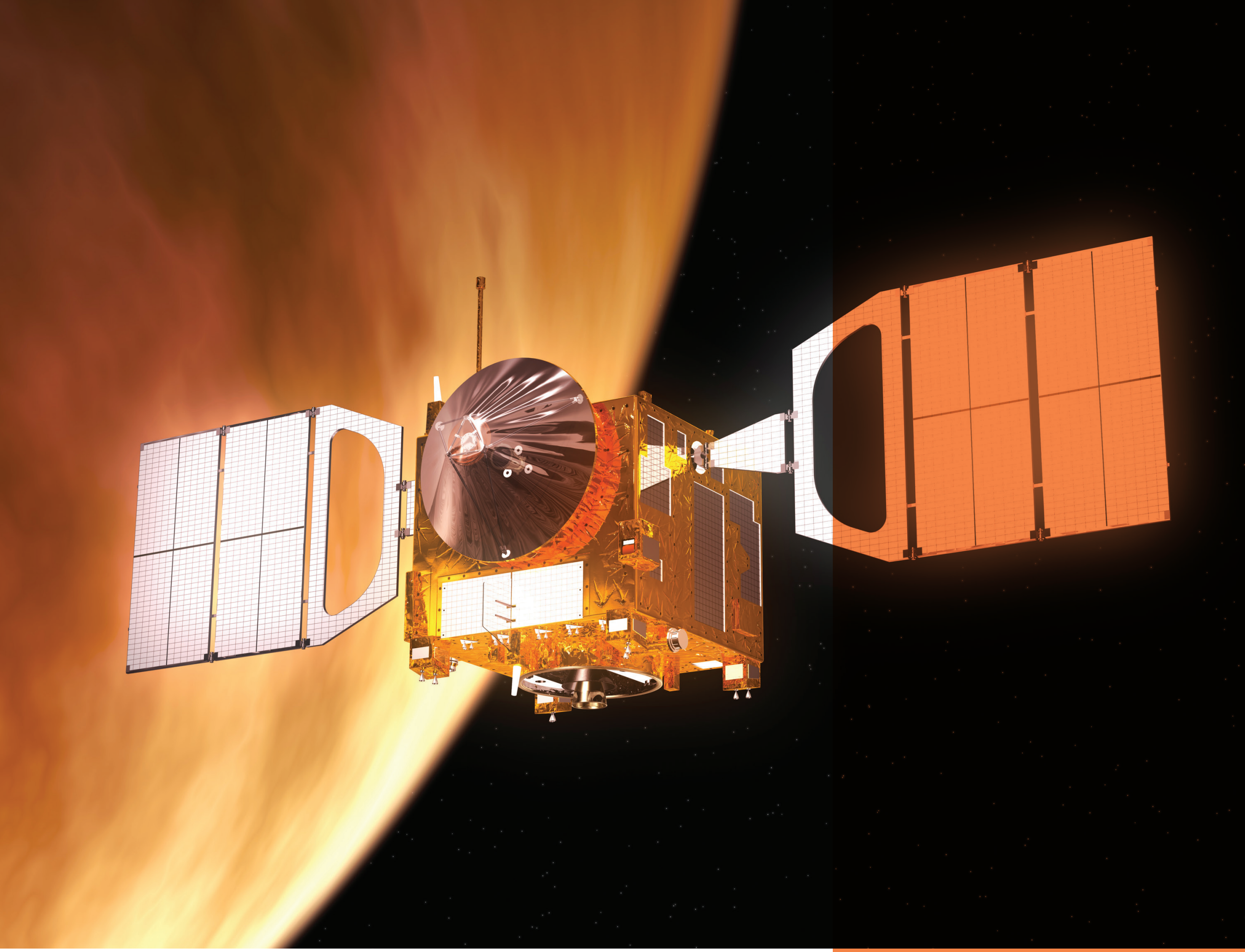

GIS IN HIGHER EDUCATION IN POLAND
CURRICULUMS, ISSUES, DISCUSSION

edited by Iwona Jażdżewska

WYDAWNICTWO
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ŁÓDZKIEGO

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CURRENT STATE AND FUTURE PERSPECTIVES OF UNIVERSITY EDUCATION OF GIS AND GEOINFORMATION IN POLAND

