

THE ROLE OF HUMAN RESOURCES IN THE CREATION OF INNOVATION POSITION OF POLAND - COMPARATIVE ANALYSIS TO EU COUNTRIES BASED ON SII INDEX

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Abstract: Because of his knowledge, skills and activities, a man is a causative factor for most processes occurring in modern organizations, and may influence the level of their safety. The ingenuity and creative commitment of a man determines his ability to create and implement innovative solutions, to develop himself and the organization and thus, to reduce business risk.

Human resources are one of the factors that positively affect the location of Poland on the EU map of innovation. The aim of this article, on the background of the definitional aspects of innovation and its measurement with the SII index, is to address the issue of the role of these resources in building an innovative position of Poland. Data characterizing the Polish economy were compared with the results of EU countries.

Keywords: innovation, human resources, SII index.

1. INTRODUCTION

Human capital is a key factor in innovation. For a company, highly skilled employees are a knowledge base which is a source of ideas for new products and processes (Skibiński and Sipa, 2015). The quality of human resources determines the financial performance of enterprises and is reflected in their innovative position. Considering the phenomenon in macro scale allows to notice the existence of relations between the quality of human resources and innovative position of economies as well. The justification of the above is also the introduction of human resources (currently as one of four dimensions) into the construction of SII indicator – the measure of innovation for the EU and its member states (Svagzdiene and Kuklyte, 2016). This index is a basis for the development of European Innovation Scoreboard (the name has been used since 2016, in 2010-2015 it was called Innovation Union Scoreboard – IUS).

This paper is based on latest results, published by the European Commission on 18 June 2018, on the innovativeness of European countries. EIS 2018 is consistent with the methodology of 2017 edition in terms of recognizing four main types of indicators

and ten dimensions of innovation, including in total 27 different indicators. Poland has for many years belonged to the group of countries with relatively low level of innovativeness, recording results allowing to classify it on the map of EU countries innovation as so-called Moderate Innovators. The situation occurred both until 2015 and in 2016-2017, however the change made to the construction of SII indicator, significantly affected the emphasis of other areas of Poland's advantage, while the withdrawal of its previous strengths, such as eg. human resources (the highest value for this category in 2015).

2. PURPOSE AND METHODOLOGY OF RESEARCH

The purpose of this paper was to highlight the problem of Polish economy innovativeness on the background of the European Union countries, with a focus on the human resources as a possible factor of innovative advantage of Poland. In order to achieve the assumed purpose, the paper used the method of analysis of: literature of the subject, Eurostat and the European Commission reports published on the Internet, as well as descriptive method and the method of graphical data presentation.

3. RESULTS AND DISCUSSION

Innovation, the ability to create and absorb it are considered nowadays as a key factor of social and economic development of enterprises, regions and countries, as well as an indicator of their competitive position (Wielgórka and Trzepizur, 2015). Given the above, innovation became the area of particular interest and „challenge” for theoreticians and practitioners of economics and management, as well as governments of countries and the European Union institutions.

3.1. INNOVATION/INNOVATIVENESS – DEFINITION ASPECTS

Among the many definitions and approaches to innovation a particular importance is attributed to the interpretation included in Oslo Manual, according to which for over a decade it was assumed that „*An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations*” (Oslo Manual, 2005). The fourth edition of Oslo Manual issued in October 2018 states that „*An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)*” (Oslo Manual, 2018).

Definitions presented in Oslo Manual are important due to their semantic capacity (they cover a wide range and diverse character of possible innovation) as well as because they are a starting point for innovative activity measurement in OECD countries. They are also used by Eurostat and therefore in EIS. The systematics of innovation was made on the basis of definitions included in Oslo Manuals. That systematics differs in subsequent editions of the Manual. 2005 edition, indicating the fact of the implementation as a common feature, distinguished 4 types of innovation: product innovation, process innovation, marketing innovation, organizational innovation (Oslo Manual, 2005; Saridakis et al., 2019).

