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Employment in high-technology industries in the European Union and job satisfaction - case study Czech Republic and Poland

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ABSTRACT

The significance and position of high-technology industries within the economy is often considered to be an attribute of the company's maturity. The aim of this study is to compare employment in the high-technology sector in selected European Union and OECD countries and to analyse university-educated workers' job satisfaction in the Czech Republic and Poland. The work will use available data concerning employment and data mining will be carried out. Job satisfaction will be examined through a questionnaire survey. From these results some dependence between employment and job satisfaction could be observed. The employment rate in the Czech Republic is slightly higher and the level of job satisfaction is also slightly higher than in Poland. It can be assumed that the importance of high-technology industries will continue to grow because it is in the interest of the companies themselves to be competitive. At the same time, this is needed for further economic growth and productivity gains, so these directions should be further developed and supported.

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1. Introduction

The high-technology sector is frequently mentioned as a typical feature of economic development in a particular territorial unit. Businesses in these industries often use advanced technologies to produce on a large scale, while the development of their products is associated with high R&D costs and subsequent innovations. The high-technology sector consists of industries within selected industries in the manufacturing industry (high-technology industry) as well as selected service industries (high-technology services).

The OECD has developed a four-way exports classification - high, medium-high, medium-low and low-technology. Classification is based on the importance of research

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and development expenditures relative to the gross output and value added of different types of industries that produce exported goods. Examples regarding high-technology industries are aircraft, computers, and pharmaceuticals; medium-high-technology includes motor vehicles, electrical equipment and the majority of chemicals; medium-low-technology includes rubber, plastics, basic metals and ship construction; low-technology industries include food processing, textiles, clothing and footwear (OECD, 2019).

It is essential to create, exploit and commercialise new technologies in the global race for competitive advantage. High-tech sectors and enterprises are key drivers with regard to economic growth and productivity, and generally provide high value-added and well-paid employment.

Sufficient skilled workers are required to develop this sector, and the proportion of university graduates is higher than in other sectors. Nowadays, when there is a labour shortage in the market, it is becoming increasingly difficult to recruit new workers when it comes to highly skilled workers – with regard to university educated, this becomes even more difficult. When a company recruits their employees, they need them to stay in the company. Therefore, to be competitive on the labour market, companies try to create the right conditions for workers. A satisfied worker is the best advert.

This study's aim is to compare employment in the high-technology sector in selected European Union and OECD countries and to analyse university-educated workers' job satisfaction in the Czech Republic and Poland.

2. Literature review

2.1. The Hofstede's model

According to Hofstede (2011) the dimensional model can be also applied at the organizational and occupational levels. Six independent dimensions were identified that could describe the most of the diversity in organizations and they can be used as a framework to describe organization cultures:

1. Process-oriented versus results-oriented
Process-oriented cultures are ruled by technical and bureaucratic routines and procedures but results-oriented cultures are lead by a common apprehension for outcomes.
2. Job-oriented versus employee-oriented
Job-oriented culture care for the employees' job performance only but employee-oriented cultures has a big deal of responsibility for their employees' wellbeing.
3. Professional versus parochial
At first, profession gives members their identity, and then they derive their identity from the organization for which they work.
4. Open systems versus closed systems
This dimension points out the usual style of internal and external communication, and how easy outsiders and newcomers are acknowledged.
5. Tight versus loose control
This dimension deals with the degree of formality and accuracy inside the

organization; for example banks are expected to have a tight control and advertising agencies loose control.

6. Pragmatic versus normative

This dimension explains the dominant way of dealing with the environment and specifically with customers. Entities that are selling services are more likely to be on the pragmatic (flexible) side and entities involved in the application of laws and rules are more likely to be on the normative (rigid) side (Hofstede, 2011).

Sokolova, Zubr, Cierniak-Emerych, and Dziuba (2019) state that there are statistically significant differences in the index of organisational culture in the Czech Republic and Poland.