STAN I PERSPEKTYWY KSZTAŁCENIA W ZAKRESIE GIS I GEOINFORMACJI W POLSCE NA UNIWERSYTECKICH KIERUNKACH GEOGRAFICZNYCH

Introduction

Geographic Information Systems (GIS) have found a permanent place in education at universities, not only in strictly geographic, geologic or geophysical departments and faculties. The interest in geographic information systems as a research tool and a tool for implementing one's qualifications and accomplishments in business practice is exhibited by specialists in virtually all areas of knowledge (Zwoliński 2010, Churski, Zwoliński 2011), if not as a whole, then at least in areas concerned with phenomena occurring in the geographical space. Among the scientists and specialists in various disciplines other than earth sciences known to the authors and presenting their achievements at conferences, especially high interest in the development and application of the GIS may be seen among experts in such areas as archaeology, philology, history, ethnology and anthropology, psychology (environmental), sociology, economy, biology, experts in environmental protection, safety and crisis management, and many others. On the other hand, geographic information systems are obviously a particular object of interest to the extent of computer sciences and other technical sciences, as evidenced by regular, interdisciplinary conferences for specialists in various disciplines devoted to the problems of geodatabases, geotechnologies (geoinformation technologies), i.e. algorithmisation and the geospatial data, called geocomputaion or, more broadly, computational science and its applications[1]. Technical sciences worth mentioning surely include geodesy, environmental engineering, architecture, construction, highway engineering, etc.

1 http://www.iccsa.org/, http://www.geocomputation.org/ [15–03–21]

However, the following facts and conclusions are meant to discuss the narrower subject matter of the transformations in the GIS education in recent years at the university level in Poland as a part of geographical studies, i.e. concerning the place, significance and changes of the GIS and geoinformation/geoinformatics in the case of the Bachelor's degree studies, engineering studies, the Master's degree studies and post-graduate studies in various disciplines and specialisations in the main units of universities, faculties and institutions authorised to award scientific titles in geographical sciences. Formally (according to the standards of the national qualifications framework[2]), geography is one of life sciences[3], but several faculties and specialisations are shared with other areas, e.g. cartography or remote sensing are classified as technical sciences (along with geodesy), while social and economic geography is a social science. We should also mention land management and (geo)tourism, that cannot be considered as purely geographic education.

In such a situation, a graduate of geography emerging onto the labour market should at least have knowledge and qualifications in the GIS and geoinformation specific to the specialisation and which furthermore would provide for a competitive advantage over other specialisations. In order to appropriately define what competitive advantage means for a geographer and an expert in the GIS/geoinformation/geoinformatics in the labour market, we should quote the definitions of geographic information systems and geoinformation (spatial data). However, we cannot discuss this problem separately from the internal determinants of the development of geographic research, i.e. the debate concerning the relationship between geography as a research discipline and the long-postulated area visible in the scientific life in conferences, seminars and through existing and new scientific societies, known as the GIScience (geographic information science), geomatics, geoinformation or geoinformatics. The aim is, however, to uncover those significant aspects of the situation, that directly influence the subject matter and scope of the GIS/geoinformation/geoinformatics education at universities, and not just a description of scientific discourse.

2 Regulation of the Minister of Science and Higher Education dated 08.08.2011 on areas of knowledge, fields and science and arts, and scientific and artistic disciplines.

3 On June 21, 2013, the Committee of Geographical Sciences of the Polish Academy of Science adopted a resolution by which they approve the concept of working towards classifying geography as a double-area (life sciences, Erath science and social sciences, economic science) in the scientific structure of Poland.

Terminology

There are many definitions of the GIS (Zwoliński 2009, 2011). Each one emphasises the role of three components: spatial data, computer software and hardware, and the community of the GIS users. According to Eurostat (2011[4], 2015), a geographic Information System (GIS) integrates hardware, software and data for capturing, managing, analysing and displaying all forms of geographically referenced information (i.e. on the surface of Earth). It allows you to map where things are, map quantities, map densities, analyse spatial relationships and visualise data and statistics in ways that reveal interactions and patterns. This broad definition presented on the website of the European Statistical Office shows the wide acceptance of the technological instruments of geoinformation, treated both as research tools and practical enterprise activities.

A wide introduction of the GIS into geographical science and education results in a research paradigm shift in this discipline, which may be compared to the "quantitative revolution" in the second half of the 20th century. Back then, due to the wide introduction of mathematics and statistics to geography, the discipline developed through the progress in mathematically described methods of spatial analysis. Many of them were hard to use as, we should remember, the researchers did not have appropriate hardware or software. Now, thanks to this possibility and the development of the GIS, we are witnessing the next paradigm shift in geography.

Geoinformation systems also have their roots (at least partly) beyond geography, although they widely use the achievements of cartography. They also stem from various other sciences as well as enterprise. The process of development of geoinformation technologies is (still) happening in the context of the relationship between science, economy and society, and the most significant impulses for the development of the GIS also come from outside of geography and, sometimes, outside science – they are the result of concrete economic applications.

