 48%) while 8 (i.e, 38%) know but do not use yet Copernicus/EO data (Group B), with the remaining 3 (i.e., 14%) that do not have any knowledge about the Copernicus program (Group C) (Figure 8).

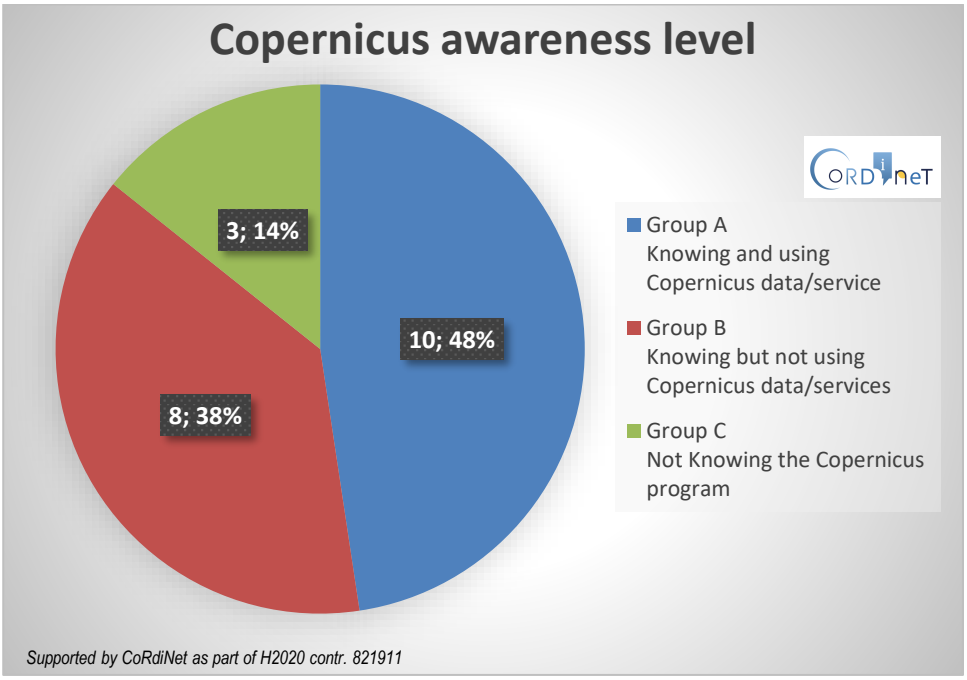

Figure 8. ISSeP Stakeholder Copernicus Program Awareness

Focus on Expert stakeholders (i.e., Group A), it was found (Figure 9) that they mainly use/provide Copernicus based services for Mapping and Monitoring (i.e. 34%), Planning and Management (i.e. 23%), Support to the decision (i.e. 23%) and Early warning (i.e., 14%) in good agreement with results achieved for the stakeholders engaged by CoRdiNet partners (see Figure 3).

