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GIF GLOBAL IMPACT FACTOR

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COBISS NUBSK

I2OR INTERNATIONAL INSTITUTE OF ORGANIZED RESEARCH

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A CUTTING-EDGE HIGHER EDUCATION OF GEOINFORMATICS IN AALTO UNIVERSITY, FINLAND

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SUMMARY

The Aalto University School of Engineering, Finland, hosts the Master's Programme in Geoinformatics. This relatively new two-year curriculum is research-based and provides courses in geoinformation technology, geodesy, photogrammetry, laser scanning, and remote sensing. Since all teaching and teaching materials are in English, the programme is well suited for international students. We aim to help our students grow into skilled academic professionals in geoinformatics. Part of our success formula is to continuously develop our courses in order to provide top quality academic education. Aalto University also participates in the Nordic Master in Cold Climate Engineering Space Track, which has a focus area of Mapping and Navigation. Enrollees study one year at Aalto University, and another year at the Technical University of Denmark. This curriculum confers a double degree, and the courses in Aalto University are largely the same as in the Master's Programme in Geoinformatics. We gladly welcome talented students to the Master's Programme in Geoinformatics as well as to the Nordic Master in Cold Climate Engineering.

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Key words: Geoinformatics, curriculum, geoinformation technology, geodesy, photogrammetry, laser scanning, remote sensing

INTRODUCTION

Aalto University, Finland, consists of six Schools and has nearly 20 000 students and over 4000 staff members. The university is relatively young, because in 2010 three previously independent universities (the Helsinki University of Technology, the Helsinki School of Economics, and the University of Art and Design Helsinki) were merged into one. Aalto University continues to maintain the legacy of these respected three universities and has recently been internationally recognized as the ninth best young university in the world (QS Top 50 Under 50, 2019).

Our campus (Figure 1) is located in Espoo (Otaniemi district), an eleven-minute subway ride away from the center of the capital Helsinki. Subway and bus connections make the campus easy to access, and there are many student apartments available. Students, student associations and hobby clubs ensure that the area is full of activities. In addition, shops, eateries and sport centers ensure that daily life is easy within the campus area.

Figure 1: *The Aalto campus, with the Candidate Centre building in the front of the picture.*

All Bachelor's and Master's programmes at the Aalto University School of Engineering were revised recently. The new Bachelor's programmes started in 2013 and the retooled Master's programmes started in 2016. The curriculum structure follows the Bologna declaration (European Ministers of Education, 1999), i.e., a 3 + 2 years structure. These changes had a strong impact also on the teaching of geoinformatics. One major decision was that all Master's programmes in our School be in English, thus allowing also foreign students to pursue Master's degrees in our new programmes. The Bachelor's level teaching is generally in Finnish. However, individual courses can be in English or offer bilingual study materials. In addition, there are a couple of English Bachelor's level programmes, in which foreign students may enroll.

The aim of this paper is to describe the current Geoinformatics curriculum in Aalto University. Since curricula are subject to change, the details of this paper apply to the situation in 2019. Up-to-date information on the courses and study structure can be found from the web pages of the programme (https://www.aalto.fi/en/study-options/masters-programme-in-geoinformatics). Our curriculum encompasses geoinformation technology, geodesy, photogrammetry, laser scanning, and remote sensing.

GEOINFORMATICS AT THE BACHELOR'S LEVEL

Currently, there is no separate Bachelor's programme for geoinformatics in Aalto University. The official route to study in the Master's Programme in Geoinformatics goes through the Bachelor's programme of Energy and Environmental Technology. From this Bachelor's programme it is possible to continue to the Master's programmes of Energy Technology, Geoinformatics, Geoengineering, or Water and Environmental Engineering. In their major studies, Bachelor's students are offered three courses dedicated to geoinformatics (Table 1). From these courses, one course is mandatory for all students in the Bachelor's programme of Energy and Environmental Technology.

In the mandatory geoinformatics course, Geoinformation in Environmental Modelling, students learn the basics of geoinformatics, and its subfields taught at Aalto University. The course goes through the basics of geodesy, measurements and data gathering methods, data management, analysis, and visualization in geoinformatics. In the elective courses, the students can build on this foundation to learn more about measurements and data gathering, as well as management of spatial data and spatial data sets.

__Table 1:__ Bachelor's level courses in geoinformatics

Course	ECTS	Status	Teaching year	Language
Geoinformation in Environmental Modelling	5	mandatory	2nd year	English
Surveying and Observing the Environment	5	elective	2nd year	Finnish
Management of Environmental Data and Information	5	elective	3rd year	English

In addition to these three courses, we offer a minor supporting geoinformatics: Computation and Modelling in Engineering. This minor includes 25 ETCS of courses that are highly useful for geoinformatics students. The minor also serves many other disciplines.

Should a foreign student wish to study a Bachelor's degree in English at Aalto University, and continue to the Master's Programme in Geoinformatics, we recommend the English Bachelor's Programme in Science and Technology - Data Science (https://into.aalto.fi/display/enbsctech/Data+Science). This programme is hosted by the Aalto University School of Science. In order to prepare for the geoinformatics major, the student should take at least two of the geoinformatics courses presented in Table 1.

MASTER'S PROGRAMME IN GEOINGORMATICS

Our Master's Programme in Geoinformatics is a two years' curriculum. When it started in 2016, we dedicated a considerable amount of planning in order to allocate courses to all sub-fields, to prevent unnecessary overlap between courses, and to ensure that necessary core content would be covered. Because the previous curriculum structure was radically changed, we had the opportunity to carefully plan and restructure the programme. More details about the planning process can be read from Rönnholm and Haggrén (2016).

Our aim is to provide our students a higher education that develops their abilities to their full potential. This includes learning core substance matter of geoinformatics as well as general working-life skills. Applied mathematics, technologies, algorithms and programming are integrated in our courses. In addition, our students learn communicating, networking, project work and management, oral presenting, scientific writing, team work, and information searching, just to name few. Our teaching staff is motivated and pedagogically experienced which creates a favorable environment for learning. A broad range of teaching methods and assignments develop students' skills in an efficient way. Our students grow as independent, skilled academic professionals who are able to face new and complex problems, acquire the most recent knowledge, and have the courage to develop new solutions.

The overall structure of the curriculum of our Master's Programme is illustrated in Figure 2. The curriculum consists of 30 ECTS of major studies, which are mandatory for all students. These courses are all given during the autumn semester (Table 2). The course list reveals that our students get a very broad foundation in all aspects of geoinformatics. This ensures that students understand the contents of each subfield. The students then select 30 ECTS of elective major studies (see list in Table 3) in order to deepen their understanding of the field(s) they wish to study more. Elective major studies enable students to specialize in one or more subfields of geoinformatics. In practice, the topic of the Master's thesis is usually selected from these focus areas.

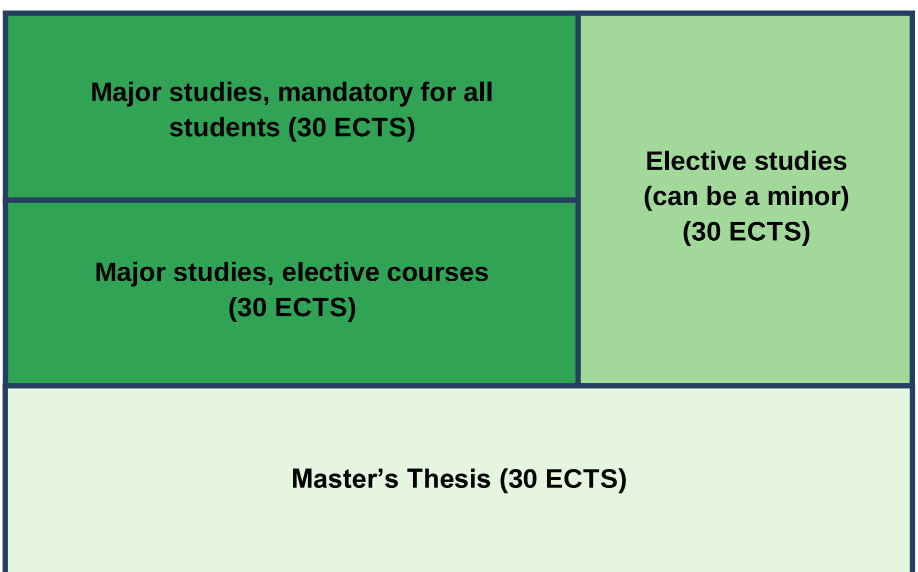

Figure 2: *The curriculum structure.*

Table 1: *Mandatory major courses in the curriculum of the Master's Programme in Geoinformatics to be completed during the first semester (periods I-II).*

Course	Period
GIS-E1010 Geodesy and Positioning (5 ECTS)	I (autumn)
GIS-E1020 From Measurements to Maps (5 ECTS)	I (autumn)
GIS-E1030 Introduction to Spatial Methods (5 ECTS)	I (autumn)
GIS-E1040 Photogrammetry, Laser Scanning and Remote Sensing (5 ECTS)	II (autumn)
GIS-E1070 Theories and Techniques in GIS (5 ECTS)	II (autumn)
GIS-E1060 Spatial Analytics (5 ECTS)	II (autumn)

Table 3: *Elective major courses in the curriculum of the Master's Programme in Geoinformatics. Students select 30 ECTS from this list of courses.*

Course	Year	Period
GIS-E3010 Least-Squares Methods in Geoscience (5 ECTS)	1st	III (spring)
GIS-E3020 Digital Image Processing and Feature Extraction (5 ECTS)	1st	III (spring)
GIS-E4020 Advanced Spatial Analytics (5 ECTS)	1st	III-IV(spring)
GIS-E3030 Advanced Laser Scanning (5 ECTS)	1st	IV (spring)
GIS-E3040 Advanced Photogrammetry (5 ECTS)	1st	IV (spring)
GIS-E5040 Mathematical Geodesy (5 ECTS)	1st	IV (spring)
GIS-E3050 Advanced Remote Sensing (5 ECTS)	1st	V (spring)
GIS-E4030 GIS Development (5 ECTS)	1st	V (spring)
GIS-E5030 Physical Geodesy (5 ECTS)	1st	V (spring)
GIS-E6010 Project Course (10 ECTS)	2nd	I-II (autumn)

A set of elective courses totaling 30 ECTS can constitute a minor. However, it is possible to select any elective courses, even if they are not related to each other. This option allows students to learn various skills to strengthen their professional profile.

The Master's thesis process allows students to shine and use all their skills to make a coherent academic study. Students can find the topic for a thesis from the industry, municipalities, university, or research institutes. In Finland, in addition to universities, we have several active research institutes giving excellent opportunities for research careers. In all cases, our staff gives high quality supervision and guidance to students ensuring great possibilities for success. Because a Master's thesis requires profound work and exhaustive literature reviews, students also learn a lot during the process. An excellent Master's thesis is like the student's business card to future employers.

Especially the elective major studies of the curriculum in geoinformatics are strongly research-based, and offer students access to the very latest knowledge, thinking and instrumentation in the field. The teachers in our Master's programme are active also in research, and well networked with the national and international scientific communities in their own disciplines. For example, in 2019, our teachers are involved in the Centre of Excellence in Laser Scanning Research in Finland, run a highly prestigious remote sensing project funded by the European Research Council, and develop open geospatial information infrastructures at national-level. A few Master's students each year also work as research assistants in the projects. Overall, our Master's programme also offers an excellent foundation for continuing further in research by completing doctoral studies in geoinformatics either in Aalto University or elsewhere.

Annually, we reflect our teaching against comments from stakeholders. We have established an advisory steering group for our Master's programme. Each professorship proposes two stakeholder representatives for the steering group. This allows general discussions with the whole group but also professor-oriented discussions in smaller groups. As a result, we are able to deal with both larger issues and professor-specific issues in developing our curriculum.

Our academic advising system ensures that every student gets individual support from a named staff member. There is a biannual opportunity to meet the academic advisor face-to-face and to discuss about studies and future plans. This also serves as an early-warning tripwire when things are not going as they should. Furthermore, it is easy to approach the academic advisor whenever there is a need to discuss or get help.

NORDIC MASTER IN COLD CLIMATE ENGINEERING

Under the umbrella of the Nordic Master in Cold Climate Engineering (http://www.coldclimate-master.org/), there is a Space Track. A student accepted in this track may select the Mapping and Navigation focus area. Students in this focus area study one year in the Aalto University and another year in the Technical University of Denmark (DTU). Students can select at which university they want to start their studies. In Aalto University, they mainly study the courses listed in Tables 2 and 3.

Graduation from this curriculum confers a double degree. From Aalto University, students get the degree of Master of Science (Technology), and DTU grants the title of Master of Science in Earth and Space Physics and Engineering.

DISCUSSION

Our Master's programme in Geoinformatics provides high-level teaching in all aspects of geoinformatics. Active contacts with industry, companies, municipalities, mapping agencies, and research institutes, as well as our own research projects keep our teaching up-to-date. Our students learn a broad foundation in geoinformatics which opens many employment opportunities. Currently, the employment rate of our graduates is excellent.

The annual intake of students coming from outside Aalto University is 15-20. The applicants need to have a Bachelor's degree or a degree from a university of applied sciences from a field related to geoinformatics. In some cases, we accept also students who have a strong programming background even if their prior knowledge of geoinformatics is insubstantial.

In Aalto University, the programmes at both the Bachelor's and Master's levels have no tuition fee for students coming from the EU or EEA countries. However, the university collects a tuition fee from students coming from countries outside the EU and EEA. In the academic year 2018-2019, the tuition fee was 15 000 € per year. The Aalto University Scholarship Programme offers scholarships of 100 % and 50 %. The full scholarship is usually available only for one or two students per Master's programme. Therefore, the majority of non-EU and non-EEA students need to pay either the full tuition fee or half of it.

CONCLUSIONS

Aalto University's Master's Programme in Geoinformatics is a fairly new two-year curriculum which provides courses in geoinformation technology, geodesy, photogrammetry, laser scanning, and remote sensing. Since all teaching is in English, it is well suited for international students. Also the students of the Nordic Master in Cold Climate Engineering Space Track have access to our courses.

Aalto University is an internationally recognized university, and we put great emphasis on giving high-quality teaching. We aim to assist our students to develop into skilled academic professionals in geoinformatics. We gladly welcome talented students in the Master's Programme in Geoinformatics or to the Nordic Master in Cold Climate Engineering.

