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Workplace Selection Preferences of Electrical Engineering Students in Hungary – in View of Social Network Impact and Migration Potential

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Abstract: *The interdisciplinary research explores the workplace selection preferences of Electrical Engineering (EE) students in eight Hungarian universities. The topic contributes to the overall discussion on career decision making and within the wider context of the changing nature of work.*

The theoretical framework of the research incorporates concepts of employer attractiveness, career decision making, social network, and migration theories.

The research adopted a mixed method approach and data was collected through a key survey with EE students (n=587) and qualitative interviews with both students (n=55) and key informants (n=57) such as engineering employers, recruitment agents, university personnel and members of engineering associations.

Early research findings provided some interesting insights. Majority of EE students reported to be prepared to make short term compromises in order to achieve their long-term career goals. Numerous compromises shared by EE students were around social network relationships and around migration potential. Despite of the willingness to make trade-offs in family relationships for careers, family members and partners appeared to influence the workplace selection of EE students the most. Majority of the EE students in the research consider working abroad or moving to another region within Hungary for an attractive job opportunity.

Further analysis of the research data may expand findings and answer additional research questions.

Keywords: employer attractiveness, career decision making, social capital, social network, migration, electrical engineering students, Hungarian labour market, mixed methods research design

1 Introduction

This research explores the career decision making preferences of electrical engineering (EE) students at eight Hungarian universities in the view of social

network impact and migration potential. Numerous studies confirmed the shortage in engineering profession both in the global and in the Hungarian labour market. The Talent Shortage Survey published by Manpower (2015; 2018) reported a continous rise in the shortage in professional talent between 2008 and 2018. In fact, talent shortage reached its highest level in 2018 since the survey started in 2006 (Manpower, 2018). Engineers, including electrical engineers were ranked among the top five hardest positions to fill consecutively for ten years (Manpower, 2018).

The Hungarian labour market faces several challenges. On one hand the unemployment rate steadily decreased between 2012 and 2019 confirming the general shortage of labour. The figure below shows the Hungarian unemployment rate falling from its highest level of 11.9% in 2012 to its lowest level of 3.3% in 2019 (Hungarian Central Statistical Office, 2020).

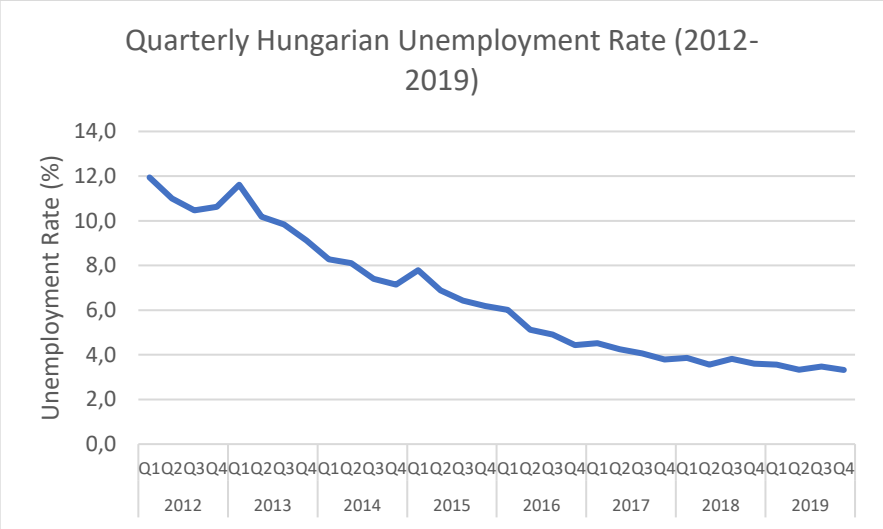

Figure 1 Quarterly Hungarian Unemployment Rate between 2012 and 2019; Source: (Hungarian Central Statistical Office, 2020)

