An analysis of employment opportunities of graduated students in the field of information and computer sciences

Darko Matotek

Faculty of Economics in Osijek

University of Josip Juraj Strossmayer, Osijek

Gajev trg 7, 31000 Osijek

darko.matotek@efos.hr

Dušan Mundar

Faculty of Organization and Informatics

University of Zagreb

Pavlinska 2, 42000 Varaždin, Croatia

dusan.mundjar@foi.hr

Abstract. *The aim of this study was to determine on which jobs are usually employed people who have graduated from certain university or faculty. This study was conducted among persons who are employed and have a first-hand insight on the labor market. Additional power of this research is that respondents give their opinion on the state of the organizations in which they work or where they worked during his career. The significance of this study is twofold. High school graduates based on the results of this research can conclude which higher education institution should enroll if they want to work on the observed jobs. Higher education institutions management and administration may see whether is really those jobs that are considered to educate their students. In this way, faculty management could align their curricula according to the situation on the labor market. Observed are institutions that educate students in the field of information science. These faculties educate students within the technical and social fields.*

Keywords: Education; Information and computer sciences

1 Introduction

In higher education appear many stakeholders: students, higher education institutions, parents and the wider community. As the ultimate consumers of higher education services could be pointed out graduated students and companies in which they are employed. This research represents a small contribution to high school graduates in making a decision when choosing a particular field or faculty to study.

In several countries have been conducted similar studies with aims to assess different aspects of higher education. In Australia [3] has happened expansion of higher education. Research is conducted using data from the 1999 to 2009. Graduate Destination Surveys is conducted to investigate the absorption of recent university graduates into the Australian labor market.

Problems of over education for several professions were also discussed.

Greece [4] is characterized by high levels of graduate unemployment, which vary considerably with the field of study, and relatively low levels of wage flexibility. In study [4] are estimated wage returns to different academic disciplines in the Greek labor market using recently available data. The estimated returns are found to vary considerably across the various degrees or subjects examined, with important gender and public/private sector differences established.

One interesting research with objective to found out how different fields of study make a difference in the university-to-work transition, and how this difference varies over time is carried in Italy [1]. Conclusions were that during 1995–2004 the best-performing subjects in terms of the probability of finding a stable job were and remain the 'quantitative' ones (Hard Science, Hard Social Sciences, and Technical degrees).

Main issue in Canada ICT sector and education is decrease in enrolments of new students in Computer Sciences (CS) universities. [6] Enrolment is declining since 2000. Possible solutions for that problem are focusing on changing the public's perception of the industry and its employment opportunities and adapt the CS curricula to remain engaging and relevant for all Canadian students.

International empirical evidence suggests that the wages of university graduates are strongly determined by the field of study. In particular, it appears that graduates from natural sciences have the highest and graduates from arts/humanities have the lowest wages [2]. Using data on German university graduates, on that [2] longitudinal research were investigated wage differences between graduates from arts/humanities and graduates from other fields of study. When entering the labor market, the raw wage gap of arts/humanities compared to social sciences is 36%, compared to natural sciences it is 26% and compared to engineering it is 40%. Five to six years after graduation, the wage difference is of a similar size ranging between 32% and 34%. In category Natural

Sciences are included math, natural science, pharmacy, IT and forestry.

Problems met by the graduates of the bachelor program in Petroşani University, Romania in looking for employment and finding a job are researched. Also the correlation or lack of correlation between the academic offer of professionals and demand on the market is observed. The demand is much under the offer, the employment market absorbing in the respective professional education only 15% of the graduates at institutional level and 27% at national level [5].

This paper is composed in a way that after the introduction follows the methodology and technology of research which provides more details on methods of data collection and processing, as well as the characteristics of respondents. This is followed by research results and a discussion of the results and finally is stated conclusion and unavoidable limitations of this study as well as a proposal for future research.

2 Objectives and research subject

Studies specified in the theoretical framework of observed problems facing young people - just graduated students. The specificity of this study is that the results are not based on the opinions and wishes of the students, but the experiences of more proficient respondents about their actual positions or work places. The subject of this research are six faculties, namely: Faculty of Electrical Engineering and Computing (FER); Faculty of Organization and Informatics (FOI); Faculty of Science (PMF); Faculty of Mechanical Engineering in Slavonski Brod (SFSB); Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture in Split (FESB) and Faculty of Economics and Business (EFZG). Subject of this research were workplaces on which are employed students who graduate from these faculties. Observed positions are as follows: Marketing and sales; Telecom jobs; IS management; Designing and programming of the IS; Computer System activities; other jobs. This study aims to assess whether on some jobs graduates of the certain faculty could be employed more often than in other workplaces. Or whether for that matter is all the same at which faculty is someone graduated. According to Table 1, could be concluded that is a very large number of graduates each year, considering framework of Republic of Croatia. This fact gives additional importance to this research.