REFERENCES

1. European Ministers of Education (1999). The Bologna Declaration on Higher Education. Joint Declaration of the European Ministers of Education Convened in Bologna on 19 June 1999. http://www.magna-charta.org/resources/files/BOLOGNA_DECLARATION.pdf [accessed 21.08.2019]
2. Rönnholm, P., Haggrén, H. (2016). Development and implementation of a new Master's Programme in Geoinformatics at Aalto University, Finland. The Photogrammetric Journal of Finland, Vol. 25, No. 1, pp. 1 – 19.
3. QS Top 50 Under 50 (2019). https://www.espooinnovationgarden.fi/en/espoo-innovation-garden/media/news/aalto-university-selected-in-global-top-10-of-young-universities/ [accessed 27.8.2019]

GEOGRAPHICAL NAMES IN THE ERA OF BIG DATA A NECESSARY UPDATING IN THE CURRICULUM DESIGN OF THE GEOSCIENCIES

Adriana VESCOVO [1]

UDC: 81'373.21:006.32]:[528.935:004.62

SUMMARY

After a long stage of low visibility, place names are revitalized by the digital revolution and globalization. As part of the map, geographical names were also affected by the technological and paradigms changes that revolutionized not only the mapmaking process but also the management of spatial information in all its stages. In this new context, the interoperability requirements of the data intended for the Spatial Data Infrastructure and for multiple users and services drove the normalization processes. Geographical names are not alien to this need. In another aspect, new cultural paradigms associated with globalization joined to renew interest in geographical names in the last half century: the revaluation of local identities, open data policy and the collaborative model. The objective of this article is to stimulate the reflection on geographical names in this new context, their special meaning as cultural heritage and the need and benefits of their national and international standardization. And, consequently, the inclusion of geographical names in a necessary revision and update of the geoscience curricular designs.

Key words: Geographical Names Standardization; toponymy; national cultural heritage; Big Data; curriculum design; public policies.

A NEW TECHNOLOGICAL CONTEXT

No one doubts that place names are an essential element of cartography.
However, geographical names (GNs) did not always receive the necessary attention and were treated with ups and downs even by national mapping

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production agencies. This situation seems to be reversing as a result of digital revolution.
The so-called "geographical explosion" broke out characterized by the arrival of computers, Internet and the World Wide Web service in 1990.
As part of the map, the GNs were also affected by these exceptional technological and paradigm changes that revolutionized the mapmaking process as well as the management of spatial information in all its stages.
As a result of this new digital era, the paper map ceased to be the main objective of geospatial production, now aimed at the development of Geospatial Databases (GDB) and Spatial Data Infrastructures (SDI), which – in this new cycle of Geospatial Information (GI) - many new products, applications and services will be developed in the most diverse formats and supports.
Within this new paradigm, almost all of the features that constitute the GDB and the SDI are associated with a name. In this sense, the GNs are still present throughout the entire life cycle of the GI, from its original capture in the field to its rapid and massive expansion.
From the point of view of the mapmaking process, the digital era allows a permanent update of the GDB and all the resulting by-products, a situation that requires, however, careful attention.
In another sense, the GNs, which reached a very slow and limited diffusion through the paper support, are now immediately, easily and quickly disseminated. And, in little more than a second through the web, they become a gateway to other billions of connections and contents, which go well beyond the place name itself. This virtuous nexus of place name and virtual space has called the attention of the world of marketing and investment, giving the GNs a previously unthinkable economic value.

THE AGE OF BIG DATA

The digital revolution marked the beginning of the information age. In the field of GI, technological advances in the last half century, accelerated in recent decades, expanded and enriched the different tools, platforms and methodologies of capture and management of geographic data: global positioning systems, digital aerial photogrammetric systems, satellite remote sensing, including private and nanosatellites; the use of UAV's, the LIDAR technology; as well as the management of information through GIS, models, maps and countless applications and services.
For each new advance, the volume of data captured, processed and transmitted is multiplied exponentially. GI also joins the Global Big Data. GI Meetings, forums and congresses are aware of this power. The characteristics of Big

Data are usually summarized in the 5 V: volume, velocity, variety, veracity and value. This complexity raises other needs: precision be updated, availability… Never has society had access to such a gigantic volume of information. But its real utility is only achieved together with the greatest demand: access the source and maintain the data quality.

OPEN DATA

New paradigms of world culture add to the technological revolution. Access to information, until yesterday reserved or limited by very high costs, is currently opened as a citizen right. The open data policy marks a new treatment of information in the governmental and scientific-technical field. At the same time, massive access to the Internet, personal computers and other devices such as mobile and smart phones is spread throughout the world. The Central Intelligence Agency (CIA) estimated for 2018 an Internet access of 3.174 million users, equivalent to 43% of the world's population. According to the Mobile Economy Annual Report 2019, 5.100 million people had a mobile phone line by the end of 2018, which represented approximately 67% of the world's population. Access to technology and the right to information open a new trend that aims to offer more and more digital services through free platforms. These routes allow an increasing access to visualize, download and share geospatial information, together with tools for its treatment.

COLLABORATIVE MODEL

The old “top-down” model in which mapping agencies or government institutions were the only generators of geographic information has been diluted as a result of the changes in the digital era. The massive access to geographic information and a more fluid and open communication between user and generator, between authority and citizen, have resulted in the collaborative model. This new trend requires an adaptation by both sectors of the information circuit: specially, an open mind of the bodies responsible for generating the GI, and trained personnel and regulations that include criteria for analyzing the quality of the data, prior to its inclusion in the information flow. An active user has proved to be an important node in the generation of information, both in the elaboration of mapmaking process and in the provision of geo-referenced data for the management of humanitarian aid or the risk of natural disasters such as hurricanes, earthquakes, volcanism, floods or Tsunamis, among others. The GNs also accompany features here, and are especially important in these circumstances. In this sense, there is an increasing interest as well as the bibliography referring to the analysis of the collaborative model and its problems.

THE MAP IN THE ERA OF BIG DATA

The digital era and the emergence of GDBs, GIS and other multiple digital applications and services questioned the current value of the map. However, the analysis of reality confirms the opposite.

Access to digital and mobile devices has increased their use. Eighty percent of people who have smart devices use some type of map for their own location, geo-referenced searches or to reach their destination. Since most of the information we handle has spatial location, the map is currently used in everyday life like never before. It remains mandatory - in paper support- in sea and air transport, and proved to be essential and practical in any other transport or sporting activity. This, not to mention the infinity of sectors of the economic and governmental activity in which the map increased its use as a result of new technological tools or the development of special applications.

Examples of this are its application in smart agriculture, in the delivery of documents or merchandise through the use of UAV's, control of the supply of drinking water or public lighting, parking, waste management and numerous other urban services (sanitary, educational, tourist, etc.) as well as in innumerable applications developed with destination to the user from tools and digital devices.

But, beyond this everyday use, maps play a unique and irreplaceable role: they allow us to identify features in their environment and analyze spatial relationships.

Summing up, like no other tool, maps make possible a visual synthesis of the essential information in the era of Big Data.

COPERNICUS PROGRAM: A CASE STUDY

Considered the best cartographic system in the world, the *Copernicus Program* of the European Union, as a product resulting from this special moment that the GI is going through, can be taken as a case study. In that sense, it means the choice of remote sensing as the most efficient and transparent tool for accessing a wide range of data on the Earth condition. *Copernicus* captures and delivers, almost in real time, huge amounts of global data from satellites and terrestrial, aerial and maritime measurement systems for the understanding and sustainable management of the planet. According to its latest 2019 report (Copernicus Market Report 2019), the volume of downloads was 28 TB through its Data and Information Access Services (DIAS), with a growth of 133% compared to 2016.

About the 5 V of *Copernicus Program* Big Data, The Visionary Paper From Copernicus Big Data to Extreme Earth Analytics (Koubarakis et al., 2019) offers the following information:

> *"Volume: The repository of Sentinel products managed by the European Space Agency (ESA) has so far published more than 5 million products, and it has more than 100 thousand users who have downloaded more than 50 PB of data since the start of the operations of the system. This volume will increase in the following years, as new Sentinel satellites are launched.*
>
> *Velocity: Copernicus data has to be delivered and processed in a short time frame to allow the provision of 24/7 information to users requiring fast responses. By the end of 2016, 6 TB of data were generated and 100 TB of data were disseminated every day from the Sentinel product repository. These rates will increase in forthcoming years as new Sentinel satellites are launched.*
>
> *Variety: The Sentinel satellites have different types of sensors (e.g., radar and optical) and different levels of processing (from raw data to advanced products). Moreover, datasets used for geospatial applications can be not only satellite data but also aerial imagery, in-situ data and other collateral information (e.g., public government data). This wealth of data is processed by Earth Observation actors to extract information and knowledge. This information and knowledge is also big and similar big data challenges apply. For example, 1PB of Sentinel data may consist of about 750.000 datasets which, when processed, about 450TB of content information and knowledge (e.g., classes of objects detected) can be generated.*
>
> *Veracity: Decision-making and operations require reliable sources. Thus, assessing the quality of the data is important for the whole information extraction chain.*
>
> *Value: The extraction of information from the Copernicus data has direct economic benefits for Europe. Several economic studies have concluded that the Copernicus programme has the potential to significantly impact job creation, innovation and growth. The Copernicus Market report of 2016 estimates that the overall investment in Copernicus will reach EUR 7.4 billion in the years 2008-2020, while the cumulative economic value generated by it in the same period will be around EUR 13.5 billion, and it will support 28.030 job years in the Earth Observation sector. (Koubarakis et a.l, 2019)*

As an example of open data policy, the Program guarantees full, open and free access to *Copernicus* data and information, and is the European contribution to the Global Network of Earth Observation Systems (GEOSS). *Copernicus* also offers an example of a collaborative paradigm through its Thematic Exploitation Platforms (TEPs). Its multiple end users include public administration, senior students, researchers, commercial companies, entrepreneurs, NGOs and citizens, both European and worldwide.
For all the above, the *Copernicus Program* could be incorporated as curricular content in Geography, Cartography and associated careers, not only for its use but also for its conceptual and contextual analysis of current trends in the field of geosciences.

A NEW CULTURAL CONTEXT

Beyond the impact of technological changes, geographical names have also been affected by a new cultural context characterized by the revaluation of local culture in response to decolonization processes and the phenomenon of globalization. This trend was reflected in the recovery of local languages and their inclusion as official languages.
In the same direction, the United Nations Educational, Scientific and Cultural Organization (UNESCO) approved in October 2003 the Convention for the Safeguarding of the Intangible Cultural Heritage. And last January, it inaugurated the International Year of Indigenous Languages 2019 (IY2019), as a reserve of culture, knowledge, values and identity. In Europe, Decision 2017/864 established the Declaration of the European Year of Cultural Heritage 2018.
This trend was very widely reflected in the GNs, with the recovery of place names in the indigenous languages, both from countries and cities, streets, squares or other features. Just to mention the best known examples worldwide - among thousands of cases - can Sri Lanka, Myanmar, Beijing, or Kolkata be cited. And more recently the recovery of the name of the highest mountain in the United States of America, Mount Mc Kinley, in Alaska, which in 2015 was renamed by President Barak Obama as Denali, “the highest”, original name in the language of the indigenous local community.

STANDARDIZE GEOGRAPHICAL NAMES

In the current context in which the GI is developed, geographical names offer two fields of analysis: as basic and fundamental data of the IDE and as cultural heritage. The digital revolution promoted the standardization processes of the entire GI in order to allow interoperability of data and the development of applications and services. Geographical names are no stranger to this requirement.

Although the initiatives to establish a single written form for each geographical name date back from the end of the 19th century, the United Nations became the permanent international discussion space on this subject since 1948. The First United Nations Conference on the Standardization of Geographical Names was held in 1967, culminating in the creation of the United Nations Group of Experts on Geographical Names (UNGEGN), an organization that will dedicate half a century of existence to this arduous task. The goal of UNGEGN is to create a unique record of all official place names of the earth. But standardizing the GNs implies achieving a unified record of the writing of all world toponyms in a global scenario that includes about 7.000 languages, among which a large part of them corresponds to languages without writing, to which different types of alphabets are added. Papua New Guinea is the country with the greatest linguistic diversity: in an area of less than half a million square kilometers (somewhat less than Spain) some seven million people speak more than 800 different languages. Greenlandic is today the only official language of the Danish island territory. Although it is spoken by only about 54.000 people - equivalent to half of the amount of inhabitants of the city of Winterthur - this language has three dialects.

In the midst of this "*Babel Big Data*", the ambitious goal of the UNGEGN can only be achieved by means of the national standardization of the GNs, the process in which each country decides its own place names following standardized principles, policies and procedures. By having standardized Geographical Names National Gazetteers will be the source of basic and official information on the construction of a global SDI.

For more than 50 years, UNGEGN pursued its objective through the development of 30 sessions and 11 conferences, and their respective Resolutions and documents resulting from the Meetings of the Working Groups, the advisory work of its Task Groups, Training courses, publication of manuals and brochures, as well as lists of geographical names and reference information of countries, digital files and compilation of documents included in its website. The UNGEGN has a structure of 24 Geographical-Linguistic Divisions, nine Working Groups and two Task Groups. It brings together more than 400 members from more than 100 countries, which includes geographers, cartographers, linguists, planners and specialists in different geosciences. The UNGEGN is one of the four bodies composed of government experts from the Economic and Social Council (ECOSOC), one of the six main bodies of the United Nations.

NEED AND BENEFITS OF GEOGRAPHICAL NAMES STANDARDIZATION

The hard work of UNGEGN stems from the conviction of the advantages, benefits and the need to standardize the Geographical Names, an objective that is renewed in the current technological context in which the GI is developed.
At the national level, these benefits are associated with the improvement of efficiency in communications and resource management that generates a unique database of GNs in the management of public policies and private sector.
These advantages are clearly visible in the cartographic activity and in the IDE of the different levels of public administration; in statistical work; disaster management; defense, security and land, sea and air communications; humanitarian aid; food safety; urban, territorial and environmental planning; tourism, industry, and commerce; academic and scientific activities; strategic planning; and development cooperation, among many others.
The establishment of an authority and of a recognized process of validation of geographical names at the national level prevents overlapping and confusing management of processes, consequent saving of human resources, capital and time, as well as human and structural risks and losses arising from inconsistencies
The official and uniform use of the writing of GNs also facilitates the communication and coordination of regional and international projects.

GEOGRAPHICAL NAMES IN THE 2030 AGENDA

In this regard, in order to serve the current global objectives of the United Nations more efficiently, the UNGEGN was dissolved and recreated according to ECOSOC Resolution 2018/2 of November 2017.
The "new" UNGEGN maintains its initial objectives and structure, updating its work methodology and dissemination formats of its results.
Under this new regulation, and organized by the United Nations Statistics Division of ECOSOC, UNGEGN celebrated its 1st. Session at the UN headquarters in New York, between April 29 and May 3, 2019.
Undoubtedly, GI is an essential input in all United Nations programs. In this regard, the 2030 Agenda and the achievement of the Sustainable Development Goals summarize the main goals of this international organization to be met in the respective states, and cannot be achieved without accessible and quality GI. In this regard, the joint work of UNGEGN and the United Nations Committee of Experts on Global Geospatial Information Management (UN-

GGIM) will be essential. The importance of GNs in the 2030 Agenda was addressed in a special presentation and in different exhibitions during this 1st. Session of the "new" UNGEGN, as well as in other previous meetings, accompanying the growing interest of the subject throughout the world.

Figure1: The 1st. Session of the new stage of UNGEGN (New York, 2019)
The 1st. Session was attended by 264 participants. It included representatives from 70 Member States, an Observer State, and representatives of the International Cartographic Association (ICA) and the International Geographic Union (IGU).

