With the support of the Erasmus+ Programme of the European Union Sector Skills Alliances N° 591991-EPP-1-2017-1-IT-EPPKA2-SSA-B

D 1.2 – Workshop on demand for space/geospatial education and training

Author(s)/Organisation(s):

- Estefanía Aguilar Moreno (P4 UJI)
- Barbara Hofer (P3 PLUS)
- Stefan Lang (P3 PLUS)

Work package / Task:

WP1 - Preparing the Space/Geospatial Sector Skills Strategy

T1.2 - Identifying the current demand for GI and EO skills and occupational profiles

Short Description:

Report of the workshop held in Castellón de la Plana (Spain) May 30th 2018. This report integrates views of partners and stakeholders on the current demand for GI and EO skills and occupational profiles.

Keywords:

Space/Geospatial education and training; demand survey; technological and non-technological trends; Copernicus

Dissemination Level		
PU	Public	X
RE	Restricted to other programme participants (including Commission services and project reviewers)	
CO	Confidential, only for members of the consortium (including EACEA and Commission services and project reviewers)	

With the support of the Erasmus+ Programme of the European Union Sector Skills Alliances N° 591991-EPP-1-2017-1-IT-EPPKA2-SSA-B

Revision History:

Revision	Date	Author(s)	Status	Description
0.1	23/05/18	Estefanía Aguilar	First draft	Structure
1	06/06/2018	Barbara Hofer	Second draft	Inclusion of notes
1.1	11/06/18	Estefanía Aguilar	Third draft	Information gathering & organisation
1.2	14/06/18	Stefan Lang	Add-ons to third draft	Summary statements etc.
1.3	18/06/18	Mónica Miguel Lago / Maria Andrzejewska	Add-ons	Panel session & conclusions
1.4	19/06/18	Estefanía Aguilar	Add-ons	Revision, pictures, style, format...
1.5	19/06/2018	Barbara Hofer	Add-ons	Adding summaries of talks
1.6	24/06/2018	Stefan Lang	Final check	Minor edits
1.7	27/06/2018	Estefanía Aguilar / Stefan Lang / Barbara Hofer	Final version	Final version ready for quality assurance evaluation
2.0	16/07/2018	Estefanía Aguilar / Barbara Hofer	Final version	Inclusion of comments from quality assurance
2.1	31.05.2019	Nicole Ferber / Stefan Lang	Final version	Integration of list of acronyms and glossary
2.2.	04.06.2019	Estefanía Aguilar	Final version	Adding a general introduction and adjusting format

Table of Contents

Acronyms

Acronym	Description
BoK	Body of Knowledge
CAP	Common Agricultural Policy
CEO	Chief Executive Officer
CLIMATE-KIC	Climate Knowledge and Innovation Community (KIC)
DG-EMPL	DG for employment, social affairs and inclusion
DG-GROW	DG Internal Market, Industry, Entrepreneurship and SMEs
DIAS	Data & information access service
DOI	Digital Object Identifier
EACEA	Education, Audio-visual, Culture Executive Agency
EARSC	European Association of Remote Sensing Companies
EC	European Commission
EO	Earth Observation (inc. Meteorology)
EO/GI	EO and GI sectors
EQF	European Qualifications Framework
ESA	European Space Agency
ESCO	European Skills, Competences, Qualifications and Occupations
ESERO	European Space Education Resource Office
EU	European Union
EURES	European Job Mobility Portal
FP7	7th Framework Programme for Research and Technological Development
GEO	Group on Earth Observations
Geo-ICT	Geographic Information and Communication Technologies
GEOSS	Global Earth Observation System of Systems
GI	Geographic Information
GIS	Geographic Information Sytsem
GIS&T BoK	Geographic Information Science & Technology Body of Knowledge
GISIG	Geographic Information System International Group
GMES	Global Monitoring for Environment and Security
HEI	Higher Education Institutions
ICT	Information and communication technology
INSPIRE	Infrastructure for Spatial Information in Europe

ISCO	International Standard Classification of Occupations
JRC	Joint Research Centre of the European Commission
LIDAR	Light Detection and Ranging
LOQ	Learning Opportunities and Qualifications in Europe
MOOC	Massive Open Online Course
NEREUS	Network of European Regions Using Space Technologies
OGC	Open Geospatial Consortium
ORCID	ORCID, Inc
R&D	Research & Development
ROI	Return of Investment
RS	Remote sensing
SME	Small and Medium Enterprises
SSS	Sector Skills Strategy
UCGIS	University Consortium for Geographic Information Science
UNIBAS	University of Basilicata
VET	Vocational Education and Training
WP	Work Package

Glossary

- **Blueprint** refers to the systematic definition of EO/GI content for the purpose of creating curricula with validity evidence.
- **Body of Knowledge (BoK)** is the complete set of concepts and relations between them, that make up a professional domain, (in this case EO/GI BoK) and the related learning outcomes as defined by the relevant learned society or a professional association.
- **Competence** means the proven ability to use knowledge, skills and personal, social and methodological abilities in work or study situations and in professional and/or personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy.
- **Earth Observation (EO) related services** is any geo-spatial information service activity which in some way involves data coming from EO satellites (including meteorological satellites) i.e. any satellite with one or more sensors that measure parameters coming from the earth's surface or atmosphere. The involvement may be direct i.e. processing or distributing imagery or indirect i.e. consultancy based around knowledge of the imagery or its use. It starts from the point where imagery is transmitted to the ground, so it does include reception and processing of imagery but does not include construction of ground stations or the satellites delivering the data. Note that it includes all geo-spatial information services activities where satellite EO data has been used and so extends to downstream information processing of geospatial information where data being used has been derived from EO imagery possibly in combination with other data types.
- **European Space Education Resource Office (ESERO)** project is ESA's main way of supporting the primary and secondary education community in Europe.
- **European Qualifications Framework (EQF)** descriptor is defined by 8 levels of descriptors that indicates at that level the learning outcomes relevant to qualifications in any system of qualifications.
- **European Skills, Competences, Qualifications and Occupations (ESCO)** is the multilingual classification of European Skills, Competences, Qualifications and Occupations.
- **Geographic Information (GI)** is the data of a geographic location combined with non-spatial information (e.g. statistical data) and their representation as a map.

- **Geographic Information System (GIS)** is a computerized tool designed for storing, analysing and consulting data where geographic location is an important characteristic or critical to the analysis.
- **Group on Earth observation (GEO)**, is a community of more than 100 national governments and in excess of 100 Participating Organizations that envisions a future where decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations.
- **Knowledge** means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual.
- **Higher Education Institutions (HEI)** are organizations providing higher, postsecondary, tertiary, and/or third-level education, it refers to post-secondary school education.
- **Information and communication technologies (ICT)** are the infrastructure and components that enable modern computing.
- **Massive Open Online Courses (MOOC)** are free online courses available and provide an affordable and flexible way to learn new skills, advance your career and deliver quality educational experiences at scale
- **Open Geospatial Consortium (OGC)** is an international industry consortium of over 530 companies, government agencies and universities participating in a consensus process to develop publicly available interface standards.

  Sector Skills Alliance (**SSAs)** are designed to tackle skills, aligning vocational education and training (VET) systems with labour market needs. This is done by: (i) modernising VET by adapting to skills needs and integrating work-based learning, (ii) strengthening the exchange of knowledge and best practices, (iii) improving labour market mobility, (iv) increasing the recognition of qualifications. More info.
- **Sector Skills Strategy (SSS)** offers a mechanism to focus comprehensively on workforce skills, from entry level to advanced, required in the space/geospatial sector. The Sector Skills strategy is informed by data, research, analysis and consultation at a regional and national level and are planned to be European-focused and it aims at tackling skills gaps with regard to one or more occupational profiles.

- **Small and medium-sized enterprises (SMEs)** are enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.
- **Soft Skills** are a combination of people skills, social skills, communication skills, character or personality traits, attitudes, career attributes, social intelligence and emotional intelligence quotients, among others, that enable people to navigate their environment, work well with others, perform well, and achieve their goals with complementing hard skills (wikipedia).
- **Skill** means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive or practical skills.
- **Vocational Education and Training (VET)** is a key element of lifelong learning systems equipping people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly on the labour market.

1. Introduction

EO4GEO is an **Erasmus+ Sector Skills Alliance** gathering **26 partners from 13 EU countries,** most of which are part of the **Copernicus Academy Network.** The project started on January 1st, 2018, upon approval by the EU Education, Audiovisual and Culture Executive Agency (EACEA) and runs over four years. Partners are coming from academia, public or private sector, and they are all active in the education and training fields of the space / geospatial sectors. The project is also supported by a strong group of Associated Partners mostly consisting of associations or networks active in space/geospatial ecosystem.

EO4GEO **aims to help bridging the skills gap in the space/geospatial sector** by creating a strong alliance of players from the sector/community reinforcing the existing ecosystem and **fostering the uptake and integration of space/geospatial data and services**. EO4GEO will work in a **multi- and interdisciplinary** way and apply innovative solutions for its education and training actions including: case-based and collaborative learning scenarios; learning-while-doing in a living lab environment; on-the-job training; co-creation of knowledge, skills and competencies; etc.

EO4GEO will **define a long-term and sustainable strategy to fill the gap between supply of and demand for space/geospatial education and training** taking into account the current and expected technological and non-technological developments in the space/geospatial and related sectors (e.g. ICT). The strategy will be implemented by: creating and maintaining an ontology-based Body of Knowledge for the space/geospatial sector based on previous efforts; developing and integrating a dynamic collaborative platform with associated tools; designing and developing a series of curricula and a rich portfolio of training modules directly usable in the context of Copernicus and other relevant programmes and conducting a series of training actions for a selected set of scenario's in three sub-sectors - integrated applications, smart cities and climate change to test and validate the approach. Finally, a long-term Action Plan will be developed and endorsed to roll-out and sustain the proposed solutions

For more information on the project please visit http://www.eo4geo.eu/about-eo4geo/.

