

TERTIARY EDUCATION SYSTEM IN SLOVAKIA

Dana Országhová¹, Pavel Flák², Viera Papcunová³

Slovak University of Agriculture in Nitra¹

Faculty of Economics and Management, Department of Mathematics

Tr. A. Hlinku 2

Nitra, Slovakia

Slovak Academy of Agricultural Sciences²

Hlohovecká 2

Lužianky, Slovakia

Constantine the Philosopher University in Nitra³

Faculty of Natural Sciences, Institute of Economics and Management,

Tr. A. Hlinku 1

Nitra, Slovakia

e-mail^{1, 2, 3}: dana.orszaghova@uniag.sk, flakpavel1@gmail.com, vpapcunova@ukf.sk

Abstract

Investments in human capital, including education, skills upgrading, the development of education and science, are nowadays a significant prerequisite for the further development of society and its economic growth. The required features of employees in the current labor market are: flexibility, adaptability and initiative with accountability. The Tertiary Education System should reflect these requirements so that graduates with acquired knowledge, skills and attitudes have been beneficial to employers. In the Slovakia the university education in the first and second grade are provided by: public university, state universities, private colleges and foreign universities. In this context, the main objective of this contribution is the analysis of known indicators of tertiary education in Slovakia in the period 2013-2016. The data sources for the individual indicators were obtained from the database "DATAcube". In particular, these are the following indicators for universities: number of faculties, number of teachers, number of full-time students, number of graduates of the daily study, the number of students studying beside employment. The obtained observations were evaluated by adequate mathematical and statistical methods; respectively by econometric analyzes to obtain information for possible further forecasting of analyzed relationships. Analyzes of indicators of tertiary education in the monitored

period pointed to the existing specificities, homogeneity; respectively heterogeneity of evaluated educational institutions. The obtained results explain more deeply not only the current situation, but they are suitable inputs for adequate proposals for optimization of the tertiary education system in the Slovak Republic.

Keywords: graduates, mathematical and statistical analyses, system of education, tertiary education, undergraduates.

JEL classification: I21, I23

1 Introduction

Higher education, with its links with research and innovation, plays important role in personal development and economic growth of country (Akhmat et al., 2016). It also confirms Abramo et al. (2014) who say that education, with the resulting of new knowledge creation present the lifeblood of socio-economic growth. Universities are base of the knowledge society. Pechočiak and Kecskés (2016) say that the role of educational institutions in university graduates training in new global space is indisputable. Their role is to respond to the new challenges of globalization and perform graduates training in order to facilitate their successful implementation in the new global environment. Jons and Hoyler (2013) say that the role of universities present key actors in the knowledge economy and they also have important economic, social and cultural impacts on regional development, provide graduates and innovations for the national, regional and local economy.

Higher education is not a closed system, but it is a dynamic system that undergoes various changes. The most significant change in the system of higher education was the adoption of the Bologna Declaration. The Bologna process according to Bendl, Voňková and Zvírotský, (2013) is a result of a series of European conferences and political decisions. It is an agreement among European and some non-European countries which aims to increase availability, attractiveness and quality of higher education in Europe. The Bologna process led to the creation of the European Higher Education Area which presents the three cycles of higher education qualification: bachelors, masters and doctoral degrees. Another authors Pino et al. (2017), Straková, J. et al. (2017) say that regarding the implementation of the Bologna reforms in Europe's universities, there is an obvious increase in investment in higher education as a means of responding to the demands of Europe's developing knowledge societies. After all, Europe's strength derives from the conception of higher education as a public responsibility responding to

societal needs, and this requires the commitment to a long-term and sustainable public funding base in the context of the new European Higher Education Area.

