STATISTICAL AND DEMOGRAPHIC ANALYSIS OF GEODESY STUDENTS APPRENTICES IN SLOVENIA IN THE PERIOD FROM 2008 TO 2011

STATISTIČNO DEMOGRAFSKA ANALIZA PRAKTIKANTOV ŠTUDENTOV GEODEZIJE V SLOVENIJI V OBDOBJU 2008 - 2011

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ABSTRACT

The model developed for evaluating the optimal division of Slovenia into provinces is based on regional centres equipped with activities of appropriate levels, including universities. Connections between universities and the industry of a province are important factors in ensuring equal opportunities to access university education. Information on the regional concentration of students and distribution of organizations providing field placements in relation to all organizations in Slovenia is an important criterion of quality of university education. University and professional studies in geodetic engineering for the entire country is conducted at the University of Ljubljana. A comparison was made between the old and the new university and professional study programmes during the transition to the Bologna study programmes, when University of Ljubljana synchronously offered the old and new study programs (academic years 2008/09, 2009/2010, and 2010/11). The focus of this paper is on the role of field placements in the university with special reference to the understanding and evaluation students' and graduates' competences. The demographic composition of students in geodetic engineering with their involvement in field placements is analysed. An analysis of regional distribution mapping and demographic analysis of organizations with the determination of distance from place of residence of students in geodetic engineering to their field placement is presented.

IZVLEČEK

Dejavniki modeliranja optimalne členitve Slovenije na pokrajine vključujejo opremljenost regionalnih središč z dejavnostmi na ustrezni ravni, med katere spadata univerzitetno izobraževanje ter povezanost univerze z gospodarstvom pokrajine in njenimi razvojnimi potrebami pri zagotavljanju enakih možnosti za dostopnost univerzitetnega izobraževanja. Podatki o regijski gravitaciji študentov in ustreznosti regijske porazdelitve organizacij izvajalk praktičnega usposabljanja glede na vse organizacije v Sloveniji so pomembno merilo kakovosti univerzitetnega izobraževanja. Univerzitetni in strokovni študij geodezije poteka za celotno Slovenijo na Univerzi v Ljubljani. Izvedena je bila primerjava med starimi in novimi bolonjskimi univerzitetnimi in strokovnimi študijskimi programi v obdobju prehoda na bolonjski študij, ko so na Univerzi v Ljubljani hkrati izvajali stare in nove študijske programe (študijska leta 2008/09, 2009/2010, 2010/11). Posebej je tudi predstavljena vloga praktičnega usposabljanja na univerzitetnem študiju geodezije s poudarkom na pojmovanju in vrednotenju kompetenc študentov/diplomantov. Analizirani sta demografska struktura študentov geodezije in njihovo vključevanje v geodetske organizacije pri praktičnem usposabljanju. Izvedeni sta bili analiza regijske razpršenosti geodetskih organizacij in demografska analiza študentov geodezije, pri čemer se je ugotavljala oddaljenost opravljanja prakse od kraja stalnega bivališča študentov geodezije.

KEY WORDS

Geodetic engineering students, geodetic organisations, higher education, field placement, regionalisation, Slovenia

KLJUČNE BESEDE

študenti geodezije, geodetske organizacije, univerzitetno izobraževanje, praktično usposabljanje, regionalizacija, Slovenija

1 INTRODUCTION

This paper examines the regionalization of Slovenia from the viewpoint of higher education as an integral part of the criteria for the arrangement of public activities for spatial planning in the context of the development planning of Slovenia. *The issue of finding an optimal solution for regionalization of the Republic of Slovenia is complicated and requires balancing the policy of finding political compromise and sufficient public support on the one hand and complying with professional guidelines, platforms and discussions on the other* (Mikoš, 2011). *The decrease of development changes and activation of the country's inner potentials is not only political but an entirely realistic development question for the competitiveness of the country as a whole. Current political discussions on the number of administrative regions or provinces and their spatial division would be enhanced by a discussion of effective development of Slovenia as a whole, in which they will represent the driver for the development of the region defined on the basis of functional characteristics (Pogačnik, Zavodnik Lamovšek and Drobne, 2009).* (Drobne, Konjar and Lisec, 2010). Functional area as a dynamic system is based on functional connection, the characteristics of which are economic and social interactions. Methods for determination of functional connections are based on various criteria (work mobility area, labour market and employment system) (Drobne, Konjar and Lisec, 2010). Workplaces are an important criterion comprising labour market, employment system and work mobility. Data collection should begin during the study and the behaviour of apprentices when choosing work organizations in connection with employment possibilities in provinces should be analysed. The collected data can contribute to analyses of province scenarios and predictions of trends in the labour market and the area of work mobility. The present analyses are of particular importance in the current time of economic crises and shortage of employment and may contribute significantly to designing and implementing the spatial and development planning of the Republic of Slovenia.

A province is an area with its own self-contained functional and infrastructural systems which make it strong enough developmentally, socially and economically to be able to provide sustainable development of its area and also the country (Pogačnik, Zavodnik Lamovšek and Drobne, 2009). When modelling an optimal division of provinces, the equipping of regional centres with activities of suitable range which also include higher (tertiary) education is an important factor. In particular universities, as especially important forms of higher education institutions, should be as much as possible connected to the province's economy and its development needs (Pogačnik, Zavodnik Lamovšek and Drobne, 2009) and should provide equal opportunities for regional access to university education. This paper discusses the study of geodetic engineering which is conducted for all Slovenia at the University of Ljubljana Faculty of Civil and Geodetic Engineering (hereinafter UL FGG). The demographic composition of geodetic engineering students and their entry into geodetic organizations that provide field placements is discussed. The collected data show regional distribution of students and adequacy of regional dispersion of geodetic organizations that provide field placement. The regional dispersion of students and the network of geodetic organisations of field placement providers are important criteria for the quality of geodetic education.

The Bologna reform in the field of university education has established cooperation between universities and the economy at the time of the analysis of educational needs and design of study programmes. Employers played an active role in the processes of analysing and planning graduates' competences which were defined in the context of the anticipated study outcomes of graduates. Employers actively participate in implementing field placement courses where students join working processes of organizations.

Professional pathways for students begin during their study; they develop further after entering the labour market and continue in throughout the whole cycle of professional activity. Field placement is the first contact of students with practice, and it should present to students their possible roles in professional work. The first contact with professional experience influences students' further decisions, i.e. the type of employment they choose. At the time of field placement students choose and make contact with the organization which trains them. Regional distribution of these organizations is thus important from the viewpoint of the regionalisation of Slovenia, because it has implications for potential future mobility of employed geodetic studies graduates. This paper presents research on the demographic characteristics of apprentices in relation to geodetic organisations in which they undertook field placements. Regional coverage with geodetic organizations including both those which do and do not provide field placements was analysed in relation to statistical and demographic analysis of geodetic engineering apprentices. The research questions asked provide information of great value for analyses of various provinces scenarios:

(1) When choosing geodetic organisations that provides field placements, is there a difference between old and new study programmes regardless the complexity of study (professional study programme vs. university study programme) or between a professional study programme of geodetic engineering and a university study programme of geodetic engineering regardless the Bologna reform (pre-Bologna study and Bologna study)?

(2) Where do students undertake field placements; near their place of residence or in the Osrednjeslovenska statistical region (near the UL FGG)?

