Career Directives for the New Generation of Engineers

Peter Holicza
Keleti Faculty of Business and Management, Óbuda University, Budapest, Hungary

Email address: holicza.peter@rh.uni-obuda.hu

To cite this article:

Received: November 30, 2015; Accepted: December 13, 2015; Published: May 13, 2016

Abstract: Based on the fact that structural unemployment is a part of the Hungarian present, it is very important to figure out, understand and identify the differences between demand and supply on the national labour market. The technical studies are the second popular on national level in 2015, while 45% of the employers emphasise recruiting problems in this area. Differences may occur because of many reasons such as: insufficient knowledge or flow of information, HR, individual, training, academic problems, etc. The study aims to present the technical students' motivation through questionnaire research to characterize their preparedness, interest and expectations in order to realize the possible matches and mismatches with the requirements of the labour market.

Keywords: Hungary, Labour Market, Career Motivation, Technical Students, Human Resources

1. Introduction

Nowadays the employment opportunities on several fields are narrowed, but technical and IT specialists seem to be wanted constantly.

One of the biggest Hungarian job portals offers more than five thousand jobs, and a third are technical, engineering, manufacturing, operations, and IT positions. Published human resource researches and articles reflect the technical sciences as the profession of the future, especially in the mechatronics sector.

According to the higher education applications, the technical studies got risen prestige between students. In 2015 it was the second popular area after the economic sciences. Excluding the IT, it counts almost 20.000 students who applied on first place, and finally 10.506 have been accepted. Beside the great numbers, engineers are ranked on the 3rd place on the hardest loaded jobs’ list. The present study intended to measure the students’ skills, experiences and results which are required to enter to the labour market and to choose the right workplace [8], [24].

In a more detailed breakdown, the mechanical engineer course is the most popular, it attracted more than three thousands applicants. The electrical engineering takes the second place with the half amount of applications compared to the mechanical area. The third most popular is the technical manager course, but this is an odd one because of its syllabus. The major part is technical, but it’s mixed with economics and management subjects also, therefore it doesn’t count as a typical technical/engineer education. The rest of the technical courses count smaller interest, led by the mechatronic and transportation engineering studies [9].

According to the Eduline’s research, the mechatronic engineers can expect the highest salaries between these areas, approximately gross 1000 €/month. Electrical and mechanical engineers are on the second and third place a bit below the 1000 € line. These are the most demanded professionals on the labour market with the highest payments. Multinational companies are continuously seeking for engineers offering competitive wages and fringe benefits for employees, what makes this area even more popular among students.

The chemical engineers and technical managers represent the middle class with their average wage. Civil, bio and architect engineers earn approximately 800 €/month [6].

Trained engineers have high career and salary expectations, but their skills, motivations and performance must meet with the requirements of the ever changing technology and labour market conditions.

“According to Farkas (2007), an effective labour market should operate based on competencies, not on qualifications, since competences summarize knowledge, skills, abilities and
attitudes. With a labour market like this, structural unemployment would decrease and in time the competency structure of new entrants would near that, expected by employers. Accordingly, with the idea of competency based labour market, the question what kind of competencies are valued/demanded should become the focus of interest.” [19]

2. Situation on the Hungarian Labour Market

It is important to study the actual situation on the national labour market to be able to compare its requirements with the preparedness of (entry level) students.

2.1. Definition of Hard and Soft Skills

These are specific, teachable abilities that can be defined and measured. By contrast, soft skills are less tangible and harder to quantify. Examples of hard skills include job skills like typing, writing, math, reading and the ability to use software programs; soft skills are personality-driven skills like etiquette, getting along with others, listening and engaging in small talk.

Soft skills refer to a broad set of skills, competencies, behaviours, attitudes, and personal qualities that enable people to navigate their environment effectively, work well with others, perform well, and achieve their goals. These skills are broadly applicable and complement other skills such as technical, vocational, and academic skills.

2.2. Hindering Factors to Load Positions in Hungary

As Hungarian HR executives reported, in most cases the lack of hard skills (technical competencies) stands in the background of the talent shortage. Secondly, the lack of (experienced) candidates also prevents good employee-job matching. Approximately, one quarter of applicants have extremely high salary expectations or are missing the appropriate qualifications. The 17% lack the workplace competencies, soft skills, and 9% are not satisfied with the geographic conditions.