2018 edition of the Manual modifies the systematics of innovation and distinguishes only two main types, ie. product innovation (new or improved good or service) and business process innovation. The product innovation term is defined as „a new or

improved good or service that differs significantly from the firm's previous goods or services and that has been introduced on the market" (Oslo Manual, 2018). Whereas a business process innovation is a new or improved business process for one or more business functions that differs significantly from the firm's previous business processes and that has been brought into use in the firm. Business process innovation is divided into 6 main categories, including production of goods or services, distribution and logistics, marketing and sales, information and communication systems, administration and management, product and business process development (Oslo Manual, 2018).

Regardless of definitions and systematics adopted, innovation and innovativeness are considered as the source of business success. The above terms, however, are not synonymous, and just like the definition of innovation grew numerous approaches and interpretations, also „innovativeness" has been interpreted in various ways and presented as (Szajt 2017, Węgrzyn, 2018):

- potential to create broadly understood innovation,
- ability to implement innovation,
- engagement of human resources in research and development,
- feature of business units or economies consisting in the ability to create and implement innovation and to absorb and use it.

To survive and improve the quality of life, continuous innovation efforts are indispensable. All major revolutionary changes in history are all about innovation for creating new or better value for human beings, organizations and nations. Political leaders underline the importance of innovation for a better quality living environment for the citizens and stress the importance of continuous innovation for new products/services and ventures for customers (Lee and Trimi, 2016).

When analyzing the essence of innovation/innovativeness it is also worth noting the factors that formulate them, thus the concept of innovation potential, consisting in the set of factors enabling the creation of activities considered innovative in a given area. This potential includes (Szajt, 2014; Kamińska, 2017):

- financial potential (equity, loans, grants and subsidies),
- human potential created by employees with specific skills and qualifications,
- material potential in the form of equipment and production devices,
- technical knowledge and market information ie. enterprise intangible assets.

Innovativeness as the result of factors defined as innovation potential may be a characteristic of business units (innovative enterprise/organization), countries (innovative economy, country) and regions. Therefore it could be considered both in micro scale (enterprise level) and in macro scale (whole economies). The result is the possibility to distinguish its several levels: unitary, organizational (innovativeness of organization/enterprise) and macroeconomic (innovativeness of economy/regions) (Tomaszewska, 2012).

The last level, in comparison with the basic element of innovation potential of Polish economy built in the framework of SII indicator dimension of „human resources", is a particular subject of interest in this paper.

3.2. MEASUREMENT OF ECONOMY INNOVATIVENESS USING SUMMARY INNOVATION INDEX (SII)

The innovativeness of individual countries and the whole European Union is illustrated by the Summary Innovation Index SII – a composite indicator calculated since 2017 on the basis of 27 sub-indexes covered in the framework of 4 main indicator groups and 10 dimensions. In the innovativeness scoreboards for 2010-2016 there were 25 sub-indexes grouped into three main indicator types and 8 dimensions, respectively (Table 1). SII indicator takes values from 0 to 1, while the closer to 1, the higher the innovativeness level of a given country. It is calculated annually (since 2000) for each EU country and the source of data for its calculation (until 2016) were Eurostat, Joint Research Centre, Web of Science, OECD and EUIPO (*European Innovation Scoreboard. Methodology report, 2016*). The basis for developing 2018 EIS was indicated as: Eurostat, CWTS (Leiden University), Community Survey of ICT Usage and E-commerce in Enterprises, Global Entrepreneurship Monitor, European Union Intellectual Property Office, World Intellectual Property Office (*European Innovation Scoreboard. Methodology report, 2016*).