(3) What is the average distance between the students' place of residence and the field placement location?

(4) What is the distribution of organizations, taking into consideration their size, across statistical regions of the Republic of Slovenia (population density, general population) and is it the same as or different from the dispersion of students?

The present research is a part of basic longitudinal research (2011-2014) on the gap between graduates' competences and labour market needs in the fields of geodetic engineering, civil engineering, electrotechnology, education, health and psychology and coincides with the implementation of the Bologna process. Longitudinal research follows students of old (pre-Bologna process) and new (Bologna) study programmes at various points during their study in academia, field placement and after graduation. The aim of this research is to learn how students perceive professional competences, how various learning environments influence learning and competence development and what the competences of graduates are at the time of entering the labour market. Particular concern is paid to longitudinal monitoring of students' contacts with organizations in the time of field placement during their study and factors which influence decisions about the type of employment after graduation. The research also covers employers and mentors of field placement. Field placement of students is one of the key factors for the development of professional competences during professional initiation and development of professional identity. The research examines the extent of influence of field placement on the development of students'/graduates' competences and the development of professional identity. The concept of competences expresses individual's potential which is realised in various areas and represents individuals and requirements of working environment (Klieme and Leutner 2006). Competences are defined as contextually specific cognitive dispositions which are needed by individuals to behave efficiently in contextual situations or tasks in various fields. Competences include the cognitive level (the ability of competent thinking and problem solving and knowledge of certain field); the emotional and motivational level (opinions, values, readiness for action); and the behavioural level (ability to adequately activate, harmonise and use potentials in complex situations) (Peklaj, 2006).

In education, requirements for responsibility in relation to results underline competency-oriented curricula. As an alternative, McLeland points out competency testing where testing with tasks from real work positions is provided (McLeland, 1973). In Bologna study programmes, competences are the basis of curriculum planning and implementation of study process. Students' competences should have already been assessed during their time of study when conditions are established during field placement in the context of real working environment (Istenič Starčič, 2011). Learning in a real working environment in the context of field placements is an integral part of education at university. There are several processes going on during field placements, from the use of theoretic knowledge in various situations of real working environment to the informal learning where apprentice participates in professional community (Lave and Wenger, 1991). Wenger claims that learning should be addressed holistically and an individual should be placed into a social and cultural environment where he or she participates in the central practices of professional communities. It is stressed that the provision of adequate and sufficient opportunities for reflection, assessment and research of new ideas is crucial (Wenger, 1998). Experiences gained through field placement are based on integration into communities of practice and cooperation, shared knowledge development and observation of employees at work (Eraut, 1994). University education should involve integration with real working environments which enable the use of theoretical knowledge in practice and the assessment of students' competences. Eraut (1990) defines the elements of knowledge which students develop from field placement: the knowledge of real situations, human resources characteristics, practices, conceptual knowledge and process knowledge. Schön (2002) emphasizes tacit knowledge and wisdom of practice which develops with experiences, acquired in real working environments.

The present paper discusses field placement in various studies of geodetic engineering. In the Department of Geodesy Faculty of Civil and Geodetic Engineering, University of Ljubljana (OGeod), the last reform of study programmes before the Bologna process took place between

1996 and 1999 as an extension and update of the existing study programmes: the university study programme of geodetic engineering and professional study of geodetic engineering. In particular, the programmes underwent content changes in which new subjects mainly from the field of law, public administration and economics were introduced. This reform was defined in the framework of the project Phare Tempus S-JEP (Structural Joint European project) 11001-96 (Šumrada and Stubjakjaer, 1999). In the context of Bologna process at University of Ljubljana (2005-2007) the following programmes were introduced:

- 1st-cycle university study of Geodesy and Geoinformation (hereinafter GIG), which is a partial substitute for the old university programme Geodesy;
- 1st-cycle higher education professional study programme of Technical Real Estate Management (hereinafter TUN), which is a partial substitute for the old higher education professional study programme and fills the gap that emerged in geodesy profession in Slovenia with the incorporation of technical support into real estate management;
- 2nd-cycle programme of Geodesy and Geoinformation, which is a substitute for the 4th year of the old university study programme of Geodesy and a partial substitute for the old masters' study programme of Geodesy.

Field placement was already an integral part of the old (pre-Bologna) study programmes and continues to be an integral part of the study after the Bologna reform. In the old study programmes, field placement was called professional practice and was not defined as an individual course of the study programme. Professional practice was a condition for the completion of the study and was recognized as passed without graded pass/fail. In higher education professional study, one month of professional practice after each of the second (180 hours) and third years (180 hours). Seven hundred and twenty hours of practice after the completion of studies but before graduation was also mandatory. During professional practice students had to keep a diary which had to be presented to the professional practice coordinator together with the company's certificate of the duration of professional practice. In university study, one month of professional practice after each of the second (180 hours) and third years (180 hours) was also mandatory.

In the framework of Bologna reform of the study of Geodesy, the Department of Geodesy conducted a survey on the effectiveness of the study of Geodesy among employers (Drobne and Modic, 2007) and graduates (Drobne, Breznikar, Babič, 2006). Employers assessed the level of competences attained and knowledge of graduates and the importance of individual fields for this discipline (Drobne and Modic, 2007). The research inter alia concluded that "almost all private companies emphasize the need to be able to use knowledge in practice and are dissatisfied with the current situation. Employers from the private sector therefore strongly support the principles of Bologna reform, namely to introduce even more hours of field placement" (Drobne and Modic, 2007, p. 97).

Graduates assessed the content of the study and the relationship between the acquired knowledge and its applicability in practice (Drobne, Breznikar and Babič, 2006). More than 40 % of professional and university study graduates stated that the study programme courses should incorporate a higher number of tutorials and the more field exercises and field work should be provided during the course of study (Drobne, Breznikar and Babič, 2006, p. 282). The authors concluded: "... students in particular wanted a higher number of tutorials and new approaches to teaching, because receiving of knowledge through traditional teaching in the form of lecturing may be too passive and therefore less effective. The study of geodesy could be more focused on problem solving and should enable students to solve practical problems from the professional field of geodesy. In the context of some subjects students would therefore have the opportunity to participate, under mentoring of professors, in actual projects in private geodetic companies and competent public institutions." (Drobne, Breznikar and Babič, 2006, p. 284).

In new, i.e. Bologna study programmes, field placement presents a part of study programme as an individual study course of the same importance as the other study courses. In the 1st-cycle higher education professional study programme TUN, field placement is worth six credit points with a duration of one month (180 hours). In the 1st-cycle university study programme GIG, field placement with a duration of three weeks (120 hours) is worth four credit points. In the 2nd-cycle masters study programme Geodesy and Geoinformation, field placement lasts two weeks (80 hours). Comparison with professional study programmes shows that TUN includes only 20 % of the total field placement of the old study programme (180 vs. 900 hours). Furthermore, comparison shows that both cycles of new study programmes Geodesy and Geoinformation include only 55 % of the total field placement of the old university study programme Geodesy (360 vs. 200 hours). Comparable programmes in foreign universities contain two types of field placement: project work (Technische Universität Wien, ETH Zürich) and field placement in organizations (Politecnico di Milano, Facolta di Ingegneria Civile, Ambientale e Territoriale). The aim of field placement is to use knowledge in practice and be introduced into roles and functions. Students encounter professional environments and the role of lifelong learning in all stages of an individual's professional development from traineeship to retirement. During on campus study it is not possible to familiarize individuals with all of the challenges they will encounter during their work (Istenič Starčič and Vonta, 2010). Their choice of specialization regarding work tasks only takes place once they are employed. Field placement enables familiarization with various professional orientations and, in the context of basic activities from the course syllabus, with a broad scope of activities which are part of land surveyor's professional competences (Lisec at al., 2009), such as land management (Lisec and Prosen, 2008) or land evaluation (Šubic Kovač and Rakar, 2010). The results of research on field placement among geodetic engineering students show that placements have effects on confirmation of professional choice. Students believed that field placement promotes the understanding of the professional role and affects their career planning (Istenič Starčič, 2011).

