

Understanding skill needs in the EO/GI sector: a job advertisements analysis

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Abstract

To increase the strategic importance of the Earth Observation and Geo-information (EO/GI) sector and strengthen the uptake of geospatial data by both the public and private sector, a mismatch between supply of education and training and the demand for skills and knowledge should be prevented. Several European policy initiatives are supporting skill assessment and intelligence to get more insight in the skills and occupational profiles that are important for the European EO/GI sector. This paper contributes to this goal through an application of a job advertisements analysis as an innovative approach for the sector to assess the EO/GI job market in Europe. Using a set of search strings based on the European multilingual classification of Skills, Competences, Qualifications and Occupations (ESCO) 118 EO/GI-related job advertisements found on LinkedIn were collected and further analysed. The results of this analysis show the importance of traditional EO/GI profiles such as cartographer and remote sensing experts, but also the existence of a large diversity of GIS profiles. In terms of skill needs it is found that more attention should be paid to skills related to ‘programming and developing’, which was identified as the most prominent skill set followed by ‘analytical methods’ and ‘pre-processing and modelling’.

Keywords: job advertisements analysis, skill needs, EO/GI, occupational profiles.

1 Introduction

The European Earth Observation and Geo-information sector is characterized by a rapid development, with a lot of new opportunities, but at the same time some major challenges (see Koutsopoulos et al., 2019; Neufeind et al., 2018). Although the sector is already of strategic importance from a policy perspective by supporting many European, national and sub-national policy domains, a lot of potential remains unused. One of the factors contributing to this is a lack of suitable specialized skills, which limits the uptake by the public sector but especially by the private sector (European Union, 2016). This is partly a consequence of a mismatch between the current supply of education and training and the demand for specific skills and knowledge. To well understand this mismatch it is essential to get more insight in the (key) skills and occupational profiles which are considered important by the European EO/GI job market. This paper contributes to this goal by introducing job advertisements analysis as innovative approach for analysing occupations and skills needed in the EO/GI sector. Before describing the methodology and results in more detail, the following paragraph provides first a short discussion of the EC policy on the new digital skills.

2 The New Skills Agenda for Europe

In 2016, the European Commission launched its New Skills Agenda to develop a common vision about the strategic

importance of skills for sustaining jobs, growth and competitiveness. The Agenda is centred around three main strands: 1. improving the quality and relevance of skills formation; 2. making skills and qualifications more visible and comparable; and 3. improving skills intelligence and information for better career choices. It contains ten different actions to make the right training, skills and support available to people in the EU (European Commission, 2016). Among these actions are the Digital Skills and Jobs Coalition, the modernisation of vocational training and education and the Blueprint for sectoral cooperation on skills. This Blueprint for sectoral cooperation on skills is a new framework for strategic cooperation between key stakeholders in a given economic sector (European Union, 2017). The Blueprint focuses on six pilot sectors, of which Space and Geo-information is one. As for all sectors, the aim is to support an overall sector skills strategy and develop concrete actions to address sectoral skills needs.

An important milestone in the achievement of the objectives of the New Skills Agenda for Europe was the release of ESCO, the European multilingual classification of Skills, Competences, Qualifications and Occupations (European Union, 2017b). ESCO provides a common reference terminology for describing, identifying and classifying skills, competences, qualifications and occupations relevant for the EU labour market and education and training, and systematically shows the relationships between the different concepts. ESCO currently contains three occupations related to the EO/GI domain: geographic information system

specialist, remote sensing technician and cartographer. For each of these profiles, a set of essential and optimal skills was defined. In total 50 different EO/GI skills were defined, of which eight skills were considered to be relevant to all three profiles. These include applying digital mapping, collecting data, using GPS, compiling GIS-data, executing analytical mathematical calculations, creating GIS reports, creating thematic maps, using digital illustration techniques and using geographic information systems. Several other skills were considered to be relevant to just one or two of the three EO/GI profiles.

3 Methodology

The study seeks to address the following research question: *What are the key skills and profiles currently required by the European EO/GI job market?* In order to answer this question, a job advertisements analysis was performed of EO/GI related job advertisements recently published on LinkedIn.

3.1 Job advertisements analysis

Job advertisements are increasingly being used in academic studies and can be seen as a rich source of information about skills and changing skill needs (Harper, 2010), specifically to get more insight in sector-specific requirements or competencies related to a specific occupation (e.g. Clyde, 2002; Kim et al., 2013; Ahsan et al., 2013; Kennan et al., 2008; Sodhi & Son, 2010). Furthermore, they are used to get more detailed information about personal transferable skills and differences in the requirement of these skills across several occupations and positions (e.g. Bennet, 2002). By analysing job advertisements, it can also become clear that employers have problems in defining the positions and the role of certain profiles, which can affect the image and attractiveness of a profile or even sector (Snyman, 2002). A job advertisements analysis can also help the development of the design of curricula (e.g. Iyer, 2009, Payne, 2008 in Harper, 2010).