Challenges of Geographic Information

These facts divided the society of geographers, scientists and lecturers (similarly to mathematics and statistics in the previous century) in the world (Wright et al. 1997, Goodchild 2010) and in Poland (Churski, Zwoliński 2011,

4 Eurostat, 2011. Geographic Information System (GIS). Online:http://epp.eurostat.ec.europa.eu/portal/page/portal/gisco_Geographical_information_maps/introduction [March 2011]

Jażdżewska 2014). Some treat geoinformation technologies as (slightly more complex) tools, boiling the problem down to the ability to use software packages as well as the familiarity with and ability to use their functions (outsourcing is sometimes used). Others see geoinformation sciences not only as universal tools and research technologies but as the modus operandi of studies and applications used for algorithmisation of research problems in geography, cartographic visualisation and the introduction of artificial intelligence elements, that will lead to the formation of new directions and specialisations in geography. A spectrum described by these two extreme approaches of academic lecturers towards geoinformation technology is very wide but everyone accepts the presence of the GIS in the geographic curriculum. It is not without significance, that the definition of geoinformation claims it is a science of geographic information (GISc), which redefines and develops the currently accepted concepts, theories and views of geographical sciences in information science categories that provide new possibilities of interpretation (Zwoliński 2009). This dual perception of geographic information systems and geoinformation has resulted in the GIS&T document (2006), which delineates the areas of interest of the scientific and technological approaches.

In this context, the question arises (which will remain open) about the influence of the current practice of research and education in various fields of geography on the use of the GIS tools and on the development of curricula in the geographic information system education.

The GIScience/geoinformation/geoinformatics is seen as an artificial, interdisciplinary, multi-dimensional discipline, which geographers share with other areas, as evidenced by the names of some units and departments in geographic faculties. On the other hand there are opinions that the GIS may only be useful in further development of traditional specialisations of geography. What remains to be achieved is the modus vivendi but that does not solely depend on the scientific discourse in geography. This is evidenced, among others, by the popularity of the GIS and GPS technologies in the society at large (e.g. through universally available navigation software, Google Maps and Google Earth or mobile applications), that used to be considered to be specialist qualifications in geography and cartography no longer than a dozen years ago. This transitive status of geoinformation technologies in geography may also be illustrated by the number of active professional associations of various geographic specialisation in recent years, independent of the already existing committees within the

PTG (cartographers, geomorphologists, climatologists, hydrologists, landscape ecologists), that actively work to promote the GIS in their respective specialisations.

The situation in geoinformation technology education is also influenced by the experience of graduates and freshman students. Students' expectations and awareness of geoinformation technologies differ. A lot depends on the ability to promote geoinformation specialisations and majors, complete information about the scope of education and competences. No less important … is the habit, shaped during curricular and extracurricular education, … of using printed maps, atlases and guidebooks (Werner, 2013), as well as the ever more widely available geolocation tools. The main argument is the students' and graduates' growing trust in themselves and their qualifications in the labour market and further education. On the other hand, the first encounter between geography students and the (undoubtedly) steep learning (and understanding of algorithms) curve of geoinformatics remains contrary to the ease of use of modern software. This results in such comments as: "not my cup of tea, the lectures were interesting but that's not my level yet", "too many applications!"[5].

One solution to this problem was a proposition submitted a couple of years ago to create either a geoinformation/geoinformatics specialisation within the field of geography or to create a separate field of geoinformation/ geoinformatics (Kozak et al. 2009) which is already being implemented at several universities. The importance of geographic information systems for geography was also emphasised by Jażdżewska and Urbański (2013) who also presented an extensive discussion of the approach to the GIS in Polish science, pointing to its flexibility and universality of application in numerous fields.

These external conditions for education in the field of geoinformation technologies at universities' geography units are also supplemented by two factors that apply to all advanced education facilities. The first is related to the development of technical culture in the society, described by sociologists as the generation X, Y, C and now Z[6] (McCrindle 2009, Piotrowska 2011, 2015), as the consequence of the implementation of the more and more advanced ICT[7] and GIS technologies. The second one is

5 Excerpts of comments from student surveys after selected classes in geoinformation technology subjects

6 Generation X – those born in the years 1965–1983, Generation Y – in the years 1984–1997, Generation Z – after 1995 (September 2007).

7 Information and communication technologies.

Fig. 1. Tag cloud composed of names of subjects (or their elements) in GIS /geoinformation/ geoinformatics in undergraduate studies at universities, in geography, geoinformation and geoinformatics majors. The sizes are proportional to the number of occurrences (own studies based on information from individual units, courtesy of: Jacek Kozak, Leszek Gawrysiak, Mariusz Szymanowski and university websites)

related to social (demographic), economic and organisational transformations – the Bologna process and the implementation of state qualification frameworks in university education. The coincidence of the three factors is reflected, among others, in a summary of majors and specialisations in geographical information systems, geoinformation and geoinformatics at the university level (cf. attachment).