Figure 2: Geographical Names and the 2030 Agenda. (New York, 2019)
The link between the Geographical Names and the 2030 Agenda had a prominent place during the 1st.Session of the new UNGEGN.

GEOGRAPHICAL NAMES AT PRESENT

Geographical Names continue incorporating new themes into their traditional discussions: migrations, gender issues, risk management, trademarks, independence movements are just a few examples. There are still changes in the names of countries (North Macedonia, Czechia, Eswatini); wind farms are named; and streets and squares take the names of women or recent political events; original names are recovered in Estonia; the name of Pablo Neruda for Santiago de Chile Airport, the emergence of globalized maps on official digital sites, and the choice of programs to manage GDB are discussed ... Geographical names accompany the historical and cultural evolution in its broadest sense.

Figure 3: Geographical Names in road signs.
Some examples in Egypt, Ethiopia, Canada and Croatia are shown on the pictures. UNGEGN participates in the International Organization for Standardization (ISO) in the international representation by alphabetic codes. In this last picture: HR for Croatia

Meanwhile, the traditional problems of the GNs are maintained, such as those related to solving writing problems in GNs of native languages; the use of exonyms or endonyms in the Atlases; GNs in cross-border geographical objects, the use of GNs in legal documents or translations; their inclusion in scientific and technical publications; GNs of features under territorial dispute; the application of new technologies in the registration of the GNs during field works; or decisions in the normalized management of the GNs: proposals of new names, changes of GNs, use of controversial names…
Or there are other specific studies: studies on the inclusion of names of flora or fauna species in local toponymy allow recreating the evolution of environments and land use; analyses of toponymy in native languages help manage disaster risk; GNs studies of foreign languages explain the historical evolution of territorial occupation and migrations; social perception assessments of Geographical Names of tourist areas define promotion plans... Closely linked to the human spirit, Geographical Names are full of meanings.

GEOGRAPHICAL NAMES AND CURRICULAR UPDATE

The evolution of Geographical Names is part of the development of GI. GNs are an essential part of mapping and the entire management of the GI. As discussed in other MMM Geo Information articles, the handling of the multiple technological tools that currently integrate the cycle of mapping production and GI requires specific training. As an essential element of cartography and basic and fundamental data of the GDB, the GNs have their own problems. Its standardization is indispensable to allow the interoperability of GI. The quality of the data is the main challenge in the era of Big Data. As an integral part of most of the Features of a GDB, the management of the GNs requires more than technical expertise. The normalization of GNs also requires human resources formed in concepts, contexts and trends: officials and operators who are aware of the importance, the need and the benefits of standardization of national GNs and of maintaining the quality of the data throughout the entire production cycle. The standardization of the GNs also requires human resources formed in principles, policies and procedures. Together with the technical training that offers the necessary skills for the management of technological tools, it is necessary to train in conceptual knowledge. At a higher level of training, the inclusion of content associated with the importance of GNs in public policies will also be necessary. Contents will be adapted to the different degrees levels. The enormous changes produced in the field of GI make it necessary to update the curricular designs of all careers associated with cartography, geography and geosciences. Geographical Names should be incorporated into all of them.

The case studies can be a very suitable support to bring the concepts to real practical examples.

CONCLUSIONS

Geographical Information has always been strategic knowledge. As part of this information, geographical names are an essential element of public policies, as georeferenced data and as identity provider. As intangible cultural heritage, geographical names contain in themselves a social and economic value, as well as rich information regarding the context of their origin and their changes. As a link between generations, they create a network of belonging and continuity in the midst of a global, fragile and mobile world. Maps, in the past, and databases at present, can be important reserves of that living memory that technology allows to disseminate as never before. In the era of Big Data, access to information seems to be secured through the availability of technological tools and the open data paradigm. In this same current context, information and knowledge are a collective creation. In a world with a volume of data and geographical information as never before, quality is one of the greatest challenges of geosciences and one of the greatest responsibilities of the present time society. The use of standardized geographical names ensures a reliable quality geographical information flow. The academic world must train capable human resources to respond to these challenges.

REFERENCES

1. Buzai, G. (1999) Geografía Glob@l. El paradigma geotecnológico y el espacio interdisciplinario en la interpretación del mundo del siglo XXI. Buenos Aires, Lugar Editorial. pp216.
2. GSMA (2019) Mobil Economy 2019. Mobile Economy Annual Report. https://www.gsma.com/r/mobileeconomy/ [accessed 05-10-2019]
3. ICOS, (2010) XXIV Congreso Internacional de ICOS sobre Ciencias Onomásticas (2010), Universidad de Barcelona. http://blog-idee.blogspot.com/2010/09/xxiv-congreso-internacional-de-icos.html [accesseed 16.08.2019]
4. Koubarakis, M. et al.(2019) From Copernicus Big Data to Extreme Earth Analytics.Visionary Paper. Published in Proceedings of the 22nd International Conference on Extending Database Technology (EDBT), March 26-29, 2019, ISBN 978-3-89318-081-3 onOpenProceedings.org.

https://openproceedings.org/2019/conf/edbt/EDBT19_paper_321.pdf [accesseed 05.10.2019]

5. PwC (2019)Copernicus Market Report 2019. https://www.copernicus.eu/sites/default/files/2019-02/PwC_Copernicus_Market_Report_2019_PDF_version.pdf [accesseed 05.10.2019]
6. Ruiz Almar, E. (2014) *La explosión geográfica: las tecnologías de la Información Geográfica y su impacto en la Geografía y la Cartografía*. Revista do Departamento de Geografia da Faculdade de Filosofia, Letras e Ciências Humanas da Universidade de São Paulo, volumen especial Cartogeo, pp. 286-301 ISSN 2236-2878 DOI:10.7154/RDG.2014.0114.0011Brasil. http://www.revistas.usp.br/rdg/article/view/85556/88345 [accessed 04.06.2019]
7. Ruiz Almar, E. (2010). Consideraciones acerca de la explosión geográfica: geografía colaborativa e información geográfica voluntaria acreditada, GeoFocus- Revista Internacional de Ciencia y Tecnología de la Información Geográfica- (Artículos), nº 10, pp.280-298. ISSN: 1578-5157. http://www.geofocus.org/index.php/geofocus/article/view/ [accesseed 24.06.2019]
8. UNESCO, Convention for the Safeguarding of the Intangible Cultural Heritage https://ich.unesco.org/en/convention [accesseed 04.06.2019]
9. UNESCO, 2019 International Year of Indigenous Languages https://en.iyil2019.org/about/ [accesseed 04.06.2019]
10. UNGEGN, United Nations Group of Experts on Geographical Names https://unstats.un.org/unsd/ungegn/ [accesseed 15.08.2019]

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GEOINFORMATICS EDUCATION IN UNIVERSITY OF PRISHTINA

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SUMMARY

The department of geodesy is one of the five departments of the faculty of civil engineering and architecture, which within a period of 15 years has managed to establish study programs at both Bachelor and Master. The main purpose of these programs is to produce professional graduated staff who will be knowledgeable in both geodetic measurement techniques, Cartography, Geoinformatics and Remote Sensing. Within this period, these programs have been through some changes, actually in use is the third curriculum of 2015 year re-accreditation, while next academik year 2020/21 will start with curricula of 2019 re-accreditation with some minor changes. Compared to the previous two curricula, the curicula of 2015 has been developed in collaboration with Tempus project simultaneously has developed the curriculum in master level. While the second master's curriculum has come into use in this academic year. With this paper we will attempt to elaborate on the Geoinformatics aspect within the four curriculas in bachelor level and two curriculas at the master level of Geodesy within the Department of Geodesy.

Key words: Education, Geoinformatic, Geodesy, Curricula, University of Prishtina.

INTRODUCTION

Over the last decade, geoinfromatics has become a term that has been used by different groups of geospatials and geoscientific fields. Geoinformatics is a new discipline, thanks to the development of science and technology that has made it a field that integrates various fields of geoscience and those dealing with geospatial information such as Geodesy, Information Technology, GIS,

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Cartography, GNSS, Geology, Photogrammetry, Agri-culture, Forestry and other soil sciences. Geoinformatics can be thought of as the field in which geoscientists and computer scientists are working together to develop tools to address a range of complex scientific questions, using advanced spatial information technologies and integrated analysis (Keller, 2011).

Kosovo as a new country has faced the need to build new professional staff in the higher education with the inclusion of geoinformatics field. Students, before the year 99 studies in these fields have mainly taken place in the university centers of the former Yugoslavia as well as in the other European countries. The most visited centers in the former Yugoslavia were university in Zagreb, Sajarevo and Belgrade (IDRIZI, 2013). At that time in Kosovo, certain subjects in these fields were part of other programs, such as geodesy in Constructive program, Mine surveying in Geology/Minig, etc. In 2003, the first study program at the bachelor of geodesy was opened, within the Faculty of Civil Engineering and Architecture respectively the Construction Section. With the opening of the new program, the opportunity to build the new professional staff in the field of geoinformatic has also been opened. During these 15 years of existence of this program there have been several changes in curricula, academic development and training, development of laboratory (equipment and software), infrastructure, etc. In addition, the program has collaborated with other international Universities, such as the ERASMU + program and the implementation of other funding projects such as Tempus, where a Master degree curriculum has also been developed.

A BRIEF OVERVIEW OF THE DEVELOPMENT OF THE GEODESY DEPARTMENT

The University of Pristina is the most important educational, scientific and cultural institution in Kosova. For more than forty years it was the sole carrier of higher education. The University of Prishtina is relatively new – forty-three years old, but the path of its development was dynamic, and the educational, scientific and artistic activities were rich and with great results, with undeniable and historic weight. The first institution of higher education in Kosova was the Higher Pedagogical School in Prishtina (1958). Till year 1970, several independent high institutions have been established, such as higher schools and faculties, in total 13 higher education institutions (IDRIZI, 2013).

As part of the Technical High School in Pristina in 1961, the section of Civil Engineering was also erected, which is also known as the foundation of today’s faculty. In 1965, this technical high school was transformed into the Technical Faculty with the Construction Section. This trend of transformation continues even in 1988, which is divided into three faculties: Faculty of Civil Engineering and Agriculture, Faculty of Electrical and Faculty of Machinery (UP, 2005). Within the Faculty of Civil Engineering and Architecture two sections were developed: that of Construction and Architecture. In the academic year 2002/2003 the faculty began work on the directives of the Bologna Declaration, first at the Bachelor level and then at the master's degree in 2005 (Prishtinës). Based on market economy requirements in the academic year 2003/2004, FNA for the first time opened the Geodesy study program for the Bachelor level. Following the opening of the geodesy program, the FNA had an organization and the programs shown as the figure below.

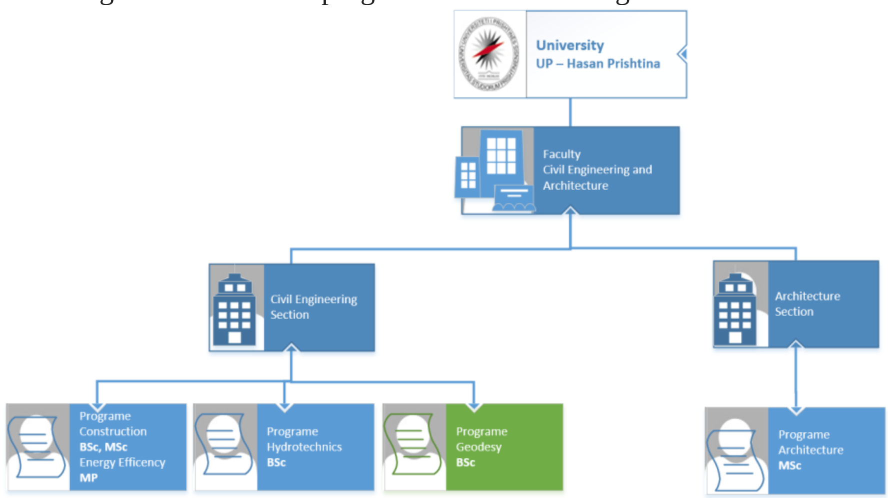

Figure 1 Organogram of Faculty of Civil Engineering and Architecture/ programs

In December 2017, the council of the Faculty of Civil Engineering and Architecture re-organizes within the faculty, and decides on the establishment of the Department of Geodesy by delegating responsibilities, obligations and duties in an equivalent form to other departments such as that of Civil Engineering, Architecture, Hydro-techniques and Environmental Engineering. The new organogram and programs are presented as follows.
Since its formation, the mission of the Faculty of Civil Engineering and Architecture (FNA) has been focused on the teaching and learning, continuous scientific research, researches from academic staff in the service of the academia and society at large as well as developing professional staff with market requirements. The goal of the FNA is to provide quality based on the highest standards in the field of teaching and learning to support the needs and expectations of students, other stakeholders and the whole society. The politics and procedures developed and adopted for all programs by the Faculty

of Civil Engineering and Architecture are applicable to geodesy programs as well.

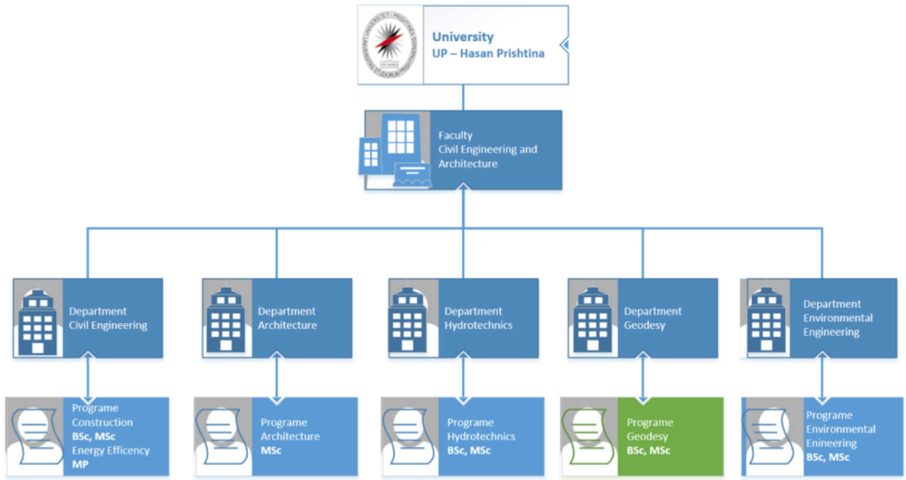

Figure 2 Organogram of Faculty of Civil Engineering and Architecture after re-organistation 2017 / programs

The teaching staff engaged in geodesy programs is qualified and highly experienced. As such, they are committed to achieving the highest results in research and teaching. Currently, the geodesy study program includes a total of thirteen teachers with academic qualification Professor. According to the academic titles, five are full professors, two are associate professors, five are assistant professors, two lecturers. This program includes teachers who are trained in teaching methods as well as student assessment practices in the context of learning. It is important to note that the Department of Geodesy has made progress in advancing academic staff. During 2018 a full-time assistant professor was employed; with a rate also engaged a professor for lectures. From the CVs of the academic staff, it is clear that during the last three years they have published scientific papers in international journals, which are part of well-known databases such as Scopus. In terms of international cooperation, the academic staff regularly participates in various research at international universities and conferences. Part of the academic staff are also four assistants, who are currently completing their PhD studies, two of which are expected to be completed by 2019.
In the context of enhancing the quality of teaching, the Department of Geodesy has also been active in projects with international universities, thus benefiting from the TEMPUS project to create a new Master's degree program in Geodesy. This project was developed in partnership with four international universities: Kungliga Tekniska Högskolan-KTH, Sweden; University of West Hungary, Hungary; Vilnius Gediminas Technical University, Lithuania;

Aristotle University of Thessaloniki, Greece; as well as five local partners: Ministry of Agriculture, Forestry and Rural Development; Ministry of Education, Science and Technology; Kosovo Cadastral Agency; Istog Municipality; "Geo & Land" with a duration of three years 2013-2016 (MPG). Upon completion of the project the geodesy program has benefited from a new master's program in Geodesy (its curriculum will be discussed below); creation of a new geodesy laboratory with geodetic equipment; computer equipment; training in partner university from project on topics such as: GIS and its application held-Hungary, digital mapping and image processing-Greece, Cadastral-Lithuania Information System, modern geodetic concepts Pristina; development of new teaching materials; implementation of new pedagogical methods.
In terms of technical equipment, the department is enriched with the latest technology equipment provided through the TEMPUS project. The geoinformatic cabinet is equipped with the latest commercial and open source software and the geodesy laboratory with the necessary equipment.

