

Zapošljivost i kompetencije studenata inženjerskog menadžmenta – očekivanja studenata Fakulteta za inženjerski menadžment

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Apstrakt: Inženjerski menadžment se često definiše kao specifična vrsta menadžmenta koja je potrebna za uspešno vođenje inženjerskog ili tehničkog osoblja i projekata. Inženjerski menadžment kao visokoškolski studijski program je nov u srpskim visokoškolskim ustanovama. Ovaj rad proučava zapošljivost studenata inženjerskog menadžmenta putem analize postojeće literature, a putem empirijskog istraživanja proučava očekivanja studenata od visokoškolskih centara za razvoj karijere vezano za svoju zapošljivost na tržištu rada, odnosno da li studenti menjaju svoja očekivanja pre i posle programa koji osnažuju upravljanje karijerom studenata kroz visokoškolske centre za razvoj karijere i dodatne kurseve na primeru studenata Fakulteta za inženjerski menadžment u Beogradu. Zaključuje se da visokoškolski centri za razvoj karijere predstavljaju ključ u asistenciji studentima u razvoju tzv. prenosivih veština, ali da su potrebna dalja istraživanja u cilju procene na koji način zapošljivost studenata inženjerskog menadžmenta može da se poveća kroz različite programe usmerene ka poboljšanju prenosivih veština.

Ključne reči: inženjerski menadžment, zapošljivost, studenti, kompetencije.

Employability and Competencies of the Engineering Management Students – Expectations of School of Engineering Management Students

Abstract: Engineering management is frequently defined as a specific type of management that is implemented for successful leading of engineering or technical personnel and projects. Engineering management as a higher education study program is new to Serbian higher educational institutions. The aim of this study is to evaluate employability of engineering management students and to, through empirical research, answer the question whether the students' change their expectations career development centers and their employability at the job market before and after receiving soft skills development trainings on the example of the students of School of Engineering Management from Belgrade, Serbia. It is concluded that the key in assisting the students in acquiring those skills are the programs and courses provided by higher education career development centers, but that the further study is necessary in order to assess the ways in which employability of the engineering management students can be increased through various programs aimed for improving their transferrable skills.

Key words: Engineering management, the students, employability, competencies.

1. Introduction

Engineering management is frequently defined as a specific type of management that is needed for successful leading of engineering or technical personnel and projects. Engineering management as a concept is a novelty in Serbia and exists for ten years, even though it is introduced in the US in 1950's and its roots can be traced back to the beginning of 20th century. Engineering management as a higher education study program is also new to Serbian higher educational institutions, the programs are prone

to changes and adaptation, and the students, prospective students, and general public are not yet aware of the usefulness of the knowledge and skills acquired. Furthermore, many employers aren't yet responsive to the advantages of the program and the broad range of knowledge that the engineering management students acquire during their undergraduate and graduate studies that can be applied in various work situations and settings.

Competencies are often defined as evident and measurable behaviors of a person needed for completion of a job task and include knowledge, skills, abilities and behaviors and can be grouped in general competencies (reading, writing) and technical competencies (Dessler, 2013). Transferable skills are the ones that can be applied in different work (and life) situations and environments and are essential for employability in the 21st century (Pellegrino, Hilton, 2012). Some of the most important transferrable skills are communication, interpersonal skills, teamwork, flexibility, achievement orientation, time management, judgment, decision making, analytical and problem solving skills.

The aim of this study is to evaluate employability of engineering management students and to, through empirical research, view the students' expectations of higher education career development centers regarding their employability before and after receiving development training through *Career Management* course provided by career development centers on the example of the students of School of Engineering Management from Belgrade, Serbia.

2. Employability and Competencies of Engineering Management Students – Literature Review

In today's economy, based on knowledge and susceptible to fast changes and increasing influence of technology, some of the greatest assets of the job seekers, both in engineering and management fields, are their flexibility, adaptability and willingness for continual development and learning. Strong professional knowledge (statistical and mathematical methods and models) and "hard" skills (data collection and interpretation) are necessary, but not enough, and the job seekers, especially recent graduates, are often confused on employers' expectations. Engineering managers, too, need to acquire knowledge, skills, abilities, and experience in management and engineering disciplines, but also to take a step further, to develop necessary skills in motivating, mentoring, and training of employees, especially in technical field. Their main task is often to act as an internal consultant for all departments in an organization in order to manage change, i.e. to develop, apply, and monitor new, more efficient and effective business processes and strategies. They are often required to generate new ideas, identify problems, and to find solutions in short period of time (Lawson & Price, 2003, p. 3).