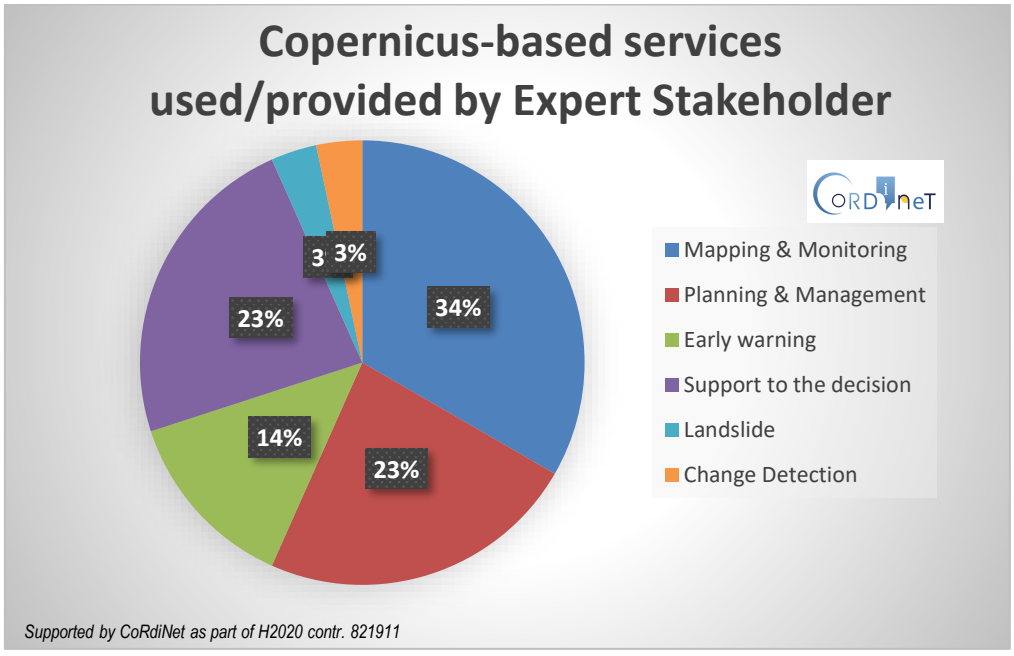

Figure 9. Copernicus service types provided/used by IeSP expert stakeholders

Three of these expert users/providers declared to have encountered issues or problems in finding and/or using Copernicus EO data for their activities, while they all agree on the relevance of these data for their

activities. In particular, 80% of the sample considers the Copernicus information “essential” and 20% “helpfully supportive” for their work.

Regarding the different kind of data used (Figure 10), the ones coming from Sentinel Missions and other Earth Observation Satellites are the most used (i.e, 48% and 33% respectively), followed by multi-mission satellite data (i.e., 10%), while records from other space-based data are less used (i.e, 9%). Also in this case, a general agreement with results achieved at the CoRdiNet consortium level is found.

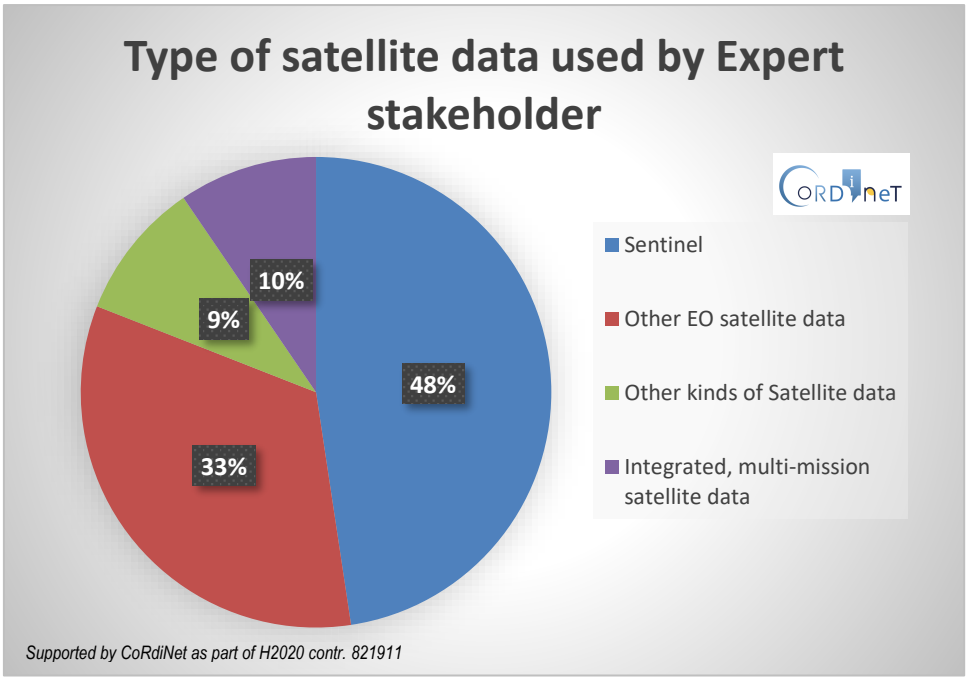

Figure 10. Type of satellite data used by the ISSeP “expert” stakeholders

Focusing on Group A stakeholder, their needs, challenges and barriers were also analyzed and discussed in the following.

