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THE IMPACT OF INNOVATIVE PROFESSIONAL QUALIFICATIONS ON THE SENSE OF EMPLOYMENT SECURITY: EVIDENCE FROM POLAND

Anna Lewandowska

*Department of Management,
University of Information
Technology and Management in
Rzeszów, Poland*

E-mail:

alewandowska@wisz.rzeszow.pl

ORCID 0000-0002-5351-8490

Mateusz Stopa

*Department of Social Sciences,
University of Information
Technology and Management in
Rzeszów, Poland*

E-mail: mateuszstopa@gmail.com

ORCID 0000-0002-9286-5073

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ABSTRACT. There is much discussion on how contemporary economy is based on innovativeness and how important innovative sectors become. There is much discussion on how contemporary economy is based on innovativeness and how important innovative sectors become. We can point on the examples of state education policy that stress the importance of innovative directions in education. This article examines whether formal education and skills in innovative sectors influence positively the sense of employment security. To achieve this goal we compare the results of the survey conducted on a representative sample of 10,906 Polish citizens of the working age, analyzing potential differences in average subjective situation in perspective of their formal education and skills. It is important to stress that formal education is measured in 95 directions of education on three different levels each: basic and secondary vocational education, higher education and professional courses. To the authors' best knowledge, for the very first time formal education has been surveyed on such a detailed level, along with subjective perspective of individual situations at the labor market. The main conclusions are as follows: innovative qualifications are mostly of engineering and science character, they are more often chosen by men, and they do not correlate with a clearly greater feeling of own security at the labor market. Another factor that may influence the subjective perspective of employees and self-employed respondents is the character of the innovation itself: in Poland it is mostly connected with entrepreneurs that use their own resources (including financial ones) and R&D departments, rarely cooperating with third parties. This situation strengthens the position of employers and lowers workflows. Poland seems to be ahead of the situation when highly trained and qualified experts in "innovative" fields will freely change workplaces and professions, competing on labor market.

JEL Classification: I21, I25,
J24, O10, O31.

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Introduction

Today's situation at the labor market is difficult for all age groups, it is especially problematic for younger people who do not have experience, and their competences are seen as inadequate to the needs of the labor market. During the past two decades, the concept of mismatch has been broadened to include the type or field of education as a source of mismatch. A situation in which employees' attended field of education is unrelated to the field required for the job is also referred to as horizontal mismatch (Robst, 2007). This type of mismatch is of special relevance as employees are not solely matched based on their level or quantity of education. Given that particular fields of education aim to prepare students for a range of occupations, matching job requirements with employees' field-specific skills is essential for an efficiently functioning labor market (Somers *et al.*, 2016). Meanwhile, work is not only a source of income, it also has direct impact on personal independence and autonomy. As such, this mismatch can be considered undesirable and result in an underutilization of skills. On the one hand, many graduates end up having a job that does not match their educational qualifications. On the other hand, skill shortages are repeatedly reported by specific sectors across various OECD countries (e.g., Enequist *et al.*, 2006; De Jong and Berger, 2006; Smyth *et al.*, 2006). One of the most important issues affecting the development of innovative economy is the observed qualifications mismatch.

In contemporary innovative economic systems, the quality of human capital and the use of this capital at the labor market is a very important development factor (Lee and Rodríguez-Pose, 2016). The increase of the economic, innovative and business potential has a strong links with innovative development of educational systems (Tvaronavičienė *et al.*, 2018). Employers are increasingly aware of the importance of employees' qualifications at the highly competitive markets, both domestic and global. An efficiently operating labor market requires the balancing of two structures - demand and supply - within competition and competence requirements.

Bouarbat and Chernoff (2012) found that education characteristics have higher meaning for this mismatch as compared to demographic and socioeconomic features. Information asymmetry between job seekers and firms results in a situation in which future employees choose inappropriate fields of education and thus invest in inappropriate skills. Horizontal educational mismatch is defined as the mismatch in the field of study or vocational field (Witte and Kalleberg, 1995), or more specifically in qualifications or skills (Mavromaras *et al.*, 2010).