2. The workshop: introduction

In the framework of conducting WP1 preparatory activities to layout and better define the Sector Skills Strategy for the EO/GI sector, under specific consideration of the needs expressed by public and private bodies, the workshop "on demand for space/geospatial education and training", carried out on May 30, 2018 (additional contributions of the European Commission were provided on May 31) at the University of Jaume (UJI), Castellón, Spain, pursued the following objectives:

(1) To bring together representatives from academia and education, public administration and authorities, small to large industries, as well as EC institutions, to exchange viewpoints on GI/EO sectoral skills demands, currently and against potential future scenarios

(2) To review first results of the demand survey currently conducted based on preliminary analysis of answers received from some 120 respondents.

(3) To elaborate, in three breakout groups, the current workforce situation, the specific training measures taken in various types of organisations, and the job-related challenges arising from future trends in societal transformation and digitization in general.

(4) To discuss, in a panel composed by different sector representatives, specific skills requirements and the potential (mis-)match with current educational contents.

Group picture of workshop participants

The agenda (see annex 7.2) was a combination of enlightening talks, information about the project itself, and also considered the direct participation of the attendants in a session for breakout groups and a panel discussion. The workshop was organised around preliminary results emanated from the survey about the demand of professionals in the space/geospatial sector. In order to have a broader perspective about the survey results, some illuminating talks were given (see annex 7.1 for list and short bios of speakers), and then experts and stakeholders (see annex 7.1) were invited

to actively participate in the discussions. The workshop gathered 53 people, including project partners (38), associated partners (2) and experts (13).

3. Talks and main messages

The workshop started with an **introduction to the EO4GEO project** (Milva Carbonaro - P1 GISIG) and some indications regarding **workshop logistics** (Estefanía Aguilar - P4 UJI) see pdf

Milva Carbonaro from GISIG introducing the EO4GEO project to the audience.[1]

After a general introduction of the EO4GEO project and its policy framework, Milva pointed out the main outcomes to be generated by the project: demand and supply of training; Body of Knowledge development; platform with associated tools; designing of curricula and a portfolio of training modules; training actions in three scenarios (integrated applications, smart cities and climate change), and a long-term action plan.

Milva also presented some insights from supply survey: issues of spatial coverage; mostly courses described; 35% of the learning materials not accessible; 50% of respondents on master or PhD level; 50% of the sample use Copernicus services; sample of main topics addressed and related open questions on thematic and technical coverage; 69% of the training providers were Higher Education Institutions, followed by SMEs (17%); and a lack of indication of soft skills.

Estefanía gave an overview of the agenda and some instructions about how the session was going to be organised.

[1] Remark: all speakers and panellists gave consent for the use of images, recordings and videos taken during the workshop

Following this introduction, **Michael Gould**, representing ESRI Inc., presented "Skills requirements: the perspective from a big GI Company". Michael Gould gave us the perspective of a big company. From his experience, thematic areas (verticals) not always match between industry, Copernicus and even with the current GIS&T Body of Knowledge. So, there is a need in building bridges between verticals and the horizontal or transversal methodological skills.

Michael Gould (ESRI) during his presentation

Users have very specific tasks and objectives, while universities are more focusing on general skills/training. Moving to the specific case of ESRI, as a multinational, they have many projects done, which require a diversity of employees, from well-trained GIS staff to personnel who supports the GIS people (sales, developers etc.). That turns into **"workflow" as an important term, and the need of people who fit a very specific context, who can solve problems in the real-world scenarios**.

Undergraduates do not have practical skills, they have course hours but no practical skills. It is said that for being an expert you need to invest 10.000 hours, so how do we get our 10.000 hours to be really a master? Josh Kaufman, in his TED talk "The first 20 hours: how to learn everything" gave some shortcuts to be taught.

In Michael's opinion data, (handling, managing, understanding, etc. data), is key. Data (pre-) processing is paramount these days, knowing how to clean data, search data, create data, etc. always based on a cost benefit analysis is so crucial that we can maybe start thinking about a **data-oriented curriculum**.

"A smart person (social skills) with 20-hours of focused training might be more valuable to Enterprise/Organization, than one with 1000s of theory hours." Michael Gould

After an introduction about the Group on Earth Observations (GEO), **Steven Ramage** presented "Global challenges are local". Events happening around the world have local impact on; supply chains, climate change, etc. to name a few. Understanding Earth processes allows us to predict and, consequently, make sound decisions, establishing the nexus between Science and Policy.

In order to tackle global problems at local level, Steven put the emphasis on the importance of **human interoperability and the actual relevance of soft skills**, despite they are hard to acquire.

Steven Ramage (GEO) during his presentation

Barbara Hofer from PLUS was in charge of presenting the preliminary results of the survey on demand of geospatial workforce: "Skills and occupation requirements: first lessons learned from the survey on demand". First, Barbara outlined the overall structure of the demand survey, which aims at retrieving information about the skills and tasks relevant in organisations as well as demanded occupational profiles. The description of occupational profiles based on a rating of relevant skills sets is one of the core objectives of the survey.

Barbara Hofer from PLUS giving a first account to the outcome of the EO4GEO demand survey

The preliminary results, which are based on about 120 responses from 23 countries received until May 22, 2018, showed that mostly employees with a master or PhD degree are needed in organizations; in detail 53% of the specified profiles require a master's degree and 34% of profiles a PhD degree. The labels of the specified profiles indicate that highly specialised workers in the EO/GI sector are demanded: e.g., remote sensing technician, GIS developer, remote sensing expert, data Analyst and scientist, EO/GI applications developer, GIS analyst, etc. The use of these labels is heterogeneous in regards of the skills indicated as important for the profiles. Further analyses are required to identify high priority profiles based on the available relevance ratings of skills. In addition to the overview on the EO/GI related skills requested on the market, survey results concerning transversal skills and training in organizations were presented. The most frequently requested transversal skills are: 1) has independent and proactive working attitude; 2) is motivated to enter new thematic fields and 3) has foreign language skills. Skills referring to entrepreneurial skills were among the least requested ones. Training is widespread across all types of organisations with the most common types of training being inhouse training, external workshops and distance learning.

These first insights gained on the demand of EO/GI workforce provided the input for the discussions in the breakout groups as for example the absence of occupational profiles for workforce with vocational training, the specific nature of training measures in organizations as well as emerging future workforce demands.

The final enlightening talk was given by **John Wilson** (UCGIS) in the afternoon. Professor Wilson explained the US experience in developing the Geographic Information Science & Technology Body of Knowledge (GIS&T BoK) with "Developing a new Body of Knowledge as a basis for curriculum design: the US experience". John gave a general overview of the strategy followed in the development of the GIS&T BoK and the way contributors participate in its development. UCGIS is now in the process of updating it to GIS&T BoK2 with a clear objective: finding a way to acknowledge contributors. In this vein, the strategies used are: to make it more accessible and transparent; to add a wide range of contributors; to include a peer revision system; and to be linked with persistent digital identifiers, such as DOI[2] and ORCID[3]. He also explained the format of a typical entry in BoK2 though examples.

John Wilson (UCGIS) explaining the GIS&T BoK

John also mentioned the importance and positive impact a **Certification program for GI professionals** could have. In the United States there is "GISP - Certified Geographic Information systems professionals" certification which ensures the applicant's background in Ethics, Education, Experience, and Contributions to the Profession. In Europe, EARSC Certification Scheme for the EO services industry helps companies offer a more professional service, to assure customers that

[2] DOI: Digital object identifier system https://www.doi.org/
[3] ORCHID: Identifier for researchers https://orcid.org/

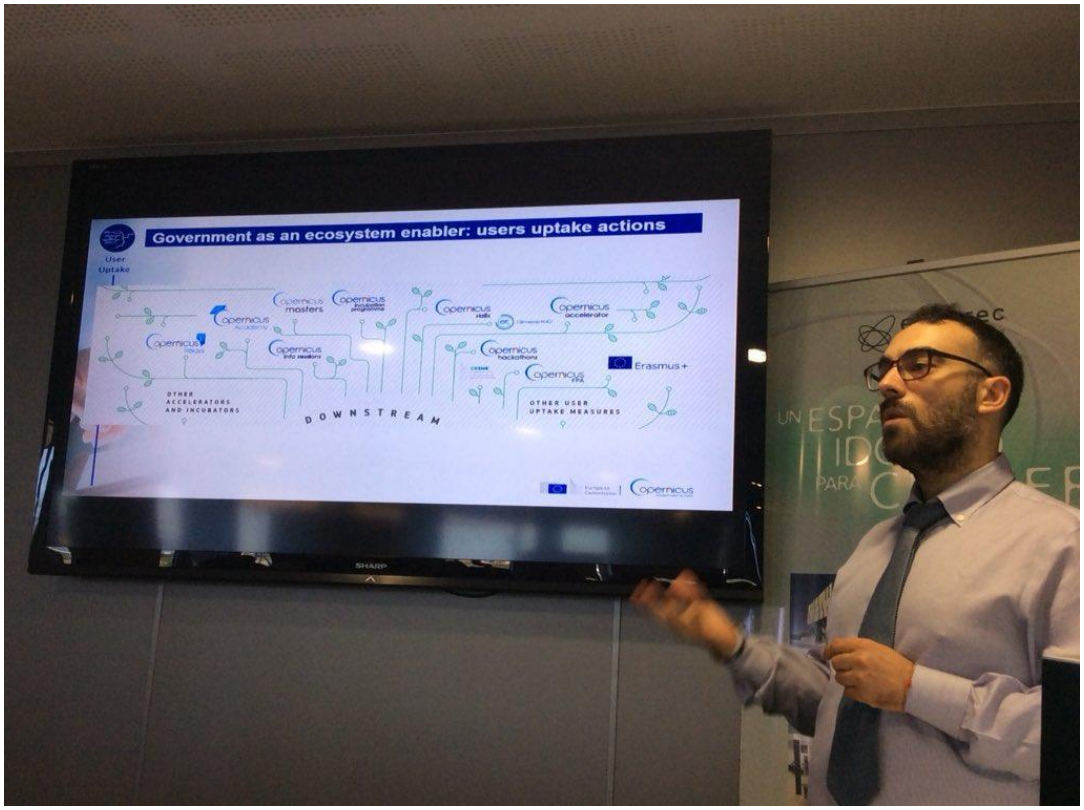
the EO service supplier offers products and services of quality and to help reduce the procurement costs by standardising products across suppliers.