The most important questions posed by the university applicants for geography, geoinformation and geoinformatics studies are related mainly to the benefits of studying them[8], often comparing them to geodesy and cartography, spatial planning at various universities, taking into consideration employment opportunities after they graduate. Aspirations, skills and abilities of candidates, as well as their expectations of their future professions are met with varied responses, even though the full offer and information presently concern the Master's degree studies since only few universities offer such courses in the field or specialisation of the GIS/ geoinformation/geoinformatics in geography majors, as was the case in Poznań beginning in 2002/2003 (Zwoliński 2012). Additionally, they are being developed (Łódź, Warszawa, Toruń) or restructured (Kraków).

Current State of Geographic Information Education

A detailed list of the main subjects of education (and their descriptions) in the areas of the GIS/geoinformation/geoinformatics at the undergraduate

8 e.g.: http://wizaz.pl/forum/showthread.php?t=765216

level in geography, geoinformation and geoinformatics majors and specialisations is available on university websites (cf. attachment). Therefore the study was limited to uncovering the shared scope and presenting the names as a tag cloud (fig. 1). Composite names using the conjunction and were separated, provided that they could be presented as separate, and the names and inflections of nouns were standardised (e.g. geographic information systems were replaced with the GIS, and spatial data infrastructure – with the SDI).

A variety of specialisations of geography treats the GIS instruments, in conjunction with WebGIS, as necessary tools, analogous to the statistical and mathematical methods, by integrating them into the achievement of research and application goals. Their use is often associated with the collection and creation of (integrated and distributed) multiresolution and multirepresentation (Gotlib, 2009) spatial databases. Huge databases are created containing, among others, geospatial data for economic and social purposes, sponsored by international, state and public benefit organisations and often made available free of charge for scientific and educational use. At the other end, there are specialisations concerned more closely with designing algorithms and tools that often focus on new software functionalities (subprograms, models, plugins) and whole systems for analyses, visualisations, syntheses and simulations.

Methods of Geographical Information Education

Thus, we can define a certain spectrum of education and qualifications goals planned by the authors of the GIS/geoinformation/geoinformatics specialisations at the bachelor's degree level: from methodology-oriented with some geographical knowledge involved (including engineering studies, algorithms, system and application programming languages, databases), through routine and application use of the GIS programming tools, and the organisation of spatial data (databases), to solutions to specific problems in one or more fields of geography or, more broadly, earth sciences, using the GIS software. But in every field, the GIS/geoinformation/geoinformatics education is interdisciplinary and parallel to education in various other fields.

In all geographic units discussed, education in geoinformation technologies is compulsory and (in the case of the bachelor's degree-related training course) present as a separate major (in Poznań, Łódź and Lublin) and specialisation (in Słupsk, Warsaw, Gdańsk, as geoanalytics in Szczecin). In all cases, though, it is interdisciplinary education related to acknowledged,