2 WORK METHODS

UL FGG is in the process of transition from the old study programmes to the new, Bologna study programmes. For the purpose of this research, data on geodetic engineering students were obtained from the electronic database of student office of UL FGG for the academic years 2008/2009, 2009/2010 and 2010/2011. The research addressed the following old study programmes:

- three-year higher education professional study programme of Geodesy,
- four-year university study programme of Geodesy and the 1st cycle of the following new three-year Bologna study programmes:
- higher education professional study programme of Technical Real Estate Management (TUN; first enrolment year 2008/2009) and
- university study programme of Geodesy and Geoinformation (GIG; first enrolment year 2009/2010).

Data for the old study programmes include data from 2008/2009 onward and data for the new programmes include data from 2009/2010 onwards. Demographic structure of students was presented by gender, completed secondary education, Matura / matriculation exam success and the place of residence at the time of enrolment. The enrolment and demographic data were supplemented with information on the year of field placement and size and registered office of the organization in which the field placement took place.

The aforementioned information was analysed for each of the above study programmes. The analysis of field placement of students is presented by students' place of residence and registered office of the placement organization. The average distance between the students' place of residence and the field placement location is calculated. The above mentioned analyses were conducted in the 12 statistical regions of Slovenia and the number of inhabitants in individual regions in 2008 and GDP of statistical regions in 2007 were taken into account (Slovenian regions in numbers, 2010). Since differences between the sampled years are insignificant, data is provided in an aggregate or average of all years. The analysis addressed all geodetic organizations. The source used was the Slovenian Chamber of Engineers (IZS, 2012). Regional analyses addressed statistical regions as defined by the Statistical Office of the Republic of Slovenia (SORS). The analysis was conducted using the program ArcGIS. It shows data about: regional dispersion of students by place of residence at the time of enrolment; about regional dispersion of all geodetic companies in Slovenia; and the network of field placement providers for geodetic engineering students. It is presented on the map of Slovenia for the whole three periods; the temporal component has not yet been taken into account. Advanced processing with the spatio-temporal component being taken into account (Triglav at al., 2011) will be possible after the completion of a longitudinal study in 2014. The results of the analyses are presented in charts and tables. Descriptive statistics were produced using Excel.

The research sought answers to four research questions:

(1) When choosing geodetic organisations that provides field placements, is there a difference between old and new study programmes regardless the complexity of study (professional study programme vs. university study programme) or between a professional study programme of geodetic engineering and a university study programme of geodetic engineering regardless the Bologna reform (pre-Bologna study and Bologna study)?

(2) Where do students undertake field placements; near their place of residence or in the Osrednjeslovenska statistical region (near the UL FGG)?

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3 RESULTS AND DISCUSSION

3.1 Data about companies and students

For the purpose of analysis, we collected data about all geodetic companies which are registered with the Slovenian Chamber of Engineers (IZS, on 25 March 2012) and supplemented them with data about other companies where students undertook field placements, i.e. construction and architecture companies where geodesy is not the primary line of business but is a part of their work, and public institutions such as regional geodetic offices of the Surveying and Mapping Authority of the Republic of Slovenia and municipalities. These data were supplemented with data from the Business Directory of Republic of Slovenia (PIRS, on 25 March 2012) which collects data about the size, products and services of companies.

3.1.1 Structure of geodetic engineering students

The analysis addressed general upper secondary school graduates and geodesy upper secondary school graduates because geodetic engineering students come from various secondary schools; the latter were categorized as Other (Table 1). The comparison of the distribution of students in the old higher education professional study programme shows that mostly students from other secondary schools enrolled in this programme. They are followed by geodesy upper secondary school graduates. A similar distribution exists in the new study programme TUN; however, the percentage of geodesy upper secondary school graduates is higher. Almost all male university study programmes students are general upper secondary school graduates, whereas one third of female students are graduates of other secondary schools. All GIG female students are general upper secondary school graduates. Male students of GIG are mostly general upper secondary school graduates, too, with only two students from other secondary schools. GIG has no geodesy upper secondary school graduates enrolled. Table 2 shows data about students' points scored at the Matura exam by study programmes and regions. The comparison shows that more successful students are enrolled in the university study programmes and GIG which, according to Table 1, are mostly general upper secondary school graduates. In higher education professional study programmes and TUN success is comparable, since in both female students were slightly more successful at the Matura exam.

Secondary school	Professional study		University study		Professional study TUN		University study GIG	
	F	M	F	M	F	M	F	M
Surveying secondary school	12	38	3	4	3	14		
Gimnasioum	4	22	103	123	6	2	13	8
Other	74	47	38	2	12	10		2
Total	90	107	144	129	21	26	13	10

Table 1: The structure of geodetic engineering students from UL FGG by gender (M – male, F – female) and completed secondary school and study programmes in academic years 2008/2009, 2009/2010 and 2010/2011.

Statistical region	Professional study		University study		Professional study TUN		University study GIG	
	F	M	F	M	F	M	F	M
Pomurska	16	14	24	22		18		
Podravska	20	17	20	21		17		20
Koroška		15	19	24				
Savinjska	17	18	23	23	21		26	
Zasavska	18		18					
Spodnjeposavska	20	17	22	22		21		
JV Slovenija	18	16	24	24	19	18		
Osrednjeslovenska	19	16	22	24	21	18	24	
Gorenjska	16	20	22	26	24		20	25
Notranjsko-kraška		17			17		21	
Goriška	19	19	25	23				
Obalno-kraška	15	17	21	24	16			
Average points reached at Matura exam	17,8	16,9	21,8	23,3	19,7	18,4	22,8	22,5

Table 2: The success of geodetic engineering students from UL FGG in points reached at the Matura exam by gender (M – male, F – female), study programmes and statistical regions of place of residence in academic years 2008/2009, 2009/2010 and 2010/2011.

3.1.2 The structure of companies providing field placement and the number of students undertaking field placement

The information about the size of companies is taken from PIRS: micro companies (< 15 employees), small companies (< 50 employees), medium-sized companies (< 250 employees) and large companies (> 250 employees). The information about the size of the companies where students conduct field placement (Table 3) show that most geodetic engineering students undertake field placements in micro companies which are usually private (private entrepreneurs or limited liability companies). The distribution of companies by statistical regions (Figure 1) shows that larger companies are concentrated in urban statistical regions, especially in the Osrednjeslovenska statistical region and Podravska statistical region, while in statistical regions in general micro companies are most common. The total number of companies is highest in the Osrednjeslovenska statistical region while only one third of them employ apprentices from the study of Geodesy (Table 3). Least cooperative are companies in the Notranjsko-kraška statistical region, Obalno-kraška statistical region and Podravska statistical region, while most cooperative are those in Zasavska statistical region where there is at the same time the lowest number of companies and students.