The aim of this paper is to explore the impact of innovative professional qualifications on the sense of employment security. The research methods adopted for this paper are statistical analysis of the Internet job offers along with the Internet data collection preceding it.

The article is organized as follows. The first section of the paper outlines shortly the motivation for this research along with the purpose of this article. The second section presents literature review on formal education and skills in the innovative sectors as related to the sense of employment security, highlighting correlations and the possibility of their joint examination. In the third section the authors present the description of methods and data used. The fourth and fifth sections consist of the presentation and discussion of the results. The paper ends with the concluding remarks.

1. Literature review

Structural mismatch is the result of various mismatches in the supply and demand for labor, these include: seasonal (temporary), regional (spatial), sectoral, level of education (secondary and higher education), education (humanistic, exact), qualifications and competence. Petrongolo and Pissarides (2001) provide the results of international research on the quality of matches between participants of the labor market in the cross-section of general occupations, sectors of the economy, countries and regions. They point to the large heterogeneity of supply and demand for work.

The education-related factors can be classified according to two levels; the individual level and the country level (Somers *et al.*, 2016).

1.1. Individual level

One of the factors is *the field and level of education*. The highest degree of mismatch is among graduates with general education, and the lowest for graduates from health-related fields (Robst, 2007; Wolbers, 2003). This may be the result of discrepancies between supply and demand for graduates in a specific field. Both universities and institutions as well as employers are responsible for this. Cosser (2010) shows that while in South Africa the demand for graduates is mainly in the field of science, engineering and technology, most graduates have obtained a degree in the field of humanities.

Another reason for the mismatch is the effect of choosing the fields of education for non-market reasons (e.g. academic entitlement, education costs). *Lack of university response to changes in the labor market* and *failure to make changes in programs and quality of education relevant to the current requirements of practice* is another reason for mismatch (Bender and Heywood, 2011; Federowicz and Wojciuk, 2012).

Somers (2016) shows that the horizontal mismatch indicator can be reduced in size if it includes the level of use of skills in the workplace. It means that insufficient use of skills affects employees' dissatisfaction with work. Financial effects (lower income) for mismatch will be higher in the case of fields of study / fields of education with more specific skills (Nordin *et al.*, 2010).

Other researchers focus on *vocational training*. Sienkiewicz and Gruza (2009) prove that vocational education at the upper-secondary level, based on the classification of vocational education occupations, is not adapted to the requirements of a knowledge-based economy. It is influenced in part by mismatching vocational education to the needs of the labor market, as well as the fact that the content of education included in the current curricula and curricula for occupations are too rarely updated, and the qualifications and professional competencies of graduates often do not coincide with the expectations of employers. In the vocational secondary schools for most professions, especially in technical schools, theoretical teaching dominates, and practical training in both quantitative and qualitative dimensions is far from satisfactory. Even worse in this respect is what is found at universities educating engineers. General academic studies prevail with a minimum participation of apprenticeships, preparing students (according to program assumptions) mainly for scientific and research activities. In vocational schools, unsatisfactory development of key competences is observed (especially in the field of communication in foreign languages, mathematical competence and basic competences in the field of natural and technical sciences, as well as IT competences and entrepreneurship). Vocational school graduates are more likely to be horizontally matched than graduates without vocational training (Levels *et al.*, 2014). Professional programs provide students with primarily professional skills, creating a strong relationship between the field of education and work.

Another factor of horizontal mismatch is *the level of education of people*. Employees who are unable to find a job corresponding to their level of education may compete with less educated employees for jobs below their level, but in a related area / discipline. When it comes to the level of education, education is today one of the most important factors of social inclusion (Solarczyk-Szwec, 2012). The higher the qualifications, the higher the probability of stable employment. Employees with a higher level of education than required are more capable than properly matched employees at similar work levels (and with similar experience), but only by a slightly smaller amount than indicated by the achieved level of education. On the other hand, employees with a lower level of education than the required level are less able than their matched colleagues, but more capable than other employees with a similar level of education (Korpi and Tählin, 2009). Kucel and Vilalta-Bufí (2013) demonstrate that prestigious university students are less mismatched horizontally.