Table 1

Components of Summary Innovation Index SII included in innovation results tables before and after 2016

CATEGORIES AND DIMENSIONS OF SII SUB-INDEXES (2010-2016)					
		CATALYSTS	FIRM ACTIVITIES	OUTPUTS	
Innovation dimensions		Human resources	Firm investments	Innovators	
		Open, perfect and attractive research systems	Relationships and entrepreneurship	Economic effects	
		Finance and support	Intellectual assets		
CATEGORIES AND DIMENSIONS OF SII SUB-INDEXES (EIS 2017-2018)					
		FRAMEWORK CONDITIONS	INVESTMENTS	INNOVATIVE ACTIVITIES	IMPACTS
Innovation dimension		Human resources	Firm investments	Innovators	On employment level
		Attractive research systems	Finance and support	Linkages	On sales level
		Innovation-friendly environment		Intellectual assets	

Source: (European Innovation Scoreboard. Methodology report, 2016; European Innovation Scoreboard, 2016; European Innovation Scoreboard. Methodology report, 2018).

According to the methodology of SII calculation in 2010-2016 EIS 3 main categories of sub-indexes were distinguished (*European Innovation Scoreboard, 2016; Lorek, 2015*):

- enablers (innovation possibilities),
- firm activities,
- outputs (innovation effects).

2017 EIS and the subsequent one were based on modified SII, which used 4 main categories of sub-indexes (*European Innovation Scoreboard. Methodology report, 2018*):

- framework conditions,

- investments,
- innovative activities,
- impacts.

EIS 2015 results indicate that Polish economy, yet still categorized into the group of Moderate Innovators, demonstrated some positive changes in the dimension of „human resources” and relatively high values of the indicators. Indicators used to evaluate this dimension in EIS 2016 were (*European Innovation Scoreboard. Methodology report, 2016*):

- 1.1.1 New doctorate graduates per 1000 population aged 25-34,
- 1.1.2 Percentage population aged 30-34 having completed tertiary education,
- 1.1.3 Percentage youth aged 20-24 having attained at least upper secondary level education (indicator removed from the construction of SII in EIS 2017).

As indicated above, the subsequent years brought the change to the methodology of calculating SII and also to the structure of the best areas distinguishing Poland. The evaluation of the dimension of human resources analyzed in this paper involved (*European Innovation Scoreboard. Methodology report, 2018*):

- 1.1.1 New doctorate graduates,
- 1.1.2 Population aged 25-34 with tertiary education (indicator modified in relation to previous years),
- 1.1.3 Lifelong learning (new measure).

Changes in the development of the above mentioned sub-indexes are presented in the further part of this paper.

3.3. INNOVATIVENESS ANALYSIS FOR THE EUROPEAN UNION AND POLAND

Based on average results calculated using the Summary Innovation Index member states are divided according to four different categories: Innovation Leaders, Strong Innovators, Medium Innovators and Modest Innovators.

Despite pro-innovation activity Poland, as a Medium Innovator, records results worse than the EU average in all categories of the EU scoreboard in terms of research and innovation, both before the change of the indicator – in 2015, as well as in the latest 2017 - a year after the change (Fig. 1). The achievements of Poland in terms of innovativeness proves that the innovativeness of Polish economy is relatively low.

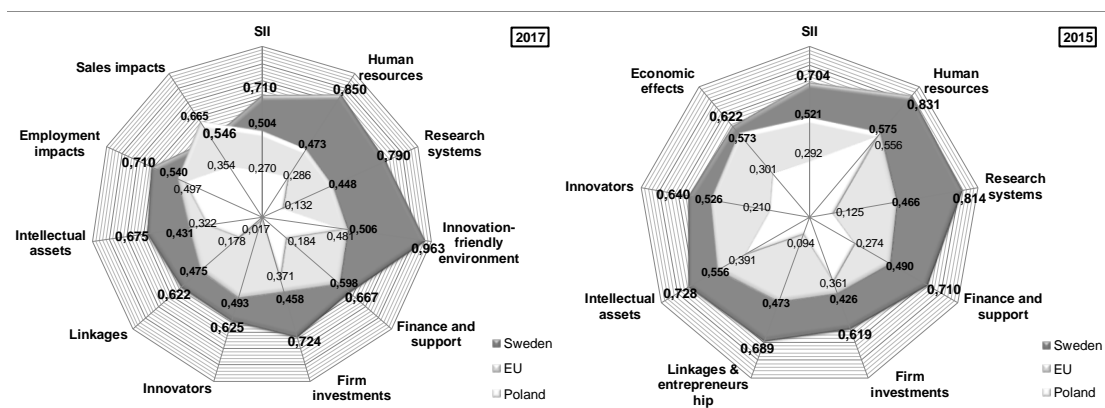


Fig. 1. Components for Summary Innovation Index (SII) for the EU, Sweden and Poland in 2015 and 2017
 Source: own elaboration based on Eurostat data.