In good agreement with the results discussed in Sections 4.1.1 and 4.1.2, Needs (Table 5) and Challenges (Table 6) are generally very specific and strictly linked to the type of data/service used/provided and to the stakeholder thematic sector. However, also in this case, two common general requests can be identified for both the categories: one is mostly related to the data/product quality (yellow rows in tables 5 and 6), and the other one refers to data accessibility (orange rows in tables 5 and 6). Besides, it is worth saying there are a few stakeholders that are not able to indicate any needs/challenges.

Table 5: Summary of Needs identified by ISSeP Group A (“Expert Group”)	
NEEDS	***TYPE***
/	
monitoring of agriculture, deforestation, land use changes	Specific need
Monitoring environnemental	Specific need
Download by plot and No neither per tile	General need (Data Accessibility)
/	

need for Sentinel data of pre-processing level 3 "inter-calibrated" (e.g. radiometrically and geometrically (co-registration)) with data from other sensors	General need (Data/Product quality)
synthesis of the different possibilities of access to clouds with advantages and disadvantages for each	General need (Data Accessibility)
System for dynamic monitoring of regional territories; Easy application of methods to different geographical contexts; Development aid	Specific need
Landslides, precision agriculture, irrigation	Specific need
data quality; geo-referencing; super-resolution algorithms	General need (Data /Product Quality)

Table 6: Summary of Challenges identified by ISSeP Group A ("Expert Group")

CHALLENGES	**TYPE**
/	
biodiversity monitoring, black frame mapping (would require night images)	Specific challenge
AI, Time Series	Specific challenge
No identified	
/	
they are very numerous	Specific challenge
analysis of targets of small areas	Specific challenge
Big Data; Procedure automation; Multiple data management	General challenge (Data Accessibility)
Ship detection (refugees), pollution (degassing), insurance sector	Specific challenge
time series analysis supported by innovative AI approaches; multi-sensor integration (optical-optical and radar-optical)	Specific challenge

Moving to the barriers (Table 7), their general classification in at least four categories speculated in Section 4.1.3 seem to be confirmed, with the only exception of the "Information" one, that has not been indicated by the engaged stakeholders.

Table 7: Summary of Barriers identified by ISSeP Group A ("Expert Group")

BARRIERS	**TYPE**
the size of the data sets, the variable quality of the pre-processing (atmospheric corrections, cloud detection, etc.)	Data/Product quality
Storage, amount of data	Technical
No identified	
/	
the 10m resolution of S2 does not allow to address all needs	Technical
public contracts/costs to access DIAS	Costs
a) Infrastructure costs;	Costs
b) Access to external infrastructure (cloud);	Technical
c) Skills available on the labour market	Training
Essentially training	Training
in some cases, specific needs in terms of spatial resolution No met by Copernicus data	Data/Product quality

All the other categories have been instead identified (Figure 11), with a slight higher (i.e.33%) percentage for the Technical one than all the others (i.e., 22% for Training, Cost and Data Product quality)