On the other hand the international migration from Hungary to foreign countries is on the rise. Based on the Hungarian Demographic Research Institute's estimation, 335.000 Hungarians lived abroad which accounted for 7.4% of the population aged between 18-49 years (HVG, 2017). According to a representative statistical research of the Hungarian Research Instituate, majority of the young and middle aged population wished to leave Hungary, nearly half of the 18-24 years old generation planned to leave Hungary, and 53% of students considered to move abroad after finishing their studies (M. Laszlo Ferenc, 2017). The study concluded that based on the wishes, plans, and considerations of the population additional 370.000 Hungarians may leave their home country in the coming years (M. Laszlo Ferenc, 2017). The talent shortage in the labour market combined with the increased

external migration from Hungary causes challenges for companies and creates difficulties in hiring (VG, 2017; Manpower, 2018).

The demand for highly skilled workforce, including engineering talent rises in Eastern Hungary. Several high-tech companies announced investment plans into Eastern Hungary. The total investment value was close to 400 billion Hungarian forints (around 1.1 billion Euros) and the total number of new workplaces were more than 4000 in the past years (Kiss, 2019). Few other companies reported additional investment plans into Debrecen in 2020. With the additional investments the total investment value increased to 480.5 billion HUF (around 1.3 billion Euros) and the total number of workplaces increased to 5766. The table below summarizes the company names, the investment values, the number of new workplaces, and the locations of the planned investments into Eastern Hungary.

Company name	Investment value (HUF)	Number of new workplaces	Location	Source
National Instruments (ni.com)	5.5 billion	210	Debrecen	(HIPA, 2016)
Lego (lego.com)	30 billion	1600	Nyíregyháza	(Trangbaek, 2015; MTI, 2016)
Continental (continental.com)	5.1 billion	681	Debrecen	(autopro, 2015)
Krones (krones.com)	15 billion	500	Debrecen	(HAON, 2017)
Thyssenkrupp (thyssenkrupp.com)	11 billion	250	Debrecen	(HBN-PA, 2017)
Diehl (diehl.com)	2.7 billion	150	Debrecen	(HAON, 2017)
BMW (bmw.com)	330 billion	1000	Debrecen	(HAON, 2018)
Deufol (deufol.com)	*7.2 billion*	*120*	*Debrecen*	*(dehir, 2020c; dehir, 2020e)*

BHS Trans (bhstrans.hu)	*7.5 billion*	*165*	*Debrecen*	*(Portfolio. hu, 2020; dehir, 2020f)*
Sensirion (sensirion.com)	*unpublished*	*50*	*Debrecen*	*(dehir, 2020b; dehir, 2020d; dehir, 2020g)*
4iG (4ig.hu)	*unpublished*	*100*	*Debrecen*	*(Portfolio, 2020a)*
Inter Traction Electronics Kft. (itkholding.hu)	*unpublished*	*500*	*Debrecen*	*(dehir, 2020h)*
Semcorp (en.semcorpglobal.com)	*66.5 billion*	*440*	*Debrecen*	*(dehir, 2020a; Portfolio, 2020b)*
Total	**480.5 billion**	**5766**		

Table 2 List of high-tech companies which announced investment plans into Eastern Hungary; Source: (see table for details)

The criticality of the engineering profession combined with the difficulty to fill open engineering positions creates challenges for the Hungarian economy (MTI, 2015; Sági, 2015). Better understanding the career decision making process, the impact of socital networks to the workplace selection process and the migration potential of early career electrical engineers may help Eastern Hungarian employers to attract more electrical engineering talent, may increase the success rate of planned investments and may promote further investments into the region.

The primary purpose of this paper was (1) to explore the short versus long term time orientation of electrical engineering students in terms of career decision making; (2) to measure the level of impact of the different social network ties in the workplace selection process; and (3) to quantify the internal and external migration potential of Hungarian electrical engineeiring students after graduation.