		Number of companies in statistical region				Number of companies with apprentices				
Statistical region	No.	Micro	Small	Medium	Large	No.	Micro	Small	Medium	Large
Zasavska	6	6				3(50%)	4(67%)			
Koroška	10	9	1			5(50%)	4(44%)	1(100%)		
Notranjsko-kraška	13	12	1			2(15%)	1(8%)	1(100%)		
Pomurska	16	16				5(31%)	5(31%)			
Spodnjeposavska	17	17				8(47%)	5(29%)			
Goriška	25	24			1	7(28%)	6(25%)			1(100%)
Gorenjska	26	23	1	2		8(31%)	5(22%)	1(100%)	2(100%)	
JV Slovenija	27	24	3			9(33%)	6(25%)	3(100%)		
Obalno-kraška	28	26	1	1		5(18%)	4(15%)		1(100%)	
Savinjska	43	43	2	2	2	13(30%)	7(16%)	2(100%)	2(100%)	2(100%)
Podravska	48	44	2		2	12(25%)	9(20%)	1(50%)		2(100%)
Osrednjeslovenska	133	113	12	5	3	46(35%)	34(30%)	8(67%)	2(40%)	2(67%)

Table 3: The total number of companies in statistical regions of Slovenia and the number of companies with apprentices – geodetic engineering students from UL FGG in academic years 2008/2009, 2009/2010 and 2010/2011 by size.

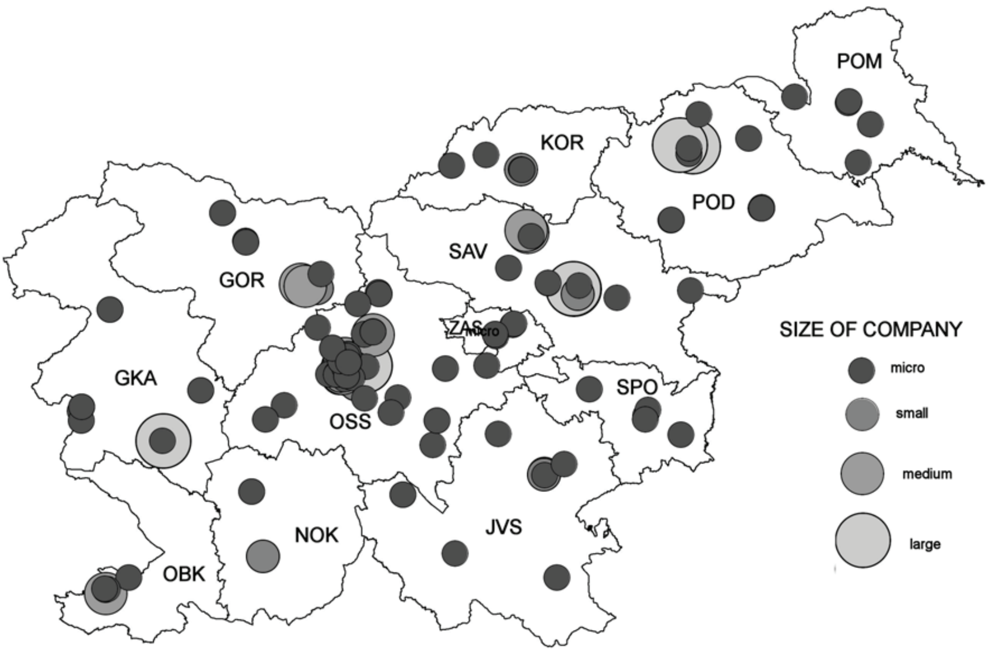

Figure 1: Companies providing field placement by size and statistical region of Slovenia (statistical regions abbreviations: OBK – Obalno-kraška statistical region, GKA – Goriška statistical region, GOR – Gorenjska statistical region, OSS – Osrednjeslovenska statistical region, NOK – Notranjsko-kraška statistical region, ZAS – Zasavska statistical region, JVS – Jugovzhodna Slovenija statistical region, SAV – Savinjska statistical region, SPO – Spodnjeposavska statistical region, KOR – Koroška statistical region, POD – Podravska statistical region and POM – Pomurska statistical region).

3.1.3 Study programmes and students' selection of the size of company providing field placement

The research question addressed was: When choosing geodetic organizations to provide field placements, is there a difference between old and new study programmes and between the Bologna professional study programme (TUN) and the Bologna university study programme (GIG)? Students from all study programmes mainly chose micro companies for their field placements (Table 4). Slightly higher number students of the old university study programme undertook field placement in small and medium-sized companies. This could be related to the fact that small and a few medium-sized geodetic companies perform operational field work as well as development and research work. Field placements in large enterprises were undertaken by only few geodetic engineering students; namely students of the old study programmes with greater emphasis on field placement.

	2008		2009				2010			
Company size	Professional study	University study	Professional study	University study	TUN	GIG	Professional study	University study	TUN	GIG
Micro	22	16	31	36	10		24	17	7	10
Small	5	4	2	10	3	1	3	6	3	1
Medium	1		1	4	2		3	1	1	1
Large	1	3	2				2	2		

Table 4: Company size and the number of geodetic engineering students from UL FGG undertaking field placement by years 2009, 2010 and 2011.

Geodetic engineering students from statistical regions with the lowest number of geodetic companies undertook field placements further from their place of residence than those in regions with higher number of companies, where the distance is smaller. Taking into account that distance and mobility are higher with female students of geodetic engineering (Table 8), it can be suggested that, if possible, male students of geodetic engineering wish to undertake field placement near their place of residence while female students are ready to undertake field placement in a large distance from their home. The pattern of connections between students' place of residence and the company of field placement is shown in Figure 3.

3.1.4 Dispersion of students across statistical regions

Students from all analysed study programmes of geodetic engineering come from all statistical regions of Slovenia (Figure 2); however their number varies according to the region. Taking into account the area of the statistical regions, the density of geodetic engineering students from UL FGG is highest in the Osrednjeslovenska and Zasavska statistical regions (52.8 and 49.3 students per 1000 km^2) and lowest in the Notranjsko-kraška statistical region (8.9 students per 1000 km^2; Table 7) with the average density in Slovenia being 26.6 geodetic engineering students per 1000 km^2. With regard to the number of inhabitants of the statistical regions, the highest density of geodetic engineering students is in the statistical region of Jugovzhodna Slovenija (517 students per 1 million people) and the lowest in the Podravska and Pomurska statistical regions (both having 167 students per 1 million people) with the average density being 266 students per 1 million people.