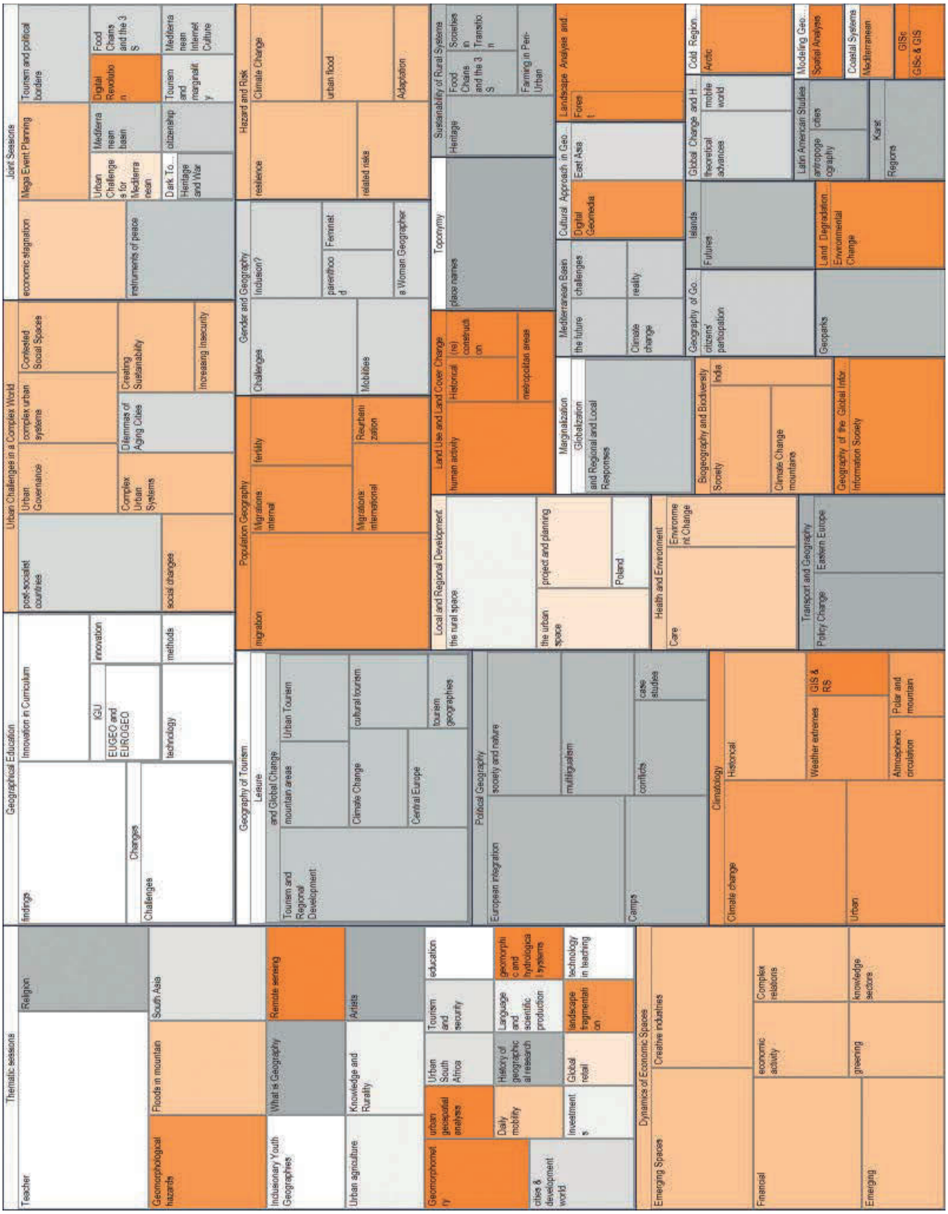

Fig. 2. Session names and main themes at the 25th Regional IGU Conference in Cracow, 18-22 August 2014. (treemap, own study based on conference materials. Shades of orange signify sessions with papers with considerable GIS tool content)

leading fields in science: geography and geoecology in Poznań; geography, information technology and mathematics in Łódź; mathematics in Lublin; geography in Słupsk; cartography and remote sensing in Warsaw; oceanography in Gdańsk; earth sciences in Szczecin.

Such positioning of training courses and specialisations in the field of geoinformation technologies and their coexistence with other disciplines stems, among others, from their utilitarian perception and is mainly the product of the formal division of science[9]. All of the majors and specialisations listed emphasise in their graduates' descriptions the benefits of qualifications in geoinformation (and/or geoinformatics) in the labour market[10],

The situation is similar in the case of full-time master's degree-related courses. Most geography units offer specialisations in the GIS/geoinformation/geinformatics in the course of the master's degree studies, related either to earth sciences (such as cartography, remote sensing, geoecology, oceanography – in Warsaw, Sosnowiec, Toruń and Gdańsk, as a part of geography in Kraków), or separate interdisciplinary majors combined with disciplines from other sciences (such as photointerpretation, mathematics, information technologies in Łódź or mathematics in Lublin), while in Poznań geoinformation is related to geoecology. Observing the recent and common changes in curricula of universities' geography units, including the GIS/geoinformation/geoinformatics, we may assume that this situation will continue into the near future, as it is connected, among others, to the unstable state policies regarding science and, concurrently, with the popularisation of the geotechnological paradigm in earth sciences. Developments in geoinformation technologies, combined with such processes as ICT development, including cloud computing, big data, wireless networks and mobile devices, real time data processing or augmented reality also constitute an obvious additional factor[11].

At the Polish Geographers' Forum in Poznań in 2011, a graphical visualisation of expected applications and development of geotechnology was presented, that could significantly influence the shaping of the labour market and geography education (foresight: geospatial technology projection, Werner, Opach 2013). By highlighting the milestones in the GIS

9 even though geoinformation technologies are also the sole subject in large number of bachelor courses in the same universities

10 for geography graduates.