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2 Literature Review and Theorethical Framework

The theoretical framework of the research connected four major interdisciplinary theories. Firstly, employer attractiveness theories, which was widely researched by multiple disciplines including management science (Gatewood, Gowan and Lautenschlager, 1993), vocational psychology (Soutar, 1983), applied psychology (Jurgensen, 1978), communication (Bergstrom, 2002), and marketing (Ambler and Barrow, 1996; Gilly and Wolfinbarger, 1998; Ewing, et al., 2002). One of the frequently cited definition of employer attractiveness is *"the envisioned benefits that potential employee sees in working for a specific organization. It constitutes an important concept in knowledge-intensive contexts where attracting employees with superior skills and knowledge comprises a primary source of competitive advantage."* (Berthon, Ewing and Hah, 2005 p. 151). Electrical engineering is a knowledge-intensive occupation, therefore including employer attractiveness theories in the theorietical framework of the research was relevant.

Secondly, career decision making theories such as the 'careership' model by Hodkinson and Sparkles (1997), which blended three artificially separated theories. The three artificially separated theories included: (i) the *pragmatically rational decision-making*, (ii) the *choices within the life course* consisting of partly unpredictable pattern of routines and turning points, and (iii) the *choices as interactions with others in the field*. All three pillars of the 'careership model' had relevance to this research. Electrical engineering is part of the four closely connected areas of study often referred as STEM (Science, Technology, Engineering, and Mathmatics). STEM students, including electrical engineers, are generally considered to be pragmatic and rational, therefore the pragmatically rational decision-making theory was considred applicable for the research. In addition, the 'careership' model differentiated three types of turning points within the life course. One of the turning point types was called *structural turning point*, which comes at partly predictable times such as the end of mandatory schooling or the end of university education. This research considered the school-to-work transition of EE students to be such structural turning point. Lastly, career decisions are seldom made completely separated from others. In fact, career decisions can be influenced by interactions with others in the field. These interactions were explored deeper by social capital theories and by social network theories.

Thirdly, social capital theories and social network theories were included in the theoretical framework of this study. Although the concept of social capital has a long research history, the term social capital has been considered vague and means *"many things to many people"* (Narayan and Pritchett, 1999 p. 2). Many definitions of social capital can be found in the academic literature, which most of them are complimentary to each other. Bourdieu defined social capital as *"the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and*

recognition – or in other words, the membership in a group – which provides each of its members with the backing of the collectively-owned capital, a 'credential' which entitles them to credit, in the various senses of the world" (Bourdieu, 1986 p. 250). Adler and Kwon simplified the definition of social capital to *"the goodwill that is engendered by the fabric of social relations and that can be mobilized to facilitate action"* (Adler and Kwon, 2002 p. 17).

The research of social capital was strongly influenced by network theorists especially in the science of sociology (Burt, 1992). Social network theories refer to the relationships between people in the network as 'ties' 'Ties' can be categorized based on the strength of the relationship between the people. 'Strong ties' are characterized by emotionally intense, frequent, multiple types of relationships (Seibert, Kraimer and Liden, 2001). 'Weak ties' are characterized by weaker emotional bonds, infrequent, and usually one or few types of relationships (Seibert, Kraimer and Liden, 2001). Granovetter (1973) found that weak ties were more likely to be the source of information about job opportunities than strong ties. Granovetter (1973; 1983; 1995) explained this finding by noticing that weak ties often serve as bridges between different social groups, therefore weak ties can become sources of unique information and resources. This research assumed that electrical engineers can be influenced by both strong ties and weak ties during their career decision making process.

Fourthly, migration theories were included as the last pillar of the theoretical framework of this study. *"At present, there is no single, coherent theory of international migration, only a fragmented set of theories that have developed largely in isolation from one another, sometimes but not always segmented by disciplinary boundaries"* (Massey, 1993 p. 432). This may be due to the complex nature of migration which examined by several disciplines including economics, sociology, geography, culture, religion, law, political science, demography, psychology (Wickramasinghe, A. A. I. N and Wimaaratana, 2016). Several economic, technical and social factors, as well as global and local changes impact the migration potential of young electrical engineers. The neoclassical theory and the world system theory of migration consider the recent trends in easy, flexible, online travel arrangements, reduced cost of transportation, increased number of cheap accommodations, improved way of communication, and low cost insurance packages. These trends reduce the cost and the effort of migration from one country to another, therefore can increase the migration potential of young electrical engineers (Massey, 1993; Wickramasinghe, A. A. I. N and Wimaaratana, 2016).