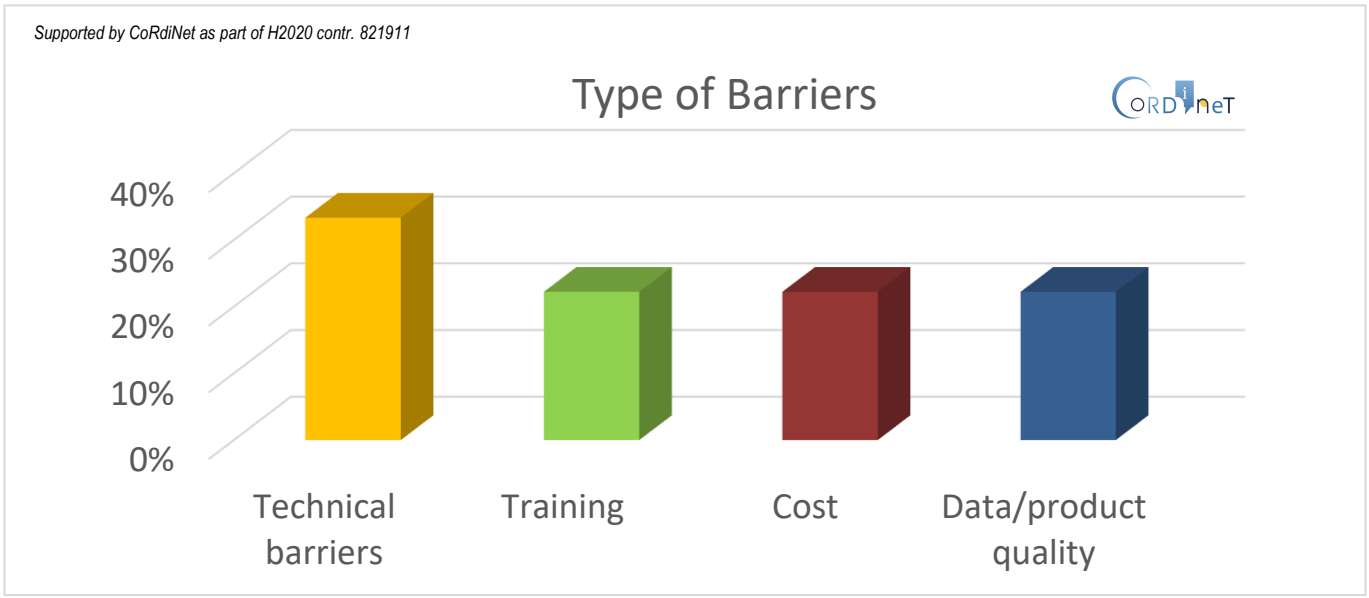

Figure 11. Barriers to a more systematic use of Copernicus data/products/services as identified by ISSeP stakeholders belonging to Group A

4.2.2 IEST Feedback Analysis

To engage its stakeholders, IEST used an adapted version of the questionnaire, based on the one designed by the Cordinet partners, but slightly modified especially in terms of "conditions" of the questions and of rules to pass from one section to another.

IEST engaged 111 stakeholders, mainly represented by SME (29%) (Figure 12). Several other stakeholder categories have been also interviewed through the disseminated questionnaire (see Figure 12).

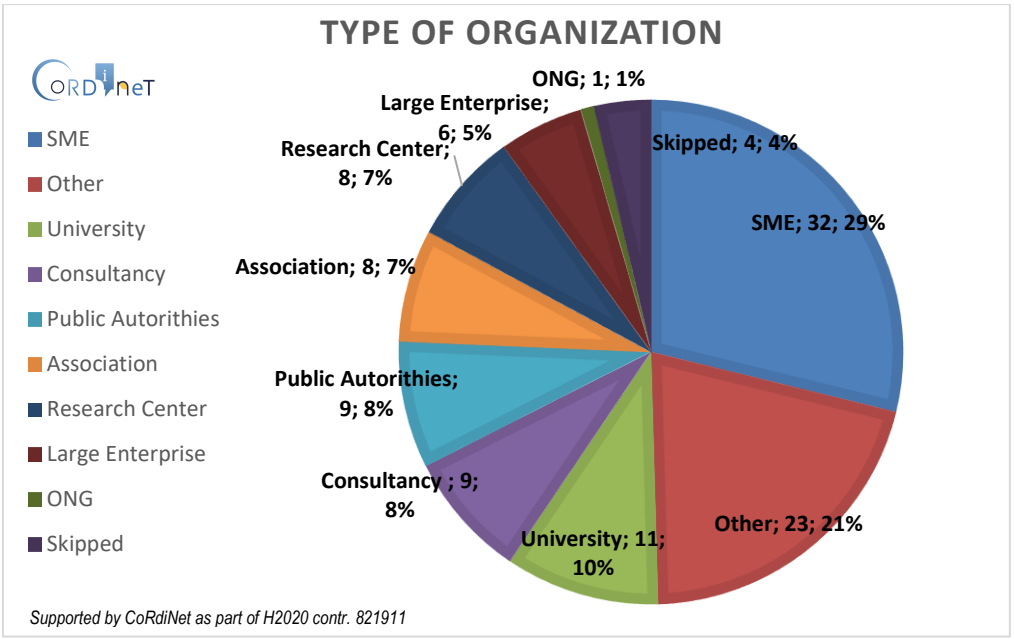

Figure 12. Type of stakeholders engaged by IEST

These stakeholders are mostly well balanced between those not aware of Copernicus data/solutions (i.e, 60; 54%) and those knowing them (i.e. 49; 44%). 25 of the latter (i.e. 22%), are those belonging to group A ("Expert" users of Copernicus data/service) and 24 (i.e. 22%) are those knowing the Copernicus Flagship Program but not using its data/services. Two stakeholders skipped this answer, because the adapted version of the questionnaire allowing for this possibility (Figure 13).