The Manpower Group interviewed 750 Hungarian HR executives regarding the reasons of the lack of specialists and skilled workforce. The outcome of the research is represented by the Figure 1.

![Figure 1. Hindering factors to load positions [18].](image_url)

The employment market is presumed to require skills and abilities, rather than capabilities and qualifications. Moreover, pursuant to research results, there is only weak coherence (Pearson: 0.2) between the nivoue of formal education and the standard of skills and abilities required by employers.

Enterprises and companies are searching for employees with the capabilities to be efficient straightaway after being employed, not aspirants who need extra support and training to fulfill the job well. Compliant with a McKinsey study 72% of HEI assume that fresh graduates are prepared for work, while only 42% of employers concur with this declaration. The situation of HEIs is factual intricate. The business and the economy are changing with a rising speed, new technologies and associated new jobs and positions necessitate new skills, abilities and competencies arise every year. Nevertheless, traditional HEIs were not conceptualized to react and respond to the ever-changing markets where abilities and competencies devalue fast and cannot always adapt their curricula at the speed the exchanging industry want them to. For this reason, the assignment of HEIs should be to initialize their graduates for the energetic, flexible and competitive work surrounding of the XXI. Century and evolve abilities, competencies and skills rising the workableness and employability of their graduates besides (or maybe in place of) offering information and theoretical learning and knowledge [13].

2.3. Labor Market Mismatches

Discordance of skills is one of the major challenges economies have to deal with. Empirical instance points out that way too much workers do not fit together with their present jobs. Some employees are overqualified for their contemporary jobs – they are competent of managing even more complex tasks and their abilities are unchallenged – while others are not adequate skilled for their latest jobs – they have a lack of acquirements that are usually needed for their job [22].

The imbalance on the labour market seems to be precipitated by two factors. Traditionally the variance of claimed and provided educational level was the fundamental origin of unemployment. Not sufficient educated workers will not find a job that fit together with their level of formal education. The second kind of labour market imbalance lies in the variance of acquired and necessary or essential skills. One possible and eventual explanation emerges based on imperfections of the labour market for instance deficient information, minor level of labour mobility and market stiffness. Nevertheless, it is more probable that the difference remains in force because the skills of the employees are not kindred within a particular group of formal education/qualification and some, appropriate for their given job on the fundament of their qualifications, are still not suitable for the same position on the fundament of their skills set [14].

Skill mismatches ride employees to lower ranked jobs, dissatisfaction and reduced performance or unemployment. Literature and research shows that highly performing people find fulfillment in their jobs, what requires person-job fit and motivation.

3. Person-Job Fit and Satisfaction

Person-job (P-J) fit may be conceptualized as either the
people worked especially to earn money. In his book, The pick a special professional career?

Herzberg's Theory. He determined the sources of occupational directive.

Another known and famous motivational theory is the Herzberg’s Theory. He determined the sources of occupational satisfaction and dissatisfaction on engineers and accountants. He recognized two kinds of factors. On the one hand there are the motivational factors which contain satisfaction and motivation and can include job content, job acknowledgement, a sequence planning, responsibilities etc. On the other hand, the hygiene factors will not inspire but in their non-attendance, they can depress motivation. They can reference to job conditions, wages, safety, relationships with subordinates, directive.

Another known and famous motivational theory is the Adair (2006) and it is called theory of group personality and group needs. Adair contemplated that work teams equal individuals because they share general needs. He accentuated three different kinds of needs: two are characteristics of the group and they are called the need to accomplish common tasks and the need to be maintained as a cohesive social unity, and the third one correlates to the amount of the individual needs of group members. In his version, Adair emphasize the strong conjunction between these types of needs and the circumstance that they influence each other in a better or worse way [1].

3.1. Motivational Theories

The professional career is influenced by many various factors. The inducements of students who pick a certain career choice can be categorized into cognitive individual factors, like personal fulfilment, need of autonomy, status, individual development or financial success, and contextual or environment-related factors such as the social pressure, the familiar professional activities, the job market or the economic environment [10]. To understand why a person chooses a certain career, it is also necessary to point out the commonly motivational factors. What let us choose a section, a certain enterprise or even an employment? What let a student pick a special professional career?