Some of the main skills increasing the employability of engineers, managers, and, especially, engineering managers, are innovative problem solving, adaptation to change, knowledge management, and decision making, but also "soft" skills like willingness to learn, customer orientation, leadership skills, interpersonal communication and cooperation, and guiding team towards a mutual goal (Desouza & Youkika, 2005; Fritts, 1998; Davenport & Prusak, 2000; Badaracco, 2002; Wenger, McDermott & Snyder, 2002; Montgomery, Lipshitz & Bremner, 2005; Lima, Mesquita, Rocha, Rabelo, 2017). Also, the emphasis is often given on building the culture that supports development of employees (Badaracco, 2002). Some authors have also stated out motivation of the employees to develop empathy and trust (Goleman, 2004; Johnson & Eaton, 2002). Platts and Tomasevic (2006) went further and developed a model and a framework for developing trust as a professional competence, based on leadership studies at the Institute for Manufacturing at the University of Cambridge and the needs of construction projects.

Assessing the abovementioned skills, it is clear that the focus of higher education institutions' career development centers and programs should be given on so called transferrable skills, the skills that are required for engineering managers, engineers, and managers, but other professionals too, at various job positions, projects, tasks, and even careers (Abdulwahed & Hasna, 2017). Many of the world's most recognized faculties and universities have realized that it is necessary to develop these skills among the students from the beginning of the studies either through teaching (project based learning, participation in case studies, presentations, etc.) or through extracurricular activities (volunteering, debates, etc.) (Niles & Harris-Bowlsbey, 2009; Swanson & Fuad, 2010). Important insights on transferrable skills importance started to emerge with the research carried out during the 1980's and 1990's proved that higher education career development courses made it easier for the engineering and natural science

students to plan career after college and the students from the experimental group showed a higher degree of decision-making skills related to a career, better understanding of own interests, values, and knowledge, and were able to search for job related information and to acquire desired jobs more easily (Hughes & Karp, 2004).

As many higher education engineering management and industrial engineering institutions struggle to include “soft” competencies of the students to curricula (Lima, Mesquita, Rocha, Rabelo, 2017), many of them see an important role of the higher education career development centers and services that assist the students in career management in order to improve their employability and offer courses aimed at improving of transferrable skills (Niles & Harris Bowsbey, 2009; Amundson, Harris Bowsbey & Niles). Some centers also create specific programs for the development of the best students with the capacity to be successful engineers and managers, which can be implemented for engineering managers, too. Niles and Harris Bowsbey (2009) state that career development center in higher education institution during the last thirty years are becoming crucial element of a higher education institution’s ability to prepare the students for the fast moving job market needs. This is becoming even more important for developing countries such as Serbia, which must take significant steps towards a knowledge-based economy that can find its place in a global and changing marketplace and requires managers, project and team leaders who will be the driving force of projects aimed at the development of the economy. Career development centers at higher education institutions started to be more present and more organized in state and private universities, faculties and colleges from 2006 onward, but still don’t have wide developed and accepted strategies on increasing of the students’ employability (Ilić-Kosanović, 2014).

3. The Scope of Study and Data Collection

Career Development Center was introduced at the School of Engineering Management from its inception in 2010 and started to implement its programs in 2012 in order to assist the students in acquiring career management and employability skills. After researching career development theory and the best practice at the higher education institutions in USA and Great Britain, among other programs the compulsory fifteen week course aimed at improving students’ transferrable skills, with the emphasis on “soft” skills (communication, presentation, teamwork, etc.) was developed for the first year students in order to improve engineering management students’ employability. Thus, from the school year 2012/13 *Career Management Course* was introduced and in that particular year, the students from first to third year participated in the course.

The goal of the study was to analyze the difference in the students’ expectations of the Career Development Center regarding their employability before - October 2012 (T1) and after - February 2013 (T2) attending the course *Career Management* that was developed in order to enhance the students’ career management and employability skills through soft skills building (presentation, team work, communications, achievement orientation, analytical and problem solving skills). Anonymous survey was created that the students from I to III year could fill it out at the Library. Total participation was 69 respondents (N=69) which comprised 82.1% of the total sample.

4. Analysis and Interpretation on Engineering Management Students’ Employability Expectations

In the employment expectations segment of the survey, key statements were:

1. I expect to be employed within one year after graduation.
2. I expect to find a job with a “good” compensation package after graduation.
3. I expect to find a job after graduation which provides various additional training programs.
4. I expect to find a job abroad after graduation.
5. I expect to develop my own business after graduation.

The five point Likert scale was used for assessing the statements (1 – I disagree completely; 2 – I disagree; 3 – I am neutral; 4 – I agree; 5 – I agree completely).