1.2. Country level

Three factors that characterize a country's education system which determine horizontal mismatch were identified, i.e.: timing of academic specialization, vocational orientation and the strength of institutional linkages.

Late specialization enables students to better understand the probability of acquiring a profession related to obtaining a degree in a given field of science. Malamud (2011) finds confirmation of this assumption because students who specialize late (Scotland) are less likely to take up positions outside the field of science than students who specialize early (England).

The same researchers indicate that the extent to which *an education system is vocationally oriented*, varies depending on the country (Somers *et al.*, 2016). Wolbers (2003) defines countries as being more vocationally oriented when the share of upper secondary education students who are enrolled in school-based or apprentice type vocational education, is larger. Other researchers (2014) also find that the horizontal mismatch incidence is greater in countries with a strong vocational orientation (i.e. the share of vocational education offered as a combination of school-based education and learning at the workplace). Probably the competition between graduates with a vocational education is stronger in countries with a large share of vocationally educated employees. Hence the advantage of a vocational education system might vanish when the share of vocational school graduates increases. Similar links are proved via impact of the share of high-skilled employees with different educational level and occupation on economic development measured by GDP per capita and connected indicators of performance in the EU (Bilan *et al.*, 2020).

The field of the degree, level of education, choice of vocational education, the type of vocational education, the vocational orientation of a country's education system and the strength of institutional linkages within a country share similar properties, on the individual as well as on the country level (Somers *et al.*, 2016). Graduates who mainly acquired specific skills are more likely to end up in a job that is closely related to their discipline. On the other hand, graduates with more general skills are more exposed to be horizontally mismatched, their skills are appreciated in a wider variety of jobs.

2. Methodological approach

The article is based on the analysis of data gathered in the research conducted within a scientific grant titled "Horizontal educational mismatch – a new method of measurement with application to Poland". The implementers of this grant, which ran from 28 July 2017 until 31 May 2019, are scientists and collaborators from the Department of Economics at the

University of Information Technology and Management in Rzeszów, Poland.

One of the main research tasks was to develop and implement a tool for carrying out large research samples among adult citizens of working age (age 18-65). Official state statistics in Poland give detailed information on numbers of graduates at each formal educational level but there is no way to compile them with official data on employment, and especially with subjective evaluation of the individual situation on labor market. Therefore, such research tool supposed to be intuitive and simple on one side, while on the other it should allow to aggregate detailed information on formal qualifications and competences along with subjective opinions. From a technical point of view, the research itself should be fast, standardized and therefore possible to be repeated regularly.

In the end, a Computerized Self-Administrated Questionnaire (CSAQ) was chosen as most suitable for the above-mentioned assumptions. It is worth adding that according to the Central Statistical Office, 80,4% of Polish households had access to the Internet in 2016 (CSO, 2016). If one considers mobile access too, it is obvious that the majority of Polish society has access to the Internet. In 2017 the research was conducted by the online research panel Ariadna, that recruits its respondents in a two-staged procedure (using Paper and Pencil Interviews and Computer Assisted Telephone Interviews to verify basic socio-demographic characteristics and to weigh the panel properly).

Thanks to standardization and automatization of the questionnaire, it was possible to achieve an average survey completion time of 25 minutes for the longest respondent's path (a working person with many and varied qualifications, often changing both places of employment and professions) with more than 3000 variables in the questionnaire. In November and December 2017, the Ariadna took 16,119 measurements. Among these 10,906 were with respondents who were active on the labor market (being employed or self-employed outside of agriculture) at the time of the research. This category of the respondents is in the interest of this publication.

The randomization of the sample and its size both allow us to determine the maximum measurement error at 1% (with confidence level $\alpha = 0.95$ and fraction $f = 0.5$). Comparison of the results obtained with official data (CSO and Eurostat) on age, place of residence, and unemployment indicated that the sample is representative for the population of Polish citizens age 18-65 years within the assumed measurement error.