Besides, being a new and innovative approach to the EO/GI sector, job advertisements are relatively easy to access which can be considered as a benefit of using them as data (Vieira da Cunha, 2009). Although especially longitudinal studies can provide insight in changing needs and shortages (e.g. Sakethoo et al., 2002; Copeland, 1997), these require a strict methodology and frequent data collection. Our research does not aim that accuracy, but provides a first test of the usefulness of a job advertisements approach for the sector, while the main aim is to provide input for other tools to bridge skill shortages and gaps.

Some other limitations related to an approach focused on job advertisements can be mentioned. First of all, not all jobs are published externally, which limit the available data for analysis (Croneis & Henderson, in Harper, 2010). Nevertheless, in general there is a high volume of data which can generate difficulties and makes a job advertisement analysis time-consuming, and goes together with a risk of over-saturation (Pickard, 2007 in Harper, 2010). Related to the content, it can be stressed that job advertisements can be ambiguous and unpredictable (Xu, 1996, in Harper, 2010), while specific legislations can result in limited information

(e.g. lack of seniority level) (Harper, 2010). Furthermore, job advertisements cannot always be seen as a current reality, but rather reflect a kind of expectable future situation, while also presenting a biased view of reality, since they do not provide insight in skills which successful candidates possess or the actual used skills in the job itself (ibid.).

3.2 Data collection and analysis

The three occupations related to the EO/GI domain that are included in ESCO were used as starting point for our research. Since each ESCO occupational profile consist of a preferred main term (e.g. geographic information systems specialist) and several other labels for the same occupation (e.g. GIS specialist, GIS analyst, GIS data specialist), we used both the main terms and the other labels for the three profiles, as search strings for collecting European job advertisements on LinkedIn (between 7th and 10th of November, 2018). The results for each search string were sorted by date, and the newest 50 results were checked. Although 38 different search strings were used, only 9 of them gave results, varying from 1 (“GIS Data specialist”) to 227 (“remote sensing”). In total 558 job advertisements were found, of which 118 were selected, since duplications and irrelevant job advertisements were not included in the analysis.

A database was created in which for each job advertisement, the job title, the company, the sector, the type of company (private, public, non-profit, university), the country, education requirements and the seniority level were stated if present. After identifying and collecting a maximum of ten skills for each job advertisement, some coding took place in which two predefined ‘skill sets’ were assigned to each job advertisement. A skill set is a group of related or similar skills. Seven different skill sets were used for categorizing and identifying the skills included in a particular job advertisement: a) Programming and Developing; b) Analytical Methods; c) Pre-processing and Modelling; d) Visualization and Cartography; e) Data Capture; f) Institutional, Organizational & Society; and g) Computing Resources and Platforms. The definition of these skill sets was strongly based on the knowledge areas as defined in the original Geographic Information Science & Technology Body of Knowledge (Di Biase et al, 2006).

4 Results

In total 118 job advertisements were included in the analysis. The majority of these were jobs in the private sector (77%). The job advertisements analysis also contained data on jobs in the academic sector (12%), public sector (9%) and non-profit sector (2%). This distribution across sectors probably has to do with the chosen platform (LinkedIn).

4.1 Occupational profiles

The investigation of job advertisements in the EO/GI domain, helped in identifying main job profiles currently needed in the EO/GI domain. Based on existing EO/GI related job advertisements, seven main profiles were detected (see Table 1): Remote sensing specialists (24% of the investigated job advertisements), GIS Developer (17%), GIS – Data –

Specialist (15%), GIS Consultant (14%), GIS Technician (12%), GIS Analyst (10%) and Cartographer (9%).

The findings from the job advertisement analysis show that:

- Cartography and cartographer still is a relevant domain/occupation, but its importance in the current EO/GI job market is relatively limited (less than 10% of all job advertisements);
- Remote sensing (specialist) constitutes the biggest part of the detected job advertisements, with around one fourth of the detected job advertisements;
- The remaining job advertisements all deal with a GIS related job or occupation, of which the most often needed are GIS Developers, GIS Specialist and GIS Consultants. This can be seen as an indication of the need to make a clear distinction between different GIS profiles, and move away from the general profile of ‘GIS Specialist’ as used in ESCO.

Table 1: Occupational profiles in EO/GI job advertisements

Occupational profiles	No.	%
Remote sensing	28	23.7
GIS specialist	17	14.4
GIS data specialist	1	0.8
GIS analyst	12	10.2
GIS technician	14	11.9
Cartography/Cartographer	10	8.5
GIS developer	20	16.9
GIS consultant	16	13.55
Total	118	100

Source: own data collection

4.2 Skills needs

The job advertisement analysis also investigated the need for particular skills in the EO/GI sector based on the recently published job advertisements. All skills included in the vacancies were collected and categorized based on the seven predefined skill sets. For each job vacancy, we identified the two most evident skill sets. It should be noticed that some vacancies only included skills related to one particular skill sets. Of the seven skill sets we used, two were rarely found in the job advertisements in the analysis (see Table 2). The skill set ‘Computing Resources and Platforms’ was hardly recognized in existing job advertisements, with 1% of the detected skills that were related to this skill set. Also the skill set ‘Institutional, Organizational and Society’ was little included in the job advertisements (3,1%). While the skill sets ‘Visualization and Cartography’ (12,0%) and ‘Data Capture’ (9,4%) clearly were more relevant in current EO/GI job advertisements, especially the three other skill sets were very present in these vacancies. With almost 27% of the mentioned skills, the skill set ‘Programming and developing’ was the most prominent skill set in the recent vacancies for the EO/GI job market. Also ‘Analytical Methods’ (26%) and the newly defined skill set ‘Pre-processing and modelling of data’ (22%) were highly relevant, according to the job advertisements.