Due to the fact that the expansion of SII categories and sub-indexes starting from 2016 from three and eight to four and ten, respectively, significantly affected the results of Poland, it was considered right to look into the effects of this modification. The analysis of the European Union averages within eight components of the indicator in 2015 reveals they ranged between 0.426 for firm investments category to 0.575 for human resources, and in case of the Innovation Leader – Sweden – between 0.619 and 0.831 determined by the same sub-indexes categories. The analysis of Fig. 1 indicates that Poland's strengths before the indicator modification related strongly to human resources, firm investments, intellectual assets and economic effects. While the category of human resources was already mentioned in previous reports of the European Commission as Poland's strength among member states, the other areas of intellectual assets, finance and support or firm investments could be noticed for significant improvement of results, unfortunately invisible at that moment at other levels of innovativeness.

In 2017 the indicator for 2016 was presented in a new version, including ten analysis levels instead of eight. In case of Poland it had a significant effect on the dislocations in terms of strengths of the country's innovativeness, which also continued in the following year. Based on the analysis of Fig. 1, previous „drivers” of Poland's innovation were replaced by Employment impacts, including employment in knowledge-based activities and rapidly growing firms of innovative sectors, Innovation-friendly environment, related to access to broadband Internet and the share of individuals involved in entrepreneurship improvement, as well as Firm investments, covering R&D expenditure in business sector, non-R&D innovation expenditures, and the percentage of enterprises providing training to develop or upgrade ICT skills of their personnel. Human resources dimension came only in the 6th position, and the search for a reason for such situation is the basis for further analysis in this paper.

3.4. POLAND'S POSITION IN TERMS OF HUMAN RESOURCES IN COMPARISON TO THE EU RESULTS

The analysis of Fig. 1 revealed the following three areas in which Poland, according to the latest SII construction (2017), recorded results closest to the EU averages:

- Innovation-friendly environment (SII indicator dispersion between Poland and the European Union in this category is the smallest: $SII_{UE}-SII_{PL}=0.025$),
- Employment impacts ($SII_{UE}-SII_{PL}=0.043$),
- Firm investments ($SII_{UE}-SII_{PL}=0.087$).