3 Research methodology and technology

In this paper is used a statistical test, specifically χ^2 test to determine whether the observed jobs are distributed evenly by faculties

Table 1: Number of graduates at observed institutions in the period of 2006 -2012
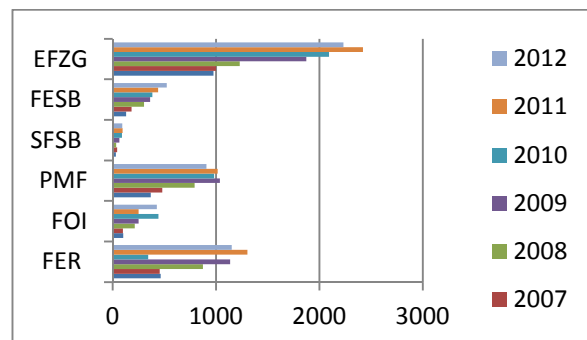
Source: Authors by [7] [8]

In accordance with the above framework is developed questionnaire. The questionnaire consists of two parts: the first part of the general socio-demographic information about the respondents. In the second part of the questionnaire respondents are asked to choose jobs where are employed graduates from certain faculties. Respondents are supposed to circle answers in regard to their well-known situation in their company or career. Two different ways are used to collect data from respondents: one way was filling out a paper form questionnaire for those respondents which were directly contacted and second way with the help of Google Docs where the participants filled out a questionnaire in electronic form. Respondents were allowed to give more than one answer to a question, differently said they could choose more then one job on which are employed graduates from observed higher education institutions (HEI). Data were collected from two categories of respondents that were available to the authors. The first category of respondents was participants of Life-long education programs in one Open University, and the second category are the postgraduate (PhD) students at the Faculty of Organization and Informatics in Varaždin. Subjects were filling questionnaires independently, after which they took them in the enclosed envelope and pasted, and handed them over to the examiner - to ensure complete anonymity of answers. For questioner was not possible to connect response to specific respondent. As for other ways of completing the questionnaire via online form - examiner in this case could not connect response to specific respondent.

In the data processing software package for spreadsheet calculations - MS Excel was used.
Data for the study were collected from 73 respondents of whom 35 women (47.95%) and 38 men (52.05%). The table below shows the subjects distributed in two

groups with regard to the education program which they attended at the time of this research.

Table 2: Distribution of survey respondents by gender

Category of respondents	Men	Women	Total by category
PhD students	22 (62. 86 %)	13 (37.14 %)	35 (47.95 %)
Life-long learners	16 (42.11 %)	22 (57.89 %)	38 (52.05 %)
Total by gender	38 (52.05 %)	35 (47.95 %)	73 (100.00 %)

According to Table 1, it can be noted that the sample evenly represented women and men.

Table 3: Distribution of respondents according to their age and work experience

Category of respondents	Average age (years)	Average work experience (years)
PhD students	32.17	7.53
Life-long learners	30.53	5.53

It may be noted from Table 2 that the PhD students are older 1.54 year in relation to life-long learners in observed sample. Students of doctoral study have an average of two years more work experience then participants of the life-long learning education programs.

4 Results and Discussion

The tables below show the respondents' answers to stated questions: On which jobs are employed graduates from observed higher education institutions. Results are shown first by higher education institutions (Table 3), and then by the observed work positions or jobs (Table 4).

In the bottom row of Table 3 are presented results of χ^2 test with significance p less than 0.001. These results show that jobs by observed higher education institutions are not evenly distributed in all cases.

In the bottom row of Table 4 are presented results of χ^2 test with significance p less than 0.001. These results show that higher education institutions by observed jobs are not evenly distributed in all cases.