During the second day (May 31st) representatives from the European Commission joined us. **Emanuele Barreca** from DG-GROW, gave a talk with the title: "The importance of the sectoral skills strategy and the contribution expected from EO4GEO in the space-geospatial field".

Emanuele presented figures on the expected growth of the spatial/geospatial field and mentioned that the upstream market is expected to grow by 1700 employees in the next few years (2021-2027); the downstream market is expected to require an average of 2100 permanent jobs between 2021 and 2031. Overall the **downstream sector has the most economic potential**, which is strongly linked to Copernicus services and the free and open data policies supported by Copernicus. This market growth and the required sectoral skills strategy is the context in which the EO4GEO project is placed.

Emanuele emphasized that the money moves from data and hardware to business intelligence. Business intelligence is thereby linked to platforms like DIAS - the Copernicus Data and Information Access Services. DIAS was launched 2018 June 20th during "Baveno +20: From GMES to Copernicus and beyond" meeting. DIAS will provide Copernicus data access in combination with Big Data analytics in the cloud as well as data fusion with EO and non-EO data. The DIAS platform is expected to boost the development of new business models and to contribute to the growth of the downstream sector.

Emanuele then presented **first results of a Copernicus ecosystem survey**, which had been conducted by the JRC and reached about 150 companies between March and May 2018. The survey aimed at identifying new business models put in place as well as the impact of DIAS and related European initiatives to the development of the market. A need that has been confirmed is the required user uptake in the spatial/geospatial field. Most space data are not directly used by end users, which indicates a skills gap. Training in the area of Geo-ICT, covering the use of satellite imagery, geo-computation, cartography, data modelling etc. is required for addressing the skills gap. Training in technical skills needs to be complemented with business and transversal skills. Overall, the Commission provides an ecosystem of Copernicus related initiatives for enabling user uptake and downstream market development.



Emanuele Barreca (DG Grow) during his presentation

Summarising, three key follow up points to better strength on Commission side are highlighted:

- Achieve synergies with DIAS (the future eLearning and CV design tools could be hosted in one or all DIAS). Chase interest of DIAS becoming associated members of the EO4GEO.
- Achieve synergies with the ESA EDUCATION OFFICE, ESERO and the Redu Office that is active in EO training. Chase interest for becoming associated members of the EO4GEO.
- Follow up the intervention from and support (as Commission) with the European Skills, Competences, Qualifications and Occupations ESCO strategic framework : https://ec.europa.eu/esco/portal/document/it/01192a20-a7c0-4d0d-b5d3-29d1f9b819c8
- Sector Skills strategy discussion at the Copernicus Ecosystem workshop (October 9th, 2018)

Then, **Nuria Moyes** from ESCO gave us an overview of "The European Classification for Occupations, skills and qualifications"

The main features of ESCO are introduced to the Consortium, also with a video showing some use cases of the classification. The three main pillars on which ESCO is based are:

- Occupations, where almost 3000 occupations (occupational profiles) in different sectors are described through concepts and hierarchical relationships (in 5 levels) and metadata strictly connected to the International Standard Classification of Occupations - ISCO. Furthermore, they list the knowledge, skills and competences that experts considered relevant terminology for this occupation on a European scale (essential or optional for occupation).
- Skills, distinguishes between i) skill/competence concepts and ii) knowledge concepts by indicating the skill type. It includes an explanation of the concept in the form of description, scope note and definition and is structured, among others, through skills relationship with occupations, i.e. by using occupational profiles as entry point. ESCO skills can help to define learning outcomes in a common language.
- Qualifications, coming from databases of national qualifications that are owned and managed by the European Member States (MS) and provided by them on a voluntary basis. The Commission also envisages integrating private, international and sectoral qualifications from other sources into ESCO in the near future (under discussion with the MS). Each national qualification is related to EQF.

Nuria Moyes introducing ESCO

In 3 years, all Member States will have to align their classifications to ESCO; to do that, they need to follow a common schema implementing the EURES system (EU job portal to upload vacancies and CVs and better match people to jobs).

The portal LOQ (Learning Opportunities and Qualifications in Europe) is also mentioned as tool to gather transparent information on qualifications, where national qualification frameworks can be compared.

The **manifold points of contact and possible synergies between ESCO and connected EU portals and the activities to be performed within EO4GEO are underlined**, in particular when it comes to the alignment of the EO4GEO schema for description of qualification to be defined with that already used in ESCO, the explanation of the concepts in ESCO and how they are explained in the GIS&T BoK, the cross-check of hierarchical organization of occupational profiles and of the related skills and competences, the possibility to intervene in the continuous improvement of ESCO for the occupations, skills and qualifications in the space/geospatial sector thanks to the community forums hopefully accessible from the second half of 2018 to collect feedback from stakeholders.

General view of workshop attendants

4. Breakout groups

Stefan Lang, from PLUS, introduced the breakout groups. He invited the participants to zoom out from the details that were discussed before, and to recall the main rationale of the survey. Considering this being an initial stage of the project so not all roads are taken, he emphasized the overall capacity gathered at this workshop, that should best be utilized.

The rationale of the breakout groups was to find consensus among workshop participants on key issues related to sectorial demands, and to discuss potentially diverging opinions. Three core topics (focus areas) were identified as guiding questions for each of the groups, with the specific objectives to:

(1) discuss preliminary findings of the EO4GEO survey on workforce demand,

(2) assess specific needs of the space/geospatial market regarding training supply, and

(3) collect views on future developments and drivers on the space/geospatial market.

4.1 Breakout organisation

Three breakout groups had been proposed and each group was assigned a moderator and rapporteur:

- Group 1 Workforce - Required competencies of job applicants and employees
  Moderator: Peter Zeil (P16 SpaSe)
  Rapporteur: Inese Suija-Markova (P24 VRI IES)

- Group 2 VET - Vocational education and training and professional training as opportunities for the space/geospatial market
  Moderator: Kevin Ramirez (P17 CLIMATE-KIC)
  Rapporteur: Barbara Hofer (P3 PLUS)

- Group 3 Future - Future drivers of the space/geospatial market and required skills
  Moderator: Marc Olijslagers (P2 KU Leuven)
  Rapporteur: Ilaria d'Auria (P21 NEREUS)

The breakout group on "VET"

In preparation of the workshop, some guiding questions for the breakout groups had been circulated (Annex 7.4). Based on this description on the breakout groups, the attendants indicated their preferred group in a Doodle poll beforehand. A maximum group size of 15 participants assured an even distribution of attendants over the three breakout groups.

4.2 Discussion and main outcomes

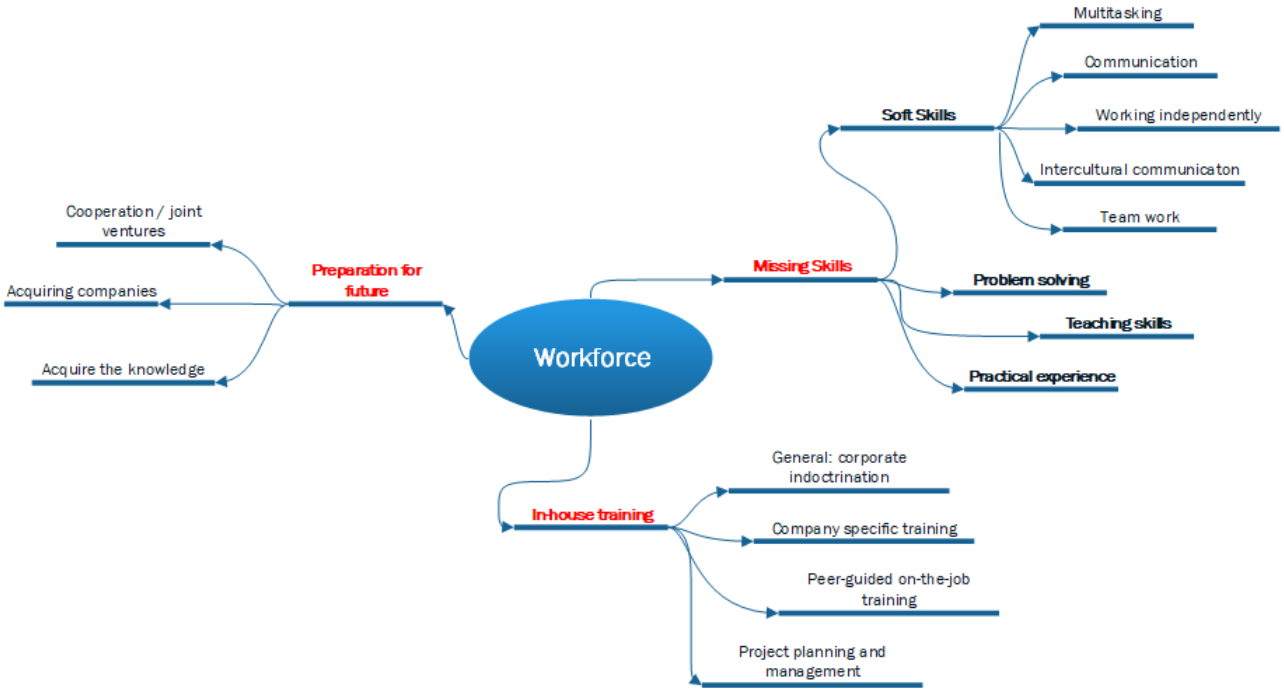
In the afternoon, a joint session for presenting the main outcomes emanated from the breakout groups was organised. Rapporteurs introduced breakout group's main findings in "What did we learn from the breakout : quick 3' summary of the findings for each group"

Group 1 Workforce - Required competencies of job applicants and employees

Q1: What are the «missing skills»?