Computer equipment under the new cabinet:

- Server, WorkStations, Laptop, Printer, Ploter, Scanner, Projector
- Commercial software: ArcGIS, Erdas IMAGINE, Trimble Bussines Center.
- Free and open source software: QGIS, GrassGIS, Geogebra, FreeCAD, uDig, Geoserver, Mapserver, Geonode, OpenLayers, Heron GIS, MapStore, GeoTools, GDAL / OGR, PostgreSQL / PostGIS, Orfeo ToolBox, Monteverdi, OSSIM, gsal , RTKLIB, JAG3D, etc.

Geodetic equipment within the geodesy laboratory:

- GPS receivers (Base & Rover & Controller) with all supporting equipment,
- Total Robotic Station with all supporting equipment,
- Total Manual Stations with all supporting equipment,
- Digital Levels with all supporting equipment,
- Manual levels with all supporting equipment,
- As well as various accessories for the needs for geodetic exercises.

So far about 400 students have graduated from the bachelor Geodesy program and one in the master's degree.
At the end of 2018, the Department of Geodesy has renovated new spaces, which are necessary and sufficient for the progress of student teaching, research and learning.

GEOINFORMATICS EDUCATION IN DEPARTAMENT OF GEODESY

It is important to understand the strategic importance of geoinformation for geodesy as well as for other areas (such as spatial planning, environmental monitoring, forestry, agriculture management, etc) that also use maps and geospatial information. Among the main objectives of the program is to educate younger generations, which will greatly help improve the geosciences sector in Kosovo, as well as improve the level of application of geo-information in Kosovo, which can significantly improve state of management of information related to spatial planning, infrastructure, environment, agriculture, forestry etc.

From the above discussion we see that the department and study program in Geodesy within FNA is a relatively new branch of studies. However, it is important that for these 15 years of operation, the program has already laid the groundwork for sustainability but also the desire to adapt to the growth of market-oriented curricula. Analyzing the curricula of this program, we find that there are constant changes in it. Currently, the third curriculum is in use for bachelor level which came into force from the re-accreditation of 2015. As in the first two curricula, as in the last and next curricula the total credits foreseen are 180 ECTS credits of 3 years duration (6 semesters), but in 2015 are including 12 ETCS for diploma thesis while from next curicula 2020 will be 9 ETCS for diploma thesis. This opens the way for the creation of a Master's Degree Curriculum in Geodesy, is a 120 ETCS Master's Degree Program in a duration of 2 years (4 semesters) including a Master diploma thesis with 30 ETCS (MSc, UP). Below we present the four curricula(2003-2020) for bachelor level and two for master level (2015-2019) for all subjects along with details about the number of hours for lectures, exercises, Obligatory (O) or Elective (E) status, semester and ETCS credits.

Table 1 Content of the first year bachelor curricula with changes over the years

		curricula 2003				curricula 2007				curricula 2015				curricula 2019 (start 2020/21)			
	No	Subject	Status	L+E	ECTS	Subject	Status	L+E	ECTS	Subject	Status	L+E	ECTS	Subject	Status	L+E	ECTS
Semestre 1	1	Mathematics 1	O	3+3	7	Linear algebra and analytical geometry	O	2+2	6	Linear algebra and analytical geometry	O	2+2	6	Linear algebra with the analytical geometry	O	2+2	6
	2	Descriptive geometry 1	O	2+2	5	Programming	O	2+2	6	Programming	O	2+2	6	Programming	O	2+2	6
	3	Physics 1	O	2+2	5	Physics	E	2+2	6	Physics including Mechanics	O	2+2	6	Physics with Mechanics	O	2+2	6
	4	Practical geodesy 1	O	3+3	7	Geodetic instruments and introduction into geodesy	O	2+2	6	Database technology	O	2+2	6	Basic Geoinformatics	O	2+2	6
	5	Foreign language	O	2+0	2	Foreign language	E	2+0	6	Foreign Language	O	2+0	6	Foreign language	O	2+0	3
	6	Sociology	E	2+0	4	Basics of geoinformatics and informatics	O	2+2	6	Ecology	O	2+0	3	Geodetic Instruments	O	2+0	3
	7	Computer and informatics	E	2+2	4												
Semestre 2	1	Mathematics 2	O	3+3	7	Computer geometry	O	2+2	6	Calculating geometry	O	2+2	6	Calculating geometry	O	2+2	6
	2	Descriptive geometry 2	O	2+2	5	Mathematical analyses	O	2+2	6	Mathematical Analysis	O	3+3	9	Mathematical analysis	O	3+3	9
	3	Practical geodesy 2	O	3+3	6	Land surveying	O	2+2	6	Land surveying	O	2+2	6	Basic of geodesy	O	2+2	6
	4	Geodetic drawing	O	1+2	4	Analyses and processing of geodetic measurements	O	2+2	6	Basic Geoinformatics	O	2+2	6	Database Technology	O	2+2	6
	5	Foreign language	O	2+0	2	Field measurements	E	2+2	6	CAD in surveying	E	1+1	3	CAD application in geodesy	E	2+2	3
	6	Physics 2	E	2+2	4	Basics of property rights for land registration	E	2+2	6	Basic Geotechnical engineering	E	2+1	3	Object Oriented Modelling and Programming	E	2+2	3
	7	Geoinformatics 1	E	2+2	4	Spherical trigonometry	E	2+2	6					Introduction to geotechnics	E	2+1	3
	8	Academic writing with communication	E	0+2	2												

Table 2 Content of the second year bachelor curricula with changes over the years

		curricula 2003				curricula 2007				curricula 2015				curricula 2019 (start 2020/21)			
	No	Subject	Status	L+E	ECTS	Subject	Status	L+E	ECTS	Subject	Status	L+E	ECTS	Subject	Status	L+E	ECTS
Semestre 3	1	Mathematics 3	O	3+3	7	Databases	O	3+2	7	Geodesy	O	3+3	9	Land surveying	O	2+2	6
	2	Geoinformatics 2	O	2+2	5	Differential geometry	O	2+2	6	Cadastre	O	2+2	6	Cadastre	O	2+2	6
	3	Practical geodesy 3	O	3+3	6	Cadastre	O	2+2	6	Engineering surveying	O	2+2	6	Differential Geometry	O	2+2	6
	4	Topography	O	2+2	5	Geodetic plans	O	2+2	6	Adjustment methods	O	2+2	6	Adjustment methods	O	2+2	6
	5	Foreign language	O	2+0	2	Topography	E	2+1	5	Topographic mapping	E	2+1	3	Compilation of plans and maps	E	2+2	3
	6	Mechanics	E	2+2	5	Practical work with geodetic instruments	E	2+2	5	Registration and Valuation of Immoveable Property	E	2+2	3	Registration and valuation of real estate	E	2+1	3
	7	Geodetic software's	E	2+2	5									The use of geoinformation	E	2+2	3
Semestre 4	1	Geoinformatics 3	O	2+2	5	Cartography	O	2+2	6	Differential geometry	O	2+2	6	Basic of Engineering Geodesy	O	2+2	6
	2	Practical geodesy 4	O	3+3	7	Geodetic reference frames	O	2+2	6	Photogrammetry	O	2+2	6	Photogrammetry	O	2+2	6
	3	Theory of errors with adjustments 1	O	3+3	6	Photogrammetry	O	2+2	6	Cartography	O	2+2	6	Cartography	O	2+2	6
	4	Real estate cadastre 1	O	2+2	5	Utilization of geoinformations	O	2+2	6	Field surveying, practice with geodetic equipment	O	2+2	6	Field surveying with geodetic equipment	O	2+2	6
	5	Foreign language	O	2+0	2	Geoinformation modeling	O	2+2	6	Water management	E	2+1	3	Water management	E	2+1	3
	6	Mathematics 4	E	3+3	5					Spatial planning	E	2+1	3	Spatial Planning	E	2+1	3
	7	Geodetic astronomy 1	E	2+2	5					Feasibility study for GIS	E	2+1	3	Basic of GIS	E	2+2	6

Table 3 Content of the third year bachelor curricula with changes over the years

		curricula 2003				curricula 2007				curricula 2015				curricula 2019 (start 2020/21)			
	No	**Subject**	**Status**	**L+E**	**ETCS**	**Subject**	**Status**	**L+E**	**ETCS**	**Subject**	**Status**	**L+E**	**ETCS**	**Subject**	**Status**	**L+E**	**ETCS**
Semestre 5	1	Theory of errors 2	O	2+2	6	Satellite positioning	O	2+2	6	Satellite Positioning	O	2+2	6	Satellite positioning	O	2+2	6
Semestre 5	2	Engineering geodesy 1	O	3+3	7	Engineering geodetic basis	O	2+2	6	Remote sensing	O	2+2	6	Remote sensing	O	2+2	6
Semestre 5	3	Real estate cadastre 2	O	2+2	6	Remote sensing	O	2+2	6	Geodetic control networks	O	2+2	6	Geodetic networks	O	2+2	6
Semestre 5	4	State survey	O	2+2	6	Land development	O	2+2	6	GIS applications	O	2+2	6	GIS Application	O	2+2	6
Semestre 5	5	Photogrammetry	O	2+2	6	Land information systems	E	2+2	6	LIS	E	2+1	3	Land Information System	E	2+2	3
Semestre 5	6	Land development 1	E	2+2	6	Topographic cartography	E	2+2	6	LAW	E	2+1	3	Legislation and geodesy provision	E	2+0	3
Semestre 5	7	Road projects	E	2+2	6					GNSS in positioning and navigation	E	2+2	3	GNSS application in positioning and navigation	E	2+1	3
Semestre 5	8	Geodetic astronomy 2	E	2+2	5												
Semestre 6	1	Engineering geodesy 2	O	3+3	7	Engineering geodesy	O	2+2	6	Land Regulation	O	2+2	6	Land regulation	O	2+2	6
Semestre 6	2	State survey 2	O	2+2	6	State survey	O	2+2	6	Land Management	O	2+2	6	Land management	O	2+2	6
Semestre 6	3	Land development 2	O	2+2	6	Map projections	O	2+2	6	Professional ethic	E	2+0	3	Mathematical cartography	O	2+2	6
Semestre 6	4	Geodesy and environment protection	E	2+2	6	Geoinformation infrastructure	E	2+2	4	Management	E	2+0	3	Three Dimensional Laser Scanning in Geodesy and Geoinformatics	E	2+2	3
Semestre 6	5	Physical planning and urbanistics	E	2+1	5	Web cartography	E	2+2	4	Web Cartography	E	2+2	3	Management in geodesy and geoinformatics	E	2+2	3
Semestre 6	6	Introduction into GIS	E	2+2	6	Basics of geodetic astronomy	E	2+2	4	**DIPLOMA THESIS**	**O**		**12**	WEB Cartograph	E	2+2	3
Semestre 6	7	**DIPLOMA THESIS**	**O**		**0**	Hydrographic survey	E	2+2	4					**DIPLOMA THESIS**	**O**		**9**
Semestre 6	8					**DIPLOMA THESIS**	**O**		**0**								

Table 4 Content of the Master curricula

	curricula MSC 2015 -First year										curricula MSC 2019 -First year							
	No	Subject	Status	L+E	ETCS		Subject	Status	L+E	ETCS	Subject	Status	L+E	ETCS	Subject	Status	L+E	ETCS
Semestre 1	1	Geodetic reference systems	O	2+2	6	Semestre 2	Global Navigation Satellite Systems	O	2+2	6	Geodetic reference systems	O	2+2	6	Global Navigation Satellite Systems	O	2+2	6
	2	Geospatial databases and data integration	O	2+2	6		Advanced theory of errors	O	2+2	6	Geospatial databases and data integration	O	2+2	6	Advanced theory of errors	O	2+2	6
	3	Geovisualization	O	2+2	6		Geoinformation Science & Spatial analysis	O	2+2	6	Geovisualization	O	2+2	6	Geoinformation Science & Spatial analysis	O	2+2	6
	4	Research methodology	O	2+1	3		Cadastre Information Systems	O	2+2	6	Spatial data Infrastructure	O	2+2	6	Cadastre Information Systems	O	2+0	3
	5	Applied mathematics	E	2+2	6		Land market economy	E	2+2	6	Applied Mathematics	E	2+2	6	Land Market Economy	E	2+2	6
	6	Foreign language	E	2+0	3		Real Estate	E	2+2	6	Foreign language	E	2+0	3	GIS in Environment	E	2+1	3
	7	Advanced digital photogrammetry	E	2+2	6		Virtual Cartographic Modeling	E	2+2	6	Advanced digital photogrammetry	E	2+1	3	Virtual Cartographic Modeling	E	2+2	6
	curricula MSC 2015 - Second year										curricula MSC 2019 -Second year							
	No	Subject	Status	L+E	ETCS													
Semestre 3	1	Physical geodesy	O	2+2	6	Semestre 4	**DIPLOMA THESIS**	**O**		**30**	Physical Geodesy	O	2+2	6	**DIPLOMA THESIS**	**O**		**30**
	2	Advanced Image Processing and Remote Sensing	O	2+2	6						Advanced Image Processing and Remote Sensing	O	2+2	6				
	3	Engineering surveying (mine included)	O	2+2	6						Engineering surveying (mine included)	O	2+2	6				
	4	Project management	O	2+2	6						GI Project management	O	2+0	3				
	5	Web GIS	E	2+2	6						Web GIS	E	2+2	6				
	6	Agriculture Information Systems	E	2+2	6						Agriculture Information Systems	E	2+2	3				
	7										Decision Support System	E	2+0	3				

In general, in all four geodesy study curricula in bachelor, the fields of geodesy, cartography, geoinformatics, GNSS, cadaster, remote sensing, etc. are intertwined.