The 'migration network theory' is a sociological and anthropological theory (Castles and Miller, 2009) and is closely linked with the social capital and social network theories applied in this research. Arango defines migration network *"as a set of interpersonal relations that links migrants or returned migrants with relatives, friends or fellow countrymen at home"* (2000 p. 291). Massey expands this definition of migrant networks by defining it as the *"sets of interpersonal ties*

that connect migrants, former migrants, and non-migrants in origin and destination areas through ties of kinship, friendship, and shared community origin" (1993 p. 448). Both definitions declare that migrant networks can provide information about job opportunities, facilitate employment, provide accommodation and financial support during the early days of employment. Therefore, migrant networks can reduce the cost and the risk of migration and can increase the willingness of young electrical engineers to migrate.

The combination of several theories from four multidisciplinary themes of (1) employer attractiveness, (2) career decision making, (3) social networks, and (4) migration intended to create a coherent interdisciplinary theoretical framework for the research.

3 Research Methods

The study used mixed methods research design and combined qualitative and quantitative approaches both during the data collection and during the data analyis (Guba, 1990; Wildemuth, 1993). Semi-structured, face-to-face interviews were conducted with 58 key informants in engineering careers during the first phase of data collection. Key informants were selected with purposive samplings and included HR professionals of engineering employers, recruiters from headhunters specialized in engineering selection, universtiy staff of electrical engineering faculties, student services, and members of engineering associations in Hungary. The interviews with key informants were scheduled between July 2018 and April 2019.

Quantitative data were collected from 587 electrical engineering students at eight Hungarian universities through online survey in the second phase of data collection. All universities with electrical engineering faculties in Hungary participated in the research. Two third (69%) of the respondents were born between 1997 and 2009 and represented Generation Z in the research. One third (31%) of the respondents were born between 1981 and 1996 and represented Millenials in the study. The research population was dominated by male electrical engineering students studying full time on BSc level. The quantitative data was collected between November 2019 and February 2020.

Semi-structured, face-to-face interviews were conducted with 55 electrical enginerring students in the third phase of data collection. Convenience and purposive sampling were combined to recruit interview participants. No exclusion was made based on gender, age, ethnicity, or country of origin. The 44 male and 11 female interviewees were between 19 and 30 years old. Preferences were given to students with engineering related work experience and to students closer to their

graduation dates. The interviews with electrical engineering students happened between October 2019 and February 2020.

Due to the large group of participants the research made thorough ethical considerations. The Department Research Ethics Panel (DREP) of Anglia Ruskin University provided ethical approval for the research. The research complied with General Data Protection Regulations (GDPR) and no sensitive data were collected. Permission was granted by all Hungarian Universities with electrical engineering faculties to conduct the research in their institue. Research participants took part in the research voluntarily, gave consent to collect, to process, and to disseminate the anonymized data during the research. Code names were assigned to interview participant to ensure anonymity. Expert Interviews (EI) got code names between EI01 and EI58. Electrical Engineer (EE) students got code names between EE01 and EE55. Quotes from interviewees were used in anonymised format referring to the code names.

The mixed methods research intended to strengthen the benefits and offset the limitations of qualitative and quantitative research methods. The research achieved high level of reliability by careful research design, detailed documenation and accurate record keeping. The high level of reliablity ensures that the research can be replicated at different times, at different places, by other researchers, with other research population. However, the research had some limitations in terms of internal validity and generalizability. The research participants were contacted only one time during the cross sectional study. The internal validity of such cross sectional research can be lower than the internal validity of a 'before and after' or a longitudinal study. The research data was collected between 2018 and 2020 from electrical engineering students in Hungarian universities only. As career preferences can change over time and can differ based on profession and location, therefore generalization of the findings to professions other than electrical engineering in countries other than Hungary can be limited (Alniaçik and Alniaçik, 2012 p. 343). As the data analysis is still ongoing, therefore final findings of the research may differ from the early findings presented in this paper.