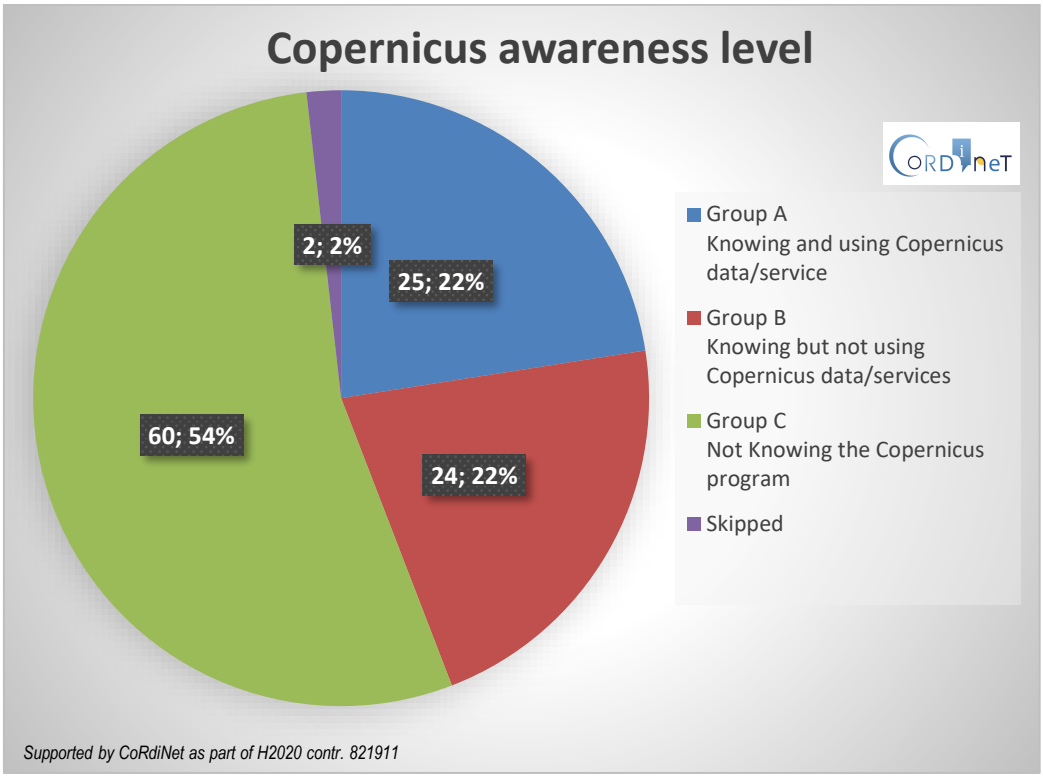

Figure 13. IEST Stakeholder Copernicus Program Awareness

The possibility to skip some questions, not allowed in the CoRdinet version of the questionnaire, reduced the population of some fundamental answers, as reported in Table 8 but, in any case, allowed for the achievement of the main goals of the questionnaire.

Table 8: Summary of feedback collected by IEST				
Group / Population		**Needs**	**Challenges**	**Barriers**
	#Question	B9	B10	B11
GROUP A (Yes/Yes): 25	Answer	7	9	10
	Skipped	104	102	101
	#Question	C5	C6	C7
GROUP B (Yes/No): 24	Answer	11	11	17
	Skipped	100	100	94
	#Question	D4	D5	-

GROUP C (No): 60	Answer	17	14	-
	Skipped	94	97	-

Concerning the thematic area of the service provided/used by the Expert stakeholders (Figure 14) it was found also in this case that the actions related to Mapping and Monitoring are the most considered ones (i.e., 37%), followed by Early Warning (i.e. 22%), and Support to decision (i.e. 20%). Planning and Management activities have less (but still significant) relevance for this specific group (i.e., 15%).