2.2. Employment and unemployment

Employment and unemployment are the two basic pillars in the labour market assessment. Unemployment rate is more accentuated in particular. If 10% is passed through the 'magic' threshold, then state labour market interventions often take place to reduce this value. On the other hand, there is the employment in the population - its role is not over-emphasised, but employment is in many respects a much more important indicator of a positive labour market trend than monitoring unemployment. It shows how many people actually actively participate in creating economic goods.

As a place of conflict between supply and demand for labour, the labour market is tied to the person who is the work carrier. Therefore, it is understandable that the labour market is determined by the labour force - the economically active population.

In the case of labour force, it concerns everyone irrespective of their gender, who are older than the specified threshold and qualify for inclusion as either employed or unemployed. In most countries, including the Czech Republic, they are over 15 years of age, except for example Great Britain, where it is the population over 16 years of age. Often the upper age limit is also limited, for example, when 74 years of age is taken as the ultimate limit of economic activity.

The inclusion of a person between employed or unemployed can be very volatile and its validity is always determined by the specific date that the economic status is surveyed. Regarding the Labour Force Survey (LFS), it is a person's status during the reference week (i.e., actual activity in a given week).

The number of economically active inhabitants is decisive for the calculation of the rate of economic activity (given in %), which determines the share of the labour force (i.e., employed and unemployed) in the total number of inhabitants older than the considered monitoring limit. According to the International Labour Organisation (ILO), this is the proportion of the labour force (employed and unemployed) in the number of all persons over 15 years of age.

2.2.1. Employment rate

According OECD (2019) 'employment rates are defined as a measure of the extent to which available labour resources (people available to work) are being used. They are calculated as the ratio of the employed to the working age population. Employment

rates are sensitive to the economic cycle, but in the longer term they are significantly affected by governments' higher education and income support policies and by policies that facilitate employment of women and disadvantaged groups. Employed people are those aged 15 or over who report that they have worked in gainful employment for at least one hour in the previous week or who had a job but were absent from work during the reference week. The working age population refers to people aged 15 to 64. This indicator is seasonally adjusted and it is measured in terms of thousand persons aged 15 and over; and as a percentage of working age population'.

2.3. Job satisfaction

The definition characterises job satisfaction as a positive emotional response and experience from the evaluation of one's work (Locke, 1976; Pavelka, Skála, & Čadil, 2014). The level of job satisfaction is comprised of internal and external satisfaction (Ryan & Deci, 2000). Significant attribute of internal satisfaction is success, responsibility or recognition, while external satisfaction is represented by payroll and other bonuses, relationships with co-workers and working conditions. Job satisfaction affects job performance, if workers are dissatisfied for in the long-term, it may increase staff turnover, absenteeism and associated costs (for example, Judge, Thoresen, Bono, & Patton, 2001).

Job satisfaction can be described as a positive development on an employee's emotional state, resulting from their job. Frederick Herzberg's Two Factor Theory (1966), place the emphasis on factors affecting job satisfaction, and classify these factors in two groups: motivational factors, such as responsibility and achievement and hygiene factors, such as pay and supervision. The classification of satisfaction and dissatisfaction was prevalent in the 1950s (Weitz, 1952) and in some way these two groups were also related to this classification. Existing motivational factors can lead to satisfaction and non-existent hygiene factors can bring about dissatisfaction. Hygiene factors are sometimes called extrinsic factors and motivational factors are also called intrinsic factors.

While some studies have been published, they have always been small samples of respondents and often professionally focused. There are several studies that have been carried out, for example, in healthcare (Gurková, Čáp, Žiaková, & Ďurišková, 2012; Kaarna, Pölluste, Lepnurm, & Thetloff, 2004; Lorber & Skela Savič, 2012; Puriene, Petrauskiene, Janulyte, & Balciuniene, 2007).

Available data suggests that the level of job satisfaction in Central and Eastern Europe countries was relatively small compared to Western and Northern Europe. Four countries from Central and Eastern Europe - Hungary, Slovenia, Bulgaria and the Czech Republic - are among the eight countries with the lowest job satisfaction (Sousa-Poza & Sousa-Poza, 2000).