The CSAQ contains 8 questions on basic socio-demographic information, 19 questions on actual employment situation (divided into parts for non-active and active workers), 44 questions on formal qualifications from professional courses to higher education and planned changes, and 5 questions on professional competences. For the analysis presented in this article, we chose the questions on formal qualifications on all three educational levels (courses, secondary professional schools and higher education) and 6 questions that in our opinion give direct and indirect information on subjective evaluation of individual situation on labor market: a) how many times one has changed profession and b) if one is going to change profession in the next 12 months; c) how many times one has changed the place of employment and d) if one is going to change the place of employment in the next 12 months; along with e) assessment of own qualifications and f) plans for the changes in qualifications in the next 12 months.

3. Pro-innovative education

Actually, there is no one standardized classification of directions or disciplines of education that allows to qualify specific fields of education as particularly innovative. However, it is possible to find official guidelines and statistics that directly connect high-tech industries and knowledge-based services with innovativeness, e.g. (CEIES, 2003; Eurostat,

2010, 2017, 2018). As part of this logic, more innovative are the disciplines that produce potential employees for these industries and services. Of course, it does not mean, that without specific formal qualifications it is impossible to work in high-tech industries or knowledge-based services, but it definitely makes more difficult to find an employment and enforces retraining. Contrariwise, one's formal education in pro-innovative disciplines of education does not determine the employment in these two areas. Ultimately, it is more likely that a graduate with such qualifications will find employment easier and stay longer in innovative sectors.

Within mentioned high-tech industries and knowledge-based services there are specific directions developed and strengthened at the level of national strategies. In Poland as the most important have been indicated: software engineering, knowledge and decision support engineering, telecommunication, optoelectronics, new materials and technologies, nanotechnologies (especially in chemistry, medicine and technical studies), biotechnology and bioengineering, chemistry (Polish Ministry of Science and Higher Education, 2015). They are perceived as economy flywheels, and at least in theory should guarantee more stable and safe employment, as the result of public policy, public financial support and competitiveness on the global market. According to this line of argumentation we decided to treat particular disciplines and education fields from the International Standard Classification of Education (Korpi & Tåhlin, 2009) as pro-innovative more than the others.

The CSAQ used in the survey analyzed in this publication contains three levels of formal qualifications: professional courses, secondary education and higher education – all divided as in ISCED (2013) into “broad field”, “narrow field” and finally “detailed field”. Respondents were asked to mark if they had achieved formal qualification in particular “broad field” on each level, and then they were presented “narrow fields” and “detailed fields” in the end. Such solution allows to capture all possible “educational flows” during the whole career. It is not hard to imagine, that in population of people in working age there are individuals who only graduated from primary or secondary school with no particular qualifications (general education without any professional qualifications), as well as individuals who obtained many and very different qualifications on all stages of formal education and still continue learning on additional courses. In other words, one may have secondary education in field of electro-mechanics, but bachelor's degree in journalism and master's degree in sociology. Not mentioning, that because of the profession performed and place of employment this particular person could complete qualifications at vocational courses of computer graphics (as hypothetical example, of course). What is even more important, there are no limits for possible choices on each level and within each ISCED field. This finds confirmation in gathered data, as the *Table 1* presents.

To make the analysis easier, all choices of “narrow fields” on each level of education characterized as “innovative” are being marked as “1” and all others (“non-innovative” or “less innovative”) as “0”. We are fully aware how arbitrary is the classification proposed by us for the purposes of this article – we have tried to match ISCED “narrow fields” to innovative areas of the research and education proposed by Polish Ministry of Science and Higher Education.