We will characterize some of the most significant motivational theories. One of the first developed theories of human motivation was from Taylor. Taylor contemplated that people worked especially to earn money. In his book, The Principles of Scientific Management, he characterizes a management system which tenders incentives for excellent work and the employees give their best.

The best known and criticized theory about motivation is the hierarchy of needs by Maslow. He is confident that humans are motivated to reach special types of needs. If one is fulfilled, they aspire after fulfilling the next level of need, and so on. In his book, A Theory of Motivation, he ranges individual needs in five categories: physiological needs, needs for safety, needs of belonging, needs of esteem and self – actualization needs. Hersey, Blanchard and Johnson (2001) declare a very important matter about Maslow’s needs: their chronological order shouldn’t be inflexible respected. It is not necessary for a person to satisfy a low level need before trying to reach a higher level need.

In 1969, Alderfer review Maslow’s theory and, as proposed by Robbins (1993), he characterizes the hierarchy of needs more realistic [2]. In his ERG theory he proposed three categories: needs of existence, needs of relatedness and needs of growth. He declared that when higher level needs were not fulfilled, individuals double their endeavour invested in a low level category [25].

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3.2. Job Satisfaction

Job satisfaction is the conclusion of the employee, how well the job conglomerates the important things in his point of view. In general, job satisfaction is defined as ‘the pleasurable or positive emotional state resulting from the appraisal of one’s job or job experience’ [15]. It is also often clarified by the outcome, if it meets or tops the expectations of the employee. It epitomise several attitudes like payment, promotion possibilities, the work itself, as well as supervision and colleagues or co-workers. These are important attributes of a job which have an immense effect to the employees [16]. The importance of a job satisfaction shows, that its absence very often gives rise to lethargy and shortened and reduced organizational commitment [20]. Employees with no job satisfaction quit their jobs faster or become more absent than employees with job satisfaction [26].

Another point can be associated with job satisfaction: career satisfaction. Employees spend more time in learning and further education and they associate with other involved people when they enjoy their job. Job satisfaction can be favourable connect to someone’s choice to adjust to change circumstances, in fact when the circumstances are daunting or disturbing. It involves welcoming changes of job and organization, continue the working instead of quitting the job. Accordingly, these employees who declare to enjoy their jobs are supposed to have a strong motivation for job and career or vice versa.

Looking to the previous research for career motivation, favourable relationships between components of job satisfaction, affective organizational commitment and career motivation were determined.

3.3. Organizational Commitment

Organizational commitment has three primary elements: a strong conviction in and approval of the organization's aims and merits; a disposition to wield significant effort on behalf of the organization; and a strong urge to preserve with the organization [21].

Intimately involved employees contemplate to stay in the organization and work hard for the organizational goals [14].

Meyer & Allen (1991) contended that there are three different types of organizational commitment: Affective Commitment: belongs to employee’s emotional commitment to the identifying with and implication in the organization. Employees with a strong emotive dedication continue working with the company or business because they like to. Maintenance Commitment refers to cognition of the costs
accompanied by abandon the organization. Employees whose mainly link to the business are grounded on continuance commitment stay because they need to do. Proper commitment mirrors a feeling of engagement to continue employment. Employees with a high degree of normative commitment have the feeling that they have to stay with the organization. Career identity can be notional relate to work commitment, organizational obligation and organizational citizenship [5], [27], [23].

As a result, career motivation can positively cohere with organizational commitment. Despite affective, resumption, and normative commitment are accustomed to embrace the multidimensional character of organizational commitment, affective commitment is taken a more effective valuation of organizational commitment.

Employees with powerful affective commitment have motive to higher levels of accomplishment and effect more useful contributions than employees who remark resumption or normative [3].

Consequently, affective commitment itself is one part of the main concepts of employee conduct. In this research study the conjunction between affective organizations commitment and career motivation was determined.