3. Employment in high-technology industries in the Czech Republic and Poland in the European Union context

The following table (Table 1) shows the employment rate in 2018 for selected countries in the context of the European Union and the OECD. Sweden has the highest

Table 1. Employment rate, Total, % of working age population in 2018.

	Employment rate
Sweden	77.53
Netherlands	75.85
Denmark	75.38
Germany	75.25
Estonia	74.78
United Kingdom	74.13
Czech Republic	73.63
Austria	72.2
Lithuania	72.1
Latvia	71.8
Finland	69.97
Portugal	69.7
Slovenia	69.28
Hungary	68.17
OECD - Total	67.7
European Union (28 countries)	67.67
Ireland	67.65
Luxembourg	66.28
Slovak Republic	66.17
Poland	66.13
France	65.35
Belgium	63.13
Spain	62.4
Italy	57.98
Greece	53.5

Source: OECD, 2018; own processing.

employment rate with 77.53%, while Netherlands, Denmark and Germany still have an employment rate higher than 75%. The Czech Republic with 73.63% is also well above the EU average (67.67%) and OECD (67.7%). Poland is close to the EU average with 66.13%, however, compared to the Czech Republic, employment is more than 7% lower. Italy and Greece have an employment rate below 60%.

In 2017, 35 million people were employed in manufacturing industry in the EU-28, representing 15.4% of the total employment. In 2017, employment in EU countries varied significantly in the high-technology manufacturing and service sectors. Out of this, 2.4 million people were employed in high-technology manufacture, corresponding to 1.1% of the total employment (Table 2). The Czech Republic employs 85,000 people (1.6%), in Poland 128,000 people (0.8%) in high-technology manufacture. Therefore, the Czech Republic is well above the European Union average, while Poland is average.

When analysing its share of the total employment, the lowest percentage (0.4) of high-technology workers employed in the total employment was in Cyprus, while in 2017 the highest 3.1% was in Ireland. This share is 1.6% in the Czech Republic and Germany, 0.8% in Poland and 1.3% in Slovakia.

More than three times more people were employed in knowledge-intensive services, which accounted for 3.0% of total employment (Table 3).

Differences in the relative importance of high-level knowledge services in overall employment were also observed across countries, with Ireland (5.4%), Finland (4.7%), Estonia (4.5%) and Sweden (4.4%) being the largest among EU members., while the lowest values were recorded in Greece (2.0%) and Lithuania (2.1%) (see Table 3). The

Table 2. Employment in high-tech sectors in manufacture, EU-28 and selected countries, 2017.

	High-tech manufacturing	
	Total in 1000s	% of total employment
EU-28	2414	1.1
Belgium	49	1.2
Bulgaria	22	0.9
Czech Republic	85	1.6
Denmark	44	1.7
Germany	691	1.6
Estonia	7	1.1
Ireland	63	3.1
Greece	18	0.5
Spain	113	0.7
France	249	1.0
Croatia	12	0.6
Italy	209	1.0
Cyprus	2	0.4
Latvia	5	0.5
Lithuania	5	*
Lixembourg	*	*
Hungary	105	2.3
Malta	5	2.4
Netherlands	42	0.5
Austria	54	1.2
Poland	128	0.8
Portugal	22	0.5
Romania	69	0.7
Slovenia	19	2.1
Slovakia	41	1.3
Finland	25	1.1
Sweden	33	0.7
United Kingdom	296	0.9

* not available

Source: Eurostat, 2018; own processing.

Czech Republic has a share of 3.0%, Germany 2.4%, Poland 2.2% and Slovakia 2.8%. Turkey was the only country to record a value lower than 1%. (Eurostat, 2018)

4. Comparison of job satisfaction level in the Czech Republic and Poland

In view of the above, the following research assumptions can be made:

- university-educated people and their motivation to work are a precondition for the growth of the high-technology sector, which is a typical feature of the economic development of a specific regional unit;
- job satisfaction is an important factor influencing work motivation and it is a determinant shaping organizational culture;
- differences in organizational culture are identified in the Czech Republic and Poland;
- there is a different employment rate in the Czech Republic and Poland.