Q2: What does in-house training include?

Q3: How is the preparation for the future done?



Context matters

- Size of an organisation
- Type of an organisation
- Public sector institution
- Business enterprise
- Academic institution
- Geographical location

Group 2 VET - Vocational education and training and professional training as opportunities for the space/geospatial market

In this breakout group the discussion focused on two main questions:

Q1: Do you have to be an expert in the field to be effective in what you do?

Q2: What training is required to fulfil your tasks in the job?

In the discussion of these questions, the importance of the organization type in which someone is employed has been emphasized. In small and medium enterprises, employees need to be flexible and adapt to given tasks and problems quickly. Chances for training are rarely formalised, but depend on the motivation of the employee himself or herself. In large companies, specialisation on specific tasks of workflows is possible and there is a chance to develop a specific profile over time. In public authorities, employees have to run through an extensive procedure for employment; once a public servant is working in a job, he/she has to cover a large variety of tasks in the sector at hand. For specific projects, cooperation with companies are sought.

A potential conflict of interest has been identified regarding the 'ideal training' from an employee's perspective and an employer's perspective. It has been said that it might not be of interest to the employer to have employees with strong entrepreneurial skills - these skills could, however, be beneficial to the future of the employee.

The discussion on the required training did not focus on the technical skills that are required, but rather put the attitudes and transversal skills of employees at the centre. Employees in the EO/GI sector should:

- Be able to extinguish fires
- Be "updateable"
- Solve real-world problems
- Willing to train themselves
- Be flexible – be a chameleon

These personal traits are hard to link to an educational level. Nevertheless, problem solving capabilities should be an integral part of education from an early age onwards. In general it is important to equip future employees with lasting foundations to make them apt for the evolving market.

Group 3 Future - Future drivers of the space/geospatial market and required skills

Q1: What are the drivers that shape the space/geospatial market?

1. Situational awareness
    a) “the collapse of the planet” (including the anthropogenic dimension, along with natural hazards)
    b) increased awareness that everything has a location: problem-solving and innovation are place-based
    c) context matters: ubiquity of location linked to citizen science and crowdsourcing
2. Technological dimension
    a) very rapid development of disruptive technologies (machine learning, artificial intelligence, digitization,…)
    b) in parallel, an increase of data availability that leads us to the question of data quality and open standards
    c) increasing data availability does not necessarily mean that this data can be transformed into useful information and knowledge: think about integration, interoperability, multidisciplinarity
3. Economic dimension
    a) climate change / “climate chance”: think about where the money is coming from – ROI
    b) circular economy
    c) sharing economy
    d) public (national and sub-national) are a key user group that have the mandate to tackle territorial challenges (global and local) with limited resources: public users are the only clients in certain domains (emergency management, for example): global challenges are local, limited expenditure capacity of public authorities requires also shared technological solutions to improve cost-efficiency, transparency, accountability,…

Q2: What does this mean in terms of profiles?

Basic assumption: think about the future – native digitals with confidence and easiness with networking, crowdsourcing, peer-to-peer learning and collaboration (in terms of soft skills, beyond the use of technologies)

Set of skills:

- Soft skills
- Problem-solving
- Capacity to foresee innovation (not only current innovation management)
- Thinking in terms of vision
- Adaptability and flexibility (we do not know what is awaiting us) – agile thinking
- Communication skills: from translation to synthesis – it's not about speaking of Earth Observation but about saving lives
- Skills integration reflects the need for technology integration. Approaches: Value chain: there needs to be an understanding of the entire value chain (from upstream to downstream) as those who design satellites systems have to understand that they will impact the data production and services development in response to specific needs in a broad range of application domains. It doesn't mean that you have to be an expert at 360°, but understand the value chain and the collaborative dimension between the different links along the chain.

Q3: What does this mean in terms of new job profiles?

1. DATA BROKER[4]… however…
2. "I am nobody without the subject matter expert"...
3. which brings us back to the question of tackling the context of multi/inter/intra/big and the ability to work in teams and capacity to work with different stakeholders ("put the language into")

"Future is about what you can do, not about what you cannot do". John Wilson.

4. Panel session

The main purpose of the panel discussion on May 30, organised by Mónica-Miguel Lago (P18 - EARSC), was to collect expert judgments on specific needs for education and training, including life-long learning, training on the job, etc. Also, the current skills levels should be assessed in terms of match or potential mismatches with the requirements from different sectors (public

[4] According to Gartner a data broker "... is a business that aggregates information from a variety of sources; processes it to enrich, cleanse or analyze it; and licenses it to other organizations." https://www.gartner.com/it-glossary/data-broker

administrations, SMEs, large industry, etc.) in order to enhance employability. The panel was continued on May 31st with the contributions from the European Commission.

4.1 The panellists

The panel session gathered six experts with different profiles, background and experience. The panel included experts at international (ESRI, GEO and UCGIS), European (SatCen and GMV) and national (IGN). The panel also intend to balance the presence of different stakeholders such as: industry (with a big company as ESRI and a SME like GMV); academy (UCGIS), EU agency (SatCen) and national agencies (IGN).

Panellists were (panellists' short bios could be found in the annex 7.1):

- Michael Gould - ESRI (MG)
- John P. Wilson - UCGIS (JW)
- Álex Arnal - SatCen (AA)
- Steven Ramage - GEO (SR)
- Amaya Atencia - GMV (AAY)
- Bruno Pérez - IGN (BP)

Participants in the panel session (May 30th)

4.2 Panel organisation

As moderator, EARSC stimulated the discussion around bridging the skills gap between supply and demand of education and training in the EO/GI sector.

Each representative on the panel was asked to make short, sharp interventions presenting his/her point of view with regard to:

- gap between the offerings of academic and of vocational education and training
- uptake of existing EO services due to a lack of specialized technical and scientific skills, what is needed to make this uptake happen fluently?
- how to scale up a sector skills strategy into national perspectives?
- geospatial technology is now empowering IT-enabled services and optimizing engineering workflows and business processes: how will this affect the new skills?
- geospatial industry is now open to larger market drivers, creating new growth opportunities. Giving the value of geospatial knowledge for users became a determining factor for successful integration, how this could be integrated into the skills strategy?

Then, as moderator EARSC formulated a couple of questions for each of the panellists aiming at engaging into a lively discussion. The full set of prepared questions could be seen in the annex 7.5. The last part (last 15 minutes) was used for a “lightning round” whereby audience was invited to comment on the overall discussion.

The same was done during the second day (May 31st) for the 'Open discussion and comments on the demand for space/geospatial education and training workshop' continued with EC experts, and the last part was used for a “lightning round” whereby audience was invited to join the discussion.

4.3 Panel discussion and main outcomes

Q1: Panellists opinion on the gaps between the offerings of academic and of vocational education and training

Steven Ramage pinpointed that the **pace of change of technology is moving much faster as the academy**, and curriculum can hardly follow technological developments, therefore training development will be a best effort initiative. Although difficult to implement, it’s important to provide flexibility and track the progress of the training plans.

Alexandre Arnal indicated that SatCen is a Copernicus data user and a training centre as well (https://www.satcen.europa.eu/what-we-do/training). Because they have perceived the mismatch between training offer and needs inside the agency but also companies, they have developed a special training in-house to overcome it. SatCen own training program covers a variety of topics such as imagery, data models, standards, reporting, radar, etc., and also project management

courses. This is particularly relevant in terms of workflows inside the institution and specific training. Not just newcomers have to be familiarised with the technologies and standards they are using, but there is also a continuation training programme for personnel.

Amaya Atencia Yépez elaborated on Alexandre's comment and explained the idea about giving added value to the group with **people ready to cover the whole spectrum of the added value chain.** The difficult part is to find broad profiles covering the whole workflow from user needs to application design, giving the fact that people tend to be specialised in a topic, rather than having a holistic view. Therefore, there is a demand of professionals with a balance between a 'global understanding' of the tasks and skills in the domains or market sectors (verticals). There is a need in training people for a global inclusive understanding "**global mindedness**".