4 Analyses and Early Research Findings

This paper summarizes the findings related to three themes of the theoretical framework introduced in the Literature Review and Theoretical Framework section. Firstly, it introduces the quantitative and qualitative findings about short and long term time orientation of EE students during the career decision making process. Secondly, it measures the level of influence of the different social network 'ties' of EE students through the workplace selection process. Finally, it quantifies the internal and external migration potential of EE students of Hungarian universities.

Short versus Long Term Time Orientation in Career Decision Making

The research explored the short term versus long term time orientation of EE students with respect to career decisions. EE students replied to two questions about time orientation in the online survey. Respondents marked responses on a five point Likert scale for both questions. First, EE students were asked if they are ready to make short term compromises to achieve their long-term career goal(s). Majority (83%) of EE students agreed or strongly agreed with the statement expressing that they are willing to make short term compromises to achieve long-term career goals. The number of online survey responses for each of the five Likert scale categories is presented in the figure below.

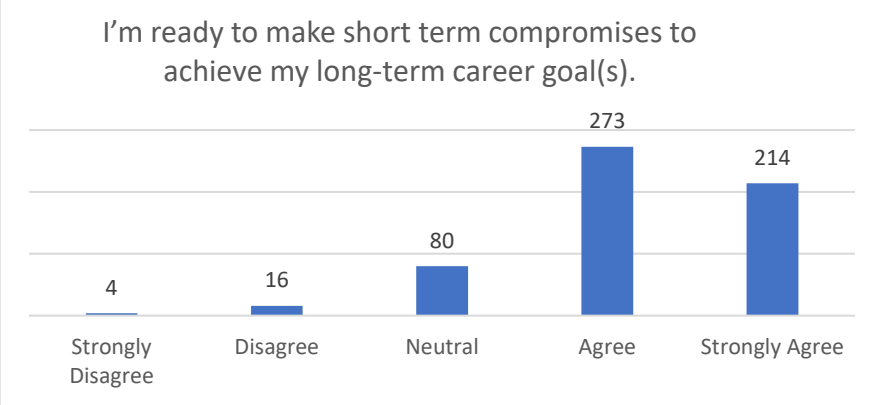

Figure 2 Long term time orientation of EE students on five point Likert scale (n=587)

EE students were also asked if they try to maximize the short term benefits even if they have to sacrificy their long-term career goal(s). Nearly half of the respondents (48%) strongly disagreed or disagreed with this statement. Around one third (30%) of the students remained neutral. Only one out of five students (22%) agreed or strongly agreed with the statement to be ready to sacrificy their long-term career goals in order to maximixe their short term benfits. The number of online survey responses for each of the five Likert scale categories is presented in the figure below.

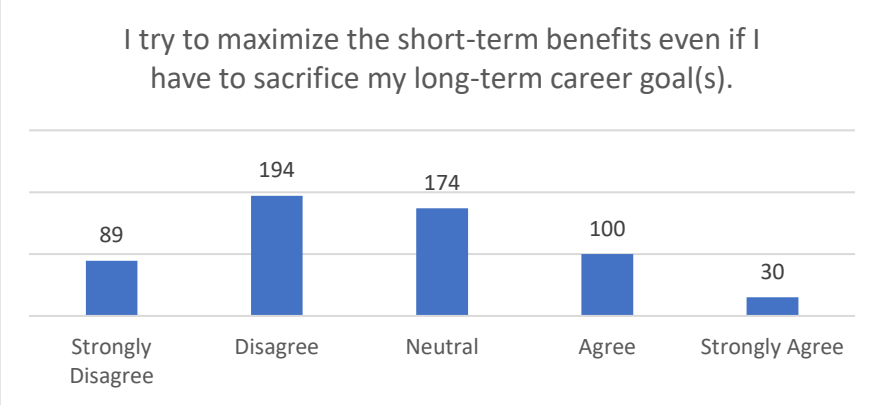

Figure 3 Short term time orientation of EE students on five point Likert scale (n=587)

Both questions confirmed that majority of EE students thinks long-term rather than short-term during the career decision making process. The result of the full research population (n=587) were consistent with the early research findings based on some early survey respondents (n=164) presented in FIKUSZ 2019 (Kiss, 2019).

