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Analysis of the Quality of Academic Education of Geodesy and Cartography Graduates with Respect to Employment in Geodesy Administration

1. Introduction

With the dynamically developing spatial information infrastructure, which has a determining effect on the data collected in geodesy and cartography administration offices, the personnel of such offices have to meet increasing requirements. Some claim that geodesy graduates are not prepared to work for state and local government administration.

Opinions relating to this issue are exchanged in geodesy periodicals [1], on internet forums [2] and during conferences [3, 10]. It should be emphasised that there is a variety of opinions expressed and that in general, they concern a broad range of universities teaching geodesy. Thus, no uniform position can be formulated on this issue. Our purpose is to analyse and confront the teaching process of Geodesy and Cartography students at the AGH University of Science and Technology in Krakow vis-à-vis the expectations of administrative offices employing geodesy and cartography graduates.

2. Studies at the Faculty of Mining Surveying and Environmental Engineering (FMS&EE) and Graduate Employment in Geodesy and Cartography Administration

In accordance with the Higher Education Law of 27 July 2005 [4], the AGH University changed its teaching system in the 2007/2008 academic year from one-level 5-year MSc courses to two-level courses: engineer followed by MSc course,

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supplemented with a third level – PhD courses. As a result of the change, the two academic systems will be implemented simultaneously over the next few years. Table 1 compares the two systems.

Table 1. Academic teaching system at the FMS&EE

One-level MSc courses			Two-level courses	
Course term 1–6	Specialty term 7–10	No. of students specialising in the field	Engineer courses Course term 1–7	MSc courses Specialty term 8–10
G&C Geodesy and Cartography	EIG Engineering and Industrial Geodesy	80	G&C	EIG
	RPEC1 Real Property Evaluation and Cadastre	22		RPMC Real Property Management and Cadastre
	GIPT Geoinformation, Photogrammetry and Teledetection	23		GIPT
		Geomatics		
M&G Mining and Geology		40		M&G

¹ The name of the specialty in the new teaching system is Property Management and Cadastre.

It should be emphasised that the quality of education of an MSc engineer graduate of the Faculty of Mining Surveying and Environmental Engineering is not affected by the teaching system itself. However, in the future, the difference between the level of education of an engineer course graduate and an MSc course graduate will become apparent.

The specific field in which a graduate specialises is also an important information in terms of their preparedness to work in different areas of geodesy. Graduates of the Faculty of Mining Surveying and Environmental Engineering at the AGH University receive diplomas in one of the fields of specialty specified in table 1.

2.1. Syllabus

At an early stage of academic education, common for all Geodesy and Cartography students, before they select their respective specialties, students are taught several subjects, listed in table 2, of particular importance for their prospective work in geodesy administration. The scope of every subject is described in the University's Syllabus [9].

Table 2. Important subjects before selecting a specialty

Subject	Term
Economics	3
Basics of spatial planning, urban planning and cadastre	4, 5
Basics of law	4, 5
Vocational training in the basics of cadastre (6 days in an office)	4 or 6

Early into a one-level MSc course, students are taught certain aspects of national legislation, civil law, property law, administrative law and geodesy law. They also learn about the structure, division and functioning of the geodesy services in Poland. With respect to cadastre, students learn in a practical way about various concepts related to land and building register, and real property management.

At the same time, it could be doubted whether the 6 days of basic vocational training in offices in the field of cadastre is enough to effectively teach students about all the issues to be covered during such training. Moreover, the problem with vocational training outside the university is that most geodesy offices or businesses do not have dedicated personnel responsible for supervising trainees and what they actually learn during their training period.

The problem of insufficient supervision over trainees both in geodesy firms and public offices is raised on the geoforum.pl portal [2], and some of the opinions are quoted in *Geodeta* monthly [1].

Below are two quotations from the above portal:

From my own experience: I had my training in one company, and all I did during this training was one and the same thing: hammering nails in asphalt. That's how much I learned!

You think that two weeks of intensive university training in various fields, using state-of-the-art equipment is worse than two weeks of photocopying in a company? If I am wrong, than I would like all companies, for example from Warsaw, which would accept 200 students for 2 weeks and spend some time to teach them something, to sign up.

The following tables (Tabs 3, 4 and 5) describe respective specialties within the G&C courses. Due to a large number of subjects, the tables contain only specialist subjects and subjects which are helpful for future work in administration, the latter in bold print.