Michael Gould encourages various domains to combine their skills with GIS skills. i.e. looking general profiles, not just geography. In the same vein, Michael encourages to use software from different fields and having experts with geospatial knowledge involving different disciplines across University **"involving disciplines".**

Bruno Pérez informed about the examination process for becoming a civil servant. Civil servants profiles usually have a proven theoretical knowledge, but they lack the practical part. In most public institutions, they demand for training to the institution they belong to, they organise training themselves or ask companies to organise it, because there is an increasing awareness of what can be done with geodata. "**Transversal skills**" as part of the training in public administration

John Wilson considered **"Geo" as core competence for different training and sectors**, to be cultivated from high schools. This can be checked in the interest of the online master program University of Southern California has with 50 graduates per semester – 400 over the last years; 100% placement of graduates. They are also creating a new joint master about "Spatial economics and data science" and further development on training about Earth Observation focus. John also explained how they bridged stakeholders in trying to anticipate opportunities having a distinctive trademark and mixing ideas. They use different methods in combination: (1) building relationships with companies, (2) place students in internships and (3) giving prices for undergraduate research.

Q2: Uptake of use of Copernicus services – what can help to make uptake happen fluently and how can training support it

Steven Ramage believed that a solution of user's uptake of Copernicus services could be into include **highly qualified people specialised in other areas, and then train them in geospatial**. This idea was also present in Michael Gould's presentation.

John Wilson said that online teaching courses are the same as the classroom learning classes, there is no difference. On the top of that Michael Gould suggested that other forms of training: MOOCs, hackathons… entrepreneurs could play a role because they look their own way outside University curricula.

About the uptake of EO services, Steven Ramage linked the fragmentation of information and resources to the need of training for using Copernicus services. The Network of Networks (also considered under EO4GEO) might facilitate the awareness establishing and maintaining lines of communication with stakeholders. Resources are hard to find and there are no clues about where to go to search or find them. People do not need to know about complexity, things should be kept simple (simplicity will help on awareness). Alexandre Arnal opinion about that was related with Copernicus as a demand service and the need of translating user requirements into product requirements. Most of the times users do not know exactly what they want. Copernicus skills can just be provided on the job (learning by doing). **This is not about developing special training for helping users, but about mentoring and experience instead** (**how can benefit from the experience).**

Amaya Atencia Yépez pinpointed that users need to be close to the Copernicus data (e.g. using Copernicus Data and Information Access Services, DIAS) in order to explore its capabilities. Users from different disciplines are clear users of EO, and sometimes they do not even know that Copernicus data are free. On the other hand, for businesses, a return of the investment is required. – who are the users that pay for an application in the end? (Paying customers)

Bruno Pérez asked for a coordination between all agencies at all levels European, national or regional. On this behalf Amaya Atencia Yépez asked Bruno Pérez a question about how IGN (as a National Agency) could enforce the use of EO data? BP first answer was about the different languages companies and public agencies are speaking. John Wilson suggested accreditation programs as a possible solution to that, and the fact that there is an increasing number of universities are looking for this kind of accreditation. Amaya Atencia Yépez presented directives such INSPIRE or the Common Agricultural Policy (CAP) of the European Union. The latest aims at improving the European agricultural productivity in a sustainable manner. For example, the Sentinels for Common Agricultural Policy - **Sen4CAP** project aims at providing to the European and national stakeholders of the CAP validated algorithms, products, workflows and best practices for agriculture monitoring relevant for the management of the CAP and this could be taken as example of policies driving development and training programmes.

Closely related to that, Steven Ramage pointed at governments as responsible to raise awareness of open data and the money that could be saved by its use.

At that point some attendants also contributed to the discussion, Valerio Tramutoli (P9 - UNIBAS) also mentioned the missing profile of an EO specialist covering all the workflow with an understanding of the needs of the application, not only being able to develop these applications but with a full set of skills. There is not a single curriculum for this kind of profile, at least having the understanding of all the chain or having some basic knowledge of everything, suitable for developing downstream services in the market. He also pinpointed **the important role public administration play in the use of EO data**. Universities are not just transferring but producing new knowledge out of it. From a company point of view Amaya Atencia Yépez agreed in the need of a profile with a general view of the whole process, recognising there is a gap beyond industry

capabilities and downstream services. Steven Ramage also suggested satellite missions and space agencies covering the whole workflow and lessons that could be extracted from that communities.

Valerio Tramutoli also commented on the importance of pushing the regulations, at European or national level, to define and push the public demand in order to move the market "**Public entities as customer of geoinformation"**

Q3: Is geoinformation and geospatial a sector itself? Are they getting closer? Is there a need to define the sector currently called EO/GI? Do we need to combine the two sectors?

There is the tendency to count the two sectors EO/GI together regarding financials and market share – geospatial technologies. The potential market grew and will continue to grow, because the two sectors were combined.

John Wilson said the important thing is to share the tasks and find people who bring in their competencies, for instance doing proof of concept and solve problems, which are the technologies and move forward. The name of the discipline/s is not so important if we get an answer for the questions.

For Bruno Pérez and Alexandre Arnal having a harmonised BoK would be useful and it could be much appreciated if a consensus could be reached among stakeholders.

For Amaya Atencia Yépez education is a key value. Supporting user uptake/ EO is at the basis of knowledge for the society. Also for Steven Ramage, there is a need for understanding the whole value chain: role / users … we do not have to reinvent the wheel. The "**value approach**" is another element that will help on adoption of EO/GI. On the other hand, for MG there is a clear need for working hard on the user uptake: If people would need the solution there would be immediate uptake.

During the second day as we did May 30th, Emanuele Barreca and Nuria Moyes also contributed to the discussion.

Q4: Improving the awareness about Skills Development and monitor progress made discussing EO/GI skills awareness seems needed, will be the Copernicus Ecosystem Workshop the right context?

Emmanuel Barreca brought into the discussion the **Copernicus Networks** (Relays / Academy) and in general how to boost the **Copernicus Ecosystem**. It has been suggested to bring sector skills topic in future agenda discussions.

Q5: From your experience with the European Skills/Competences, Qualifications and Occupations (ESCO), how EO4GEO should build on the previous work done by the European Commission and sectoral partners addressing sector skills mismatches?

Nuria Moyes proposed the contribution of EO4GEO into their **classification system.** The common reference terminology can help make the EO/GI sector more effective and integrated. Therefore, she was glad to understand that EO4GEO will analyse skills, competences, qualifications and occupation for the EO/GI sector.

Emanuele Barreca (DG Grow) and Nuria Moyes (ESCO) during their interventions in the discussion panel (May 31st)

5. Conclusions, Outcomes and Workshop Evaluation

Maria Andrzejewska (UNEP-GRID, P20) prepared a short wrap-up of the workshop. The workshop allowed for exchange of ideas, presented perspectives related to different participant's backgrounds. Overall, the workshop has been the occasion to get important input by high level stakeholders in the geospatial field, with different perspectives and consequently different and complementary inputs.

From the GI industry perspective for example, personnel should have data-oriented curricula, but with the capacity of collecting the data needed (with the proper level of quality) for different applications and the knowledge of the procedures for processing the data. Training within a company should target guidance and orientation, leaving to practical experience, as training on the job, the acquisition of additional skill. A multidisciplinary approach and integration capacity are also important skills, for example in Smart City applications.

As a general conclusion, it is outlined the demand for soft skills in problem solving, to support user uptake, also with vision about technological trends and innovation capacity to complement technical skills. Therefore, the **main outcomes** from the workshop were:

- Skills other than technical are paramount to cope with future societal challenges, soft skills particularly. This also entails a multidisciplinary approach, integration, and socio-cultural competence.
- From a technological point of view, data-centred curricula are getting more important, to be capable of dealing with data in any step from creating to storing
- Awareness raising on Copernicus data availability, taken into account the requirements of users outside the core EO/GI sector.
- Training of other professionals than GI experts, in order to convey geo-spatial as a core, transversal competency
- Experts need to cover the full spectrum of the value chain, at different levels of specialization, but with a general understanding
- The advancement of technology may exceed the capacity of undergoing extended academic education, there is a need to look for complementary training methods
- Several continuous training methods could be used: in-house training, MOOCs, online, mentoring, etc., in response to the dynamic needs of the sector on up-to-date professionals
- Public administration could play a key role in professionals' development asking for services to make Copernicus data use more dynamic and business models adaptive
- Importance of Agenda 2030 - demand for a broad range of data to monitor its implementation.

The workshop attendants were asked to evaluate the workshop with the questionnaire provided in Annex 7.6. The results of these evaluations were highly positive, with an overall rating of the workshop with 4,6 points on a scale between 1 (poor) and 5 (optimal). This positive evaluation is supported by the fact that 31 out of 32 respondents would recommend an upcoming EO4GEO Workshop to their friends/colleagues. A section of the evaluation included questions related to the expected impact of EO4GEO, which will be followed-up by WP9. Details on the evaluation of further aspects of the workshop, i.e. organizational issues, introduction to the project, thematic presentations etc., can be found in Annex 7.7.

6. Next steps

As next step for the analysis of the demand for space/geospatial education and training within EO4GEO, it would be necessary to get additional inputs from the running survey, currently unbalanced with answer mainly from the Academy world, by stressing in particular inputs about the company demand. All the partners and the EO4GEO "Community" are expected to contribute to this important challenge.

7. Annexes

7.1. Speakers and experts' short bios

Panellists & speakers

Álex Arnal (SatCen) www.satcen.europa.eu
Alexandre Arnal is a Project Officer for the Copernicus Service in support to EU External Action (SEA) at European Union Satellite Centre (SatCen). He holds a Degree in Technical Surveying Engineering and a Master's Degree in Transportation, Land and Urban Development from the Polytechnic University of Valencia (Spain) and a Master in GIS from ESRI (Spain). Before joining the SatCen, he worked in different sectors related to geospatial technologies both in public agencies and private companies.