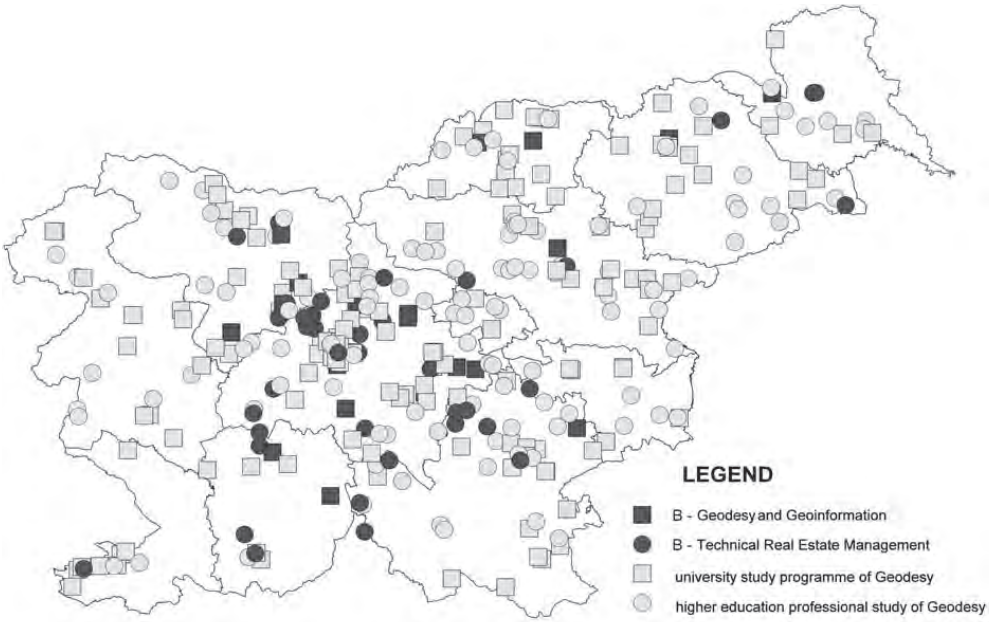

Figure 2: Regional distribution of place of residence of geodetic engineering students from UL FGG by study programmes (statistical regions abbreviations: OBK – Obalno-kraška statistical region, GKA – Goriška statistical region, GOR – Gorenjska statistical region, OSS – Osrednjeslovenska statistical region, NOK – Notranjsko-kraška statistical region, ZAS – Zasavska statistical region, JVS –Jugovzhodna Slovenija statistical region, SAV – Savinjska statistical region, SPO – Spodnjeposavska statistical region, KOR – Koroška statistical region, POD – Podravska statistical region and POM – Pomurska statistical region).

The question addressed was: Where do students undertake field placement; near their place of residence or in the Osrednjeslovenska statistical region (that is, near the UL FGG)? On the one hand, the companies which provide field placements are dispersed across statistical regions in one pattern (Figure 1) and on the other geodetic engineering students are dispersed across statistical regions in a different pattern (Figure 2). Therefore geodetic engineering students have two options: to undertake field placement near their place of residence or due to their ambitions to undertake it near the place of study and later also search for a job there. Taking into account the possibilities of finding a company that provides field placements, geodetic engineering students can be mobile also in terms of remote statistical regions. Therefore the pattern of connections between the students' place of residence and companies where they undertake field placements can differ substantially (Figure 3).

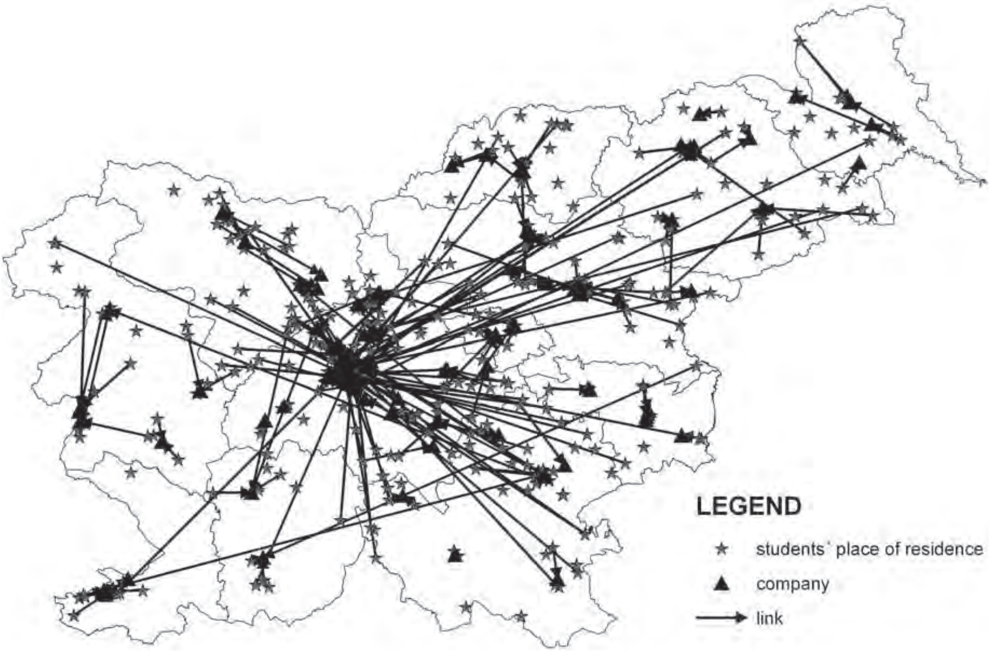

Figure 3: Connections between the place of residence of geodetic engineering students from UL FGG and the place of field placement (statistical regions abbreviations: OBK – Obalno-kraška statistical region, GKA – Goriška statistical region, GOR – Gorenjska statistical region, OSS – Osrednjeslovenska statistical region, NOK – Notranjsko-kraška statistical region, ZAS – Zasavska statistical region, JVS –Jugovzhodna Slovenija statistical region, SAV – Savinjska statistical region, SPO – Spodnjeposavska statistical region, KOR – Koroška statistical region, POD – Podravska statistical region and POM – Pomurska statistical region).

3.1.5 Distance between the students' place of residence and the place of field placement by regions

The question addressed was: What is the average distance between the students' place of residence and the location of field placements? The average distance between geodetic engineering students' place of residence and their field placement location is approximately 25 km and is the same in the old and new study programmes (Table 6). On average, the distance to the place of field placement is shortest for students from the Zasavska statistical region where the number of geodetic engineering students and companies is low and distances are short (Table 5). Distances between the place of residence and the field placement location are also short in the Osrednjeslovenska statistical region where the number of companies is the highest. Field placements in the Osrednjeslovenska statistical region are undertaken mainly by students whose place of residence is Ljubljana (Table 3). On average, the distance to the field placement location is longest in the Podravska statistical region where the number of companies is quite low, taking into account the area (Figure 1), with a low percentage of companies providing field placements (Table 3). It can be concluded that in statistical regions with a low number of companies, geodetic engineering students undertake field placement in relatively remote places.

Statistical region	Professional study		University study		Professional study TUN		University study GIG		Average
	F	M	F	M	F	M	F	M	
Zasavska	15,6	-	5,7	-	-	-	-	-	10,7
Osrednjeslovenska	17,5	10,7	10,9	8,7	12,6	11,5	15,3	-	12,5
Goriška	6,9	22,2	28,2	9,9	-	-		-	16,8
Koroška	-	7,7	47,2	19,7	-	-	11	-	21,4
Obalno-kraška	78,4	9,6	11,4	4,2	5,1	-		-	21,7
Pomurska	26,4	12,8	61,1	8,3	-	2,3		-	22,2
Gorenjska	27,2	35,7	14,8	16,7	44,7	-	17	16,8	24,7
Notranjsko-kraška	-	56,5	-	-	4,4	-	18,2	-	26,4
Savinjska	37,8	40,9	23,8	8,1	44,3	-	8,6	-	27,3
Spodnjeposavska	50,9	3,6	40,1	8	-	52,9	-	-	31,1
Jugovzhodna Slovenija	68,3	8,1	36,7	39,4	32	4,6	-	-	31,5
Podravska	3,7	25,3	42,8	21,7	-	15,6		110,1	36,5

Table 5: Average distances (km) between the place of residence of geodetic engineering students from UL FGG and the place of field placement by regions, gender and study programmes in academic years 2008/2009, 2009/2010 and 2010/2011.