Table 3. Specialty: Engineering and Industrial Geodesy

Subject	Term
Special geodetic measurements	7
Motorways and junctions	8
RTK GPS application in engineering	8
Building appraisal	8
Advanced engineering measurement technologies	8
Field training in engineering and industrial geodesy	8
Marketing and management	8
Geodetic measurements of displacements and deformations	9
Interpreting the measurements of displacements and deformations of buildings	9
Acts of law for real estate trading purposes	9
Specialist engineering software	9

Table 4. Specialty: Real Property Evaluation and Cadastre

Subject	Term
Geodetic servicing of property management	7
Management of farm, forest and water, and industrial activity	7
Estimation methods of real property value	8
Statistical models in spatial information	8
Economic and legal aspects of property and business appraisals	8
Field training in cadastre and real property management	8
Field training in real property appraisal	8
Marketing and management	8
Acts of law for real estate trading purposes	9
Cadastre systems	9
Appraisal of different types of real estates	9

Table 5. Specialty: Geoinformation, Photogrammetry and Remote Sensing

Subject	Term
Digital photogrammetry	7
Engineering photogrammetry	7
Elements of image geoinformation	8, 9
Digital photogrammetry	8
Computer cadastral systems	8
Introduction to data bases	8
Field training in geoinformatics and remote sensing	8
Marketing and management	8
Numerical terrain model	9
Acts of law for real estate trading purposes	9
Remote sensing	9

2.2. Student Profile

Taking into account the specificity of working in geodetic administration, RPEC is the specialty which prepares students in the best way for their future work in the field. Table 1, however, shows that students most often choose the EIG specialty. Employers confirm the tendency, as in their opinion students are better prepared for working in the field of industry and economy rather than geodesy administration. Employers' opinions, though, may result from the fact that the specialty of applicants is not taken into account during the recruitment process.

It is important to emphasise here that a new subject called "Management in Geodesy" will be introduced into the 3-level teaching system. The subject will be taught during the last term of engineer studies and it will comprehensively deal with the principles of geodetic administration and different-sized geodetic firms, as shown in the detailed syllabus in table 6.

Hopefully, students graduating from the engineer level of the Geodesy and Cartography of the AGH University will be more familiar with the above-mentioned subject matter.

Apart from the compulsory subjects, students are offered a range of optional courses. The list of complementary subjects is updated every academic year.

Table 6. Management in Geodesy, syllabus

Management in Geodesy
<ul style="list-style-type: none"> - Presentation of current tendencies on the geodesy job market - The most important current projects of state administration - Geodesy in the structure of public administration divisions - Basic terminology of the Business Activity Law. Registration of business activity on the example of the Municipal Office of Krakow - Legal bases of civil and commercial law companies - Organization of the State Geodetic and Cartographic Service, competences of geodetic and cartographic supervisory bodies - Geodetic and Cartographic Resource Fund Relations between administration and geodetic performance: application of geodetic and cartographic projects, supervision of geodetic documents and contractor units. - Licenses for independent performance of geodesy functions - Geodetic and Cartographic Documentation Centres (ODGiK) – organization and principles of operation - Operating a small & medium-sized geodetic company - Running an independent business - cooperation with employers, rates of payment, cooperation with Geodetic and Cartographic Documentation Centres - Public Procurement Law, tenders

Unfortunately, a closer analysis of the programme of such elective classes may lead to the conclusion that few of them deal with issues related to working in administration. Yet, because some of the graduates start their employment in geodesy administration, it would be meaningful to extend the optional curriculum by adding topics useful in administration work.

Whether a specific course should be approved is determined by the number of students who enroll for it. For example, in the 2009/2010 academic year, from the list of 48 courses suggested to students, including 6 related to employment in administration, the university will run 29 classes, 3 of which are relevant to administration (items in bold in table 7).

Table 7. Optional courses for the 2009/2010 year, relevant to employment in administration

Item	Subject
1	Using the EWMAPA system in generating and operating numerical maps in projects
2	Basics of real property brokerage and management
3	Selected aspects of property appraisal
4	Estimating real estate value for specific purposes
5	Professional licenses in connection with property appraisal
6	Professional licenses in geodesy and cartography

Judging from the above information, students do not always show the need to explore the knowledge of administrative or legal issues while still at the university.

3. Requirements of Administration Offices Concerning Geodesy Graduates

Offices of geodetic administration recruit new employees on a continual basis, which is reflected in the number of job offers advertised by various departments. Consequently, students should not have problems with finding employment in administration.