The quantitative data of the online survey was enriched with qualitative information collected during semi-structured interviews with EE students. EE students were asked about the kind of compromises they are prepared to make in order to achieve their career goals. Thematic analysis of the interview responses outlined two recurring themes. First, many EE students expressed willingness to make compromises on their *social network connections*. The below quotes describes some compromises EE students mentioned to make on their families, friendships, partnerships, and other social relationships.

"I would push out the foundation of my family. Age of 25 is too early yet. I would put family, friends in the background. I would go abroad for one year, far away from my friends." (EE18)

"I don't want a family. I don't want any children, unless I will care for them alone. I will be a perfect aunt. I rather build my career than sit at home." (EE32)

"I would sacrifice anything. I'm happy as a bachelor. I could stand in the middle of nowhere alone at the age of 40. But not at the expense of my health." (EE28)

"I would go if they would offer higher salary. I have no family, no girlfriend, nothing." (EE14)

While most EE students pointed out the compromises they were ready to make on their social network connections, one EE student emphasized just the opposite: she had a very strong determination not to build her career at the expense of her family. She named family as a 'sacred thing' which should never be compromised on (EE19).

The second recurring theme was about internal and external *migration potential*. Many EE students expressed willingness to move to another location inside or outside of Hungary for an attractive job opportunity. The below quotes from interviewees shows how far they were ready to go to achieve their career goals.

"I would move 100 km away from Budapest. I would work long hours. Eight, ten, twelve hours of work." (EE35)

"I would move to another city or to Budapest, even if the salary would be lower." (EE12)

I would give up Budapest. The city I was born in. The city I love. I would be ready to move to unknown places. Abroad. Where I don't know anyone." (EE3)

"I would be ready to move. To another county. To another region." (EE23)

"I have clicked on nuclear physics in the secondary school. I would be ready to move to Paks. Or to Switzerland." (EE16)

Influence of Social Network Connections

The research measured the level of influence of social network connections on the workplace selection of early career EEs. EE students had to rank the level of influence of different persons and information sources on their workplace selection on a three point scale. The three different cateogories on the scale were named as 'no influence', 'small level of influence', and 'high level of influence'. Numeric value was assigned to each category. Zero was assigned to the category of 'no influence', one was assigned to the category of 'low level of inluence', and two was assigned to the category of 'high level of influence'. The average level of influence was calculated by taking the avarage of the numeric values for each person and information source listed in the survey. The list of persons and information sources included both strong network tie connections (e.g. family members, partners, etc.) and weak network tie connections (e.g. headhunters, interviewers of employers, etc.). The figure below represents the average level of influence of social network connections to the workplace selection based on the online survey responses.