The first curriculum (FNA, 2003) had a total of 44 possible subjects, 28 of them with obigatory status with 150 ETCS, while for the other 30 ETCS students had the option to select some of the 16 subjects. In the first curriculum, the field of geoinformatics includes subjects in the same field:

geoinformatics I, geoinformatics II, geoinformatics III, GIS Introduction and related subjects such as Computer and Informatics, Geodetic Drawing, Software in Geodesy, Digital Cadastre. It implies that 8 possible subjects with 37 (~ 20%) ETCS, where 3 subjects with 14 (~ 8%) ETCS of them having mandatory status. From this it can be seen that the first curriculum enabled the student to make a choice of subjects and a desire to orient themselves.

The second curriculum (FNA, 2007) that was implemented from the 2007/2008 academic year had a total of 37 possible subjects, 24 of them with 145 ETCS were obligatory, while for the other 35 ETCS the student had the option to choose. Within the field of geoinformatics or similar in this curriculum we find the following: Geoinformatics basics and informatics, Programming, Databases, Geoinformation modeling, Remote sensing, Land information system, Geoinformation infrastructure, Web Cartography. It implies that 8 possible subjects with 45 (~ 25%) ETCS, where 5 subjects with 31 (~ 17%) ETCS of them having obligatory status. This shows that the second curriculum gave more ETCS in the field of geoinformatics but less opportunity for the student to select them.

The third curriculum (FNA, 2015) which was implemented by the academic year 2015/2016 had a total of 37 possible subjects, of which 27 with 147 ETCS were obligatory, thus extending the diploma thesis with 12 ETCS, while for another 21 ETCS students there was space to choose from 13 subjects. Subjects related to the field of geoinformatics within this curriculum include: Geoinformatics basics, programming, database technology, CAD in geodesy, Feasibility study for GIS, Remote Sensing, GIS Applications, Land Information System and Web Cartography. It implies that 9 possible subjects with 42 (~ 23%) ETCS, where 5 subjects with 30 (~ 17%) ETCS of them having obligatory status. It can be seen from this that the third curriculum gave less ETCS to more potential subjects in the field of geoinformatics.

The fourth curriculum (FNA, 2019) which after re-accreditation in 2019, will start implemention into academic year 2020/21, will have a total of 40 possible subjects, of which 25 of them with 147 ETCS are Obligatory, thus extending the diploma thesis with 9 ETCS, while for another 21 ETCS the student have space to choose from 15 subjects. Subjects related to the field of geoinformatics within this curriculum we find are identical to those of the 2015 curriculum but adding some additional electives such as: Object Oriented Modeling and Programming, the use of geoinformation, basic GIS and geodesy and Geoinformatics. It implies that 13 possible subjects with 54 (30%) ETCS, where 4 subjects with 24 (~ 13%) ETCS of them having obligatory status. From this it can be seen that the fourth course gives more subjects and possible credit to the field of geoinformatics.

In comparing these curriculums in the cartographic aspect that Prof. Idrizi points out in his work, the second curriculum has contained more cartographic subjects, such map projections, topographic cartography, web cartography, geodetic maps, general cartography, geoinformation modeling etc. According to him, the second curricula gave the study a wide range of knowledge, for practical work in the cartographic sector, and to deal with many types of mapping projects.

CONCLUSIONS

From the aspect of curriculum change it can be seen that the Geodesy program is tilting in the direction of the geoinformatics field with about ~ 25% of the subject credits related to it. Add to that the subjects directly related to fields such as Cartography, Geodesy, Photogrammetry, Cadaster, Agriculture, Forestry, etc. it implies that this program are related to geoinformatics. Based on the analysis of curiculums we can conclude that in the near future the geodesy program can be re-viewed and recognized as a Geoinformatics or Geomatics program. This path is also traced to the development of the latest geoscience trends in terms of big geospatial data, Artificial Intelligence AI, Machine Learning, and Deep Learning, where more space should be given to programming related subjects.
In conclusion, we can say that the current curriculum in the field of geoinformatics is an important part of training students in applying and managing geospatial information.

REFERENCES

1. CARTOGRAPHIC EDUCATION OF SURVEYORS WITHIN THE UNIVERSITY OF PRISHTINA [Conference] / auth. IDRIZI Bashkim // 26 INTERNATIONAL CARTOGRAPHIC CONFERENCE. - Dresden, Germany : ICC, 2013.
2. Development of a new master program in geodesy [Online] / auth. MPG // Up2Europe. - Up2Europe. - 09 16, 2019. - https://www.up2europe.eu/european/projects/development-of-a-new-master-program-in-geodesy_116092.html.
3. Historiku i Fakultetit [Online] / auth. Prishtinës Universiteti i // Fakulteti i Ndërtimtarisë dhe Arkitekturës. - Universiteti i Prishtinës . - 09 13, 2019. - https://fna.uni-pr.edu/historiku.aspx.
4. Monograph - University of Prishtina - 2005 [Book] / auth. UP Prishtina, University of. - [s.l.] : University of Prishtina, 2005.

5. Pasqyra dhe planet mësimore në programin e bachelor i Gjeodezisë 2007 [Report] / auth. FNA UP. - [s.l.] : UP, 2007.
6. Pasqyra dhe planet mësimore në programin e bachelor i Gjeodezisë 2015 [Report] / auth. FNA UP. - [s.l.] : UP, 2015.
7. Pasqyra dhe planet mësimore në programin e bachelor i Gjeodezisë 2019 [Report] / auth. FNA UP. - [s.l.] : FNA, 2019.
8. Pasqyra dhe planet mësimore në programin e Master i Gjeodezisë 2015 [Report] / auth. MSc FNA, UP. - [s.l.] : 2015, UP.
9. Pasqyra e planeve mesimore, Programi Bachelor i GJeodezisë 2003 [Report] / auth. FNA UP. - [s.l.] : UP, 2003.
10. Science needs and challenges for geoinformatics [Book Section] / auth. Keller G. Randy // GEOINFORMATICS Cyberinfrastructure for the Solid Earth Sciences / book auth. G. Randy Keller Chaitanya Baru. - Cambridge : Cambridge University Press, 2011.

GEOTECHNOLOGIES CURRICULA IN DEPARTMENTS OF GEOGRAPHY IN THE SPANISH PUBLIC UNIVERSITIES: CHALLENGES AND PERSPECTIVES FROM THE UNIVERSITY OF BALEARIC ISLANDS

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SUMMARY

A significant increase in demanding graduates with geographic perspectives and technological competencies is experienced in many countries with the advent of newest technological advances. However, the educational offer in geotechnologies in the Geography curricula is not consolidated and uniform in public universities of Spain. Besides, the offer of master's programs is also diverse and very concentrated in certain universities for decades. In the coming years the Spanish Academia should develop a renewal of the curricula for its adaptation to these new realities in scientific and professional frameworks. Accordingly, it is required addressing a specialized training in geotechnologies and the development of a standardized training model. From a general assessment of geotechnologies in the Spanish public university, this paper evaluates the strategy of the University of the Balearic Islands, where Geography studies are developed since the end of 1970s decade, assessing the challenges in terms of GIT training at both pre- and postgraduate levels in order to guarantee quality skills for students and their integration into working environments.

Key words: Geotechnology training, master programs, Spanish Geography departments

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INTRODUCTION

The European Higher Education Area (EHEA) developed from the statements of Sorbonne (1998), Bologna (1999) and Prague (2001) provided the basis for a profound change in the European university model (Martínez Fernández & Delgado Urrecho, 2017). The process of European convergence in higher education has been a commitment to the construction of "strong universities, for a strong Europe" being one of the critical elements the incorporation of new information and communication technologies (Casado Ortiz, 2006). Consequently, Geographic Information Technologies (GIT) training may boost this innovative educational process in the field of Geography through an educational process to be determinant for stakeholders in employability. The use of GIT in public administrations as well private sector offers a new demand for new type of experts educated in this new framework (Bliš, Kovani, & Kovani, 2015).

The administrative process for the preparation of academic curricula in Spain is based on different laws (cf. BOE 2007), establishing that the bachelor's degrees must sum up a total of 240 ECTS and their main aim is a general training adapted to the professional exercise (Esparcia Pérez & Sánchez Aguilera, 2012). The Master's degrees are focused on specialization, encompassing a minimum of 60 ECTS. Both title types are validated by the Agency for Academic Quality and Accreditation (ANECA, its acronym in Spanish language) which releases a mandatory and determining report. Likewise, ANECA develops a continuous evaluation to maintain their accreditation.

The White Paper for the Design of the Degree in Geography and Territorial Planning (ANECA, 2004) emphasized that the geographer's specialization in Europe is focused on three main areas: territorial planning, environmental issues and geographic information technologies and its applications (ANECA, 2004, pp. 297). Normally, in current Geography curricula, GIT subjects are included in a group of subjects integrated in the Geography Techniques module; including cartography, quantitative and qualitative techniques of geographic information analysis, photointerpretation, remote sensing and geographic information systems as the common subjects. Therefore, GIT do not in themselves constitute a specific corpus in the geographer's curriculum.

The offer of official Master's degrees in GIT proposed by the departments of Geography in the Spanish public universities is scarce, but well consolidated. These are multidisciplinary programs managed by these departments of Geography but also with the participation of lecturers from other university departments or specialized professionals.

A significant offer of non-official Master's programs in GIT is deployed by Spanish public universities, normally providing a professional profile to students.

The Department of Geography at the University of the Balearic Islands (UIB) develops a training program in GIT linked to Geography degree studies, and with a non-official Master's degree in Geographic Information Technologies, although it should be noted that the integration of GIT in teaching and research issues at UIB was established at the end of the 1980's decade with the creation of the GIS Laboratory (currently the GIS and Remote-Sensing Service). Committed to its own tradition, the Department is nowadays starting the administrative and academic procedure for offering an Official Geotechnology Master program.

The objectives of this study are to (1) analyse the training offer in GIT subjects in the official Geography curricula at the Spanish public universities, (2) evaluate their effectiveness to provide for GIT professional skills, (3) assess the offer of Official master's degrees by departments of Geography of public universities evaluating their characteristics, and finally (4) deeply investigate the training offer in GIT at UIB also deliberating on the perspectives to undertake an improvement of the curricula.

METHODOLOGY

A systematic analysis of the GIT training offer in Geography degrees curricula in the Spanish public universities was carried out based on web pages queries. A total of twenty-nine university web pages were visited, being their curricula and teaching guides consulted. Subsequently, those subjects referring to GIT were assessed in each university: Geographic Information Systems, Remote Sensing or Geopositioning Systems. Despite being the fundamentals in GIT, those subjects related with cartography were not analysed since many of them do not use GIT in the teaching process.

Likewise, the website of all of the departments of Geography in the Spanish public universities were visited and the official and non-official offer in master program studies in GIT verified.

Finally, the GIT training in the University of the Balearic Islands was meticulously analyzed thorough the current curricula of the Geography degree, the teaching guides of its subjects as well as the training programs of the non-official Master program in GIT.

GEOTECHNOLOGIES IN THE DEGREES OF GEOGRAPHY IN THE SPANISH PUBLIC UNIVERSITIES

On paper, the Geography degree title qualifies for different occupations such as geographer, technician in GIS, technician in urban planning, technician in environmental management, technician in territorial planning, and teacher of Social Sciences in high school. Despite such study plan trained for these professional exercises as geographer, exclusive professional skills for geographers in Spain are still lacking. Consequently, no specific guidelines were developed in the design and elaboration of the Geography degree curricula, although the creation of the Professional Association of Geographers was approved by the Spanish Parliament 20 years ago (BOE 5/05/1999), being an important milestone for its development.

One of the main criteria used for the design and elaboration of Geography degrees curricula in Spain was the employability analysis of professional geographers conducted by the Spanish Professional Association of Geographers (Colegio de Geógrafos, 2008). This study particularly highlighted GIT skills of geographers as one of the main real market niches.

The Spanish public universities offer GIT courses in twenty-nine Geography degrees in Spain. Initially, the analysis of the Geography degrees that were teaching GIT depicted different denominations of these degrees, sharing all of them the term ‘Geography’. With the convergence to EHEA at the beginning of the 2010’s decade, only two of them conserved the original title ‘in Geography’: Universitat de Barcelona and also UIB. However, during the last years three other universities recovered the title demonstrating that Geography is a consolidated science per se: Universidad de Granada, Universidad de Salamanca, and Universitat de Lleida. The other twenty-seven universities decided to add into the title several terms related with the basic skills recommended in the White Paper (ANECA, 2004). As a result, there are 15 degrees in Geography and Territorial Planning; 5 degrees in Geography; 2 degrees in Geography and Territorial Management; 1 degree in Geography and Environment; 1 degree in Geography, Environment and Territorial Planning; 1 degree in Geography, Territorial Development and Sustainability; and 1 degree in Geography, Territorial Planning and Environmental Management. Besides these titles focused on the fields of knowledge developed by the academic Geography, it is worthy to be noted that 3 degrees in Geography and History were found, the traditional combination previous to the 1990’s decade.

Table 1: Geotechnology subjects offered by Geography degrees in Spanish public universities.