Amaya Atencia Yépez (GMV) www.gmv.com
Amaya Atencia Yépez is the Business Manager Executive at GMV on the domain Earth Observation (EO) for Payload Data Processing Facilities and Remote Sensing Applications and Infrastructures. As Business development Executive Amaya Atencia is leading Earth Observation Payload Data Processing and Remote sensing Applications commercial actions both at European and international level, and coordinating EO commercial activities across divisions and countries within GMV. Amaya holds a M. Sc. degree in Mathematics, Astronomy and Geodesy at University Complutense of Madrid. She has more than 12 years of experience working in the Space Business in several areas. Her specialties are Space, Earth observation, System Safety and Engineering, Critical Systems, Space applications, Business development, strategy and negotiation. GMV is a multinational industrial group, privately owned company devoted to engineering, software development and turnkey systems integration for the aerospace and defense markets. GMV has been providing high quality solutions since its creation in 1984 and has a remarkable international experience in cooperation with the most relevant international institutions and organizations in its target markets. Throughout these years, GMV has been involved in consultancy, specification, design, implementation, deployment, maintenance and operations of different systems in the areas of satellite control centres, remote sensing and data processing, flight dynamics, mission analysis, mission planning and navigation systems and applications.

Emanuele Barreca (EC DG Grow) https://ec.europa.eu/growth/index_en
At university, I started with a 3+2 cycle in Economics and Management of Innovation and pursued with an international master on management of space programmes. After a strong international work experiences in the private sector (i.e., PWC and Toyota Motors Europe), I achieved my target: working for EU space programmes inside the EU Commission Space directorate. What moved me targeting a career in the public space sector is the deep belief that the key for a better future is to create the conditions for the optimal progress brought by key new technologies applications. EU political commitment towards an ideal knowledge-based society

inspires me and programmes like GALILEO and COPERNICUS, are contributing to the creation of a worldwide integrated information system to face Earth-Societal challenges such as: the Climate Change, Food and Energy sustainability, Health and Education conditions equity.

Michael Gould (ESRI) www.esri.com

Michael Gould studied GIS (PhD 1994 Univ Buffalo) and has been teaching and researching in Spain since then. He helped create the Erasmus Mundus masters degree in Geospatial Technologies, and the Marie Curie doctoral programme "Geoinformatics: enabling open cities". In 2009 he joined Esri (Redlands, California) and is currently Global Education Manager, supporting projects in collaboration with universities and with 84 Esri offices around the world.

Nuria Moyes Prellezo (ESCO) ec.europa.eu/esco/portal/home

Nuria Moyes is a EU affairs professional, with a specialisation in education and training policy at EU level. Some of the public organisations she has worked for are the French Ministry of Economy (in the framework of the French EU Presidency in 2008) and the European Commission (SME unit). From 2010 to 2015 she developed extensive professional experience in the SME policy field, in particular regarding education and training through her experience at the French Confederation of SMEs. Today, she is public sector consultant at everis Belgium. She is currently involved in the development of the ESCO taxonomy (European Skills Competences Qualifications and Occupations) for DG Employment and social affairs (European Commission), dealing in particular with the aspects related to education and training (qualifications pillar). She provided support in the development of the occupational profiles in different sectors, in particular education.

Bruno Pérez Martín (IGN) www.ign.es

Mr. Bruno Perez is Head of the Remote Sensing Service in the Spanish National Geographic Institute. He holds a MSc in geospatial engineering by the Technical University of Madrid (Spain), including a one-year specialization in Earth Observation at the Katholieke Universiteit Leuven (Belgium). He has working experience in photogrammetry and Earth observation data processing, having been involved in several ESA and H2020 projects. Currently he coordinates the Spanish Remote Sensing Programme, aiming at the coordination of all acquisitions of satellite imagery made by Spanish Public Administrations, as wells as participates in projects related with the Group on Earth Observations (GEO) and Copernicus.

Steven Ramage (GEO) www.earthobservations.org

Steven Ramage leads global stakeholder engagement and external relations for the intergovernmental Group on Earth Observations (GEO) addressing climate change, disaster risk reduction, urban resilience and the United Nations sustainable development goals. During his career Steven has successfully completed a management buyout, created a government consulting business which he managed, and was on the Board and subsequently Director of Strategy for a London startup - all in the spatial domain. He's a Visiting Professor at the Institute for Future Cities, University of Strathclyde, a SASNet Fellow at the Urban Big Data Centre at the University of Glasgow and a Visiting Lecturer at the University of Geneva in the Institute for Environmental Sustainability. He works internationally with many of the GEO government and partner members, and leads private sector engagement at GEO. Steven is also part of EO4GEO advisory board.

John Wilson (UCGIS) www.ucgis.org

Dr. John P. Wilson is Professor of Sociology and Spatial Sciences in the Dana and David Dornsife College of Letters, Arts and Sciences at the University of Southern California where he directs the Spatial Sciences Institute as well as the Wilson Map Lab. He also serves as GIS Lead for the Spatial and Exposure Analytics Core in the Southern California Environmental Health Sciences Center, and holds faculty appointments as Professor in the USC School of Architecture, the Keck School of Medicine of USC's Department of Preventive Medicine and the USC Viterbi School of Engineering's Departments of Computer Science and Civil & Environmental Engineering as well as the Institute for Geographic Sciences and Natural Resources Research in the Chinese Academy of Sciences. He also serves as the Editor-in-Chief of Transactions in GIS (Wiley-Blackwell) and the Geographic Information Science & Technology Body of Knowledge project sponsored by the University Consortium for Geographic Information Science. His research focuses on the modeling of human and environmental systems and makes extensive use of GIS tools, spatial analysis, and computer models. He has published numerous books and articles on these topics, including Environmental Applications of Digital Terrain Modeling (Wiley-Blackwell, 2018) and two edited volumes, Terrain Analysis: Principles and Applications (Wiley, 2000) and the Handbook of Geographic Information Science (Blackwell, 2008). Much of this work is collaborative and cross-disciplinary with the goal of improving our understanding of the factors linking people, the environments, and human well-being. The work of his lab group can be seen at http://johnwilson.usc.edu/. John is also part of EO4GEO advisory board.

Experts

Margarita Caletrio Arcos (ICV)
Engineer in Geodesy and Cartography and Technical Engineering in topography from the Polytechnic University of Valencia. Margarita also has advanced studies in thematic cartography with a specialization in metadata catalog. She works as a technician at the Institut Cartogràfic Valencià (ICV)

César Coll (UVEG)

César Coll received the B.Sc., M.Sc., and Ph.D. degrees in physics from the University of Valencia, Spain, in 1989, 1992, and 1994, respectively. Since 2010, he is a Professor of Earth Physics with the Department of Earth Physics and Thermodynamics, Faculty of Physics, University of Valencia. His research interest focuses on the physical processes of thermal-infrared (TIR) remote sensing, atmospheric and emissivity corrections, temperature-emissivity separation, and ground validation of TIR products from AATSR, MODIS, ASTER and other satellite sensors. He has published more than 60 papers in SCI international journals. Dr. Coll is currently the director of the Remote Sensing Master's degree program of the University of Valencia.

Laura Díaz (UN)
Laura Diaz (Computer Scientist, University of Valencia, 2000) (Geospatial Technologies PhD, University of Castellon, 2010) has developed her professional career in different countries working for public and private sector as well. She has participated in multiple R&D projects in the context of GIS. She is the author of research papers about geospatial services interoperability and hybrid GI infrastructures for the generation and publication of GI. She is currently working for the UN as Data Scientist in the domain of the Intelligence Analysis as part of the Situational Awareness Program of DFS.

Luis Dueñas Domingo (ICV)
Luis is engineer in Geodesy and Cartography from the Polytechnic University of Valencia. Technical Engineer in Topography from the Polytechnic University of Madrid. He works as a technician at the Institut Cartogràfic Valencià (ICV)

Joan Massó (CREAF)
Since 1995 he is a researcher at CREAF and GIS developer. Co-creator of the MiraMon compressed map and the MiraMon Map Reader idea in 1997; the first MiraMon technology for Internet distribution. Teacher in a RS and GIS master in the UAB. Creator of Remote Sensing imagery visualization and download web data portals with MiraMon owned technology. Expert in JPEG2000 and topologic GIS formats. He is involved with professional/scientific bodies: He is an active member of the TC of the Open Geospatial Consortium (OGC) since 2003 (editor OGC 07-057r7 WMTS, OGC 13-082r2 simple profile, OGC 12-108 GMLCOV for JPEG2000 and 08-085r2 GMLJP2 v2 standards), in OGC Testbeds (OWS6, OWS7, OWS8, OWS10, Testbed11 and

Testbed 12 resulting in several Public Engineering Reports such as OGC 15-053 JSON and GeoJSON), and chair of the Iberian and Latin American Forum and member of the Opengeospatial Architecture Board OAB for 1 year. Spanish representative in the ISO19115-1 and ISO 19157 and editor of ISO19165 Data and Metadata preservation standard candidate. He coordinated the GeoViQua FP7 project (Visualization of quality information in GEOSS) and is coordinating H2020 ConnectinGEO and H2020 WaterInnEU and participated in H2020 ECOPotential and the H2020 ERAPlanet as well as some other national (e.g. Fenodato) and local projects related both with remote sensing and geospatial standards and applications. Earth and Space Science Informatics (ESSI) division president in the European Geosciences Union (EGU). Member of the GEO Program Board, GEO Standards and Interoperability Forum, and GD-06 in-situ coordination GEO Tasks. GEO Spain users forum Chair.