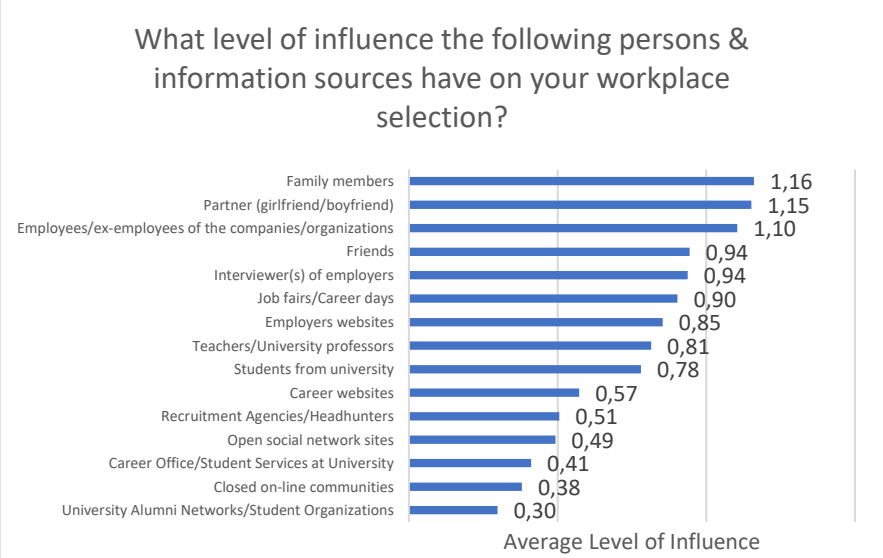

Figure 4 Average level of influence of social network connections to the workplace selection of EE students of Hungarian universities (n=587) (0 = no influence, 1 = low influence, 2 = high influence)

The study concluded that strong network ties of family members and partners (girlfriends or boyfriends) had the highest level of influence to the workplace selection of EE students. Weak network ties of friends and interviewers of employers had lower level of influence than strong network ties. University relations, such as alumni networks, students organizations, closed online communities, career offices, and student services had the lowest level of inluence on the workplace selection of early career EEs in Hungarian universities.

Migration Potential

The research measured the external and internal migration potential of EE students of Hungarian Universities. With regards to external migration potential, EE students were asked if ideally, if they had the opportunity, would they like to work abroad or not. In order to differentiate between short and long term migration potential, EE students who expressed interest in working abroad had to choose from four different length of foreign work opportunities. *Short term* migration potential was measured in terms of few weeks to months, *medium term* migration potential was measured in terms of few years, *long term* migration potential was measured by as long as possible, but not forever. Finally, *final* migration potential was measured for people expressing desire to work abroad forever.

On one hand, the research found a relatively high external migration potential. Only one out of four EE students (23%) declared that they would not like to work abroad,

even if they had the opportunity. Three out of four EE students (77%) reported that they would like to work abroad if they had the opportunity. On the other hand, only one out of five EE students (21%) would like to move abroad forever. Majority of the EE students considered to work abroad only for temporary period of time. 16% of EE students considered to work abroad for short term, 26% for medium term, and 14% for long term. The figure below represents the percentage of responses (n=587) with regards to short term, medium term, long term and final external migration potential of EE students of Hungarian universities.

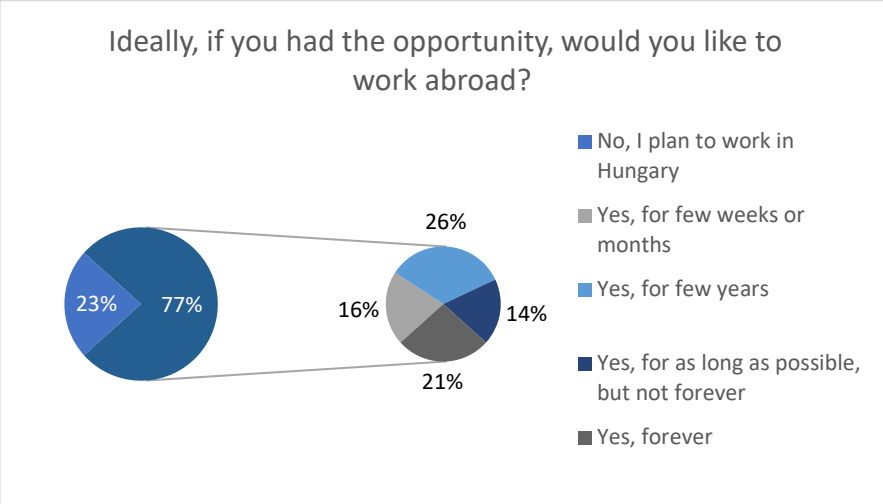

Figure 5 External migration potential of EE students in Hungarian universities (n=587)

With regards to internal migration potential, EE studends were asked if they would consider moving to another region within Hungary for an attractive job opportunity. More than two third (69%) of EE students responded positively, expressing their openness to change their working and living locations within Hungary for an attractive job opportunity.