The aim of this study is to examine the level of job satisfaction for university-educated workers in the Czech Republic and Poland, based on these assumptions, set goals and research questions.

Table 3. Employment in high-tech sectors in services, EU-28 and selected countries, 2017.

	High-tech knowledge-intensive services	
	Total in 1000s	% of total employment
EU-28	6749	3.0
Belgium	163	3.5
Bulgaria	93	3.0
Czech Republic	158	3.0
Denmark	101	3.6
Germany	1013	2.4
Estonia	29	4.5
Ireland	118	5.4
Greece	76	2.0
Spain	593	3.2
France	828	3.1
Croatia	45	2.8
Italy	565	2.5
Cyprus	10	2.6
Latvia	27	3.0
Lithuania	28	2.1
Lixembourg	10	3.7
Hungary	106	2.4
Malta	7	3.4
Netherlands	284	3.3
Austria	132	3.1
Poland	366	2.2
Portugal	112	2.4
Romania	188	2.2
Slovenia	36	3.7
Slovakia	71	2.8
Finland	115	4.7
Sweden	219	4.4
United Kingdom	1254	3.9

Source: Eurostat, 2018; own processing.

5. Research objective and methodology

This chapter will set out the aim and research questions and further define the sources and methods of data acquisition and processing.

5.1. Determination of the research question, aim and data formulation

The main aim of the presented study is to compare employment in high-technology sector in selected countries of the European Union and OECD and to analyse university-educated workers' job satisfaction in the Czech Republic and Poland.

5.1.1. Research question 1

The first research question is:

RQ₁: What are the differences in employment in the high-technology sector in the selected countries compared to the EU and OECD average - focusing on the position of the Czech Republic and Poland?

5.1.2. Research question 2

The study is based on the assumption that

- workers with higher education are more likely to work in high-technology manufacturing and knowledge-intensive services,
- an important factor in retaining existing workers and getting new ones - being a sought-after employer, is creating adequate working conditions, applying fair pay, providing information, communicating openly, enabling development, etc.

The second research question is focused on this area and should analyse the level of job satisfaction for university-educated workers in the Czech Republic and Poland:

RQ₂: What is the level of job satisfaction regarding university-educated workers in the Czech Republic and Poland?

5.2. Solution procedures

In order to achieve this, several steps need to be defined:

STEP1: Definition of basic concepts of employment and job satisfaction.

STEP2: Employment analysis in high-technology industries in the Czech Republic and Poland in the European Union context.

STEP3: Comparison of job satisfaction levels in the Czech Republic and Poland and a deeper analysis of obtained data.

STEP4: Results summary and forming conclusions.

5.3. Data sources

To define the basic concepts and to find out the current state of knowledge of the issue, a literature review of domestic and foreign literature will be performed, especially articles with a non-zero impact factor in Scopus and Web of Science databases.

For the analysis of employment in high-technology industries in the Czech Republic and Poland in the context of the European Union, data mining available data from Eurostat, the Czech Statistical Office and other economic studies will be carried out.

Data from the questionnaire survey carried out will be used to find out job satisfaction in relation to university-educated workers in the Czech Republic and Poland.

5.4. Questionnaire survey methodology

A questionnaire survey was conducted in the period January - March 2018 to assess the degree of job satisfaction. The aim of the questionnaire was to determine the level of job satisfaction in the Czech Republic and Poland. The questionnaire contained three parts. The first part included three demographic issues, the second part five questions on the organisation's characteristics. The third part focused on 'Job Satisfaction Survey', the Czech version and the Polish version of the standardised questionnaire by Spector (Spector, 1997). The questionnaire is based on 36 items that evaluate the level of job satisfaction - on a six-point scale from strongly disagreeing

Table 4. Composition of the examined sample of respondents - Czech Republic and Poland.