11 Courtesy of, cit.: Zbigniew Zwoliński, Horyzonty geoinformacji. GIS w nauce, Lublin, 23.06.2013

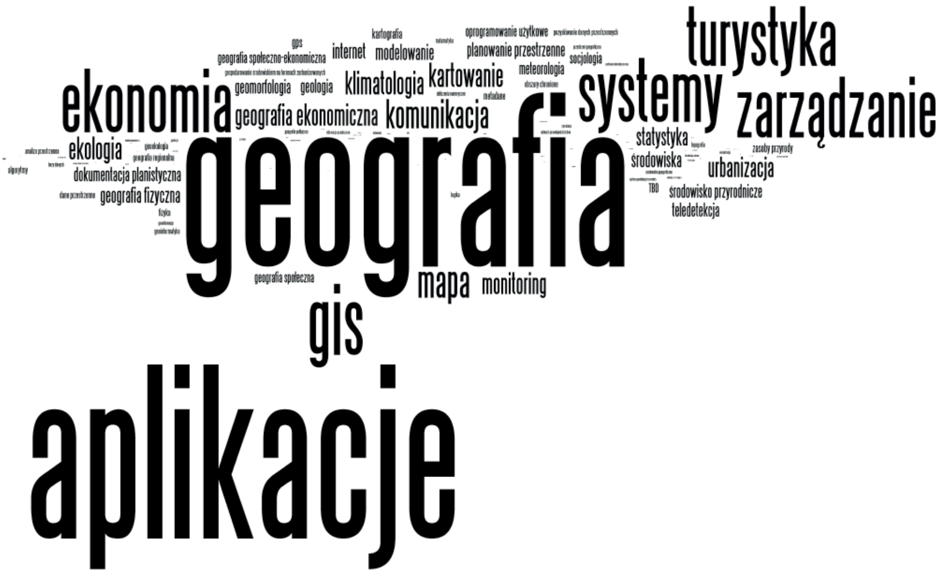

Fig. 3. Tag cloud – common names of thematic sessions at the 26th Regional IGU Conference in Cracow and the names of subjects (or parts of them) at GIS/geoinformation/geoinformatics specialisations of undergraduate studies at geography, geoinformation, geoinformatics majors at universities. Size – proportional to the number of repetitions (own study)

development, analysing the current and expected areas of applications, phases of development, i.e. pioneer, institutional, scientific and public (crowdsourcing), as well as the penetration of the GIS into the economy and social life, such as telemedicine, security and media, we may anticipate the shape of the future labour market and thus specify the needs for the geotechnology education. This is undoubtedly related to the implementation of specific scientific and research purposes, for which financing could be raised.

It appears, that at least three paths to realise this purpose in geographical units have emerged. The first one is related to (i)the dynamic development of traditionally formed areas of geography, provided that they would use IT tools for this purpose, as was the case with mathematics and statistics. Without losing sight of the existing scientific purposes, specialists in these areas will be able to carry out new research and application tasks, pose new problems and expand their geographic competences, e.g. in hydroinformation (Graf 2010). The second one depends on the creation of (ii)interdisciplinary research centres dedicated to complex social or natural issues, or to other complicated problems that may require the cooperation of specialists in many areas. Their research and cooperation could form the basis for multi-area education, above all in geotechnology. Such issues may include integrated environmental monitoring (Zwoliński 1998, Kostrzewski 2012) or the development of metropolitan areas (Kaczmarek 2012). The third one is associated with the emergence of (iii)new interdisciplinary problems at the intersection of two-three disciplines, which will result in the formation of new research areas. A classic example from the past is biogeography. Currently, we can observe e.g. the convergence of computer graphics and traditional cartography (Fiedukowicz et al. 2014) or the integration of hydrological modelling with geographic information systems (Gudowicz, Zwoliński 2009).

The above mentioned paths are selected by the interested parties themselves (consciously or unconsciously, i.e. strategically or tactically). But this is insufficient. By going down any of these potential paths, each of the basic geographic units has equal development opportunities, depending solely on the opportunity to obtain financing for their development. Defining scientific problems, obtaining funding and the development of education in geotechnology and related areas can be started with any of the above listed steps. But, surely, the execution of just two of them will not be sufficient to ensure continuity in research and education.

Geographical Information at the IGU Conference

The above considerations may be easily questioned as they are based on incomplete information, assumptions, and the information we have collected concerning curriculums at geographical units of Polish universities will be verified and (probably) modified in the future. As it happens, though, between 18 and 22 August 2014 in Cracow the second regional International Geographical Union (IGU) conference to have been organised in Poland took place[12]. We can thus analyse the position and significance of the GIS/geoinformation/geoinformatics in presentations at the IGU commission and joint sessions, as well as the disciplines most closely associated with these topics.

The conference's motto was Changes, Challenges, Responsibility. It is assumed that the conference is a platform of exchanging ideas and discussions among specialists in various areas of geography. In the context of this paper, it may also serve as a touchstone and reference point for con-

12 On the 80th anniversary of the 16th IGU Congress in Warsaw on 23–31 August 1934 (Jackowski et al. 2014).

structing the GIS/geoinformation/geoinformatics curriculums at universities' geography faculties. A summary of (abbreviated) session names and main themes of the conference is presented in the fig. 2 as a tree map. The size of fields in the map is proportional to the number of presentations. For the sake of legibility, only (subjectively) chosen main themes in different sessions were included. Conference materials provided by the organisers were used. The colours of the map have been (subjectively) chosen to signify the relation to the geoinformation and GIS with shades of orange.