However, administrative units complain that their job offers generate little interest among graduates who have the required qualifications. Additionally, administration offices point out that the newly employed staff are badly prepared for performing administrative tasks. The following chapter is an attempt at analysing the problem.

3.1. Statutory Requirements for Employment in Administration

Article 42 of Polish Geodesy and Cartography Law [5] stipulates that in order to perform administrative activities independently, employees are required to hold professional licenses. Article 43 determines the scope of such licenses, and article 44 describes the conditions under which it is possible to receive such vocational licenses.

The regulation of the Polish Minister of Infrastructure concerning required qualifications of employees within the bodies of the State Geodetic and Cartographic Service [6] specifies the requirements for applicants to the State Geodetic and Cartographic Service. One basic requirement that is common for all the posts referred to in the above legal documents is the requirement to hold relevant professional licenses in geodesy and cartography.

It may be assumed that graduates who start their career in administration offices should not be placed on posts involving great responsibility. At an early stage of employment, graduates should have a chance to learn about the scope of administrative activities and ways of practical application of the law.

It is impossible to learn how to exercise legal regulations at the university because of the variety of legal instruments used in different areas of office activity. The first years of their work are actually the time when a graduate acquires professional experience necessary for obtaining professional licenses. One should not expect that a graduate of any university will have the experience of a senior employee.

3.2. Qualifications of a G&C Graduate

According to teaching standards formulated by the General Board of Higher Education (RGSW) for Geodesy and Cartography [8], a graduate of this discipline could be characterized as follows:

Graduate's qualifications:

A graduate should be able to use advanced knowledge of technical science, geodesy and cartography. He should know how to: manage a team, make decisions, deal with basic legal and administrative problems of commercial entities, and should be inventive. The graduate should be prepared for working in: geodesy and cartography firms, related companies, his own geodetic and cartographic company, state and local administration, and education – following the accomplishment of the teaching module (in accordance with educational standards for the teaching profession). Outstanding students should be prepared to continue education at the third level (PhD courses) and to carry out research activity.

The subsequent document, presenting the structure of 2-level studies at the AGH University since the year 2007/2008 [7] contains suggestions of the RGSW regarding the professional preparedness of graduates. The document says that:

Each level of higher education should:

Prepare for professional career and provide opportunities for further education. Because the reality is developing at such a dynamic pace, studying at any of the university levels does not guarantee that a graduate will acquire a full and complete knowledge of the studied discipline, or full and complete training.

Similar opinions can be found at Geoforum.pl [2], quoted in the article [1]:

Don't panic! In my opinion, graduates of renowned universities are not that bad. I know from my own experience that university background will enable me to deal with problems from any area of geodesy. Dear employers, don't expect miracles – either you want to employ a graduate or somebody with 5 years of experience. These days, an employer would want to have all in one, which is why he is disappointed. And as far as the teaching programme, let universities deal with it.

Universities are not there to teach craft or computer programmes used at your company. I know employers would wish to have a graduate who would be working perfectly well with the programme they're using from the very beginning. Universities are there to shape the personality of a young geodesist, and to give him a sound background.

3.3. Examples of Recruitment Requirements in Geodesy Administration

This chapter presents some examples of recruitment requirements for future geodesists in the local government administration of the city and gmina of Krakow. The study analyzes the requirements versus the remuneration offered. Only those fragments of the documents studied which are relevant to this study are used.

The first example (Tab. 8) is recruitment for an administrative post at an ODGiK in the Geodesy Department, announced by the Mayor of Krakow.

Table 8. Recruitment requirements, example 1

Administrative post in ODGiK, Geodesy Department	
Obligatory requirements	<ul style="list-style-type: none"> a. Degree in geodesy b. Minimum 2 years experience of working in geodesy
Additional requirements (evaluated)	<ul style="list-style-type: none"> a. Familiarity with the Geodesy and Cartography Act. b. Familiarity with the Regulation of the Minister of Regional Development and Construction concerning registration of land and buildings c. Familiarity with the Code of Administrative Procedure d. Familiarity with issues related to the works of the Geodetic and Cartographic Documentation Centre e. Familiarity with standards in geodesy, cartography, and the national system of geographical information about terrain, in particular, the technical instruction K-1 Master Map issued in 1998 by the Head Geodesist of Poland and the technical guidelines Instruction G-5 - practical skills f. Computer literacy g. Professional licenses in the fields of geodesy and cartography
Working conditions and remuneration	Basic monthly salary of PLN 2.000-2.500 (gross)

The next document (Tab. 9) contains recruitment requirements concerning an opening for an administrative position in the Land and Building Records Office advertised by the District Office in Krakow.