Out of all 99 ISCED “narrow fields” used in our CSAQ, as “innovative” we have qualified: 1) biology, 2) biochemistry, 3) chemistry, 4) physics, 5) mathematics, 6) statistics, 7) interdisciplinary programs and qualifications related to natural sciences, mathematics and statistics, 8) operation and use of computers, 9) design and administration of databases and networks, 10) creating and analyzing software and applications, 11) interdisciplinary programs and qualifications related to IT technologies, 12) other programs and qualifications related to IT technologies, 13) chemical and process engineering, 14) technologies related to environmental protection, 15) electricity and energy, 16) electronics and automation, 17)

mechanics and metallurgy, 18) vehicles, ships and planes, 19) raw materials, 20) interdisciplinary programs and qualifications related to technology, construction and industry, 21) interdisciplinary programs and qualifications related to agriculture, 22) medicine, 23) technologies related to diagnostics and treatment, 24) interdisciplinary programs and qualifications related to health and social care and 25) interdisciplinary programs and qualifications related to services. These 25 fields of education fit best national priorities identified by Polish Ministry of Science and Higher Education, while the last ones are an attempt do detail the EU guidelines for high-tech industries and knowledge-based services as foundations for innovative economy.

Table 1. Formal qualifications obtained during all levels of education – accumulation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No formal qualifications	548	5.0	5.0	5.0
	Formal qualifications obtained only during vocational courses	253	2.3	2.3	7.4
	Formal qualifications obtained only during basic and secondary professional education	1769	16.2	16.3	23.6
	Formal qualifications obtained during both vocational courses and basic or secondary professional education	1698	15.6	15.6	39.2
	Formal qualifications obtained only during higher education	720	6.6	6.6	45.8
	Formal qualifications obtained during both higher education and vocational courses	561	5.1	5.2	51.0
	Formal qualifications obtained during both basic or secondary professional education and higher education	1785	16.4	16.4	67.4
	Formal qualifications obtained during basic or secondary professional education, higher education and vocational courses	3548	32.5	32.6	100.0
	Total	10882	99.8	100.0	
	Missing	System	24	.2	
Total		10906	100.0		

Source: own calculations on data gathered in “Horizontal educational mismatch – a new method of measurement with application to Poland” project.

All researched 99 ISCED “narrow fields” of qualifications indexed together allow to divide the research sample into two main categories: those respondents who had not obtained any of above-mentioned “innovative” qualifications at any level of education, and those who had obtained at least one such qualification on at least on stage of education (even vocational course).

Table 2. Employees and self-employed in division by innovative and non-innovative education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	non-innovative	6608	60.6	60.6	60.6
	innovative	4298	39.4	39.4	100.0
	Total	10906	100.0	100.0	

Source: own calculations on data gathered in “Horizontal educational mismatch – a new method of measurement with application to Poland”.

Socio-demographic description of employees and self-employed respondents who obtained at least one “innovative” qualification at any education level reveals fairly obvious dependence – while majority of women (74.7%) have “non-innovative” qualifications, more men (51.5%) have “innovative” qualifications. This is due to the fact that in Poland women are less likely to study in more technical, engineering fields or science. In other words, innovation in Poland is simply masculinized.

4. Results

After the arbitrary division of qualifications into "innovative" and "non-innovative" (but still on the basis of official documents), it is time to confront the fact of having one or another education with a subjective assessment of the situation on the labor market.

In first place, respondents were asked if their qualifications are: a) enough for them, b) wanted by employers, c) current, d) unique, and e) they guarantee employment security. Each time respondents chose between “0 – I totally disagree” and “100 – I totally agree” (using the slider).

Table 3. Assessment of own qualifications by employees and self-employed in division by innovative and non-innovative education

My qualifications:	Mean	
	Innovative	Non-innovative
are enough for me	70.08	67.71
are wanted by employers	68.11	63.95
are current	70.95	68.72
are unique	58.94	55.24
guarantee employment security	63.93	59.29

Source: own calculations on data gathered in “Horizontal educational mismatch – a new method of measurement with application to Poland”.

ANOVA reveals statistically significant differences between groups ($p = .000$), but it is more the consequence of the size of the sample than of the gap in assessment between these two groups. The difference is no larger than 4.64%, and generally both categories perceive their qualifications positively. Larger differences are within the categories between each element of the assessment. What is really interesting is that while more than 70% of respondents with “innovative” education think that their qualifications are current and enough for them, only nearly 59% of them consider their qualifications as unique. And quite the same assessment present people with “non-innovative” qualifications.