University	Degree	Geotechnology subjects [Course]	ECTS	Type
1. Universidad Alicante	Degree in Geography and Territorial Planning	GIS [3] GIS applied to land planning [4]	6 6	CS CS
2.Universitat Autònoma de Barcelona	Degree in Geography, Environment and Territorial Planning (Extinction) Degree in Geography and Territorial Planning	GIS [1] Remote Sensing [4] Applied GIS to planning [3] GIS [2] GIS applications [3] Remote Sensing and PhI [4]	6 6 6 6 6 6	CS OP OP CS CS OP
3. Universidad Autónoma de Madrid	Degree in Geography and Territorial Planning	GIS [1] Physical and environmental GIS applications [3] Social and Economic GIS applications [3] Photointerpretation and remote sensing (PhI/RS) [3]	6 6 6 6	CS CS CS CS
4. Universitat de Barcelona	Degree in Geography	GIS and Remote Sensing [2] Advanced GIS [3]	6 6	CS CS
5. Universidad de Cantabria	Degree in Geography and Territorial Planning	Raster GIS [3] Vectorial GIS [3] Photointerpretation and remote sensing [2] Project GIS Workshop [4]	6 6 6 6	CS CS CS OP
6. Universidad de Castilla la Mancha	Degree in Geography, Territorial Development and Sustainability	GI Technologies [1] PhI./RS [2]	6 6	CS CS
7.Universidad Complutense de Madrid	Degree in Geography and Territorial Planning	GIS I [3] GIS II [3] RS / PhI [3]	6 6 6	CS CS CS
8. Universidad de Extremadura	Degree in Geography and Territorial Planning	GIS and Data Bases [3] GI Technologies for environmental management [4] Remote Sensing for Resource Management [3]	6 6 6	CS OP CS
9. Universidad de Girona	Degree in Geography, Territorial Planning and environmental management	GIS [2] Advanced GIS [3]	12 6	CS OP
10. Universidad de Granada	Degree in Geography	GIS [2] Basic on RS [3] GIS vectorial applications [4] GIS raster applications and RS [4]	6 6 6 6	CS CS OP OP
11. Universitat de les Illes Balears	Degree in Geography	GIS I [2] GIS II [3] Spatial analysis [2]	6 6 6	CS CS CS
12. Universidad de Jaén	Degree in Geography and History	Geography Lab. [4]	6	OP

13. Universidad de la Laguna	Degree in Geography and Territorial Planning	GI Technologies I [2] GI Technologies II [2] GI Technologies III [4]	6 6 6	CS CS OP
14. Universidad Palmas de Gran Canarias	Degree in Geography and Territorial Planning	GIS [2] GI Technologies [2] GI Data Management [3]	6 6 6	CS CS CS
15. Universidad de León	Degree in Geography and Territorial Planning	GIS [3] GIS II [3] RS / PhI [3]	6 6 6	CS CS CS
16. Universitat de Lleida	Degree in Geography	GIS and thematic cartography [1] GIS / Remote Sensing [2] Advanced GI Technologies [3] GIS Databases [4]	6 6 6 6	CS CS CS OP
17. Universidad de Málaga	Degree in Geography and Territorial Management	PhI / RS [2] GIS Basics [2] GIS Developments and Applications [3] RS applications [4]	6 6 6 6	CS CS OP OP
18. Universidad de Murcia	Degree in Geography and Territorial Planning	PhI / RS [4] GIS Basics [2] GIS Applications [3]	6 6 6	CS CS CS
19. Universidad Nacional de Educación a Distancia	Degree in Geography and History	GIS [4]	6	CS
20. Universidad de Oviedo	Degree in Geography and Territorial Planning	GI treatment [2] GIS intro [2] GIS applications [4] GIS Territorial Analysis [4]	6 6 6 6	CS CS OP OP
21. Universidad Pablo de Olavide. Sevilla	Degree in Geography and History	GI Technologies [3]	6	CS
22. Universidad del País Vasco	Degree in Geography and Territorial Planning	GIS [2] GIS extension [3] Ph/RS [3]	6 6 6	CS OP OP
23. Universitat Rovira i Virgili	Degree in Geography and Territorial Planning Degree in Geography, Territorial Analysis and Sustainability	Touristic Geographic Information Techniques [2] GIS [2] PhI/RS [3] Spatial Analysis [3]	6 6 6 6	CS CS CS CS
24. Universidad de Salamanca	Degree in Geography	PhI / RS [3] GIS [3]	6 12	CS CS
25. Universidad de Santiago	Degree in Geography and Territorial Planning	PhI /RS [2] GIS Basics [2] GIS and Spatial Analysis [2] Advanced Cartography [2]	6 6 6 6	CS CS CS CS
26. Universidad de Sevilla	Degree in Geography and Territorial Management	GI Technologies introduction [2] GIS raster [3] GIS vectorial [3]	6 6 6 6	CS CS CS OP

		Computers and Advanced Statistics for GI Analysis [4] GIS for Socioeconomic analysis [4] GI Technologies, Spatial analysis and Environment [4]	6 6	OP OP
27. Universidad de Valencia	Degree in Geography and Environment	GIS I [2] GIS II [3] Remote Sensing [4]	6 6 6	CS CS OP
28. Universidad de Valladolid	Degree in Geography and Territorial Planning	GIS I [3] GIS II [3] Remote sensing [2]	6 6 6	CS CS CS
29. Universidad de Zaragoza	Degree in Geography and Territorial Planning	Remote Sensing [3] GIS [2]	6 9	CS CS

(CS: Compulsory, OP: Optative, GI: Geographic Information, GIS: Geographic Information Systems, PhI: Photo-Interpretation)

The Table 1 showed a total of 86 subjects in GIT (525 ECTS) were computed in the different web queries, being 66 compulsory (405 ECTS) and 20 optative (120 ECTS). The offer of GIT subjects per degree course for all the universities was as follows: 4 subjects offered in the first course, 26 in the second one, 32 in the third and 24 in the fourth. The average credits in GIT by degrees in Geography (excluding Geography and History) was 19.5 ECTS. Three universities only offered 6 ECTS, being those with educational plans focused on Geography and History. The rest were computed with three universities 12 credits, one university 15, fourteen universities 18, seven universities 24 and one university 36 (Universidad de Sevilla).
The training model in GIT subjects is also diverse. Some universities divided the subjects according to the used geographic data model (SIG raster/SIG vector), others organized the GIS subject in an introductory GIS I subject and an advanced GIS II, others directly referred to GIT, etc. Remote sensing subject was independently offered in very few plans, being usually included with photointerpretation. Geographic database management also appeared as a subject in some cases.

OFFICIAL MASTER PROGRAMS OFFERED BY THE DEPARTMENTS OF GEOGRAPHY IN SPANISH PUBLIC UNIVERSITIES

Five departments of Geography in public universities offered Masters in GIT. These were six courses of 60 ECTS with a high specialization level. Five of them were classroom courses and one as semi-virtual. They were Official Master Programs with a great prestige achieved thorough the large number of developed editions (Table 2). These official postgraduate degrees allowed the student to start doctoral studies. The enrolment requirements do not impose restrictions on graduates from different disciplines; such as Environmental sciences, Engineering, etc., even allowing an academic demand from the departments related with these disciplines.

Table 2: Master Program offered by the departments of Geography in Spanish public universities

University	Master Program	Subjects
Universidad de Alcalá de Henares http://geogra.uah.es/master/	University Master Program in Geographic Information Technologies Total: 60 ECTS 9th Edition Specialization lines: **Research** CS 30 ECTS OP 16 ECTS Master Thesis: 10 ECTS Research Methods: 4 ECTS **Professional** CS: 30 ECTS OP: 8 ECTS Master Thesis: 10 ECTS Practicum: 9 ECTS Business: 3 ECTS	- Thematic cartography (CS) 6 ECTS - Geography and cartographic communication (OP) 4 ECTS - Remote Sensing (CS) 6 ECTS - Classification techniques in remote sensing (OP) 4 ECTS - Data acquisition techniques in remote sensing (OP) 4 ECTS - Monitoring and modelling of dynamic processes (OP) 4 ECTS - Input, modelling and data transformation (CS) 6 ECTS - Fundamentals of analysis and spatial reasoning (CS) 6 ECTS - Procedures and methods of territorial analysis with GIS (OP) 4 ECTS - Programming in GIT (CS) 6 ECTS - Advanced Programming (OP) 4 ECTS - Research methods) OB) 4 ECTS - Master Thesis (CS) 10 ECTS -Business organization (CS) 3 ECTS -External practices (CS) 9 ECTS
Universitat Autònoma de Barcelona http://www.creaf.uab.es/master/	University Master Program in Remote Sensing and GIS Total: 60 ECTS 21st Edition Specialization lines: **GIS** **Remote Sensing**	-Science of Geographic Information, Remote Sensing and GIS (CS) 15 ECTS -Processing of Remote Sensing Images (CS) 6 ECTS - Spatial Analysis (CS) 9 ECTS -Graphic information collection methods (CS) 6 ECTS -Formation advanced in GIS (OP) 9 ECTS -Formation advanced in remote sensing (OP) 9 ECTS -Master Thesis (CS) 15 ECTS
http://geografia.uab.cat/geoinformacio/	University Master Program in GeoInformation Total: 60 ECTS 21st edition Specialization lines:	-Geospatial data (CS) 12 ECTS -Geospatial systems (CS) 12 ECTS -Programming techniques and geoinformation (OP) resources 12 ECTS -Program Development (OP) 12 ECTS -Information Management (OP) 12 ECTS -Geoapplications for Smart cities (OP) 12 ECTS -Professional Practices (CS) 6 ECTS -Master final work (CS) 6 ECTS

	GIS applications development: CS 24 ECTS OP1: 24 ECTS **Information Management for smart cities** CS 24 ECTS OP2: 24 ECTS Practicum: 6 ECTS Master Thesis: 6 ECTS	
Universidad Complutense de Madrid https://www.ucm.es/master-geografia	Universitary Master Program in GI Technologies Total: 60 ECTS 10th edition	Cartography I (CS) 6 ECTS SIG (CS) 6 ECTS Remote Sensing (CS) 6 ECTS Cartography II (OP) 6 ECTS Spatial Statistics (OP) 6 ECTS SIG II (OP) 6 ECTS Databases (OP) 6 ECTS Programming (OP) 6 ECTS Applications GIT Environment (OP) 6 ECTS Applications GIT Urban Studies (OP) 6 ECTS External practices (CS) 6 ECTS Master thesis (CS) 6 ECTS
Universidad de Extremadura https://www.unex.es/conoce-la-uex/centros/fyl/titulaciones/info/presentacion?id=0437	University Master program in GI Technologies and Remote sensing Total: 60 ECTS 12th edition Semi-virtual Classroom: 15% Virtual: 45%	Advanced spatial analysis (CS) 6 ECTS Advanced learning in SIG Raster (CS) 6 ECTS Advanced learning in GIS Vector (CS) 6 ECTS Spatial Databases (CS) 6 ECTS GIS & Remote Sensing (CS) 6 ECTS Design GIS projects (CS) 6 ECTS Master thesis (CS) 12 ECTS Geostatistics and Information Quality (OP) 6 ECTS Geoportals (OP) 6 ECTS Internships in business (OP) 6 ECTS SIG Programming (OP) 6 ECTS
Universidad de Zaragoza https://estudios.unizar.es/estudio/ver?id=608	Master's Degree in Geographic Information Technologies for Land Management: GIS and Remote Sensing Total: 60 ECTS 17th edition Specialization: GIS / Remote Sensing	Collection and organization of geographic information (CS) 10 ECTS Analysis of geographic information GIS (CS) 12 ECTS Analysis of geographic information: Remote Sensing (CS) 3.5 ECTS Visualization, presentation and dissemination of geographic information (CS) 6 ECTS GIT applications to land management: socio-economic environment (OP) 2 ECTS Applications of GIT to land management: environment. (OP) 2 ECTS Principles of Cartographic Design (OP) 2 ECTS

		Basic notions about GIS (OP) 2 ECTS Fundamentals of Remote Sensing (OP) 2 ECTS Master thesis (CS) 12 ECTS

NON-OFFICIAL MASTER PROGRAMS

The non-official Masters training offer promoted by departments of Geography was not supported by the same information channels exhibited by the Official Master's programs. The exploration in different web pages of Spanish public universities showed how these master degrees were independently managed by each university, without the control of external agencies. As a result, university foundations are normally the responsible to manage these type of courses. A specific master degree diploma is generally released by each university, although not enabling to follow doctoral studies neither obtaining European accreditation.

In the Table 3 are explained two examples of non-official Master's programs taught by the Universitat de Girona and Universidad de Sevilla were selected because both illustrated a specific and representative pedagogical structure focused on semi-virtual and classroom master types with a consolidated prestige in the last two decades.

Table 3: Non official Master Program offered by Geography departments of Public Universities

University	Master Program	SUBJECTS
Universitat de Girona https://www.unigis.es/master-sig-online/	University Master Program in Geographic Information Technologies Total: 60 ECTS 22nd edition Specialization: A.Geocomputation and programming B.Geospatial Analysis	Course I Basics on GIS (6 ECTS) Spatial data models (6 ECTS) Spatial data sources (6 ECTS) Data visualisation and cartography (6 ECTS) GIS Project management (6 ECTS) Course II Spatial Databases (6 ECTS) Final Master Thesis (6 ECTS) Specialization A: Distributed GIS and interoperability (6 ECTS) Web Map applications (6 ECTS) Python GIS programming (6 ECTS) Specialization B: Geographic Analysis (6 ECTS) GIS and Remote Sensing (6 ECTS)

		GIS and Territorial Planning and Management (6 ECTS)
Universidad de Sevilla https://cfp.us.es//cursos/mu/sistemas-de-informacion-geografica-planificacion-ordenacion-territorial-y-medio-ambiente/5820/	Geographic Information Systems: Planning, Territorial Planning and Environment Total: 60 ECTS 16th Edition	GIS Basics and Spatial Data Sources (Data & Services) 2 ECTS General Introduction ArcGIS: data management and edition (3 ECTS) Spatial components of geographic data: spatial reference systems and GPS (3 ECTS) DBMS and Spatial Databases (12 ECTS) Spatial Analysis: Vector model (4 ECTS) Spatial Analysis: Raster model (4 ECTS) Web-GIS Technologies intro (5 ECTS) Web Map Server – Web Mapping (4 ECTS) Programming Web-GIS environments and Geo-viewers (5 ECTS) Practicum (8 ECTS) Master Thesis (6 ECTS)

GEOTECHNOLOGIES STUDIES AT THE UNIVERSITY OF THE BALEARIC ISLANDS

GT AT GEOGRAPHY DEGREE

The University of the Balearics Islands offer the degree of Geography following the official rules in Spain (BOE, 2007), adapted to the EHEA.
The Geography degree curricula of the University of the Balearic Islands was started to be taught in the course 2009-2010 (BOE, 2010) and was committed to providing an academic, generalist, and rigorous training, ensuring a solid formation in the main fields of knowledge such as Physical Geography, Human Geography, and Regional Geography Assessment, but at the same time with a strong presence of technical subjects as transversal skills. This statement guarantees to the future graduates sufficient technical and professional training to ensure their employability (Geography Degree Report, UIB, pp. 11)
The curricula established a total of 240 ECTS structured into the following types of subjects by Law: Basic Training-60 ECTS, Compulsory-132 ECTS, Optional 30 ECTS, External Practices-12 ECTS, Final Degree Project-6 ECTS. Based on the regulations for the design and elaboration of official degrees in Spain, the deployment of subjects is 6 ECTS, involving a total of 5 subjects per semester.
In turn, the subjects were also structured into the following modules:

- Core. It embraces the group of subjects for acquiring the basic Geography skills constituting the central axis of the degree (84 ECTS/35%).
- Support. It is a module including those subjects to achieve complementary skills (30 ECTS/12.5%).
- Instrumental. The subjects that compound this module (54 ECTS /22.5%), allow the acquisition of specific technical skills and abilities required for the professional practice.
- Professional Orientation. It deploys those skills for deepening the professional profile of the future graduates (48 ECTS/20%).
- Transfer. Subjects developing those skills for an effective application of those knowledges, abilities and skills learnt in previous modules. (24 ECTS/10%).