Table 4: Overview of higher education institutions (HEI) by observed jobs

HEI	Marketing and sales	Telecommunications	IS management	Designing and programming of IS	Computer System activities	Other Jobs
FER	9	34	38	49	31	2
FOI	21	18	60	42	26	3
PMF	5	7	20	34	30	18
SFSB	6	9	7	17	33	22
FESB	5	17	24	33	34	18
EFZG	66	14	17	4	3	15
χ^2	153.929	27.970	63.807	46.084	26.096	27.385
p	0.000	0.000	0.000	0.000	0.000	0.000

Table 5: Overview of observed jobs by higher education institutions

| Jobs	FER	FOI	PMF	SFSB	FESB	EFZG
Marketing and sales	9	21	5	6	5	66
Telecommunications	34	18	7	9	17	14
IS management	38	60	20	7	24	17
Designing and programming of IS	49	42	34	17	33	4
Computer System activities	31	26	30	33	34	3
Other Jobs	2	3	18	22	18	15
χ^2	59.589	70.494	36.211	35.447	27.428	137.689
p	0.000	0.000	0.000	0.000	0.000	0.000

Bellow are graphically displayed higher education institutions by jobs on witch are they graduates working.

Figure 1: Distribution of observed Jobs Faculty of Electrical Engineering and Computing, Zagreb (FER)
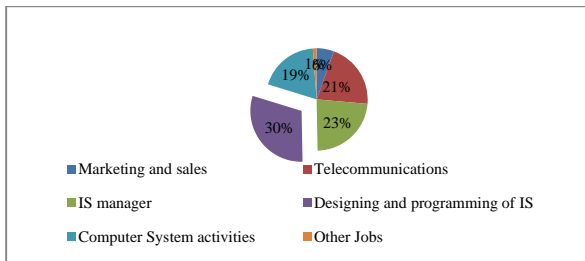

According to the survey results (Figure 1) 30% of graduates from FER are employed on designing and programming of information systems followed by manager of information systems function in company (23%).

Figure 2:Distribution of observed Jobs for Faculty of Organization and Informatics, Varaždin (FOI)
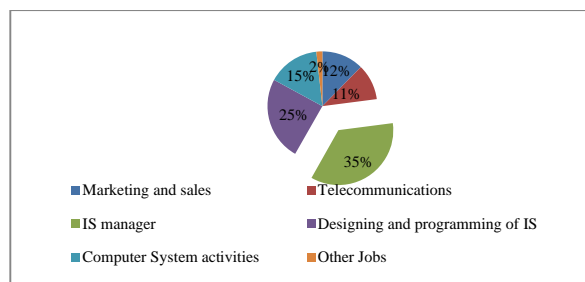

In Figure 2 are showed shares of workplaces in which are employed persons who earned they degree at Faculty of Organization and Informatics (FOI). From Figure 2 it is evident that these people usually employ as manager of information systems function in company (35%) and designing and programming of information systems (25%).

Figure 3: Distribution of observed Jobs for Faculty of Science, Zagreb (PMF)
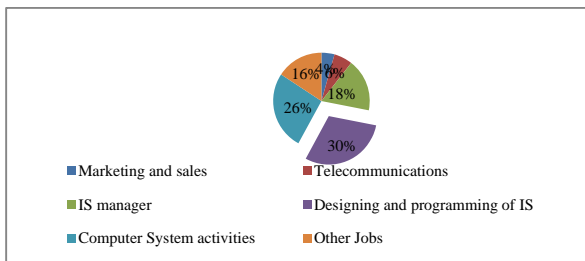
Persons who had graduated at the Faculty of Science (PMF) are usually (Figure 3) employed in designing and programming of information systems (30%) and Computer System activities (26%).

Figure 4: Distribution of observed Jobs for Faculty of Mechanical Engineering, Slavonski Brod (SFSB)
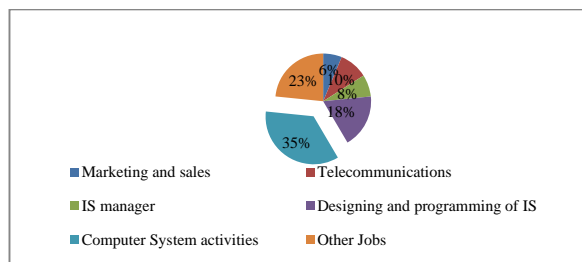
Graduates of the Faculty of Mechanical Engineering in Slavonski Brod (Figure 4) were more then one third employed in the Computer System activities (35%) and also relatively large is proportion of other jobs (18%). These other jobs are as follows: design and programming of machines, technical operations, maintenance of equipment, etc. Thus, a large proportion of other working places can be explained by small number of graduates of Faculty of Mechanical Engineering – working with this study respondents.