### 3.4. Flow Experience

Flow is a mental state of optimal performance. That can emerge, when a person gets very deep in an activity or assignment, that only the task matters to him. Forgetting the time or and all other things. As the Figure 2 shows, the flow feeling is between anxiousness and boredom. To reach this, the task needs to be hard enough matching his/her skills, leading to effortless, enjoyable, and perfect performance. This feeling can be reached in almost anything: studying, working, sports, gaming, listening or playing music, etc. Most likely, the condition can be achieved in tasks the person really enjoys to do. The concept was described by Csikszentmihalyi, it helps to see how self-supportive and creative a person is or to measure how often a person experiences the flow [4], [12].

![Figure 2. Flow: Az Áramlat.](image)

Continuing with job satisfaction, the individual can also reach a high commitment for the corporation. This effect is very essential for the corporations and companies and it is difficult to achieve. On the one hand, if a company can accomplish this – like Google, Apple or some other multinational companies, which pays attention to employee’s commitment – the individual employee will work with much more pleasure and effectivity for the company. By the use of both, commitment and job satisfaction, the employees and companies performance and the individual’s fluctuation can be improved. On the other hand, the individual employee can be dissatisfied or not really committed if the job does not correspond with his expectations or his educational level. This can lead to several possibilities for the employee, like lower level of performance, idleness or even leaving the company. These effects can probably change during the time and maybe they can evolve later.

### 4. Measure and Methods

The study is supported by primary and secondary data. Primary research part has a targeted data-collection method; participants were recruited via internet: across technical higher education institutes’ Facebook groups, direct e-mails to technical students and through teachers who shared with their students. Data was collected anonymously from Hungarian students of the higher education level. The questionnaire approximately took 5 minutes to complete. Besides demographic variables, the questionnaire collected information about academic field, experiences, expectations, career motivation, and goals.

Total number of responds is 267, mostly (97.4%) from Budapest area. The average age is 21, 8 years, the variance is 1, 66%. There is no significant difference on the basis of gender.

### 5. Results and Discussion

In the research 267 persons answered 19 questions. These answers showed future views of the different kind of expectant engineers. These future views can also be affected by many other things like student’s language skills, the choice of university as well as the high school. Furthermore we cannot ignore the possibilities of the individual’s socials skills and the skills needed to achieve the desired job like the ability to make up a proper CV, motivational letter or to conduct a good job interview.

The focus in a lot of points will be on the answers of the Mechanical, Electrical, Technical and Security engineers, because they are the major group of responders.

#### 5.1. The Distribution of the Participants

The biggest group of the participants are electric engineer and energy engineer students with 61% of the responders. The second biggest group are the students of technical management. They respond the questionnaire with 26% and almost 10% of the responders were students of mechanic engineering, transport engineering or mechatronic engineering.

#### 5.2. Preparation of Students

Most responders (42 %) think that their studies give a
casual knowledge. Nevertheless, the second biggest part (28%) estimates even more knowledge than it is necessary while entering to the labour market. More than a quarter of respondents admitted that their studies were not enough. Basically the research shows that 27% of the students are not satisfied with their studies, while the rest feels prepared enough or even more confident about the acquired knowledge.

5.3. Language Skills

Hungarian students mainly learn English or German, while many other students additionally learn different languages like Spanish, French, Russian or Chinese. It was predictable in the research that English is the main spoken (65%) language. The ratio of German speaker students is 5 %, while 20% of the respondents speak both languages. Only infinitesimal numbers of students speak other languages.

The results also show that only 17% consider themselves to speak a foreign language better than average level and 48% are of the opinion that they are on a middle level. The middle-level is equal to the intermediate or B-complex language examination. Finally 35 % think they reach only a low level.

5.4. Experiences

During the higher education period students can seize the opportunity to do an internship or traineeship depending on the modules, number of completed ECTS or the company students have the contract with.

Most of the participants, more than 75%, do not have any kind of experiences. They do not utilize the given possibilities or for some reasons they are not able to use them. Normally 1-3 months are mandatory for an internship to get the degree, but only 16% started its completion and less than 10% render more than the needed amount of traineeship.

The results led us to the conclusion that the next generation of technical workforce will enter to the labour market with minimal practical experience. One cause can be their age (the average is under 22 years) why they could not reach the mandatory minimal numbers of ECTS yet to get the opportunity for any official (Erasmus+) internship program supported by the university. Only 24% of the students have work experience related to their studies or future work.