The subjects referred to GIT are included into the Instrumental Module with a total of 54 ECTS corresponding to 9 compulsory subjects adding 12 credits of optative subjects. They are grouped into three materials: Cartography (24 ECTS), Statistics (12 ECTS) and Applied Technologies (30 ECTS).
Regarding the GIT, the UIB degree title sets two objectives:

- To form in the application of theoretical, methodological and instrumental knowledge to the integrated analysis and interpretation of spatial processes and problems, as well as the development of territorial diagnoses.
- To provide specific skills related to the knowledge of field and laboratory work techniques, especially those related to the collection, analysis, treatment and representation of spatial, geographical and cartographic information and their technological instruments

Regarding the specific training in GIT provided by the UIB curricula, the following professional profiles are indicated:

- Definition, development, implementation and management of GIS.
- Development and management definition of territorial and thematic mapping.
- Development and management of information, territorial indicators through the use of databases.
- Global Positioning System (GPS).
- Remote sensing and photogrammetry.

The teaching guides contents of the GIT subjects for the 2019-2020 academic year are presented in table 4, showing their specific skills as an introduction to this matter with a pre-graduate level.

Table 4: GIT subject syllabus course 2019-2020

Spatial Analysis 6 ECTS 2nd year	Introduction Qualitative spatial analysis techniques Exploratory Spatial Data Analysis	Spatial Patterns Multivariate analysis
GIS I 6 ECTS 2nd Year	GIS components, functions, evolution GI components, types, scales Spatial data models Spatial Data Bases: design, creation, exploitation Analysis functions: vectorial Analysis functions: raster	Digital elevation models Spatial data infrastructures Cartographic production GIS software GIS applications
GIS II 6 ECTS 3rd Year	Introduction remote sensing Image classification and analysis LiDAR: data analysis and applications Network analysis Advanced geostatistics	Multicriteria Analysis 3D modelling Spatial data quality On line Mapping

NON-OFFICIAL GEOTECHNOLOGY MASTER PROGRAM

The "Master in Geographic Information Technologies" was an innovative, complete and rigorous training project in terms of its theoretical and practical contents; a pioneering initiative at the national level in virtual education systems in GIT. The project was designed jointly by the Geographic Information Systems Service and the former Department of Earth Sciences (in September 2015 the Department recovered the title of Department of Geography, changed in 1985) of the University of the Balearic Islands. The course was approved on May 2012 by the Governing Council of the University of the Balearic Islands. The course covered a total of 60 ECTS distributed in 10 modules subsequently structured in four main axes (see Table 5).

Table 5: Educational structure of the GIT Non-Official Master of the University of the Balearic Islands.

MODULE	SUBJECTS
Basics on GI Technologies (15 ECTS)	Digital Cartography & GIS (6 ECTS) Remote Sensing (6 ECTS) Spatial Data Infrastructures (3 ECTS)
GIS and spatial analysis (18 ECTS)	Vectorial spatial analysis (6 ECTS) Raster spatial analysis & Digital Elevation Models (6 ECTS) Network Analysis (3 ECTS) Geostatistics (3 ECTS)
Spatial Databases and geospatial programming (18 ECTS)	Spatial Data Bases management (9 ECTS) GIS programming (9 ECTS)
GIS applications and GIS projects (9 ECTS)	GIS applications (6 ECTS) GIS projects (3 ECTS)
Master Thesis include a project of each module	Computed as virtual (10 ECTS)

The main objective of the course is to provide specialized training for graduates in the use of geographic information technologies from two perspectives. Firstly, as a methodological tool to support the diverse knowledge background of the students (Geography, Biology, Agricultural Engineering, Architecture, etc.). Secondly, because it constitutes a complete and specialized training with a clear projection by integrating technological and professional skills. For this reason, the course contents emphasize and deploy the learning of technological aspects of databases and application programming. The main aim is to achieve a specialized knowledge in geographic information technologies, but also the capacity to implement GIS technology.

The training of each module allows to starting without previous knowledge of the students into the skills, especially on the teaching-learning process of the most technological modules where databases and programming are explained. With this training project, UIB was committed to promoting high-quality education, with a strong impact on the labour market and entailing a low cost for the students. The course was adapted to the EHEA and to the requirements established by the internal academic regulations of the UIB.

The teaching staff of the course includes permanent lecturers from the Department of Geography, the Department of Mathematics and Computing, and the Department of Physics, as well as technical staff from the Geographic Information Systems Service and external specialized professionals who develop their activity in public administrations and companies in the Balearic Islands related to the geographic information technologies such as: Balearic Islands Government, Consell Insular de Mallorca, the public company SITIBSA SA, and the Cadastral Management Center.

DISCUSSION AND CONCLUSIONS

GIT are a matter of great importance in the formation of geographers; however, a detailed analysis of the training offer of the Geography degree curricula does not show coherence or uniformity regarding the training load deployed in the different Spanish public universities. The distribution of the subjects and credits showed substantial differences between universities. It can be stated that the incorporation into the curricula of new subjects in GIT may increase the lack of uniformity between curriculums. Heterogeneity here depicted on GIT training offer could disagree with some other published studies that argued a common basis in the Geography degree curricula in Spain (cf. Orueta, 2004).

A debate arose within the Spanish Geography Academy few decades ago on the effect caused by the emergence of GIT in the academic and scientific fields of Geography (Wright et al., 1997; Tapiador & Marti, 2007). The final consequence of this debate produced a decrease on the potential dynamics that GIT could have developed in most of the Spanish public universities. From the generalized motivation, the Spanish University moved towards a model that lethargic the exponential growth initially emerged in the 1990's decade. Chuvieco et al. (2005, pp. 53) literally pointed out that "it seems necessary to change the current consideration of GIS in Geography, estimating them as central disciplines of research and geographical teaching". It is not enough, in our opinion, to timidly introduce subjects related to these techniques into the curricula, if there is no greater involvement of the most consolidated geographers in the study and research of these disciplines, which allows students to offer innovative teaching, fuelled by the resolution of specific geographical problems".

The last decade demonstrated that those universities opting for GIT consolidated their studies, especially postgraduate studies. The direct consequences have been a clear improvement in their dynamics at the academic and scientific frameworks of Geography. Despite these concerns, a unanimous agreement existed on emphasizing the role of GIT as essential tools in the formation of the current geographer (ANECA, 2004, pp. 104). Besides, they also played an essential and profound role in geographical research (Moreno Jiménez, 2013). Although the convergence process to the EHEA could have boosted the criteria unification of GIT in Geography curricula, this process was not achieved in the Spanish public universities. Consequently, there is no common curricular program in GIT with a wide variety of academic approaches and teaching loads in Spain. This curricula structure does not allow standard contents in GIT subjects. For years, work has been carried out on proposals to adapt geotechnology/geographic information science training (Bosque-Sendra, 1999), but without enough progress. This type of standardization problem in GIT training is common to other countries (Plessis & Niekerk, 2013), underlining the need for standardization through the development of specific academic programs (Vandenbroucke, et al., 2016; DiBiase, et al. 2006).

In the coming years, a reform of the university degrees in Spain must be undertaken (BOE, 2015). In this way, universities may voluntarily reduce their degree studies from four to three years. Independently from the final decision adopted by each university, this context may lead to a fundamental change for Geography pre- and postgraduate studies in which GIT could play a leading role in this major renovation process (Gutiérrez-Herández, 2016).

Since the second half of the 20th century, as a scientific discipline, Geography has been repeatedly experiencing deep identity crises affecting its essence.

These crises prominently contribute to increasing its lack of accuracy in objectives and methods (Sallent, 2018, pp. 53), leading to a constant review of its formative aspects. GIT are responsible for the major changes in the geographic discipline in recent decades, although there is not a general consensus on the scope and meaning of these changes (Moreno Jiménez, 2013, pp. 6). However, the generation of geographical knowledge through GIT involves a new understanding and research practice (Viles, 2016). In addition, GIT can promote a repositioning of geographic knowledge contributing to their useful applications.

In postgraduate studies, a formalisation dynamic of master's studies in GIT has been developed in the last decade with the EHEA convergence because fundamental differences between both the official and non-official curricula: 1) the diploma obtained in the official master's is applicable to the entire EHEA, while the non-official masters cannot be recognized, (2) the teaching of official master's degrees must necessarily be carried out by the university teaching staff, while in the non-official titles a greater number of professionals of the private company and/or administration can participate, (3) the economic cost of Master's degree programs are usually higher than official master's degrees, whose cost is regulated by the Spanish Government. This fact promotes a competition between the official and non-official Masters Programs that are progressively causing the extinction of non-official ones.

In the case of the University of the Balearic Islands, similarly to other Spanish universities, the imminent reform of the curricula poses a series of relevant challenges regarding GIT. The first one is identifying the best training in GIT to be proposed in Geography degree curricula: subjects, teaching loads, contents, and methodologies. The second challenge is to deliberate on the feasibility of official master studies in GIT considering the EHEA provides a nationally and internationally framework with large offer to the students. In this way, the low and undefined demand of students recommends that virtual or semi-virtual courses could be a clear option to be explored. Thirdly, a rethinking will be necessary about the non-official GIT post-graduate titles to be launched.

REFERENCES

1. ANECA. (2004). Libro Blanco para el diseño del Título de Grado en Geografía y Ordenación del Territorio. Madrid: Aneca
2. Bliš, P., Kovani, Ľ., & Kovani, M. (2015). The Importance Of Geographic Information Systems Education At Universities In The Process Of Building A European Knowledge- Based Society. *Procedia - Social and Behavioral Sciences*, 191, 2458–2462.

https://doi.org/10.1016/j.sbspro.2015.04.358

3. Boletín Oficial del Estado –BOE (2010). *Resolución 11583 de 28 de junio de 2010, de la Universidad de las Illes Balears, por la que se publica el plan de estudios de Graduado en Geografía*: BOE 19 de julio de 2010, nº 174, pág. 63808. Available at: http://www.boe.es/boe/dias/2010/07/19/pdfs/BOE-A-2010-11583.pdf.
4. Boletín Oficial del Estado –BOE (2007) *Ley Orgánica 4/2007, de 12 de abril, por la que se modifica la Ley Orgánica 6/2001, de 21 de diciembre, de Universidades* BOE, de 13 de abril de 2007, nº 89, pág. 16241 a 16260. Available at: https://www.boe.es/eli/es/lo/2007/04/12/4
5. Boletín Oficial del Estado –BOE (2007) *Real Decreto 1393/2007, de 29 de octubre, por el que se establece la ordenación de las enseñanzas universitarias oficiales*. BOE, núm. 260, de 31 de octubre de 2007, nº 260, pág. 18770. Available at: https://www.boe.es/eli/es/rd/2007/10/29/1393/con
6. Boletín Oficial del Estado –BOE (2015) *Real Decreto 43/2015, de 2 de febrero, por el que se modifica el Real Decreto 1393/2007, de 29 de octubre, por el que se establece la ordenación de las enseñanzas universitarias oficiales, y el Real Decreto 99/2011, de 28 de enero, por el que se regulan las enseñanzas oficiales de doctorado*. BOE, nº 29, de 3 de febrero de 2015, pág 8088 a 8091. Available at: https://www.boe.es/eli/es/rd/2015/02/02/43
7. Bosque-Sendra, J. (1999). Nuevas perspectivas en la enseñanza de las tecnologías de la información geográfica. Serie Geográfica, 8, 25–34.
8. Casado Ortiz, R. (2006). Convergencia con Europa y cambio en la universidad. *Edutec*, 20.
9. Chuvieco, E., Bosque, J., Pons, X., Conesa, C., & Santos, J. M. (2005). ¿Son las tecnologías de la información geográfica (TIG) parte del núcleo de la geografía ? *Boletin de La AGE*, 40, 35–56.
10. Colegio Profesional de Geógrafos (2008): Perfiles profesionales de los geógrafos en España.
11. DiBiase, D., DeMers, M., Johnson, A., Kemp, K., Luck, A. T., Plewe, B., Wentz, E., Eds. (2006). Geographic Information Science & Technology Body of Knowledge. Washington, D.C., Association of American Geographers.
12. Esparcia Pérez, J., & Sanchez Aguilera, D. (2012). De la teoría a la práctica. el proceso de diseño e implantación de los grados de geografía en las universidades españolas. *Boletín de La Asociación de Geógrafos Españoles*, *58*, 405–428.
13. Gutiérrez-Herández, O. (2016). *La geografía y los geógrafos ante la*

reforma universitaria ¿Una oportunidad para definir los contenidos esenciales del Grado en Geografía? (Vol. 5).

14. Martínez Fernández, L. C., & Delgado Urrecho, J. . (2017). La Geografía en las enseñanzas universitarias de Grado en España : docencia y planes de estudios Geography in university academic degrees in Spain : teaching and curricula, 61–79. https://doi.org/10.14198/INGEO2017.67.04
15. Moreno Jiménez, A. (2013). ENTENDIMIENTO Y NATURALEZA DE LA CIENTIFICIDAD GEOTECNOLÓGICA : UNA APROXIMACIÓN DESDE EL. *Investigaciones Geográficas*, *60*, 5–36. https://doi.org/10.14198/INGEO2013.60.01
16. Orueta, E. L. B. De. (2004). La base formativa común en la enseñanza universitaria de la geografía en españa. *Boletín de La AGE*, *38*, 47–70.
17. Plessis, H., & Niekerk, A. Van. (2013). A Comparison of Geographical Information Science Competency Requirements. *South African Journal of Geomatics*, *2*(3), 206–217.
18. Sallent, A. (2018). Higher education and teaching of Geography in Spain today. *Redu*, *16*(1), 2–3.
19. Tapiador, F. J., & Marti, J. (2007). Best of Times , Worst of Times : A Tale of Two (Spanish) Geographies. *Journal of Geography in Higher Education*, *31*(1), 81–96. https://doi.org/10.1080/03098260601033043
20. Vandenbroucke, D., & Vancauwenberghe, G. (2016). Towards a new Body of Knowledge for Geographic Information Science and Technology.. Micro, Macro & Mezzo Geoinformation, 2016(6), 7-19.
21. Viles H. 2016. Technology and geomorphology: Are improvements in data collection techniques transforming geomorphic science? Geomorphology 270 : 121–133. DOI: 10.1016/j.geomorph.2016.07.011
22. Wright, D.J.; Goodchild, M.F. i Proctor, J.D. (1997). «GIS: tool or science? Desmystifying the persistent ambiguity of GIS as “tool” versus “science”». Annals of the Association of American Geographers, 87, 346-362.
23. UIB (2012) . Memoria título propio de Màster en Geotecnologías. Acord del Consell de Govern de la Universitat de les Illes Balears del dia 14 de maig de 2012.

FIRST BACHELOR STUDY PROGRAM IN GEODESY AND GEOINFORMATICS IN NORTH MACEDONIA

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SUMMARY

Geodesy and geoinformatics education as integrated studies at the bachelor level in the Republic of North Macedonia (RNM) started in year 2015, with the accredited program at the Faculty of Applied Sciences at the University of Tetova by the Ministry of Education and Science of RNM. The identical trend continued in the first accreditation for the establishment of a new university in Skopje named "Mother Teresa" in year 2016, where the program was initially accredited as part of the Technical Faculty, to be later transferred to the Faculty of architecture and civil engineering.