The following main research hypothesis (H₁) stated: There is statistically significant difference between the students’ expectations regarding their employability expressed before and after attending the

Career Management course. Null hypothesis (H_0) stated: There is no statistically significant difference between the students' expectations regarding their employability expressed before and after attending the course. Research hypothesis was further divided into sub-hypotheses:

- H_{1a}: The students expect to be employed within one year after graduation.
- H_{1b}: The students expect to find a job with a "good" compensation package after graduation.
- H_{1c}: The students expect to find a job after graduation which provides various additional training programs.
- H_{1d}: The students expect to find job abroad after graduation.
- H_{1e}: The students expect to develop their own business after graduation.

For formal hypotheses testing, *Student's t test* for Equality of Means was used to test the students' expectations regarding their employability before and after attending the *Career Management* course. Significance level (α) is .05. SPSS v 18 statistical package was applied.

Table 1 shows the basic statistical indicators of the students' *expectations of employment within one year after graduation*. In this case, expectations of the students before attending *Career Management* course (average response 4.16) are somewhat higher than expectations after attending a course (average response 3.97). *Student's t test* value is $t = 1.121$, which is below the critical test value of 1.666 (with the significance level $p = 0.266 > 0.05$). On the other hand, there is a negative correlation of the students' responses before and after attending the course ($r = -0.137$). Thus, in this case, we claim that there is no statistically significant difference (decrease) in the students' *expectations of employment within one year after graduation*. This, therefore, means that the H_{1a} hypothesis is not formally confirmed.

Table 1: *Student's t test* for Equality of Means of the students' *expectations of employment within one year after graduation*

	t test for Equality of Means									
	Mean	Std. Deviation	Std. Error Mean	N	Mean Diff.	t	P	r	95% Confidence Interval of the Difference	
									Lower	Upper
T1	4.16	1.052	0.127	69	0.19	1.121	0.266	-0.137	-0.147	0.524
T2	3.97	0.785	0.095	69						

Table 2 shows the basic statistical indicators of the students' *expectations that after graduation they'll find a job with "good" compensation package*. In this case, expectations of the students before attending *Career Management* course (average response 4.35) are somewhat higher than the expectations after attending a course (average response 3.97). The value of *Student's test* statistics here is $t = 2.578$, i.e. it "exceeds" the critical value of the test 1.666 (with the significance level $p = 0.012 < 0.05$). The negative correlation of the students' responses to this expectation before and after attending the course is $r = -0.147$. So, in this case, we claim that there is statistically significant difference (decrease) in the students' *expectations that after graduation they'll find a job with "good" compensation package*. This, therefore, means that H_{1b} hypothesis is formally confirmed.

Table 2: *Student's t test* for Equality of Means of the students' *expectations that after graduation they'll find a job with "good" compensation package*

	t test for Equality of Means									
	Mean	Std. Deviation	Std. Error Mean	N	Mean Diff.	t	P	r	95% Confidence Interval of the Difference	
									Lower	Upper
T1	4.35	0.724	0.087	69	0.38	2.578	0.012	-0.147	0.085	0.668
T2	3.97	0.874	0.105	69						

Table 3 shows basic statistical indicators that relate, first of all, to the average values of the students' *expectations to find a job after graduation which enables various additional training programs*. Before attending the *Career Management* course, students' expectations were significantly less expressed (the

average value of their answers was only 2.57), and then increased to as much as 3.78. Therefore, there is a pronounced tendency of increase of this type of students' expectations, which was statistically confirmed. Namely, the relatively low value of the test-statistics $t = -6.815$ (with the significance level $p = 0.000$), confirms that there is a statistically significant difference, as well as a increase in the students' expectations before and after attending the *Career Management* course. Finally, the positive value of Pearson's linear correlation coefficient ($r = 0.164$) points to the fact that there is a positive but poor correlation between the respondents' answers before and after the survey. In this way, the hypothesis H_{1c} is formally proved.

Table 3: Student's *t* test for Equality of Means of the students' expectations to find a job after graduation which enables various additional training programs

	t test for Equality of Means									
	Mean	Std. Deviation	Std. Error Mean	N	Mean Diff.	t	p	r	95% Confidence Interval of the Difference	
									Lower	Upper
T1	2.57	0.334	0.161	69	-1.21	-6.815	0.000	0.164	-1.574	-0.861
T2	3.78	0.905	0.109	69						

Table 4 gives basic statistical indicators of the students' expectations *that after graduation they'll find job opportunities abroad*. Here, expectations of the students before attending the *Career Management* course were strongly expressed (the average of their answers is 4.01), so that after attending the course they fell to 3.54. Nevertheless, the tendency of reducing this type of expectations is also statistically significant, as evidenced by the relatively high value of the corresponding test-statistics $t = 2.647$ (the significance level is $p = 0.010$). Therefore, it has been formally confirmed that there is a statistically significant difference, as well as a decrease in the students' expectations *that after graduation they'll find job opportunities abroad*, before and after attending the *Career Management* course. Note that there is a negative but somewhat more pronounced linear correlation of the students' responses (Pearson's Correlation Coefficient is $r = -0.215$). Consequently, in this case H_{1d} hypothesis is confirmed.