Since it is not the purpose of this article to sum up and assess the regional IGU conference in Cracow, we may briefly conclude that there is still a vast area of issues that are not yet tackled using the geoinformation and GIS approach (bearing in mind that this assessment is subjective).As far as thematic sessions are concerned, the ones most advanced in utilising geoinformation technologies were those devoted to geomorphological and flooding threats, geomorphological and hydrological systems, remote sensing and geomorphometry, geospatial analysis of cities (urbanisation), landscape analysis and dynamics of economic spaces. An analysis of sessions organised by permanent committees of the IGU allows us to list several themes, in which geoinformation tools play a significant role. This includes sessions on climate (including a special session on the GIS&RS (Remote Sensing)), a series of sessions named Urban Challenges in Complex World, sessions devoted to Population Geography, Land Use and Land Cover Changes, the global information society, the digital revolution (Joint Session) in cultural geography Landscape Analysis and Landscape Planning. Geographical information and geoinformation system tools were discussed in the course of the GISc&GIS sessions, while the geographic system modelling was discussed in Spatial Analysis session.

In order to verify this relationship, conference materials were indexed and two sets were compiled – a list of classes offered at Universities and a list of session names (unfortunately, abstracts did not use keywords, which significantly hampered the analysis). Again, coinciding names were counted and presented as a tag cloud (see fig. 3).

In view of this analysis, the application aspects of using the GIS to study geographical problems, also related to the visualisation of environmental and socio-economic phenomena on maps that may also be used for monitoring purposes, are of utmost importance.

GID Labour Market in Poland

The Geoinformation is a rapidly evolving discipline, and its largest labour market may currently be seen in the US and Western Europe. Thus, according to the classification of professions created by the Bureau of Labor Statistic on behalf of the Standard Occupational Classification Policy Committee (SOCPC) of August 2012 and the American Bureau of Labor Statistic, the graduate may find employment in the following professions (currently emerging in Poland and listed as desirable): Surveyors, Cartographers, Photogrammetrists, code: 17-1020, 17-1021). Their tasks include the acquisition, analysis and interpretation of geographical information based on geodetic studies, aerial and satellite imagery, as well as documentation, research, preparation of maps and other spatial data in digital and graphical form for legal, social, economic, political, educational and project purposes. Their main tools constitute the geographical information systems (GIS). They also design and assess algorithms, data (spatial) structures, user interaction interfaces in geographical information systems and mapping systems. On the other hand, geographers (19-3092 according to the above-mentioned institutions) are involved with the functioning of natural environments and the formation of geographical space by uncovering and interpreting the interactions among natural and cultural phenomena. They conduct research into the physical (natural) aspects of the regions, including landforms, geology, climate, water, soil, vegetation, animal life and spatial effects of human activities on their territories, including social, economic and political features. They take into account the interconnectedness of regions with the local and global scale, also using mapping and geodetic techniques.

According to the Bureau of Labor Statistic (USA) the best-paid jobs in the United States include surveyors, cartographers, photogrammetrists, urban and regional planners, database administrators and software engineers.

In terms of the Polish occupational classification, according to the directive of the Minister of Labour and Social Policy of August 7, 2014 concerning the classification of professions and specialisations for the purposes of the labour market and the extent of its application, the following professions available to a graduate of geoinformation may be listed: specialist in earth sciences (2114), geographer (211402), other specialists in earth sciences (211490), as well as cartographers and surveyors (2165).

Numerous examples of interest – in the Polish labour market – in specialists in this field may be given. In February 2015 alone, the Careers Office of the University of Warsaw had the following (example) job offers for graduates in main specialist positions: environmental protection (GIS, land management), climate and meteorology, environmental protection (hydrobiology), geophysics, geotechnology and geological engineering, environmental protection (zoology), seismology and tectonics, environmental protection (botany). New positions appearing in job offers in Poland include: a GIS analyst, whose qualifications include both familiarity with the GIS software and the ability to write software (applications).

According to the report of the Ministry of Labour and Social Policy (Competition deficit and surplus in 2014), deficit sections (with more job offers than applicants) in 2014 included public administration and national defence, mandatory social security, and information and communication. The professional, scientific and technical section was relatively balanced. The geographer was mentioned in the 2015 MPiPS report as a profession with the labour market demand lower than the number of people seeking employment. It was, however, at the end of the list sorted from the professions with the lowest surplus index (the ratio of offers to the registered unemployed population).

