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NOVE KOMPETENCIJE U AKADEMSKOM OBRAZOVANJU KROZ REALIZACIJU BESTSDI I EO4GEO PROJEKATA

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Rezime:

Razvoj tehnologija opažanja pojava na Zemlji iz svemira i zraka koje omogućuju intenizivno korištenje prostornih informacija i Infrastrukture prostornih podataka koja uređuje korištenje prostornih podataka, odnosno koncepata kao što su internet stvari, pametni gradovi, precizna poljoprivreda, inteligentni transport i sl., nameću potrebu akademskoj zajednici da redefinira kompetencije kojima studenti širokog spektra studjskih programa moraju tijekom svojeg studija ovladati. U okviru Erasmus+ programa Europske unije pokrenuta su, među ostalima, dva projekta koji imaju za cilj rješavanje ovog globalnog izazova. Na europskoj razini EO4GEO projekt ima za cilj definirati kompetencije za opažanje pojava na Zemlji iz Svemira i zraka, dok BESTSDI projekt na regionalnoj razini definira kompetencije za Infrastrukturu prostornih podataka. Sadržaj ovih projekata, pristup iznalaženju rješenja, metodologija i ciljevi navedenih projekata, odnosno očekivani efekti na studijske programe prikazani su u ovom radu.

Ključne riječi: opažanje Zemlje, Infrastruktura prostornih podataka, kompetencije.

NEW COMPETENCES IN ACADEMIC EDUCATION THROUGH REALISATION OF THE BESTSDI AND EO4GEO PROJECTS

Abstract:

Development of Earth observation technologies from Space and air which are enabling intensive use of spatial information and Spatial data infrastructure which regulates usage of spatial information, respectively also concepts like Internet of things, Smart cities, Precise farming, Intelligent transportation and similar, impose on academic society necessity to redefine competences which students of bright variety of study programmes must overmaster during their study. In the frame of European Union Erasmus+ programme is, among other, initated two projects which goal is to solve this global challenge. The EO4GEO project aim is to define Earth observation from Space and air competences on the European level, while the BESTSDI project aim is to define Spatial data infrastructure competences on the regional level. Content of those projects, solution approach obstinance, methodology and their goals, respectively also expected effects on study programmes are shown in this paper.

Keywords: Earth observation, Spatial data infrastructure, competences.

1. INTRODUCTION

Today, we are at the beginning of a Fourth Industrial Revolution entering the Digital Era. Developments in genetics, artificial intelligence, robotics, nanotechnology, 3D printing and biotechnology, to name just a few, are all building on and amplifying one another. This will lay the foundation for a revolution more comprehensive and all-encompassing than anything we have ever seen. Smart systems—homes, factories, farms, grids or cities—will help tackle problems ranging from supply chain management to climate change. The rise of the sharing economy will allow people to monetize everything from their empty house to their car [1]. This deep and far-reaching change has also tremendous impact on future development of human professions. By one popular estimate, 65% of children entering primary school today will ultimately end up working in completely new job types that don't yet exist.1 In such a rapidly evolving employment landscape, the ability to anticipate and prepare for future skills requirements, job content and the aggregate effect on employment is increasingly critical for businesses, governments, academia and individuals in order to fully seize the opportunities presented by these trends - and to mitigate undesirable outcomes.

One of the plumes of fourth industrial revolution is digital technology, technology dealing with information, more specifically with spatial information. It is well known fact that modern society is relying on effective use of spatial information resulting in concepts which are creating environment for their use and solutions which enable it. Based on Geographical Information System (GIS) development, resulting as a need to standardize collection, organization, access and dissemination of spatial information, Spatial Data Infrastructure (SDI) has been defined, representing today fundamental concept of spatial data use, especially considering segment of public data. Numerous other applicative, how to use spatial data, concepts or solutions on different levels, are developed based on SDI or in parallel with SDI like Smart cities, Intelligent Transportation Systems, Precise farming or Building Information Modelling. The main characteristic of all those concepts and solutions is intensive use of spatial data in an organized and standardized manner increasing value and efficiency of used data.