Jorge A. Recio (UPV)
Dr. Jorge A. Recio teaches remote sensing, digital image processing and GIS at Valencia Polytechnic University (Dept. Cartographic Engineering, Geodesy and Photogrammetry), and has been a visiting researcher at Institut für Photogrammetrie und GeoInformation (Leibniz Universität Hannover). His research focuses on LULC classification and change detection using object-oriented image analysis; update of spatial database, LiDAR methods and applications in forest structure, attribute estimation and mapping. His ongoing research has to do with the application of object-based classification methods for LULC geodatabase updating; the design of multitemporal descriptive features to detect environmental changes; and the analysis and mapping of forest structure and fuel variables from discrete and full-waveform LiDAR data.

Santiago Yudici Oliver (ICV)
Santiago has a degree in Geodesy and Cartography from the Polytechnic University of Valencia (UPV). Doctor from the University of Santiago de Compostela. Santiago is the head of the Cartographic Projects Service of the Institut Cartogràfic Valencià (ICV). He also works as an associate professor of the UPV in the Department of Architectural Graphic Expression.

7.2. Workshop agenda

With the support of the Erasmus+ Programme of the European Union Sector Skills Alliances N° 591991-EPP-1-2017-1-IT-EPPKA2-SSA-B

EO4GEO Workshop
Castellón de la Plana (ES), 30th May 2018

Workshop on demand for space/geospatial education and training

May 30th 2018, from 09.30 to 16.30

09:30-09:50	Welcome and Registration
09:50-13:00	**Workshop on demand for space/geospatial education and training (Morning session)** Chair: Joaquín Huerta (UJI)
10:00-10:20	Introduction to EO4GEO (Milva Carbonaro, GISIG) and objectives of the workshop (Estefania Aguilar Moreno, UJI)
10:20-10:40	Skills requirements in the GI/EO sector: the perspective from a big GI company (Mike Gould, ESRI)
10:40-11:00	The need for GI/EO skills to tackle global challenges (Steven Ramage, GEO)
11:00-11:30	Coffee break
11:30-11:50	Skills and occupation requirements: first lessons learned from the survey on demand (Barbara Hofer, PLUS)
11:50-12:00	Introduction to the breakout groups (Stefan Lang, PLUS)
12:00-13:00	Breakout Groups will discuss 2 or 3 questions Group 1 "Workforce"- Chaired by Peter Zeil (SpaSe) Group 2 "VET"- Chaired by Rahul Bansal (Climate-KIC) Group 3 "Future" - Chaired by Marc Olijslagers (KU Leuven)
Lunch 13:00-14:30	
14:30-16:30	**Workshop on demand for space/geospatial education and training (Afternoon session)** Chair: Joaquín Huerta (UJI)
14:30-14:50	Developing a new Body of Knowledge as a basis for curriculum design: the US experience (John Wilson, UCGIS)
14:50-15:00	What did we learn from the breakout: quick 3' summary of the findings for each group (Respective rapporteurs)
15:00-16:10	Panel discussion GI/EO skills requirements with representatives from different sectors chaired by Mónica Miguel-Lago (EARSC) - Alex Arnal (SatCen) - Mike Gould (ESRI) - Steven Ramage (GEO) - John Wilson (UCGIS) - Amaya Atencia (GMV) - Bruno Pérez (IGN)
16:10-16:30	Wrap-up: conclusions of the day (Maria Andrzejewska, UNEP-Grid) and next steps (Giorgio Saio, GISIG)

7.3. List of attendants

N.	ACRONYM	NAME
1	GISIG	Giorgio Saio
2	GISIG	Milva Carbonaro
3	GISIG	Silvia Gorni
4	KU Leuven	Marc Olijslagers
5	KU Leuven	Maria Da Saudade De Brito Pontes
6	PLUS	Stefan Lang
7	PLUS	Barbara Hofer
8	UJI	Joaquín Huerta Guijarro
9	UJI	Sven Casteleyn
10	UJI	Estefania Aguilar
11	UJI	Carlos Granell
12	UJI / ESRI	Michael Gould
13	UJI	Aida Monfort Muriach
14	UJI	Francisco Ramos
15	GEOF	Krtalić Andrija
16	UPAT	Kazantzidis Andreas
17	FSU-EO	Martyna Stelmaszczuk-Górska
18	UT-ITC	Lemmens Rob
19	UNIBAS	Valerio Tramutoli
20	UNIBAS	Valeria Satriano
21	UNIBAS	Giuseppe Scanniello
22	IGiK	Marek Baranowski
23	Planetek	Daniela Iasillo
24	IGEA /Maribor University	David Podgorelec
25	EPSIT	Giacomo Martirano
26	NOVOGIT	Anders Ostman
27	GIB	Greger Lindeberg
28	Spatial Services	Peter Zeil
29	CLIMATE-KIC	Kevin Ramirez
30	EARSC	Monica Miguel-Lago
32	UNEP-GRID	Maria Andrzejewska

32	NEREUS	Ilaria d'Auria
33	VITO	Erwin Goor
34	CNR-IREA	Mario Angelo Gomarasca
35	VRI IES	Inese Suija - Markova
36	ISPRA	Valerio Comerci
37	ISPRA	Tiziana Del Monte
38	HEI-RGEO	Tobias Matusch
39	UCGIS	John Wilson
40	GEO	Steven Ramage
41	UN	Laura Díaz
42	IGN	Bruno Pérez
43	EU SatCen	Alexandre Arnal
44	U. Valencia	César Coll
45	ICV	Santiago Yudici
46	ICV	Margarita Caletrío
47	ICV	Luis Dueñas
48	GMV	Amaya Atencia
49	U. Polytechnic València	Jorge Recio
50	UJI	Fernando Benítez
51	UJI	Mohamad Mehdi Moradi
52	UJI	Diego Pajarito
53	UJI	Ngo Manh Khoi

7.4. Breakout groups – Topics and questions

Workshop on Demand for Space/Geospatial Education and Training - 30.05.2018

Objectives of the interactive discussions in breakout groups during the workshop on demand for space/geospatial education and training are:

- to discuss preliminary findings of the EO4GEO survey on workforce demand,
- to assess specific needs of the space/geospatial market regarding training supply,
- to collect views on future developments and drivers on the space/geospatial market.

Group 1 Workforce - Required competencies of job applicants and employees (Chaired by: Peter Zeil, Spatial Services)

- Respondents of the survey on workforce demand indicate that most job applicants fulfill the requirements of the announced job only partially, independently of the requested profile. Are there skills that are typically lacking? Are those skills of technical nature or related to a lack of experience or 'soft skills'?
- Most organisations provide training for their employees and inhouse training is important besides workshops and online courses. What are typical topics covered by inhouse training? When is external training prefered over inhouse training?
- Skills currently requested for space/geospatial experts relate to artificial intelligence and big data among others. How does your organisation deal with such developments? Do you train existing employees or employ additional experts?

Group 2 VET – Vocational education and training and professional training as opportunities for the space/geospatial market (Chaired by: Kevin Ramirez, Climate KIC)

- The survey on workforce demand shows that the majority of respondents have a master of PhD degree and indicates a need for applicants with a master or PhD degree. What are the decisive differences between employees with a master/PhD degree and employees with a bachelor/VET/professional degree? Are there specific deficits to be expected from the latter group, and if yes which / which type of?
- Do you see the potential to foster user uptake through focused training at vocational or professional levels? Which are examples of jobs for which VET/professional training currently is sufficient in the space/geospatial sector?
- If you were to design a VET program – which space/geospatial skills are essential for such a program?

Group 3 Future - Future drivers of the space/geospatial market and required skills (Chaired by: Marc Olijslagers, KU Leuven)

- What are drivers for the development of the space/geospatial market and how can training of workforce support the development of the sector?
- Job profiles currently requested are 'remote sensing technician', 'GIS developer', 'data analyst' etc. – these profiles have a high expectation regarding the technical space/geospatial skills of the workforce. Will these specialized profiles remain at the core of the space/geospatial sector?

- Which new job profiles might gain importance to assure the future of the sector? For example integration of domain knowledge with space/geospatial skills? Or the combination of business knowledge and space/geospatial knowledge?

7.5. Panel session – Topics and preparatory questions

Alex Arnal (AA)

- *As entrusted entity of Copernicus services, what steps can be made in the harmonization of the training process? To what extent do you believe this can help the skills strategy?*
- *What are your expectations with regards to uptake of core products in downstream markets? How does this programme could be linked into the training activities you are developing?*

Mike Gould (MG)

- *In your view, what are the main elements that could help to bridge the gap between specialized technical/scientific and business skills for entrepreneurs? Could R&D activities help in that context?*
- *In your experience in the supply of training but also on the demand side of employees, what will be your recommendations?*

Steven Ramage (SR)

- *In 2015, the study "Space market uptake in Europe" published by the European Parliament, highlighted that the lack of specialised technical and scientific skills could prevent also private enterprises from exploiting the opportunities offered by space data, what is the current status of EO sector skills all around the globe and the future perspectives?*
- *Which are in your opinion the main barriers or elements that need to be addressed in order for eo4geo to better address the sector skills strategy?*

John Wilson (JW)

- *In relation with the demand side, what considerations could be improved?*
- *Following your academy experience, how the project should assess the current skills shortages and mismatches and to monitor evolution?*

Amaya Atencia Yépez (AAY)

- *Being involved as a contractor in the supply of several Copernicus Services, where do you think the most meaningful improvements in training can be made?*
- *In your experience both as a contractor for the supply of Copernicus Services and a company offering added-value services, what do you believe could be improved in terms of demand of skills for the future employees?*

Bruno Pérez (BP)

- *What are in your opinion the main elements that need to be addressed for the industry to build better competencies and skills towards the improved involvement in the supply of the service?*
- *What are in your view the steps that need to be taken to bridge the demand of skills and anticipate the sector needs in relation to those skills?*

Emanuele Barreca (EB)

- *The Sector Skills Strategy is prepared to influence how training is delivered in the (G)EO sector. Could you elaborate on the major key goals: Reduce skills gaps and shortages*
- *An annual session which improves the awareness about Skills Development and monitors progress made discussing EO/GI skills awareness seems needed, will be the Copernicus Ecosystem*

Workshop in October the right context? Will you support the inclusion of the topic in the annual Ecosystem Workshop?