It may be assumed that a new generation of specialists in geoinformation/geinformatics and geography equipped with the GIS instruments and qualifications will have numerous interesting job offers in the quickly evolving labour market.

Attachment

The list of universities and institutes educating geography with a specialisation in the geoinformation/geoinformatics, and geoinformation/geoinformatics majors at universities (for the academic year of 2014/2015).

No.	School	Unit	URL	Department	Detailes
1	Pomeranian Academy in Slupsk	Institute of Geography	http://geografia.apsl.edu.pl	Geography	Bachelor specialty: Geoinformation
2	Maria Curie-Sklodowska University in Lublin	Faculty of Earth Sciences and Spatial Planning	http://geoinformatyka.umcs.lublin.pl/ http://www.umcs.pl/pl/nauk-o-ziemi-i-gospodarki-przestrzennej,47.htm	Geography	
				Geoinformatics	undergraduate studies
3	Adam Mickiewicz University in Poznan	Faculty of Geography and Geology	https://wngig.amu.edu.pl/	Geography	Geoinformation specialty from year 1 – Bachelor and Master studies
				Geoinformation	MSc and MA studies
4	University of Gdansk	Institute of Geography	http://www.geo.univ.gda.pl	Geography	
5	Jan Kochanowski University of Kielce	Institute of Geography	http://www.ujk.edu.pl/igeo	Geography	
6	Jagiellonian University	Institute of Geography and Spatial Planning	http://www.geo.uj.edu.pl	Geography	courses at the undergraduate studies Master's degree, specialisation in Geographic Information Systems
7	University of Bydgoszcz	Institute of Geography	http://www.geo.ukw.edu.pl	Geography	

No.	School	Unit	URL	Department	Detailes
8	University of Łódź	Faculty of Geographical Sciences	http://www.geo.uni.lodz.pl	Geoinformation	undergraduate studies
					master's degree from 2015
9	Nicolaus Copernicus University in Torun	Institute of Geography	http://www.geo.uni.torun.pl	Geography	
				Environmental Geoinformation	Master's studies
10	Pedagogical University of Cracow	Institute of Geography	http://geografia.up.krakow.pl/	Geography with geoinformation	undergraduate studies
11	Szczecin University	Faculty of Earth Sciences	http://www.us.szc.pl/wnoz	Geography	Geoanalytics
12	Silesian University	Faculty of Earth Sciences	http://www.wnoz.us.edu.pl	Geography	Specialisation Geographic information systems – GIS
13	University of Warsaw	Faculty of Geography and Regional Studies	http://www.wgsr.uw.edu.pl	Geography	Specialty geoinformatics
14	University of Wrocław	Institute of Geography and Regional Development	http://www.geogr.uni.wroc.pl	Geography	

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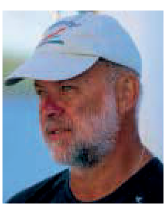

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The idea for this publication was born in June 2015, during a meeting of Polish teachers involved with Geographic Information Systems. The meeting was initiated by the Department of Geoinformation, Faculty of Geographical Sciences, University of Łódź, which received a grant to organize it. The discussion and presentations from academic teachers representing various universities in Poland were very interesting and sometimes heated. It would be advisable for other educators to familiarise themselves with the aspects of GIS education among Polish geographers, foresters, surveyors and other users. The experience of Geoinformation education in Poland is still modest, so the views of people who have been involved at Polish universities with it since the 1990s should be interesting to readers.

Geographic Information Systems (GIS) – the integration of environmental and climate issues as an important factor for economic development and quality of life – an innovative second-degree studies. Akronim GIS-E-QL: GIS for environment and quality of life

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Project objectives: The main aim of the project is to start-up attractive and innovative second-degree studies – geoinformation in mutual cooperation of the FGS and the FMCS, students education, improving the competence of academic teachers, conference organization, publishing, cooperation with practitioners and establishing contacts with partners from Norway. This aim is consistent with the "Analysis of the economy's demand for graduates in key field of strategy in the context of the Europe 2020" 2012 and "Strategy for development of higher education in Poland 2020", in the field of promoting innovative courses, formed collectively with practitioners, raising awareness of the environment. Joint actions of educators and practitioners, supported the by the strengthening of university's hardware, software and spatial data, will ensure a high quality project. The existing cooperation with practitioners indicate that further training is necessary and they would like to see postgraduates in their institutions. The final beneficiaries of the project will be the students and the academical teaching staff and indirectly the economy of the region. Students who graduate will be the main recipient of the project, the next will be teaching staff who will have contact with the practices and Norwegian partners with similar interests. In broad terms the project will benefit Polish and European economy and environment

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