Recently, space technologies become major source of well defined, georeferenced, spatial data. Earth Observation (EO) via satellites are providing massive amount of data on daily level and Global Navigation Satellite Systems (GNSS) providing reliable positioning and navigation in real-time. European Union is already one of the major global contributors in supply of EO data through the Copernicus Earth observation program, and soon will also become independent satellite positioning and navigation actor, when European GNSS Galileo becomes fully operational. Together with fast sensor development, their digitalization, miniaturization and increase in accuracy, condition has been created in which geoinformatic has become new, fast growing, branch of business. Only in 10 years, revenues of EO companies in Europe have tripled with the annual growth rate of 12% (average EU economy. 0,7%), see Figure 1.

But, at the same time the gap has been created between the offer and uptake of spatial data. Namely, use of geospatial data, including Copernicus, is still difficult for non-experts, what is clearly hampering maximization of socio-economic benefits of Copernicus, Galileo and geoinformatics in general. Having in mind that open data flow of European EO data is guaranteed well into 2030s, two major challenges have been identified as obstacles reducing the benefits of those technologies to the final users:

- most space data cannot be used directly by end users (who do not have the required technical, financial or human resources) and
- Copernicus data and service often need to be combined with other data to bring value (geospatial, socio-economic, digital …).

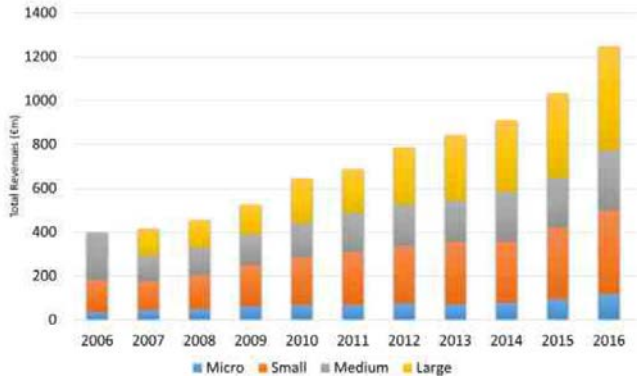
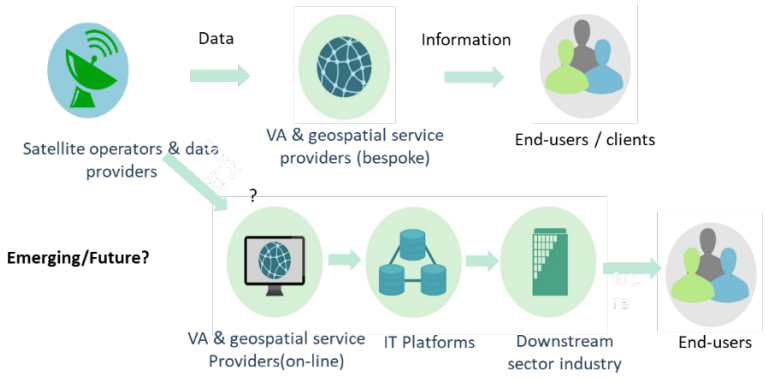


Figure 1. Revenue of EO companies in Europe [2]

Mentioned challenges are clearly indicating the need for new high-level knowledges and skills for professionals in specific sectors, imposing task on education and training institutions to identify those knowledges and skills and offer new profiles of education on levels of education scale. The question looking for an answer is: how will be the future GI services values chain? See Figure 2.



Slika 1. Figure 2. Future EO services value chain [2]

2. LEARNING AND SKILLS FOR DIGITAL ERA IN GEOINFORMATICS

Learning and skills are key contributors to society and the economy. As modern societies and economies are changing due to, amongst others, globalisation and technological progress, a fundamental transformation of education and training (E&T) throughout

Europe is required to deliver the knowledge and skills needed for growth, employment and participation in society. This forms an important part of the Europe 2020 agenda and its various flagships and policy initiatives [3]. In parallel, providing education of adequate and in future looking competences and skills is key challenge for educational institutions, especially academic ones, which should give guidance and lead the process of necessary changes in overall European and national education systems. It is noting strange in the fact that in so many European countries reform of education curriculum is high on agenda of government and society.