Data about the distance between the place of residence and the place of field placement were also addressed with regard to study, study programme (old and new) and gender (Table 5). Field placement is undertaken farthest from home by students of the new university study programme GIG, immediately followed by students of the old higher education professional study programme. The field placements of the students of the new professional study programme TUN and the old university study programme are almost one third closer to home. Distance between the place of residence and field placement location is practically the same in old and new study programmes (on average 25.1 km). Female students of geodetic engineering drive almost one third further to field placement locations than do male students which points to higher mobility of female students (28.7 km vs. 21.8 km).

Study programme	Professional study	University study	TUN	GIG	Pre-bologna study	Bologna study	Male students	Female students
No. of students	203	282	48	23	485	71	284	272
Average distance (km)	28,6	21,8	22,4	30,2	25,1	25,0	21,8	28,7

Table 6: Average distances between the place of residence of geodetic engineering students from UL FGG and the place of field placement by study programmes, calculated as the sum for three academic years (2008/2009, 2009/2010 and 2010/2011).

3.1.6 Regional dispersion of companies and presentation of statistical data

The question addressed was: With respect to their size, how are organizations dispersed across the statistical regions of the Republic of Slovenia (population density, general population) and is it the same as or different from the dispersion of students? The data in Table 7 show the number of students enrolled in study programmes in the field of geodetic engineering by regions, region area, number of inhabitants of the region, number of companies in the region and the number of geodetic engineering students per area of the region and per number of inhabitants of the region.

Statistical region	No. of geodetic engineerin gstudents	Area (km^2)	Number of inhabitants	GDP 2007	No. of compani es	No. of students / million inhabitants	No. of students / 1000 km^2
Gorenjska	55	2136,59	201.779	84,7	26	273	25,7
Goriška	37	2325,50	118.533	96,4	25	312	15,9
JV Slovenija	73	2675,08	141.166	93,1	27	517	27,3
Koroška	31	1040,79	72.481	76,9	10	428	29,8
Notranjsko-kraška	13	1456,33	51.728	75,4	13	251	8,9
Obalno-kraška	20	1044,44	108.778	104	28	184	19,1
Osrednjeslovenska	135	2554,96	521.965	143,7	133	259	52,8
Podravska	54	2169,66	322.900	85,1	48	167	24,9
Pomurska	20	1337,52	119.537	65,2	16	167	15,0
Savinjska	67	2383,98	258.845	87,9	43	259	28,1
Spodnjeposavska	22	885,14	69.900	80,2	17	315	24,9
Zasavska	13	263,75	44.750	66,1	6	291	49,3
Slovenija	540	20.273,80	2.032.362	100,0	392	266	26,6

Table 7: Statistical region data about the area, number of inhabitants of statistical region in 2008, GDP in 2007 and number of geodetic engineering students and companies in academic years 2008/2009, 2009/2010 and 2010/2011.

Pearson's coefficient	Number of geodetic engineeri ng students	Density of geodetic engineering students to the arae of statistical region	Density of geodetic engineering students to the number of inhabitatants of statistical region	Area of statistical region	Number of inhabitants in statistical region	GDP of statistical region for year 2007	Number of companies in statistical region
Number of geodetic engineering students	1	0,56	0,15	0,76	0,91	0,82	0,91
Density of geodetic engineering students to the arae of statistical region		1	0,18	-0,03	0,49	0,41	0,54
Density of geodetic engineering students to the number of inhabitatants of statistical region			1	0,15	-0,25	-0,01	-0,18
Area of statistical region				1	0,66	0,56	0,57
Number of inhabitants in statistical region					1	0,77	0,95
GDP of statistical region for year 2007						1	0,89
Number of companies in statistical region							1

Table 8: Pearson's coefficients of correlation between the number of geodetic engineering students who undertook field placements in academic years 2008/2009, 2009/2010 and 2010/2011 and the chosen indicators of statistical regions.

The following conclusions can be made from the statistical comparisons shown by the above data (Table 8) which are also presented graphically (Figures 4-8):

1. Geodetic organizations are not equally distributed across Slovenia. Their distribution across

statistical regions mainly follows the number of inhabitants of the individual statistical region (Pearson = 0.95), the number of geodetic engineering students in individual statistical regions (Pearson = 0.91) and the GDP of individual statistical regions (Pearson 0.89), and less the size (area) of individual statistical regions (Pearson = 0.57).

2. Geodetic engineering students from the UL FGG are not equally dispersed across Slovenia; the highest proportions are in the Osrednjeslovenska statistical region (52.8 geodetic engineering students per 1000 km^2) and the Zasavska statistical region (49.3 geodetic engineering students per 1000 km^2), whereas the lowest proportions are in the Notrnjsko-kraška statistical region (8.9 geodetic engineering students per 1000 km^2) and the Pomurska statistical region (15.0 geodetic engineering students per 1000 km^2).

   The highest ratio of geodetic engineering students per number of inhabitants is in the statistical region of Jugovzhodna Slovenija (517 geodetic engineering students per 1000 inhabitants), followed by the Koroška statistical region (428 geodetic engineering students per 1000 inhabitants), with the lowest ratio being in the Pomurska and Podravska statistical regions (167 geodetic engineering students per 1000 inhabitants).

   The distribution of geodetic engineering students follows the number of inhabitants of individual statistical regions (Pearson = 0.91) rather than as one might imagine, the GDP of individual statistical regions (Pearson = 0.82) or the area of individual statistical regions (Pearson 0.76).

3. It is interesting that the density of students per number of inhabitants of statistical region is independent of the GDP of statistical regions (Pearson = 0.01).

Figure 4 shows the number of geodetic companies, area and GDP of statistical regions, ranked by the area of individual statistical regions. It has been concluded that the area of statistical region does not influence the size and number of companies in that region.

Figure 5 shows the number of geodetic engineering students and companies according to size by statistical regions, GDP and the area of statistical region. From the chart it cannot be concluded that GDP has an effect on the number of geodetic engineering students in statistical regions, with only the Osrednjeslovenska statistical region standing out. However, the size of GDP has an effect on the number of small and medium-sized companies. They provide their services mainly in the Osrednjeslovenska statistical region.

Figure 6 shows data about relationships between the number of geodetic engineering students and the number of inhabitants from the smallest to the largest statistical region. The number of geodetic engineering students per head of population and the number of students per area do not show a relationship with the size of individual statistical regions.

When categorizing the number of companies by the number of inhabitants (Figure 7), a relationship between the number of inhabitants and the number of companies, mainly micro companies, can be seen.

Figure 8 clearly shows the distribution of geodetic micro companies in Slovenia (be aware that the ordinate starts at 75% of the total number of companies). The share of non-micro companies is relatively small in the Osrednjeslovenska statistical region where GDP is the highest. According to GDP ranking, the number of different company sizes increases with the increase of GDP.