The geodesy and geoinformatics study programs have a five-year accreditation, while the duration of studies is 3 years which enables students to obtain the geodesy and geoinformatics engineer degree with 180ECTS according to the Bologna study system. The program is designed by taking into account contemporary trends in geodesy and geoinformatics in developed countries, as well incorporating local specifics of state systems for geoinformations in North Macedonia, Kosovo and Albania, with the sole aim of providing graduates with knowledge and skills to be capable to work in other countries outside RNM also. The curriculum includes all the contemporary elements of geo-information sciences, but due to mismanagement by the rectorates of the two universities, implementation is at a very low level.

Both departments are in crisis because of the management approach at both universities where this study program is accredited, resulting with low quality of offer to students in terms of technical equipment - adequate laboratory, adequate teaching staff, and collaboration with other scientific institutions in the field of geodesy and geoinformatics. If the trend continues as in the past three years, both departments obviously will lose accreditation, will be closed, and will issue low-quality bachelor engineers on geodesy and geoinformatics with 180ECTS.

Key words: Geodesy, Geoinformatics, curriculum, North Macedonia

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INTRODUCTION

Formal education is education which is carried out in a variety of accredited educational institutions under approved programs to improve the knowledge, skills and competences for personal, social and professional needs and it leads to recognized diplomas and qualifications (Paar, etAll, 2014). In 1999 the European ministers of education started the Bologna Process, a series of reforms needed to make European Higher Education more compatible and comparable, more competitive and more attractive for our own citizens and for citizens and scholars from other continents. it is often unclear whether traditional long programs are being overhauled and replaced with genuine stand-alone bachelor and master's degrees based on defined cycle-specific objectives, or if they are simply being dissected into three- and two-year periods of study with little change to course content (Drobne, etAll, 2007).

Today the society is strongly influenced by globalization, carrying a number of challenges that require new knowledge and skills to help them be adequately answered. New processes affect the dynamics and adjustment of the entire society, and thus the daily activities of all stakeholders of the education system, society and individuals in it. Acquiring knowledge is a continuous process which does not end with the completion of compulsory education, but it begins before and lasts a lifetime (Paar, etAll, 2014).

Recent trends in Global Positioning Systems (GPS), Geographic Information Systems (GIS), photogrammetry, remote sensing and communication technologies require changes in surveying and related educational programs dealing with geoinformation, such as geography, environmental engineering, forest engineering and geology (Potuckova 2006). Geoinformatics as an educational package is a combination of introductory courses on Remote Sensing and Geoinformation Technique, such as basics of image processing as well as remote sensing technology, introduction to other digital spatial data collection methods like GPS, field measurements and digitizing and scanning of maps, more sophisticated courses on spatial data algorithms and geographical data management, visualization and spatial analysis as well as advanced courses on satellite image interpretation methods. Geoinformatics is not only for surveying or geography students but recently more and more students from other disciplines like Computer Science, Civil Engineering, Architecture, Geology etc. want to study Geoinformatics (RS + GIT) as their minor or even as their major subject. (Virrantaus and Haggren 2000).

The Bachelor in Geoinformatics program is intended to produce professionals who are capable of using information technology to handle geospatial information for the economic, social and physical development (Tarmidi, et All, 2015).

Changes in structure and format of University curricula across Europe within the past few years re ect this need as well as a diminishing number of survey engineering and geoinformatics students in some countries. Geoinformatics curricula at universities with a long tradition in geodesy and cartography education are usually built on solid training in mathematics, physics, programming, computer graphics, and web-applications. Multi-disciplinary education in information technologies (IT), management or economics and geoinformatics can increase employment opportunities in some labour markets. The terms `geoinformatics' or `geomatics' are used interchangeably in some university programs. The definition of both terms has not been standardized to-date (Potuckova 2006).

The goal of the reforms in geoinformation sciences, by clearly defined learning outcomes as instruments, is to make studies more successful, compatible and comparable, in order to increase the number of higher educated people ready for facing with the challenges in their professional life.

STUDY PROGRAMS ON GEOINFORMATIONS IN NORTH MACEDONIA

At RNM geodesy studies began in year 1978 within the Faculty of Civil Engineering in Skopje (University UKIM), as a five-semester course known as high school in the higher education system of the former Yugoslavia. The full five-year studies began in year 2001, after several years to begin reforming and implementing the Bologna system for the organization of bachelor (3 years) and master (2 years) studies [4]. These study programmes were the only studies of geodesy in RNM until year 2015, when the department of geodesy and geoinformatics at the University of Tetova (UT) started with organizing the bachelor studies in geodesy and geoinformatics in Albanian language [1].

A year later, with the establishment of Mother Teresa University (UMT) in Skopje, the UT geodesy and geoinformatics program was completely transferred to the new university in Skopje [2]. With this, today in RNM there are three geodesy study programs, two of which (those at UT and UMT) have also included geoinformatics studies, while the UKIM study program is a classic geodesy but with the possibility of studying in bachelor and master levels [4].

The geoinformation sciences at other state universities in RNM and other faculties of UKIM are heavily involved in accredited programs of geography, agriculture, ecology, forestry, geology, mining, IT, architecture etc [1,2,3,4,5]. It is noteworthy that at Faculty of Natural and Mathematical Sciences at UKIM in Skopje, there is a separate GIS study program at bachelor level with 240 ECTS and master with 60ECTS [4].

All programs / courses accredited at different universities, even at different faculties within the same university in RNM, have been compiled individually by the respective departments and there is no organized coordination even though these are related courses / programs, which interconnects more fields that uses geoinformations.

GEODESY AND GEOINGORMATICS STUDY PROGRAMES in UT and UMT

At the beginning of year 2015, the preparation of the bachelor's degree program in geodesy and geoinformatics at the University of Tetova began, at the request of the rector and vice-rector for education. Although I wrote to the vice-rector for education in which I pointed out the potential dangers of a lack of teaching staff and professional laboratories, the rectorate of the university through the vice-rector for education gave a green light to me to start preparing the accreditation program, by accepting all risks addressed as essential to the implementation of the program.

The program presented in Table 1 [1] was accredited in spring 2015, where professors of the department of geodesy by the University of Pristina were listed as professional subject holders, with their CVs and statements agreeing to teach professional subjects in the new program on geodesy and geoinformatics. The Accreditation Council accredited this program for a five-year duration, precisely for the period 2015-2020. Implementation of the program at UT began in September 2015.

One year later, the same curriculum presented in Table 1 [6] was accepted for the study of geodesy and geoinformatics at the Mother Teresa University in Skopje, which was initially listed as part of the Technical Faculty of UMT, to pass a few months later before starting the new university as the third study program in the Faculty of Civil Engineering and Architecture. This program

at Mother Teresa University began in November 2016, with the first generation enrolled for studies at the new university. Even in this case, the professors of the University of Prishtina provided full support for starting the department and teaching. Base on the Law on high education, this study program should be reaccredited on year 2021.
Both study programs are implemented in Albanian language [1,2].

Table 1: Curricula on Geodesy and Geoinformatics in TU and UMT

Study program	**Bachelor on Geodesy and Geoinformatics**	
Semester	**I**	
Status O/E	**Subject**	**ECTS**
O	Mathematics 1	5
O	Databases	5
O	CAD	5
O	English language	2
O	Basics of geodesy and surveying instruments	7
O	Informatics	6
Semester	**II**	
Status O/E	**Subject**	**ECTS**
O	Mathematics 2	5
O	Geoinformatics 1	6
O	English language for engineers	2
O	Geodetic measurements and surveying	7
E	Programming	4
E	Physics	4
E	Topography	4
E	Subject from the free election list	2
Semester	**III**	
Status O/E	**Subject**	**ECTS**
O	Theory of errors	5
O	English language for surveyors 1	3
O	Geodetic networks	7
O	Cadaster 1	5
E	General cartography	4
E	Geoinformatics 2	4

E	Ecology	4
E	Subject from the free election list	2
Semester	**IV**	
Status O/E	**Subject**	**ECTS**
O	Mathematical cartography	4
O	English language for surveyors 2	3
O	Satellite geodesy	5
O	Cadaster 2	5
O	Field practice 1	5
E	Mathematical geodesy	3
E	Geodetic adjustments	3
E	Hydrographic measurements	3
E	Subject from the free election list	2
Semester	**V**	
Status O/E	**Subject**	**ECTS**
O	Engineering geodesy 1	7
O	Spatial planning and regulation	5
O	Photogrammetry	5
O	Physical geodesy	5
E	Legislation and legal provisions	3
E	Management with geodetic works	3
E	Geophysics	3
E	Subject from the free election list	2
Semester	**VI**	
Status O/E	**Subject**	**ECTS**
O	Engineering geodesy 2	6
O	Remote sensing	4
O	Real estate valuation	4
E	Real estate management	3
E	Geodetic legislation	3
E	Academic writing	3
O	Field practice 2	5
O	Diploma thesis	5

The essence of the accredited program is to prepare new bachelor-level staff who will have basic knowledge of geodesy and geoinformatics, including databases, CAD design, cartography, high geodesy, basic geodesy, engineering geodesy, photogrammetry, remote sensing, GIS, SDI, cadastre, real estate management and evaluation, surveying, satellite geodesy, physical geodesy, geodetic networks, English for surveyors, geodetic legislation, and geodetic project management. The main purpose is to prepare geodesy and geoinformatics bachelors with strong theoretical and practical background. Knowledge of the above-mentioned fields is of particular importance for the preparation of staff who will be capable of pursuing master studies in general geodesy or specialized for a given field.

At both universities, there is a lack of laboratories with professional equipment for performing exercises with students and conducting scientific research by the academic staff of the department. Although we have submitted the detailed design for a modern laboratory to the university leadership, no steps have been taken since 2015 to establish the laboratories at both universities. In order to perform some basic exercises with contemporary geodetic equipment, the teaching staff used the geodesy laboratory at the University of Prishtina, which was implemented as a support from the Prishtina department for students who do not have instruments for performing their basic exercises in their universities. To be even greater irony, rather than being invested by the ministry of education as the two universities are state-owned and rely on the state budget, the only two instruments owned by the UMT geodesy and geoinformatics department in Skopje are donated by an engineer Tush Kolaj from Kosovo, who works in Malmo in Sweden, as the human act for the benefit of Albanian young surveyors.

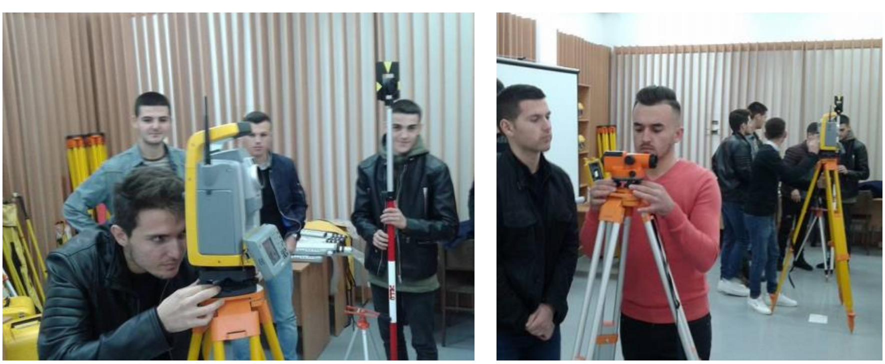

Figure 1: Exercises in the geodesy laboratory in Prishtina [6]

Figure 2: Exercises in field for 3d scanning and surveying with drone [6]

Figure 3: Teaching staff of first generation in UMT [6]
(first road: prof Bashkim Idrizi, prof Ismail Kabashi, prof Perparim Ameti;
second road: ass Veton Hamza, prof Subija Izeiroski, ass Fisnik Loshi, ing. Artan Rexhepi)

PERSPECTIVES OF STUDIES IN GEODESY AND GEOINFORMATIC IN UT AND UMT

Given the current state of affairs at the two RNM universities where geodesy and geoinformatics studies are conducted, the perspective for the foreseeable future is questionable. At UT, the teaching and exam evaluation of students is done by unauthorized persons with bachelor's or master's degrees, while other professors with academic degrees sign reports of unauthorized persons who actually carry out the whole process. At UMT also, the situation is deplorable, as faculty and university management have no interest in developing this department, but those with deliberate and deliberate actions intend to close the geodesy and geoinformatics study program.

At UT the unlawful actions of unauthorized staff are deliberate as they themselves have a desire to play the role of professor and to evaluate students' exams even though some of them are still masters students at other universities. At UMT, on the other hand, current staff with academic degrees want to work and to do the best in order to prepare professional staff, but faculty and university management with deliberate and background actions curb work with the sole purpose of closing the department. Such illegal, illogical, unethical and non-academic actions take courage from the politics, that in the North Macedonia plays a negative role and is a big barrier for development.

The dark perspective of graduated students in both departments also lies in the lack of alternatives for continuing of their education to master studies at their universities, while at other universities in the country and across the region the number of students admitted to masters is limited.

Given the regular staff and technical equipment in both departments, they risk being shut down by the state authorities, since they do not even meet the minimum requirements for academic studies in the technical field.

CONCLUSIONS

Geodesy and geoinformatics studies in bachelor level in North Macedonia began in year 2015 in University of Tetova. Same study program with same curricula began in University "Mother Teresa" in year 2016. Both study programs have five-year accreditations until years 2020 and 2021.

Given current situation in both departments, they can not be reaccredited, because of lack of academic staff and equipment. Although the project for laboratory has been submitted on time to top managements, any steps for establishing of laboratory has not been taken in both universities.

On year 2015 the rectorate of UT has accepted all risks addressed as essential to the implementation of the program, however they didn't do anything for improving the situation, even more they still allow unauthorized persons without academic degree to give lectures, to organize exams, and to evaluate students' exams. Responsible state institutions unfortunately don't take any action to stop this negative and dangerous phenomena.

Accredited curricula contain all global trends in the field of geodesy and geoinformatics, however its' implementation in both universities actually is in very low level, and can not deliver expected results!

REFERENCES

1. Potuckova Marketa (2006). Trends in geoifnroamtics education. Geoinformatics FCE CTU. Czech Republic
2. Virrantaus K., Haggren H. (2000). Curriculum of geoinformatics – integration of remote sensing and geographical information technology. International Archives of Photogrammetry and Remote Sensing Vol. XXXIII Part B6. Amsterdam 2000.
3. Tarmidi Z., Idris N.H, Ujang U., Ariffin A. (2015). Education of Geoinformatics (GIS) at University of Malaysia. FIG 2015.
4. Paar R., Tutic D., Basic T. (2014). Lifelong learning programs at the Faculty of Geodesy. Conference paper. Research Gate. ttps://www.researchgate.net/publication/3102616
5. Drobne S., Petrovic D., Lisec A. (2007). New study programs of geodetic engineering in Slovenia. Proceedings of the 2007 International Congress on Geomatics in Europe.

[1] https://unite.edu.mk/en

[2] http://unt.edu.mk/en

[3] https://www.ugd.edu.mk/index.php/en

[4] http://ukim.edu.mk/en_index.php

[5] https://www.uklo.edu.mk

[6] https://www.facebook.com/GeodesyMTU

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