Looking on geoinformatics, defined traditionally, which integrates three traditional geosciences (geodesy and surveying, geography and cartography) based on the results of informatics in the frame of rapid evolving computer sciences [4], B. Markus is emphasising that universities are under a pressure of continuous changes, transforming all traditional way of learning, working to prepare our learners for the future. Looking broader, geoinformatics might be referred to the academic discipline or career of working with geo-data in general for better understanding and interpretation of human interaction with the earth's surface. Geoinformatics might be defined in a relatively broad term as a number of different technologies, approaches, processes, and methods to interpreter issue and controversy relating to the earth's surface for collaborative decision making. In this context not only surveying, geography and cartography are influenced by geoinformatics, but also civil engineering, urban planning, architecture, environment engineering, transportation engineering, etc. The bluntest example geoinformatics affecting classical professional disciplines are Smart cities. It is hard to imagine that any of above listed professions will be able to fulfil its tasks in cities and around them without taking in consideration the concepts behind Smart cities and consequently not to implement elements of geoinformatics, being basis for this concept. Considering universities, the pressure on them has recently even increased because universities are forced to implement technological developments which are happening outside or without them with not always sufficient funding or expert capacities.

European Commission and its agencies have therefore developed comprehensive activity which should ensure European citizens to be competitive in future global market and preserve their wellbeing. On broadest level Erasmus+ program has been launched covering the fields of education, training, youth and sport for the period 2014-20201. Education, training, youth and sport can make a major contribution to help tackle socio-economic changes, the key challenges that Europe will be facing until the end of the decade and to support the implementation of the European policy agenda for growth, jobs, equity and social inclusion. The Erasmus+ Programme is designed to support Programme Countries' efforts to efficiently use the potential of Europe's talent and social assets in a lifelong learning perspective, linking support to formal, non-formal and informal learning throughout the education, training and youth fields. The Programme also enhances the opportunities for cooperation and mobility with Partner Countries, notably in the fields of higher education and youth.

In the frame of Key Action 2 of Erasmus+ focus is on high school (academic) education promoting cooperation for innovation and exchange of good practices being materialized through several actions:

- Sector Skills Alliances: ensuring cooperation between education and employment in tackling skills gaps with regard to one or more occupational profiles in a specific sector;

- Knowledge Alliances cooperation between higher education institutions and enterprises;
- Capacity Building in the field of youth supporting cooperation with Partner Countries;
- Capacity Building in the field of higher education supporting cooperation with Partner Countries.

3. BESTSDI PROJECT

BESTSDI project in Capacity Building in field of Higher Education project started in October 2016. The wider objectives of the BESTSDI project is to:

- improve the quality of higher education in Geographical Science and Technology field, SDI and geodesy,
- enhance its relevance for the labour market and society and
- to improve the level of competences and skills in HEI's by developing new and innovative education programs within the field of SDI.

These wider objectives are fully compliant with the priorities of the Capacity Building projects within the Erasmus+ program. The specific project objectives are to:

- develop, test and adapt new curricula, courses, learning material and tools within the field of SDI and
- introduce SDI and related concepts in undergraduate and graduate study programs on academic institutions which profiles are well recognized as SDI users, raising awareness among the students and professionals about the relevancy of SDI and advantages of well-organized spatial data [5].

BESTSDI is 16 academic partners (and 3 associated partners) from Western Balkans countries (Albania, Bosnia and Herzegovina, Kosovo, Montenegro and Serbia) and program countries Belgium, Croatia, Germany, Macedonia and Sweden.

Reaching half of its lifetime, BESTSDI project has carry out comprehensive analysis of existing study materials regarding SDI in Europe and region finding that most of materials are presentation and exercise, there is no project oriented approach to teaching, topics are mainly focused on standards, interoperability, legal aspects and service-oriented architecture, and user aspects are not included in existing materials. Result of those findings is that it is necessary to develop essential part of new SDI curriculum materials [6]. Further, survey among the stakeholders has been conducted aiming to analyse their needs. According to survey competency needs are ranked as follow:

- top: spatial data concepts, land management, cartography and visualization, social competences,
- middle: SDI organizational and institutional aspects and
- low: analytic GIS tools, design, modelling and management of spatial data.

Conducted survey conclusions impose that knowledge and understanding of SDI aspects among stakeholders is rather modest, especially on implementation level, resulting in challenge how to overcome the gap which is presently existing in relation to competences linked to geoinformatics.

BESTSDI project is running now the second phase of the project which should, till mid-2018, deliver following results:

- drafting knowledge catalogue,

- drafting sets of teaching outcomes,
- drafting courses structure and
- drafting teaching materials.