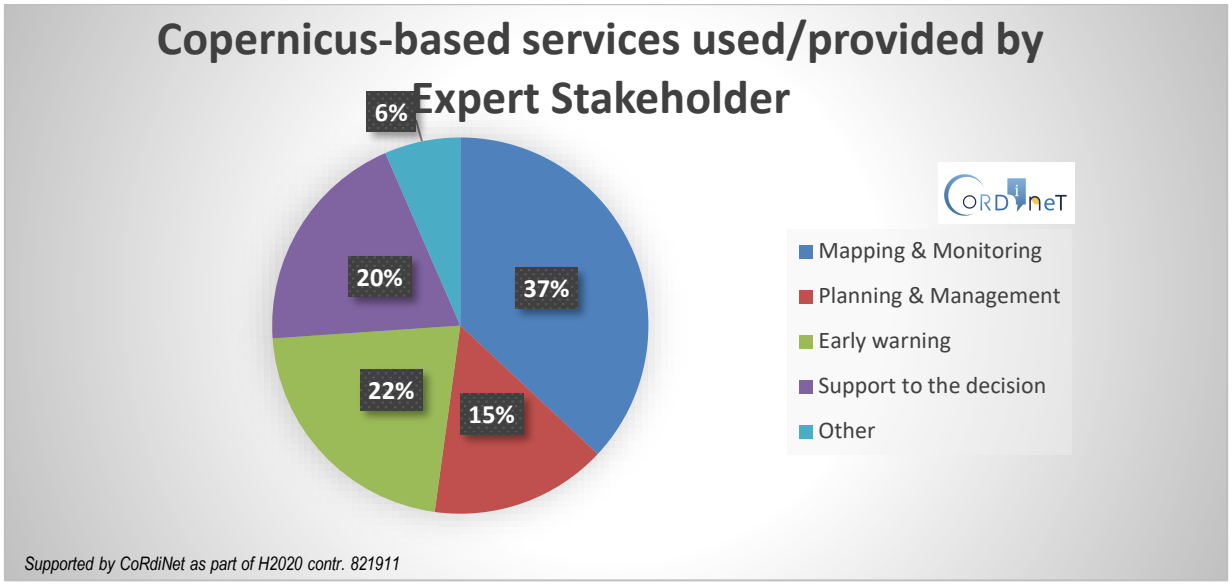

Figure 14. Copernicus service types provided/used by IEST expert stakeholders

A general consensus on the relevance of Copernicus data/service was found, with 63% of the sample considering the Copernicus information "essential" and 29% "helpfully supportive" for their work. Therefore, more than 90% of the interviewed stakeholder belonging to the "expert" group considere Copernicus and EO data greatly valuable for their jobs and activities. Besides, only 22% of the expert stakeholders indicated a few issues in finding and/or using Copernicus EO data for their activities.

Regarding the different kind of data used (Figure 15), results are well in agreement with the ones already discussed in the previous section, confirming Sentinel Missions the most used (i.e., 43%). This result is a clear demonstration of the positive impact of the European Space policy and strategy confirming that the investments made in the space sector are starting to create a new market.