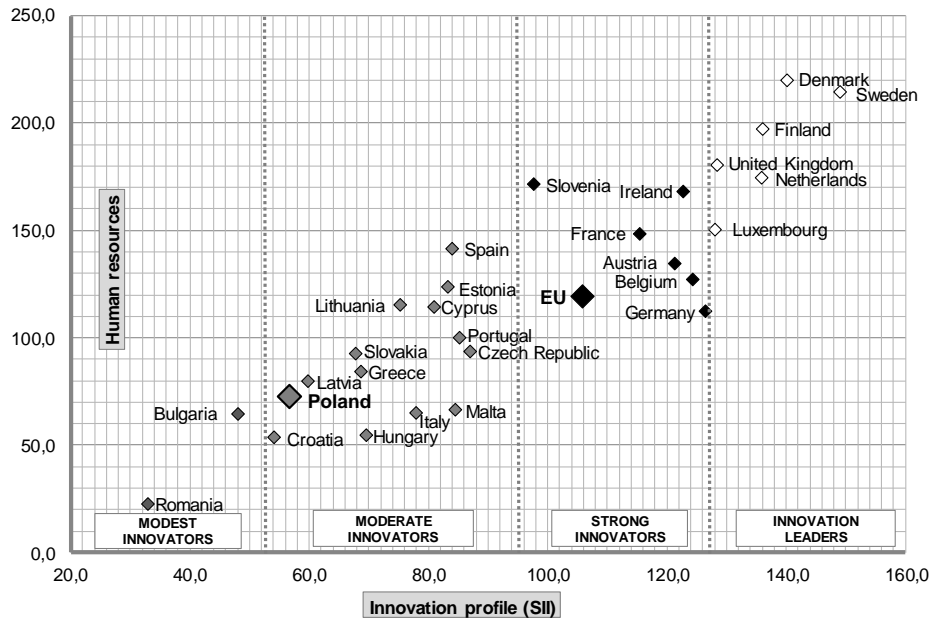


Fig. 2. Matrix of human resources indicator and innovation position of the EU member states in 2017

Source: own elaboration based on Eurostat data.

In terms of human resources this gap was significantly enlarged – $SII_{UE}-SII_{PL}=0.187$ in 2017 in relation to 0.019 in 2015. Human capital is one of three sub-categories of indicators, being researched in this paper, that are included in so-called framework conditions group. Until 2016 it consisted of three sub-indexes related to enrolment, ie. new doctorate graduates per 1000 population aged 25-34, percentage population aged 30-34 having completed tertiary education, percentage youth aged 20-24 having attained at least upper secondary level education. Since 2017 this indicator has been modified in the scope of sub-indexes 1.1.2 and 1.1.3. The position currently occupied by Poland in relation to member states in this summary category is illustrated in Fig. 2. Also detailed presentation of sub-indexes constructing this indicator was presented, for 2015 (Fig. 3) and for 2017 (Fig. 4).

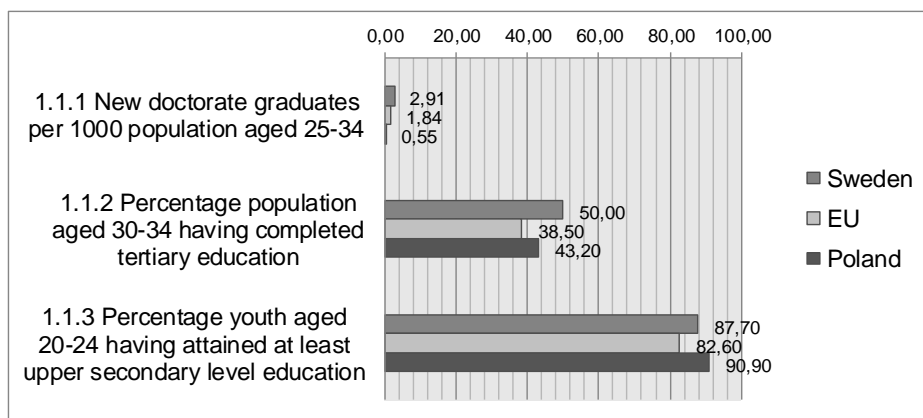
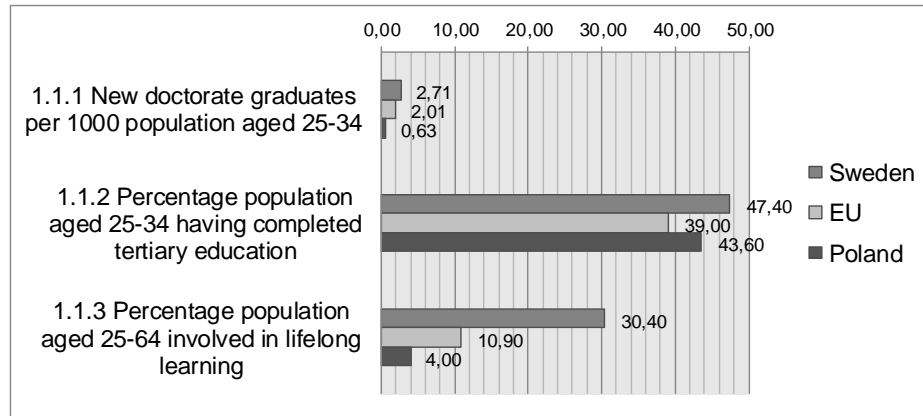


Fig. 3. Sub-indexes included in human resources indicator for the EU, Sweden and Poland in 2015

Source: own elaboration based on Eurostat data.