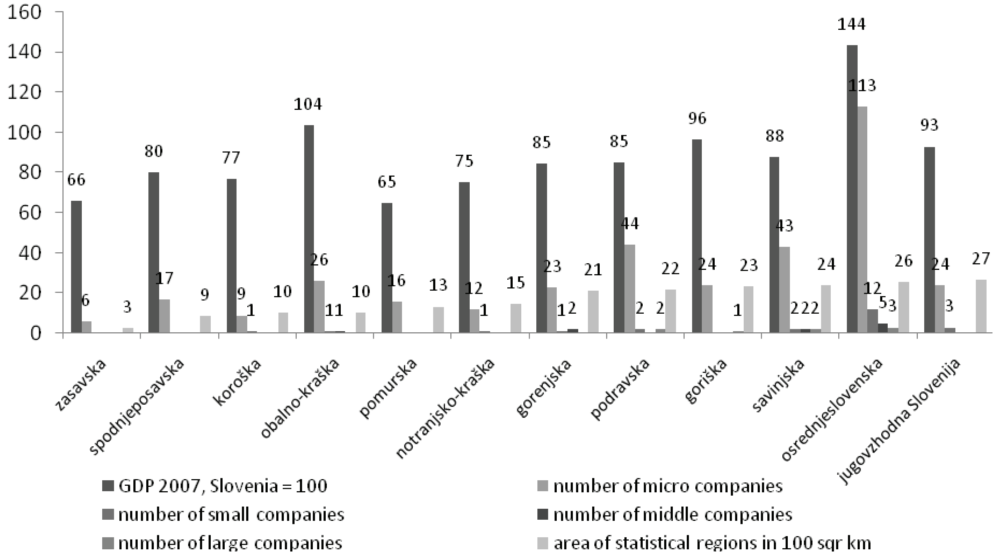

Figure 4: The number of geodetic companies by size in terms of the area of statistical regions and gross domestic product (GDP) in 2007.

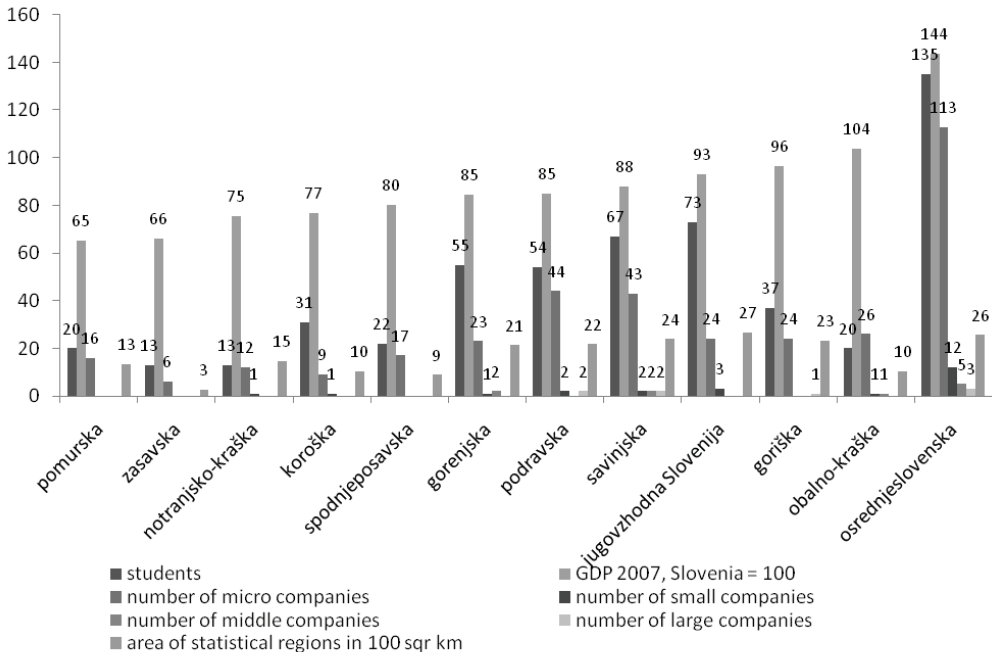

Figure 5: The number of geodetic engineering students from UL FGG in academic years 2008/2009, 2009/2010 and 2010/2011 and the number of companies by size by statistical regions in terms of gross domestic product (GDP) in 2007 and the area of statistical region.

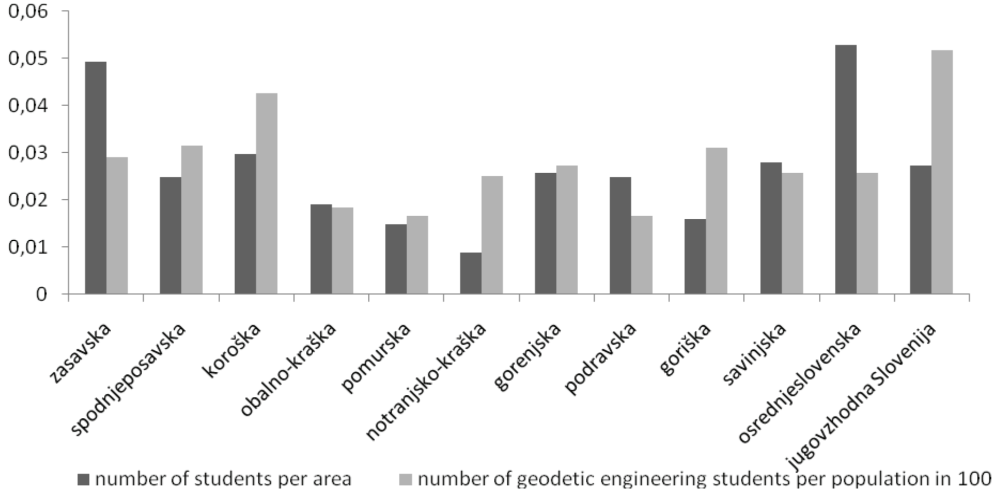

Figure 6: The number of geodetic engineering students from UL FGG by statistical regions in view of the size and number of inhabitants of statistical region.

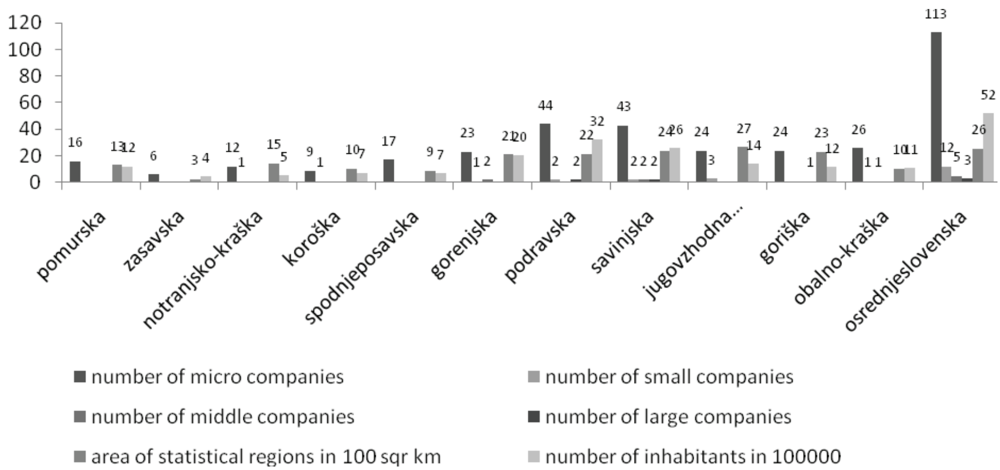

Figure 7: The number of geodetic companies in individual statistical regions compared to the number of inhabitants and size of individual statistical regions.