Once again, “innovative” qualifications are all technical and engineering fields or science, while “non-innovative” are social sciences, humanities, business and administration etc. And “innovative” education is more frequent amongst men whose situation on labor

market is better than women's. But still, the difference in assessment is not larger than 4.64%.

This dependency is also consistent in the case of plans for the changes in qualifications in the next 12 months 56.9% of respondents with "innovative" and 52.2% of respondents with "non-innovative" qualifications are going to change anything in their qualifications. Most often they declare "supplementing or refreshing qualifications within the framework of a learned or performed profession" (14-19% of the employees and self-employed).

The differences between respondents with "innovative" and "non-innovative" qualifications are even smaller when one considers the frequency of changing profession and workplace.

Table 4. Frequency of changing the profession or workplace in division by innovative and non-innovative education

How often has one changed:	Mean	
	Innovative	Non-innovative
profession	2.76	2.65
workplace	3.61	3.46

Source: *own calculations on data gathered in "Horizontal educational mismatch – a new method of measurement with application to Poland"*.

It is worth to add, that in Poland 1/3 of employees has not changed their profession and 1/4 of employees has not changed their workplace even once.

Finally, the last element of subjective assessment of the individual situation on labor market is possible change of the profession or workplace in next 12 months.

Table 5. Future plans for changing the profession or workplace in division by innovative and non-innovative education (%)

Changing in next 12 months		Innovative	Non-innovative
		profession	yes
	no	86.3	84.5
workplace	yes	15.8	17.7
	no	84.2	82.3

Source: *own calculations on data gathered in "Horizontal educational mismatch – a new method of measurement with application to Poland"*.

The majority of the respondents, regardless of qualifications, are not going to change either profession or workplace in upcoming 12 months. This does not surprise, considering the fact, that Polish workers do not change often profession or workplace, and are generally satisfied with the level of employment security.

However, the table above presents another interesting detail in overall picture of relation between employment and education in Poland employees with "innovative" qualifications are slightly less eager to change anything in their current formal labor situation than people with "non-innovative" qualifications.

Conclusion

The starting point of our argumentation is the assumption that innovation is the main driving mechanism of growth in the contemporary economy. The high-tech industry and knowledge-based services are draft horses in the EU's perspective as cited official documents explain. At the level of national strategies, this assumption is detailed in the form of specific development directions and areas of investment. This allows us to identify education fields

that are crucial for the innovative economy, which therefore should guarantee a more comfortable situation on the labor market for the graduates by providing a highly qualified workforce for the most dynamically developing sectors. In subjective perspective this might provide larger employment safety on the one hand, while on the other motivate further qualification development and specialization.

However, the analysis of the data presented in this article leads to quite different conclusions. Even though the “innovative” qualifications are of related to engineering and science, more often chosen by men, they do not correlate clearly with a greater feeling of security on the labor market. The difference between declarations of respondents with “innovative” and “non-innovative” qualifications oscillates around several percent.

In our opinion it is the result of the general character of the labor market in Poland it is still more a market of employers rather than employees. Of course, the presented data comes from the very first edition of the survey, and we do hope that further editions will reveal the change that takes place in this area. Another factor that may influence the subjective perspective of employees and self-employed respondents is the character of innovation itself in Poland it is located in small entities that usually use their own resources (including financial) and R&D departments, rarely cooperating with third parties. We think that this situation strengthens the position of employers and lowers the flow of labor, which is a significant problem for some other national labor markets due to intensive intellectual migrants flows (Mishchuk et al., 2019). Poland seems to be ahead of the situation where highly trained and qualified experts in “innovative” fields will freely change workplaces and professions, competing on the labor market.

From this perspective, most valuable would be to compare the results obtained in Poland with the results of an identical study carried out in the EU15 countries. We are convinced that at the very core of innovation’s value lies the subjective perspective of the individual’s situation on labor market for graduates’ of “innovative” education analogous to the safety and stabilization of the professional situation known to qualified factory workers in the 1960s.

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