Item	Czech Republic		Poland	
	%	frequency	%	frequency
Gender				
Men	50.33	232	45.92	163
Women	49.67	229	54.08	192
Age				
Less than 30	31.67	146	35.21	125
30–40	32.76	151	41.69	148
51–50	21.69	100	16.90	60
51 and above	13.88	64	6.20	22
Organisation size				
Up to 50 employees	34.28	158	32.40	115
Up to 250 employees	22.99	106	22.82	81
Up to 500 employees	12.58	58	10.70	38
More than 500 employees	30.15	139	34.08	121
Job level				
Manager/supervisory responsibility employee	61.82	285	84.51	300
Non-supervisory responsibility employee	38.18	176	15.49	55

Source: own.

(1) to complete agreement (6). By processing the results we will find out the level of overall job satisfaction and the value of nine determinants that influence the overall rate: Pay, Communication, Nature of work, Co-workers, Operating conditions, Promotion, Supervision, Fringe Benefits, Contingent rewards. Only survey results related to job satisfaction are used to fulfil the paper's aim.

Given that it was not possible to obtain a cross-sectional sample, data was collected in collaboration with university students who were asked to reach the respondents working in different types of organisations in the Czech Republic/Poland, they were non-manual workers.

1,574 questionnaires were obtained in the Czech Republic, 1,476 questionnaires were included in the processing (98 questionnaires were excluded from further processing due to various errors or incompleteness). In Poland, 433 questionnaires were obtained and 360 questionnaires were included in the evaluation for the same reason as those in the Czech Republic (73 questionnaires were excluded) (Sokolova et al., 2019). For this paper's purposes, respondent data with university education were used. In the Czech Republic, 461 respondents with university education participated in the questionnaire survey, 355 respondents with university education completed the questionnaire.

A more detailed description of the examined sample of respondents is given in Table 4.

It can be seen from the above characteristics that the surveyed samples of respondents in the Czech Republic and Poland are comparable, although some differences can be seen here. For example, in Poland there are more respondents with a managerial/supervisory responsibility than in the Czech Republic, as in the Czech Republic the age group 51 and above is more representative.

5.5. Research limits

The research has several limitations. The main one is the selection of respondents, when the whole territory of the Czech Republic and Poland is not covered in

geographical terms. However, this deficiency is not so crucial, as the Czech Republic and Poland have currently a relatively homogeneous socio-economic composition. Another questionnaire survey limitation is the composition of respondents in terms of age and position in employment (as mentioned above). In spite of these limitations, we believe that the data we obtained provides findings that increase our knowledge of job satisfaction in the Czech Republic and Poland.

5.6. Research result evaluation

By processing the obtained data, we achieved results regarding the level of job satisfaction and determinants that affect it. These results are summarised in Table 5 and graphically in Figure 1.

The overall level of job satisfaction is 3.85 points in the Czech Republic, which is slightly higher than in Poland, where overall job satisfaction is 3.67. The long-term low level of job satisfaction in the Czech Republic confirmed them (Sokolova, Mohelska, & Zubr, 2016). Respondents in the Czech Republic were most satisfied with the determinants of Co-workers, Supervision, Nature of work and

Table 5. Job satisfaction level - Czech Republic and Poland.

	Czech Republic	Poland	difference
Pay	3.55	3.72	-0.17
Promotion	3.26	3.48	-0.22
Supervision	4.35	3.72	0.63
Fringe Benefits	3.65	3.54	0.11
Contingent rewards	3.69	3.63	0.07
Operating conditions	3.13	3.66	-0.53
Coworkers	4.50	4.05	0.45
Nature of work	4.29	4.10	0.19
Communication	4.20	3.13	1.08
Total satisfaction	3.85	3.67	0.18

Source: own.