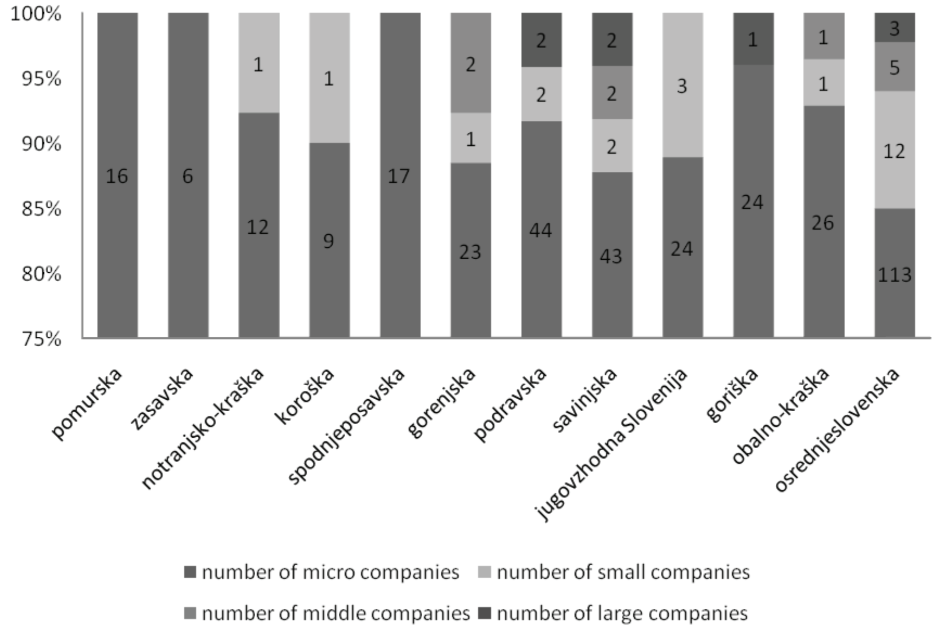

Figure 8: The structure of geodetic companies by statistical regions.

4 CONCLUSIONS

The concept of a province as a dynamic system defined by functional connections characterized by economic and social interactions is based on criteria for identification of functional regions such as work mobility area, labour market and employment scheme (Drobne, Konjar and Lisec, 2010). Workplaces are connected to all mentioned criteria: labour market, employment scheme and work mobility. Due to our belief that the analysis of situation should begin to be made during the study, we have analysed the behaviour of apprentices when choosing work organizations in connection with employment possibilities in geodetic organizations in provinces. The regional dispersion of geodetic organizations and demographic characteristics of students were analysed. The analyses addressed the distance between the place of field placement and the students' place of residence.

A province is an area with its own complete functional and infrastructure systems (Pogačnik, Zavodnik Lamovšek and Drobne, 2009). The factors of modelling of the optimal division of provinces include the equipment of regional centres with activities of appropriate level which include university-level education and the relationship between universities and the provinces' economy and development needs (Pogačnik, Zavodnik Lamovšek and Drobne, 2009) when providing equal opportunities for access to university-level education. Education for geodetic engineering is conducted at the University of Ljubljana for the whole of Slovenia. The demographic composition of geodetic engineering students and the involvement of this in the organization of field placement is analysed. The data about regional concentration of students and the adequacy of regional dispersion of geodetic organizations which provide field placements in relation to all geodetic organization of Slovenia are important criteria for the quality of university-level education.

The data about UL FGG geodetic engineering students' regional origin in the three academic years studied show the highest number of students come from the Osrednjeslovenska, Jugovzhodna Slovenija, Savinjska and Gorenjska statistical regions. The lowest numbers of geodetic engineering students are in the Zasavska and Notranjsko-kraška statistical regions. Because the information about the enrolled students were collected over a relatively short period, it is not appropriate to make any generalizations.

We have analyzed the network of geodetic organizations which cooperate with the UL FGG to provide field placements and compared those organizations with all geodetic organizations in Slovenia. The collected data show that the highest proportion of companies providing field placements is in the Zasavska and Koroška statistical regions despite their being the smallest according to the number of companies and students (Table 3).

Field placement provides the first contact with real working environments and together with various other factors influences career decisions. The main conclusions of the research about demographic characteristics of apprentices in connection with geodetic organizations in which they conducted field placement are:

1. When choosing geodetic organizations that provide field placement, is there a difference between old and new study programmes and between professional study programmes and university study programmes?

   According to data which differentiate those distances by programmes, the students of the new university study programme GIG undertake field placement the farthest from their place of residence. They are immediately followed by students of the old higher education professional study. The distance that has to be travelled by students of the new professional study programme TUN and the old university study (Table 6) is almost a third shorter. The distance between the place of residence and the place of field placement is practically equal for old and new study programmes (Table 6). The results of research about field placement of geodetic engineering students showed that the vast majority of geodetic engineering students undertake field placement in private micro companies with up to 15 employees (Table 4). The results of the survey for the purpose of Bologna reform of study programmes conducted among employers from the field of geodesy (Drobne and Modic, 2007) showed that particularly private companies providing services in the field of land cadastre and geodetic engineering emphasize practical knowledge or capability of the use of knowledge in practice. They were unsatisfied with the situation at that time and therefore agreed with the principles of the Bologna reform which require increasing the hours of field placement in study programmes (Drobne and Modic, 2007).

2. Where do students undertake field placement; near their place of residence or in the Osrednjeslovenska statistical region (that is, near the UL FGG)?

Students from statistical regions with the lowest number of geodetic companies undertake field placement farther from their place of residence than those in statistical regions with higher numbers of companies, where the distance is shorter. Bearing in mind that distance and mobility are higher with female students of geodetic engineering (Table 6), it can be suggested that, if possible, male students of geodetic engineering wish to undertake field placement near their place of residence while distance from their place of residence is not as large a concern for female students of geodetic engineering. Considering the possibilities of finding a company which provides field placements, geodetic engineering students can be mobile also in terms of different statistical regions. Therefore the pattern of relationships between the students' place of residence and the company in which they undertake field placement can vary considerably.

3. What is the average distance of geodetic engineering students' place of residence from the location of field placement?

   The average distance between the geodetic engineering students' place of residence and field placement location is 25 km and is the same in old and new study programmes (Table 6). On average, distances are the shortest for geodetic engineering students from the Zasavska statistical region where the number of students and companies is low and distances are short (Table 5).

4. What is the distribution of companies, taking into consideration their size, across statistical regions of the Republic of Slovenia (population density, general population) and is it the same as or different from the regional distribution of students?

   Geodetic organizations are not equally distributed across Slovenia and their density does not follow the pattern of distribution of population or the number of inhabitants measured by statistical regions of the Republic of Slovenia.

In the context of the research questions asked, the research contributes information which is useful for analyses of various province scenarios addressed by Pogačnik, Zavodnik Lamovšek and Drobne (2009) and Drobne, Konjar and Lisec (2010).

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