Table 4: Student's *t* test for Equality of Means of the students' expectations that after graduation they'll find job opportunities abroad

	t test for Equality of Means									
	Mean	Std. Deviation	Std. Error Mean	N	Mean Diff.	t	P	r	95% Confidence Interval of the Difference	
									Lower	Upper
T1	4.01	0.978	0.118	69	0.47	2.647	0.010	-0.215	0.118	0.839
T2	3.54	0.948	0.114	69						

Table 5 shows the basic statistical indicators that relate, first of all, to the average values of the students expecting *to develop their own business after graduation*. Before attending *Career Management* course, the students' expectations were considerably less expressed (the average value of their answers was only 2.45), and then increased to as much as 3.41. Therefore, there is a pronounced tendency of growth of this type of expectations, which is statistically confirmed. Namely, the relatively low value of the t-test statistics $= -5.299$ (with the significance level $p = 0.000$), confirms the conclusion that there is a statistically significant difference, but also an increase in the students' expectations before and after attending the *Career Management* course. Finally, the positive value of Pearson's coefficient ($r = 0.176$) points to the fact that between the answers of the surveyed students before and after the survey there is a positive but poor correlation. In this way, the hypothesis H_{1e} is formally proved.

Table 5. Student's *t* test for Equality of Means of students' expectations to develop their own business after graduation

	Group Statistics				t test for Equality of Means					
	Mean	Std. Deviation	Std. Error Mean	N	Mean Diff.	t	P	r	95% Confidence Interval of the Difference	
									Lower	Upper
T1	2.45	1.323	0.159	69	-0.96	-5.299	0.000	0.176	-1.317	0.596
T2	3.41	0.975	0.117	69						

Empirical research of the above mentioned main hypothesis and sub-hypotheses can provide the conclusions on students expectations regarding their employability expressed before and after attending the *Career Management* course. Regarding H_{1a} hypothesis, there is no statistically significant difference (decrease) in the students' expectations of employment within one year after graduation. The students still believed that the combination of their knowledge, skills and abilities would enable starting successful career after graduation. Regarding H_{1b} hypothesis, that the students expect to find a job with "good" compensation package after graduation, there is a statistically significant difference (decrease) in the students' expectations and the students in additional remarks stated that they were more aware of the other aspects important in a first job, mainly challenging tasks, and, especially, training and development opportunities.

Regarding H_{1c} hypothesis that the students expect to find a job after graduation which provides various additional training programs, there is a statistically significant difference, as well as an increase in the students' expectations before and after attending the *Career Management* course, and the hypothesis H_{1c} is formally proved. Regarding H_{1d} hypothesis on the students' expectations that after graduation they'll find job opportunities abroad, it has been formally confirmed that there is a statistically significant difference, as well as a decrease in the students' expectations and in this case H_{1d} hypothesis is confirmed. Regarding H_{1e} hypothesis that the students expect to develop their own business after graduation is formally proved.

5. Conclusion

Engineering management, which is defined as a specific type of management that needed for successful leading of engineering or technical personnel and projects, presents novelty in Serbia's higher education and business environment. Engineering management as a higher education study program is new to Serbian higher educational institutions, and the programs are prone to changes and adaptations for the students, prospective students, and general public to understand its advantages better. What is the most important, even the employers are not aware of the advantages of the program and the broad range of knowledge that the engineering management students acquire during their undergraduate and graduate studies that are applied in various work situations and settings.

Engineering management students, besides professional knowledge need to acquire so called transferable skills, the ones that can be applied in different work (and life) situations and environments and are essential for employability in the 21st century. The key in assisting the students in acquiring those skills are the programs and courses provided by higher education career development centers. In the empirical research, main research hypothesis (H_1), that there is statistically significant difference between the students' expectations regarding their employability expressed before and after attending the *Career Management* course, was proven.

Further study is necessary to assess the ways in which employability of the engineering management students can be increased through various programs aimed for improving their transferrable skills trough career development centers or through other formal and informal programs at higher education institutions with engineering management and industrial engineering study programs.

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