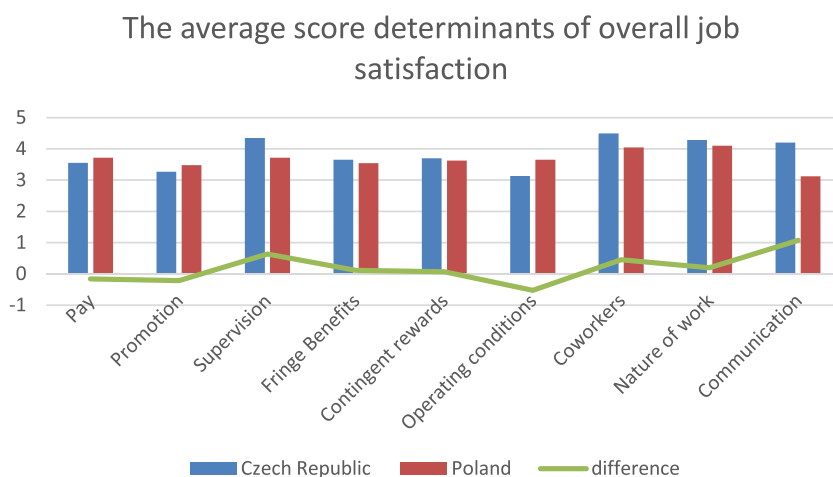


Figure 1. Determinants of Job Satisfaction - Czech Republic and Poland.

Source: own.

Communication, in Poland the determinants were mainly Nature of work, Co-workers.

More obvious differences are in determinants affecting overall job satisfaction. This difference is shown in the last column of the table and the green line in the graph, when it is the difference of satisfaction values of individual determinants in the Czech Republic and Poland. A positive value means that there was a higher level of satisfaction in the Czech Republic, while a negative level indicates higher satisfaction in Poland.

The greatest difference can be seen in the Communication determinant, where satisfaction with this determinant in the Czech Republic is 4.20 and in Poland just 3.13. In the Czech Republic, the respondents are more satisfied with the Supervision and Co-workers. In contrast, in Poland they are more satisfied with the Operating conditions determinant.

6. Results summary and forming conclusions

In the context of the first research question, it can be said that there are differences in employment rates. The Czech Republic is one of the countries where the employment rate is above the EU average. In this regard Poland has an average employment rate. Employment in the high-tech sector in the Czech Republic is again well above the average in manufacture (3% compared to the EU 1.1 average) and 3% in services, but the EU average in this sector is 3%. In Poland, employment in the high-technology sector is below the EU average – manufacture 0.8 and services 2.2.

In connection with the solution of the second research question, it can be stated that the level of university-educated workers' job satisfaction is slightly higher in the Czech Republic than in Poland. Significant differences can be seen in individual determinants of job satisfaction. The biggest difference was in the Communication determinant. In the Czech Republic, it is one of the determinants with the highest level of satisfaction; in Poland, the respondents are the least satisfied with this determinant.

From these results, we can see a certain dependence between employment rate and job satisfaction. The employment rate in the Czech Republic is slightly higher and the level of job satisfaction is slightly higher than in Poland. Research and a deeper analysis of whether this relationship really exists can be the subject of further research.

7. Conclusions

In a global competitive advantage competition, it is essential to create, use and commercialise new technologies. At the same time, high-technology industries and businesses are key drivers of economic growth and productivity, and generally provide high-paid, high-value-added work. We can assume that the importance of high-technology industries will continue to grow because it is in the interest of companies themselves to be competitive. Simultaneously, this is needed for further economic growth and productivity gains, so these directions should be further developed and supported.

Simultaneously, it is important to strengthen internal personnel marketing, which aims to achieve employee satisfaction (Barrow & Mosley, 2005). Armstrong and Taylor (2015) characterise job satisfaction as a mental state that reflects the assessment of the individual's current well-being in combination with employer involvement. Satisfied employees have a good relationship with the company, are loyal to their employer, are willing to work for the company beyond their obligations, willingly recommend the company as a good employer, help the company overcome difficult times and support its economic growth (Alktron, 2002; Skare & Lacmanovic, 2015; Zarnik-Zulawska, 2012).

Loyal and stable employees are those who maintain and influence the business culture, knowledge and awareness of customer needs (Vodák & Kucharčíková, 2011).

According to Myslivcova (2018), job satisfaction is affected by:

- work safety;
- sufficient financial and non-financial evaluation of work;
- the management style and organisation of the enterprise;
- the employee's relationship to the work being performed;
- perspective of meaningful work, satisfaction of good work results;
- the level of working conditions that the enterprise is willing to provide to employees, career development and training opportunities and development plans;
- style of communication and information sharing, ensuring a level of sustainable business at all levels.

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