5.5. Future Plans

Most of the students want to continue their studies, almost 65% of the responders want to do a Master’s degree, ~25% planning to apply for vocational or other kind of trainings, and 10% will not participate any formal education in the future.

In case of employment, most of the students planning to work for a middle-size company, secondly the multinational companies are the most wanted, and the least interest is measured toward the small sized companies.

The research addressed a question about the entrepreneurial inclination too. From 267 replies, 98 (36,7%) wish to start their own business, while 169 would not take this step towards self employment. The next generation’s ~74% imagine the future in Hungary, and ~26% prefers to build a carrier at abroad.

5.6. Motivation Factors

The questionnaire contained 17 questions about motivating and appealing factors for the individuals. These questions were divided into 4 parts according to the types such as allowances, job characteristics or workplace prospect and getting international.

Interestingly, not the amount of payment, but the “good atmosphere and working conditions” has been marked as the most important factor. Secondly the “stable job”, thirdly the “work-personal life balance” was voted, the “payment” has the fourth place with 36% in the most important category. The 25% considers the „style, personality of the leader” and the “geographical proximity” also very important.

In the second category, where the “quite matters” motivators have been chosen, the “payment” has the highest percentage (52%), followed by the “bonuses, fringe benefits”. It is clearly visible that the financial instruments are not the priority to make a decision or to choose between possible job offers. In this category the job stability, geographical and working conditions, leadership are still appearing. A new factor, the “innovative working environment” has 38% as the important factor, and 36% as average need, therefore we can assume that this also can be a key factor for a technical student. Apart this demand, previous research shows that ~ 14% of Hungarian students have high level of innovation potential, the ability to live with such opportunities [11].

In the third, the average category, the “high level responsibilities” came first with the 46% of the votes. It means that students prefer to be challenged, they do not think about responsibility as a problematic factor. The difference between the individual and group work opportunities is only 2%, where the individual environment has minimally more support. The “market position” and the “reputation of the corporation” have 34% and 33%, so they take these also into account averagely. The average factors are the social responsibility and reputation of the corporation, the foreign working environment, opportunities to participate in international project. These conditions have quite mixed ratios with the less important ones, therefore this category is not considerable as a motivating one.

6. Conclusions

The present study concludes the preparedness, motivation and future plans of young technical professionals in Hungary. More than half of them have a language examination, but due to their age (~22) only 24,7% have any work experience related to the study field. The majority planning further education such as MSc or other specialised trainings, but ~10% of them would continue in a different area. In case of employment, 74% plan to stay and work in Hungary, most of them expect to start their career at a middle-sized or a multinational company, while 37% consider entrepreneurship.
Financial conditions are just the second most important conditions, but the good atmosphere and stability are key factors to choose the right workplace. The importance of good working conditions includes innovative environment, opportunity for personal development and the character, good personality of the leaders.

To find the dream job, the person job fit is a key for continuously growing performance for the advantage of both parties. Those young labour market entrants, who cannot succeed to find the appropriated, desired conditions, have no other option, except to work in lower ranked positions. As the stable job is one of the most important motivators, it has to be fulfilled even if the person is overeducated for the available position.

In line with the current labour market situation and numerous relevant national and international literatures, the shortage of hard skills causes the most mismatches. Students reported that their HEI prepares them only on middle level, on the other hand, they do not take the necessary individual steps to improve their chances on the labour market. Most of the students decide to apply for MSc degree instead of a comprehensive, practically and more useful vocational training. Even if they are certified, the daily and professional use of languages is rare. This can be as disadvantageous as the lack of practical experience. The outlined results seem to confirm the existence of the gap between the students’ expectations and the real demand of the labour market.

Students are advised to consider carefully about their chances on the labour market before they decide about further education or retraining. They have the responsibility for their personal development and for the usage of the opportunities offered by the education system such as foreign mobility programs, optional language courses, or project works, etc. in order to work on and to overcome the reported factors of hindrance. Even a part-time practical experience, internship or traineeship improve the above mentioned and missed hard and soft skills beside the vocational or university studies. This contributes to a better background and CV for the new generation of engineers to become more competitive at the beginning of their professional life.

References