The above examples show that a graduate of the FMS&EE department who cannot meet the obligatory requirement concerning the professional experience has no chances for employment on either of the above posts.

Table 9. Recruitment requirements, example 2

Administrative post of a DEPUTY CLERK in the Office of registration for land and buildings, Geodesy, Cartography, Cadastre and Property Management Department	
Obligatory requirements	<ul style="list-style-type: none"> a. Degree in geodesy, geography, administration, environmental protection, property management b. Professional experience – minimum 6 months of internship or employment on a post dealing with land and building registration c. Good computer literacy of Word, Excel, LEX, Internet Explorer d. General knowledge of guidelines regulating administrative procedures in local councils e. General knowledge of regulations related to public activities of district offices, personal data protection, access to public information f. Specialist knowledge and the ability to apply relevant regulations
Additional requirements (evaluated)	<ul style="list-style-type: none"> a. Knowledge of the Geodesy and Cartography Law b. Knowledge of the Regulation concerning the registration of land and buildings c. Knowledge of the Land and Mortgage Register and Mortgage Law d. Knowledge of the basic aspects of the Personal Data Protection Law e. Knowledge of the Code of Administrative Procedure. f. Knowledge of the acts regulating the functioning of local governments. g. Knowledge of the provisions of the Arable Land Protection Law.
Working conditions and remuneration	Monthly gross payment of up to PLN 1.800

It is important to highlight that most job offers for geodesists from the years 2008 and 2009 required professional experience from applicants. This requirement was less seldom included in the job advertisements of other divisions. Professional requirements for administrative jobs in geodesy are more precise, more specialist and entail more specific competences than in the case of similar posts in other departments. It is also worth mentioning that the range of salaries in geodesy administration is the lowest in comparison with other departments of administration.

The final example is that of recruitment requirements for the position of a Geodetic and Cartographic Documentation Centre (PODGiK) Manager in a poviát office (Tab. 10).

The third example also proves that the possible remuneration seems inadequate when juxtaposed with extensive obligatory requirements and responsibilities. Therefore, it is not surprising that G&C graduates seek employment in areas other than geodesy administration.

Table 10. Recruitment requirements, example 3

PODGiK Manager in the Geodesy, Cartography, Cadastre and Property Management Department	
Obligatory requirements	<ul style="list-style-type: none"> a. Degree in geodesy b. Professional licenses for performing independent functions in the field of geodesy and cartography concerning: <ul style="list-style-type: none"> – geodetic topographical survey, inventory measurements, – property division and preparing documentation for legal purposes c. Work experience of minimum 5 years including at least 2 years in state administration or local government administration, performing independent functions in the area of geodesy and cartography for the period of at least 3 years d. Good familiarity with the provisions of the Geodesy and Cartography Law with the related executive directives, technical instructions and regulations applying to geodesy and cartography projects, basic knowledge of the Code of Administrative Procedure and Civil Code e. Good computer literacy in Word, Excel, LEX, Internet Explorer and such programmes as “Vega” & “V-Biuro” f. General knowledge of regulations related to public activities of poviats offices, personal data protection, access to public information. g. Specialist knowledge and ability to apply relevant regulations
Working conditions and remuneration	<ul style="list-style-type: none"> a. Basic gross monthly salary of up to PLN 3000 b. It is not possible to combine employment at the Poviats Office with other identical functions that would be contrary to or related with the activities performed as official duties, leading to a justified suspicion of bias or conflict of interest

4. Summary

Summing up the arguments presented in this study, below are the reasons why offices of the Geodesy and Cartography Service may perceive C&G graduates as insufficiently qualified:

- Apart from the RPEC specialty, obligatory syllabuses of other specialties include only a small number of subjects preparing for administration work.
- Although the list of complementary courses does contain a few subjects dealing with legal and administrative and geodetic issues, students do not always feel the need to explore those areas, which is reflected in their choice of majors and complementary classes.
- Student training in administration offices are far from ideal.
- Rates of remuneration offered for administrative posts do not encourage competent graduates to work in administration.

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