* - for the 1.1.1 indicator the most recent data is for 2016, no data available for 2017

Fig. 4. Sub-indexes included in human resources indicator for the EU, Sweden and Poland in 2017*

Source: own elaboration based on Eurostat data.

Such a good result of Human resources category in 2015 was caused primarily by the results of sub-indexes 1.1.3 and 1.1.2 – on average 43.2% of Polish population aged 30-34 graduated from doctoral studies (with an average of 38.5% for the EU and 50% for Innovation Leader – Sweden), almost 91% of the population graduated from higher education (the leader in this sub-index is Croatia with the result of 95.5%). The number giving cause for concern was related to doctoral dissertations defended in 2015 – on average per 1000 population aged 25-34 it was 0.6 defended doctorates, which placed Poland in the third position from the end in the ranking.

The modification of Human resources sub-category indicator consisted in shifting the bottom age limit in the case of 1.1.2 indicator – Percentage population aged 25-34 having completed tertiary education. It is a general indicator of advanced skills supply. It is not limited only to the area of science and technology, as the absorption of innovation in many areas, in particular in service sectors, depends on the wide range of skills. The indicator focuses on the group of people in relatively young age – 25 to 34 – and is assumed to reflect changes in education policy leading to the higher number of university graduates. The analysis of the figure proves that the change in the bottom age limit was marginal – only in the case of Sweden there was a slight decrease in the percentage of people in this group, by 2.6 p.p.

CONCLUSION

Innovation is the driver for the development of enterprises and whole economies, thus becoming an area of interest and cooperation of three sectors: business, science and government. Innovation activity, however, is not possible without the participation of human.

Despite undertaking pro-innovation activities innovation position of Poland, allowing for positive changes in that area, is not satisfactory in comparison to other European Union countries. It is confirmed by the results of the European Commission report – Innovation Union Scoreboard 2018, according to which SII for the European Union in 2017 was 0.504 (0.521 in 2015). Poland, recording SII of 0.270, falls into the group of so-called Moderate Innovators (0.290 in 2015).

The analysis of sub-indexes of SII, dedicated to the evaluation of the innovativeness in Europe, indicates that the strengths of Poland, thus its innovation potential sources

until 2015 included: human resources, intellectual assets and firm investments. The best situation related to human capital area – the normalized value of the indicator for this category (0,575) was the closest to the EU average (0,556). These results respectively in 2017 were 0,286 for Poland and 0,473 for EU. The change, that in 2017 probably affected the rapid decrease of human resources meaning in creating innovative advantage of Poland in Europe the most, is the newly created indicator of Lifelong learning. The target population for this measure is related to individuals aged 25 to 64 creating households. Information collected by Eurostat refer to all forms of education and training, regardless of whether they are relevant for current or possible employment of the respondent. The indicator covered all intentional education activities, formal, non-formal and informal, undertaken on an ongoing basis in order to improve knowledge, skills and competences. It was assumed that the intention or learning purpose is the critical point, that distinguishes those activities from non-scientific activities, such as cultural or sport activities. The analysis conducted in the article indicated that Poland differs significantly from the EU average in this aspect – only 4 of 100 respondents in the analyzed age group continue any form of learning, with the EU average of 11 and every third in this age group for Sweden. Given the very high results for 2015, suggesting that 91% of population aged 20-24 in Poland graduates from higher education, it should be assumed that those 4 individuals of 100 are mainly young people, that continue their education after graduation or to a smaller extent elderly people who attend the ever popular form of so-called „third age” studies. Those conclusions, however, require verification and further research.

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