Nuria Moyes (NM)

- *From your experience with the European Skills/Competences, Qualifications and Occupations (ESCO), how EO4GEO should build on the previous work done by the European Commission and sectoral partners addressing sector skills mismatches?*
- *EO4GEO promotes the cooperation of stakeholders gathering skills intelligence on the sector, how ESCO could provide recommendations to the EO4GEO project?*
- *What is your opinion translating the sectoral growth strategy into a sectoral skills strategy?*
- *There is an increase of initiatives targeting training, information, awareness raising on Copernicus. How does the Blueprint fit into this panorama, and how can EO4GEO avoid duplications?*

7.6. Quality assessment questionnaire

Co-funded by the Erasmus+ Programme of the European Union

QUALITY ASSESSMENT OF THE EVENT

1st EO4GEO Dissemination Seminar/Workshop, May 30 - 2018, Castellon, ES

Each participant in the event is warmly invited to fill in the following anonymous questionnaire, helping us to better manage and improve the quality of next EO4GEO events and to provide useful ideas for project activities.

Yours details	
You are:	☐ (1) in the EO4GEO Consortium ☐ (2) an external participant
If (2), select the category that better fits with you	☐ Local Body (Region, Province, Municipality, Regional Env. Agency, ...) ☐ National Body (Civil Protection, ...) ☐ University/Research Centre ☐ Private company or SME ☐ Professional Association/ Professional ☐ Association (pls specify: _____) ☐ Other (pls specify: _____)

From 1 (poor) to 5 (very good)

Organizational aspects	**1**	**2**	**3**	**4**	**5**
3 – Suitability of workshop venue and infrastructures	☐	☐	☐	☐	☐
4 – Functionality of computers, projectors and other facilities	☐	☐	☐	☐	☐
5 – Quality and usefulness of distributed material	☐	☐	☐	☐	☐
6 – Development of the workshop and chairman activity	☐	☐	☐	☐	☐
7 – Minimization of the environmental impact of the event	☐	☐	☐	☐	☐

From 1 (poor) to 5 (very good)

General content of the programme	**1**	**2**	**3**	**4**	**5**
8 – Interest and relevance of the covered topics	☐	☐	☐	☐	☐
9 - Expertise of the speakers	☐	☐	☐	☐	☐
10 - Clarity of the speakers in presenting their contents	☐	☐	☐	☐	☐
11 – Usefulness of the workshop for your work/activities	☐	☐	☐	☐	☐

From 1 (poor) to 5 (very good)

EO4GEO Project Presentation	1	2	3	4	5
12 – Completeness of information on project contents and objectives	☐	☐	☐	☐	☐
13 – Level of technical and scientific information on the project	☐	☐	☐	☐	☐

From 1 (totally disagree) over 3 (perhaps) to 5 (agree entirely). Blank = I don't know

Expected impact of the EO4GEO project	1	2	3	4	5
14 – The EO4GEO project will probably contribute to improved curricula and training offers within the space/geospatial field.	☐	☐	☐	☐	☐
15 – The EO4GEO project will probably contribute to increased skills in interdisciplinary and collaborative work among teachers	☐	☐	☐	☐	☐
16 – Due to the EO4GEO project, students and trainees will have better knowledge, skills and competences	☐	☐	☐	☐	☐
17 – Due to the GEO4GEO project, the students and trainees will be able to address a wider labour market	☐	☐	☐	☐	☐
18 – Due to the EO4GEO project, private companies will be able to discover new business opportunities	☐	☐	☐	☐	☐
19 – Due to the EO4GEO project, private companies will be able to offer new solutions in emerging fields	☐	☐	☐	☐	☐
20 – The long-term action plan will most likely be one important source of information and inspiration when your organisation initiates further developments.	☐	☐	☐	☐	☐
21 – The EO4GEO project will most likely reduce the gap between what education and training is currently provided and what knowledge, skills and competences are required by the labour market.	☐	☐	☐	☐	☐

From 1 (poor) to 5 (very good)

Evaluation of Thematic presentations	1	2	3	4	5
22a – Skills requirements in the GI/EO sector: the perspective from a big GI company (Mike Gould, ESRI)	☐	☐	☐	☐	☐
22b – The need for GI/EO skills to tackle global challenges (Steven Ramage, GEO)	☐	☐	☐	☐	☐
22c – Skills and occupation requirements: first lessons learned from the survey on demand (Barbara Hofer, PLUS)	☐	☐	☐	☐	☐
22d – Developing a new Body of Knowledge as a basis for curriculum design: the US experience (John Wilson, UCGIS)	☐	☐	☐	☐	☐

Overall grading of the event	1	2	3	4	5
23 – from 1 (poor) to 5 (very good)	☐	☐	☐	☐	☐

General evaluation	Yes	No
24 - Would you recommend a next EO4GEO event to a friend/colleague of yours?	☐	☐
If "No", please motivate and indicate suggestions to improve the organization or the content of the events:		
25 – Would you be interested to participate in evaluating and give contributions to the core deliverables of the project (the sector skills strategy, the Body of Knowledge, the EO curricula, the learning material, the long-term action plan etc)?	☐	☐
If "No", please motivate: If "Yes", please provide your e-mail address (*): _____		

(*) Privacy statement: in accordance with Art.13 of L. Decree 196/03 and Art. 13 of Regulation (EU) 2016/679 , the GISIG Association, EO4GEO project coordinator, wants to inform you that your contact data are acquired and processed using the support of telematics, hardcopy and IT means in full compliance with the Privacy Code and the GDPR.

Your personal information is collected, stored and used to contact you in relation to the purposes stated under Q20 above and to keep you informed about the activities of the EO4GEO project.

You can exercise at any time the right to be removed from the EO4GEO mailing list by contacting gisig@gisig.it.

THANK YOU!

7.7 Quality assessment questionnaire analysis

in the EO4GEO Consortium	29
an external participant	5
	34 TOTAL
Local Body	
National Body	1
University/Research Center	13
Private Company or SME	5
Professional Association/Professional	1
Assocaition (pls specify:……)	
Other (pls specify:……)	2

Organizational aspects	1	2	3	4	5	Media
Suitability of workshop venue and infrastructures		1	1	9	23	4,6
Functionality of PCs, projectors adn other facilities				8	26	4,8
Quality and usefulness of distributed material			1	11	19	4,6
Development of the workshop and chairman activity				8	26	4,8
Minimization of environmental impact of the event		4	10	8	12	3,8

General contents of the programme	1	2	3	4	5	Media
Interest and relevance of the covered topics				7	27	4,8
Expertise of the speakers			1	5	28	4,8
Clarity of the speakers in presenting their contents				9	25	4,7
Usefulness of the workshop for your work/activities		1	1	10	22	4,6

EO4GEO Project Presentation	1	2	3	4	5	Media
Completeness of information on project contents and objectives			1	11	22	4,6
Level of technical and scientific information on the project			2	16	16	4,4

Expected impact of the EO4GEO	1	2	3	4	5	Media
The EO4GEO project will probably contribute to improved curricula and training offers within the space/geospatial field.			5	16	13	4,2
The EO4GEO project will probably contribute to increased skills in interdisciplinary and collaborative work among teachers		1	6	15	11	4,1
Due to the EO4GEO project, students and trainees will have better knowledge, skills and competences			6	19	9	4,1
Due to the EO4GEO project, the students and trainees will be able to address a wider labour market			7	13	11	4,1
Due to the EO4GEO project, private companies will be able to discover new business opportunities		1	10	10	9	3,9
Due to the EO4GEO project, private companies will be able to offer new solutions in emerging fields		1	11	13	6	3,8
The long-term action plan will most likely be one important source of information and inspiration when your organisation initiates further developments.			7	16	8	4,0
The long-term action plan will most likely reduce the gap between what education and training is currently provided and what knowledge, skills and competences are			9	14	9	4,0

Evaluation of Thematic presentations	1	2	3	4	5	Media
Skills requirements in the GI/EO sector: the perspective from a big GI company (Mike Gould, ESRI)		1		1	30	4,9
The need for GI/EO skills to tackle global challenges (Steven Ramage, GEO)		1	3	11	17	4,4
Skills and occupation requirements: first lessons learned from the survey on demand (Barbara Hofer, PLUS)			1	13	18	4,5
Developing a new Body of Knowledge as a basis for curriculum design: the US experience (John Wilson, UCGIS)			4	8	20	4,5

Overall rate of the event	1	2	3	4	5
From 1 (poor) to 5 ()				9	24

General evaluation	Yes	No
Would you recommend a next EO4GEO event to a friend/colleague of yours?	31	1
Would you be interested to partecipate in evaluating and give contributions to the core deliverables of the project (the sector skills strategy, the Body of Knowledge, the EO curricula, the learning material, the long-term action plan etc)?	21	4