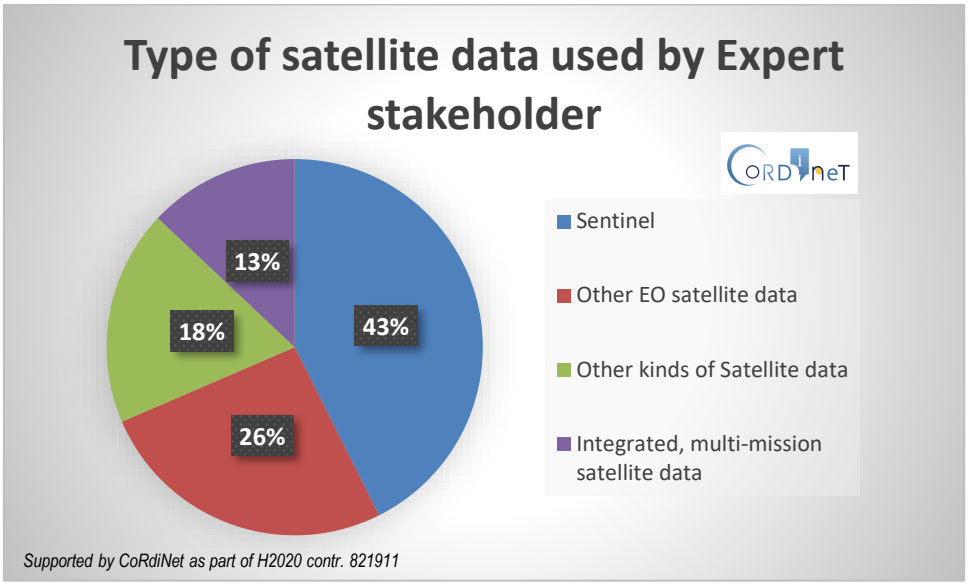

Figure 15. Type of satellite data used by the IEST "expert" stakeholders

Following the same scheme already applied in previous sections, in the following the needs, challenges and barriers of Group A stakeholder are analyzed and discussed.

Collected feedback are well in line with the previous already acquired both among CoRdiNet consortium and ISSeP stakeholders. Apart from a few specific indications, the common general requests about data/product quality and data accessibility are confirmed (i.e. Yellow and Orange rows in Table 9 and 10).

Table 9: Summary of Needs identified by IEST Group A ("Expert Group")	
NEEDS	***TYPE***
Weather data and prediction is needed faster. The copernicus climate chance program are challenging to work with, and they are very important, I whish could be easier.	General need (Data/Product quality)
Early warning program is needed to better know the tropical cyclone trajectory to protect the population. It's done with war data from sentinel 1.	Specific need
More hyperspectral data More cross organization i.e. Nasa ISRo etc collaboration More funding for early stage startups More technical mentorship on data AI etc	Multiple need (Technical/Costs)
Analisys of pollution preventing natural disaster	Specific need
Scaricamento più veloce	General need (Data Accessibility)
1) high resolution SAR imagery with dual or quad polarization; 2) daily revisit time (more satellites are needed); 3) high precision DEM covering entire globe",	General need (Data/Product quality)
Estaria bien disponer de mas informaciones procesada a nivel 2A	General need (Data/Product quality)

Table 10: Summary of Challenges identified by IEST Group A ("Expert Group")	
CHALLENGES	***TYPE***
More frequent revisit. Higher resolution imaging purchase	General challenge (Data/Product quality)
Make easier access to display data	General challenge (Data Accessibility)
Real Time Data	General challenge (Data Accessibility)

Difficulty comes from the storage capacity limited to sentinel 1.	General challenge (Data Accessibility)
Carbon Monitoring	Specific challenge
Huge volume of data processing	General challenge (Data Accessibility)
Faster access and more data	General challenge (Data Accessibility)
1) 10-20m resolution is insufficient for most of the commercial applications; 2) infrequent revisit times impact our abilities to deal with natural disasters; 3) Euro-DEM is not sufficient for our use	General challenge (Data/Product quality)
Decaimiento de masas forestales, Inventario forestal dinámico, Incendios forestales	Specific challenge

Concerning the barriers (Table 11), the investigated sample provides a clear answer about the lack of proper information and awareness (~80%) about Copernicus program and, as a minor issue, the need of specific training activities.

Table 11: Summary of Barriers identified by Iesp Group A ("Expert Group")

BARRIERS	Type
Issues of awerness in countries, many company work in traditional way not using these kind of data	Information
Issues of awerness in countries, many company work in traditional way not using these kind of data	Information
Lack of daily information for some specific criteria	Information
Awareness/info and	Information
tech training	Training
There is not something clearly defined for this use	Information
Administrative paperwork, Beauracracy, Less representation of tech-savvy digital native millenials	Political
Knowledge	Information
C'è poca conoscenza delle reali possibilità offerte dai dati Copernicus	Information
Market	Info/Costs?
Yo dotaría de presupuesto a los copernicus Relays, para poder aumentar la formación a traves de esta via	Training

The integration of the feedback collected by the associated partners, provided a more comprehensive figure of the stakeholders' requirements and of their general feeling about the Copernicus program. Moreover, this additional analysis allowed for an increase of the number of the stakeholders belonging to Group C (Knowing but not using/providing Copernicus data/services) which is a particularly interesting group as far as the investigation about causes presently limiting the full exploitation of EO/Copernicus data is aimed at.