Figure 5: Distribution of observed Jobs for Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split (FESB)
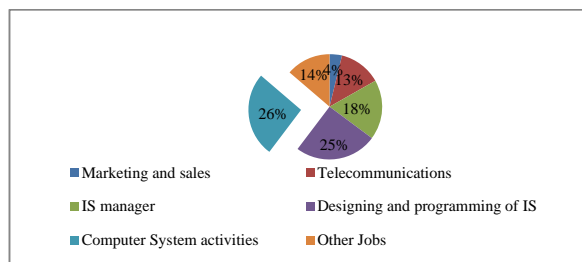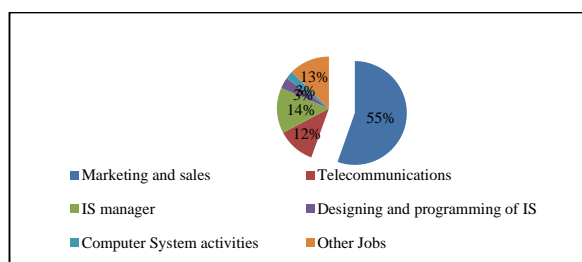

Figure 5 shows that after the graduates from Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture Split are employed a like on Computer System activities (26%) and Designing and programming of Information Systems (IS) with a share of 25%.

Figure 6: Distribution of observed Jobs for Faculty of Economics and Business (EFZG)

Regarding the Faculty of Economics and Business the situation is clear because the 55% of graduates are employed in marketing and sales (Figure 6).

At the end of this section: it is interesting to note that of all observed jobs - solely jobs in Telecommunications are jobs on which are not commonly employed graduates of any of the observed six faculties.

5 Conclusion and Limitations

In this study were observed six faculties and six potential jobs that persons who have graduated of the selected higher education institutions employ. Based on the results of χ^2 test can be concluded following: the observed working places and positions by selected faculties are not evenly distributed in all cases. This study showed the following:

A person who has graduated from the Faculty of Electrical Engineering and Computing (FER) usually work on the following tasks:
- designing and programming of information systems
- manager of information systems function in company

A person who has graduated from the Faculty of Organization and Informatics (FOI) usually work on the following tasks:
- managing of information systems function in company
- designing and programming of information systems (IS)

A person who has graduated at Faculty of Science (PMF) usually work on the following tasks:
- designing and programming of information systems (IS)
- computer system activities

Graduates from Faculty of Mechanical Engineering in (SFSB) usually work on computer system activities.

A person who has graduated from the Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture usually work on the following tasks:
- computer system activities
- designing and programming of information systems (IS)

A person who has graduated at the Faculty of Economics usually work in the working places in marketing and sales.

In accordance with the above results the potential students can choose where they would like to study. If they would like to be designers and programmers or even managers of information system function they should choose the Faculty of Organization and Informatics (FOI) or Faculty of Electrical Engineering and Computing (FER). And a slightly difference is that FOI is a bit more oriented towards managing then FER.

Limitations of this research would apply primarily to small sample. This is a sample of respondents that were available to the authors.

In future research the sample size should be increased as well as number of jobs in order to obtain an accurate picture. That picture would be able to show for which jobs are educated graduates. Therefore, students would be able to easily choose the institution where they want to study, because they would immediately know position or working place to be expected in the future. Higher education institutions in the field of information and computer science would be able to profile themselves for specific niche.

6 References

[1] Ballarino,G.;Bratti, M. Field of Study and University Graduates' Early Employment Outcomes in Italy during 1995–2004, *Labour* 23(3):421–457, 2009

[2] Grave, B. S. ; Goerlitz,K. Wage differentials by field of study – the case of German university graduates, *Education Economics*, 20(3):284–302, 2012

[3] Li, I. W.; Miller, P. W. The Absorption of Recent Graduates into the Australian Labour Market: Variations by University Attended and Field of Study, *The Australian Economic Review,* 46(1):14–30, 2013

[4] Livanos, I.; Pouliakas,K. Wage returns to university disciplines in Greece: are Greek higher education degrees Trojan Horses?, *Education Economics*, 19(4): 411–445, September 2011

[5] Răscolean,I. et al Social-Economic Aspects Regarding Employment and Activity of Higher Education Graduates from the University of Petroşani and at National Level, Annals of the University of Petroşani, *Economics*, 12(3): 241-254, 2012

[6] Slonim,J.;Scully,S.; Mcallister,M. Crossroads for Canadian CS Enrollment, *Communications of the ACM*, 51(10):66-72, 2008

[7] Visoko obrazovanje u 2010; Statistička izvješća ISSN 1331 7784, *Državni zavod za statistiku*, Zagreb, 2012

[8] Visoko obrazovanje u 2012; Statistička izvješća ISSN 1331 7784, *Državni zavod za statistiku*, Zagreb, 2014