Discussion of results

Results of this research repelled results of other studies about short term versus long term time orientation during the career decision making process of younger generation. On one hand, this research found that EE students of Hungarian universities think long term about their careers. On the other hand, a research by InsideOut development highighted the impatience of the younger generation during their career development (InsideOut Development, 2018). The study carried out in the USA discovered that more than 75% of Generation Z survey respondents believed that they should work less then twelve months in their first position before being promoted. In fact, 32% of survey respondents believed that they deserve promotion within the first six months of work (InsideOut Development, 2018). The

researches were carried out in two different countries (one in Hungary and another in the USA) and focused on two different population (one on young EE students and another on Generation Z). Therefore, future research may investigate the connections between profession, geographic location, and time orientation during the career decision making process the clarify the seemingly contracting results.

The research result about the influence of social networks on the workplace selection was consistent with the findings of other surveys. A robust research collected data from 49.000 Generation Z participants in 47 countries to explore the influence of social network ties on career decision making (Focardi, 2015). Close to 60% of the respondents declared that strong network ties with parents influenced their career decisions the most. Also, only 24% of the respondents said that weak network ties with friends shaped their careers the most (Focardi, 2015). The more recent research findings may call for a deeper investigation of the historical research findings of Granovetter (1973), which highlighted the more powerful impact of the weak network ties on career decisions. As this research recognized heavy influence of strong social network ties on the workplace selection process, employers may consider delivering targeted messages to parents and partners in order to attract more early career EEs to their workforce.

The research result about external migration potential aligned with the findings of other surveys. Boston Consulting Group (BCG) carried out a giant global survey about international talent mobility which collected over 200.000 responses (Boston Consulting Group, 2016). The survey found that 63.8% of the global workforce were willing to go to another country for work. The research included 5144 Hungarian responses and found that around 50 to 60% of Hungarian respondents were willing to work abroad. The global survey highlighted that people in engineering and in technical jobs were the most open for foreign work opportunities. Globally, around 70% of engineers declared to be open to work abroad. Similar to the global study, this Hungarian research confirmed the relatively high external mobility of the Hungarian EE talent. On top of that, this Hungarian research complemented the results of the global survey with additional findings about the short term, medium term, long term, and internal migration potentials of Hungarian EE students. As majority of the Hungarian EE students considered temporary migration to foreign countries, employers, engineering associations, governmental institutions may consider launching a ‘return program to Hungary’ to simplify the return and re-integration of those EEs who wish to return to Hungary after their temporary foreign work experience. The return program could not only simplify the returns and re-integration of EEs, but could also help the employers and the Hungarian economy to capitalize on the knowledge and experience the EEs collected abroad.

Conclusions

This paper explored three different aspects of the workplace selection preferences of EE students in eight Hungarian universities: (1) the short term versus long term

time orientation of the career decision making; (2) the level of impact of the social network connections; and (3) the external and internal migration potential.

Firstly, the research discovered that majority of EE students were ready to make short term compromises in order to achieve their long term career goals. Also, half of the EE students were not ready to sacrifice their long term career goals even if they could maximixe their short term benefits.

Second, the research uncovered that strong network ties of family and partners had the highest level of influence; weak network ties of friends and interviewees of employers had second highest influence; while university relations such as alumni networks, students organizations, closed online communities, career offices, and student services had the lowest level of inluence on the workplace selection of early career EEs in Hungarian universities.

Third, the research measured relatively high external and internal migration potential of EE students. With regards to external migration potential, 77% of EE students reported that they would like to work abroad if they have the opportunity. More then half of the EE students were open for *temporary* short, medium, or long term external migration. Only one out of five (21%) EE student considered *final* migration to a foreign country. With regards to internal migration potential, 69% of EE students were ready to move to another region within Hungary for an attractive job opportunity.

Readers should consider the limited generalizability of the findings reported in this paper. Career decidion making preferences, social network influence, migration potential can change over time, and can be influenced with personal or environmental factors such as the recent COVID-19 pandemic. Therefore, a longitudinal study can be considered to discover the changes in the workplace selection preferences of EE students over time.

Acknowledgement

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