Numbers reported in Table 12 indicate that the lack of: i) specific skills on how to use/process/interpreting Copernicus data/solution and ii) clear information and guidelines on how to find them, are the main obstacles that have prevented their more large diffusion among the interviewed stakeholders. This situation seems to be a common issue regardless the specific sample investigated.

Table 12: Reasons why Group C stakeholders are not using/providing Copernicus data/solution (Question C.1 of the questionnaire)

	CORDINET	ISSEP	IEST	TOT
I find them useless for my activity	1		2	3
I believe that they cannot provide an added-value for my business			2	2
I am not able to find/discover/downloading them	1	2	4	7
I am not able to using/processing/interpreting them	2	2	4	8
Other	2	6	14	22

Looking also at the "Other" specific reasons provided, in addition to some very particular justifications, again, the lack of awareness and of specific skills are the main reasons indicated.

5 Strategy to cope with needs and barriers

The analysis carried out in the framework of WP2, which now includes also feedback from the interviews carried out by the two associated partners, highlighted the main barriers encountered by local/regional stakeholders in using EO Copernicus data/services. It should be stressed that the additional feedback collected (received from the associated partners), is perfectly in line with the previous achievements, confirming the general feeling of regional/local stakeholders toward the Copernicus program. In the following, a few preliminary suggestions about how to cope with these barriers are provided.

As discussed in the previous section, the main barrier that came out from the stakeholder feedback analysis is still a lack of education/training of the human resources working at their premises as well as a need for a more systematic information provision. Therefore, additional efforts have to be done, at different levels, to address these requests. The Copernicus User Uptake initiative should be more and more implemented, fostering a better interaction and collaboration between the Copernicus Relays (CR) and Academy (CA) networks. From top level, European Commission should assure a continuous support, also in terms of funds, to the two networks. Continuos updating of very recent successes of Copernicus solutions should be promptly provided and presented to the CR in order for them to systematically pass such information to the local/regional ecosystem. Language barriers have also to be definitively overcome: nowadays, several information material is still provided and available only in English and this represent a serious issues when "small" actors, mainly operating at local/regional level should be reached and informed about.

For what concern education and training, of course, a better collaboration between CR and CA should be aimed at, especially where they are both present locally or regionally. In particular, CRs should provide a clear figure of the specific educational needs at local level, and the CA whole network should address such a training request.

Moreover, ad hoc learning modules on EO Copernicus data/service for university students should be prepared and delivered within specific and thematic high education courses, better exploiting the CA network which can enable the involvement of the best expertises available at EU level.

Technical barriers are partially on the shoulder of European Commission, which should assure an easier access to the data. The intrinsic complexity of the Copernicus ground segment, with the availability of different platforms (i.e., Sentinel-1A, Sentinel-1B, Sentinel-2A, Sentinel-2B, etc.) equipped with several sensors (S3-OLCI; S3-SLSTR, …), together with the disposal of different access points (Copernicus Hubs, several DIAS, etc.), makes the discovery, selection and access to data not always easy. Therefore, the generation and divulgation of adequate and updated "data access kit" is a priority. Concerning in particular Level 2 products, according also to the stakeholder feedback about needs and challenges, they should be easily accessible and of high quality/reliability, regardless the data/software/algorithm in the back-end. They should also be immediately ingestible within the already existing procedures and protocols operating at the stakeholder premises (i.e. interoperability should be fully assured).

However, the technical barriers highlighted by the engaged stakeholders might also be an effect of the lack of proper information/education, suggesting a link among different barriers that should make easier to cope with them.

Concerning the costs, they are mainly referring to the ICT infrastructure investment/upgrade needed to manage the big amount of data/products, as well as for supporting ad-hoc education/training initiatives for the internal staff. Stakeholders should be made aware of the different funding opportunities to support their investments on this topic. Hence, a better dissemination/promotion of these opportunities should be made at different levels, from the European scale to the local/regional one. NEREUS could have a relevant role in this activity, representing an effective link between European Commission and regional governments.