The analysis also demonstrates the different skills needs across the three main occupational profiles, when linking the skill sets to the different profiles. Skills required by the profile of ‘GIS Specialist’ are mainly related to ‘Programming and

Developing’, ‘Analytical Methods’ and ‘Pre-processing and Modelling of Data’. The most relevant skill set for the profile of ‘Remote Sensing Technicians’ is ‘Analytical Methods’, in combination with especially ‘Programming and Developing’. Cartographers hardly need skills related to ‘Programming and Developing’, but have one dominant skill set: Visualization and Cartography. However, the job advertisement analysis revealed the existence of different underlying profiles within the profile of ‘GIS Specialist’. Many vacancies required a profile of ‘GIS Developer’, for which the skill set ‘Programming and Developing’ is dominant. The profile of ‘GIS Consultant’ on the other hand required a combination of various skills related to ‘Analytical Methods’, ‘Programming and Developing’ and ‘Pre-processing and Modelling of Data’.

Table 2: Relevance of skill sets in EO/GI job advertisements

Skill sets	No.	%
Programming and Developing	51	26.7
Analytical Methods	49	25.7
Pre-processing and Modelling	42	22.0
Visualization and Cartography	23	12.0
Data Capture	18	9.4
Institutional, Organizational & Society	6	3.1
Computing Resources and Platforms	2	1.0
Total	191	100

Source: own data collection

4.3 Discussion

The ESCO Classification, which contains descriptions of 2942 occupations and 13.485 skills, is the EC initiative to develop a common vocabulary for describing occupations, skills and qualifications. The current version of the classifications contains 3 occupations and 50 skills that are relevant to the EO/GI domain. Based on the results of our job advertisements analysis, three main recommendations can be made on how the EO/GI component of ESCO can be improved. First, our analysis clearly shows the need to rethink and revise the unique occupational profile of ‘geographic information systems specialist’. In reality, several different GIS related profiles exist, with particular skills needs and requirements. Second, also the current list of EO/GI skills as included in ESCO needs to be reviewed and updated. There is a clear need to include new skills, especially related to broader skill sets such as ‘Programming and Developing’, ‘Analytical Methods’ and ‘Data Capture’. It is especially striking that none of the ESCO skills across the three profiles is related to programming and development, while skills as “knowledge of Python in a GIS context”, “GIS Programming”, “Programming for analysis”, “development experience in C# and/or Python”, “development of GEO-ICT applications” are examples of skills found across the job advertisements. Finally, it should be stressed that more attention should be paid to soft and transferable skills. These are largely absent in the ESCO profiles (only “identify customer’s needs” is mentioned) nor in our skill sets, but were often found in the job advertisements (e.g. communication, organization and presentation skills, ability to foster relations, project management et cetera depending on the profile).

In this paper, the results were presented of the application of the method of job advertisements analysis for analyzing skills needs in the EO/GI sector. The analysis provides a snapshot of the current EO/GI job market, where new jobs requiring new skills have emerged in recent years. This analysis does not rely on the collection of new empirical data via surveys or interviews, but is fully based on data from real job advertisements published by employers. Notwithstanding the promising results of this first application of job advertisements analysis in the EO/GI domain, also the limitations of this application should be recognized. This analysis gives for example no insight in these skills which are the most difficult to fulfill, and where consequently a potential skill gap can be found. Other platforms than LinkedIn can be more useful in this respect since only limited information is given in LinkedIn for each record. Finally, the analysis is restricted to skills needs at a specific moment in time, while especially longitudinal analyses are valuable for understanding and identifying changing skills needs.

5 Conclusion

The aim of this paper was to introduce job advertisement analysis as a new approach for monitoring and assessing the demand for skills and occupations in the EO/GI sector. The analysis of advertisements for jobs in the EO/GI sector allowed us to identify the main occupational profiles in the sector, including traditional profiles as included in ESCO such as cartographer and remote sensing expert, but also different types of GIS profiles, such as GIS Developer, GIS Specialist, GIS Analyst and GIS Technician. The best way to understand these occupational profiles and how they are different to each other is by looking to the skills demanded for each of these profiles. With regard to these skills, the results and findings of our analysis showed the importance of recognizing 'Programming and developing' as a key EO/GI skill sets, alongside other skill sets such as 'Analytical Methods', 'Data Capture' and 'Visualization and Cartography'. These findings will contribute to the further development and consolidation of the sector in terms of skills and competencies.

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