4. EO4GEO PROJECT

EO4GEO is Sector Skills Alliances (SSA) type of Erasmus+ project. SSA are transnational projects which should enable to achieve among others the following objectives:

- Identification of existing and emerging skills needs for professions in specific sectors, strengthening the exchange of knowledge and practice between education and training institutions and the labour market;
- Modernizing Vocational Education Training (VET) by adapting provision to skills needs,
- Integrating work based learning in VET provision, and exploiting its potential to drive economic development and innovation, increasing the competitiveness of the sectors concerned;
- Building mutual trust, facilitating cross-border certification and therefore easing professional mobility in a sector, and increasing recognition of qualifications at European level within a sector;
- Supporting a strategic approach ("Blueprint") to sectoral cooperation on skills, see Figure 3.

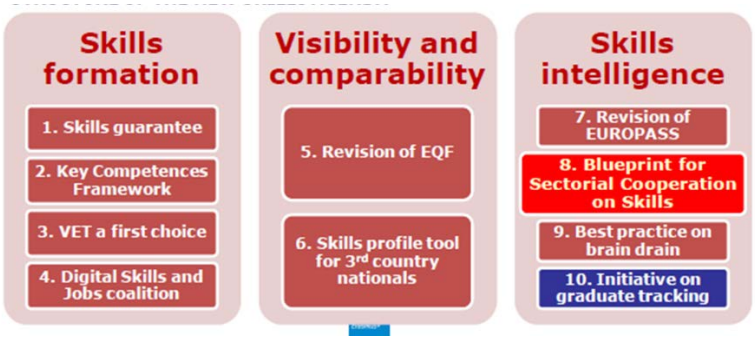


Figure 3. New skills agenda for Europe [7]

The EU Education, Audiovisual and Culture Executive Agency (EACEA) has approved the project EO4GEO - Towards and innovative strategy for skills development and capacity building in the space geo-information sector supporting Copernicus user uptake. EO4GEO is an Erasmus+ Sector Skills Alliance gathering 26 partners (and initially 22 associated partners, looking forward to new adhesions) from 16 countries from academia, private and public sector active in the education/training and space/geospatial sectors. It is coordinated by the Association GISIG (www.gisig.eu) and will run over four years, starting from 1st January 2018. EO4GEO aims to help bridging the skills gap between supply and demand of education and training in the space/geospatial sector by reinforcing the existing ecosystem and fostering the uptake and integration of space/geospatial data and services in end-user applications. 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; the 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 (www.copernicus.eu) 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.

To identify needed knowledge and skills initial tasks and outcomes of the EO4GEO project are defined:

T1: Identifying supply of GI / EO education & training at academic and vocational levels - resulting in findings of the analysis of previous relevant studies, results from new survey with metadata descriptions of courses/modules;

T2: Identifying demand for GI / EO skills & occupational profiles - resulting, based on previous related studies and on new survey and interviews in definition of priority occupational profiles for space/geospatial sector;

T3: Analysing trends, challenges/opportunities in GI / EO sector: technology watch - identifying major trends relevant to impact on space/geospatial sector, focusing on the technological (general ICT) and non-technological aspects (soft skills developments);

T4: Assessing skills shortages, gaps between supply / demand - discussing findings, vision, choices / options resulting in assessment of shortages and gaps.

T5: Defining GI / EO sector skills strategy - proposing approach / methods to bridge the gaps and resolve mismatches, describing concrete actions and feed European Skills Panorama.

5. SUMMARY

Developing new competences and skills for new geoinformatic profession based on spatial data as one of building blocks of Digital Era represents great challenge for academic institutions what is recently not jet well recognized among them. Having in mind that it still takes minimum 5 (rather 10) years for full implementation of new profession curricula in academic institutions, while geoinformatic and related industries demand new professionals much sooner, gap is created between supply and demand. This fact has been recognized on numerous levels, and one of the actions undertake is execution of BESTSDI and EO4GEO projects which should reduce this gap and support academic institutions in Europe in development and implementation of new curricula in SDI and geoinformatics, providing for business sector so desperately missing professionals. For academic institutions of technical provenience in Western Balkans region this situation creates, beside challenge, also opportunity to make visible lunge, and adopting new SDI and

geoinformatic curricula, reduce the gap towards business sector, but also towards European academic institutions.

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