In the last twenty years, Kleňhová (2010) say, that is, in the period since the Velvet Revolution, the society in Czech Republic has significantly changed the view of the importance of the education and has also changed the value of education in the labor market. Together with the development of new industries and changes in the labor market structure, new jobs have emerged, requiring a more skilled workforce. As a basic requirement to the work is required at least secondary education, but more and more positions is required a tertiary education. In addition, wages began to vary to a greater extent, depending on the highest level of education attained. Together with the increasing demand for the tertiary education, universities began to open new studies programmes after 1989 and also is created new public higher education institutions, especially on a regional level and began to since 1999 is created private universities. A similar situation took place in Slovak republic. Today the Slovak education system is currently characterized by a very high and also growing recruitment to universities. Kureková (2010) say the countries with a high measure of graduates of universities have greater potential to develop or maintain a high-skilled workforce. However, its real benefit is decreasing as a result of the devaluation of the value of tertiary education, because the quality of tertiary education is decreasing respectively to adapt to the average standards of the admitted students. The growth of the number of university graduates does not produce the desired effect because the structure of graduates does not meet the expectations and needs of the labor market. She also say, that surveys show that employers' demand for graduates from technical, informational and natural study programs exceeds supply over the longer term, although on average nearly a quarter of universities students undertake mathematical, natural or technical education. Nestorová – Dická (2013) say that increasing the level of higher education increases in proportion to the demand for employment in the labor market, which would adequately offer adequate professions. The countries of Central and Eastern Europe struggle with the post socialist transformation of the economy and the creation of adequate employment for their own economically active population. Of course, the economic crisis has made it difficult for graduates of different levels of education to be employed. However, during the prosperity or economic crisis, the number of the unemployed with the low level of education is higher and the number of the unemployed with the tertiary education is lower.

It also confirm Kuzmišin and Kuzmišinová (2010) who say that one of the main problems of regional development in Slovakia is the insufficient level of economic development potential based on the usage of knowledge, to create new

sources of development is insufficient, and they will still be more built on the usage of creativity, education and skills of the workforce.

2 Materials and methods

Higher education is ranked according to the international classification into category ISCED 5, which includes, besides higher education (5A), also includes the level of higher education (5B), and is collectively named tertiary education.

The main objective of this contribution is the analysis of known indicators of tertiary education in Slovakia in the period 2013-2016. The data sources for the individual indicators were obtained from the database "DATAcube". In particular, these are the following indicators for universities: number of faculties, number of teachers, number of full-time students, number of graduates of the daily study, the number of students studying beside employment.

The observations of numbers of various traits in the Slovak universities were statistically evaluated by the next methods: basic statistical characteristics, Pearson correlations, two factor analysis of variance with the fixed factors: Sciences and Years, Multivariate Analysis of Variance (MANOVA) for the four main traits common for all studied universities on the form of sciences, and by Cluster Analysis, (Johnson and Wichern, 2007). For Statistical elaborations was used statistical package InfoStat [5]. We remark that traits measured as numbers are not usually normally statistically distributed, but for our paper we analyse only primary data.

3 Results

Higher education was one of the first areas where a major reform began after 1998. The basis for reform was the concept of further development of higher education in Slovakia for the 21st century, which was approved by the government in August 2000, and which was also confirmed by the Government's Statement in 2002. The legal basis for the reform was Law No. 131/2002 Coll. about Higher Education which the National Council of the Slovak Republic approved on 21 February 2002 and which entered into force on April, 1, 2002. At present time, has Slovak Republic 5.5 million inhabitants and have 35 universities. For comparison in Italy (Abramo et al. 2014), which has nearly 60 million inhabitants have 96 universities. In Italy, the Ministry of Education, Universities and Research (MIUR) recognizes a total of 96 universities as having the authority to issue legally-recognized degrees. Sixty-seven are public and generally multi-disciplinary universities, scattered throughout the nation. Public universities are largely financed by government through non-competitive allocation.

The analysis follows, that changes in the Slovak higher education system had an impact on the structure and the number of universities and faculties. In Table 1 are means and standard deviations of basic characteristics of the universities in Slovak Republic.

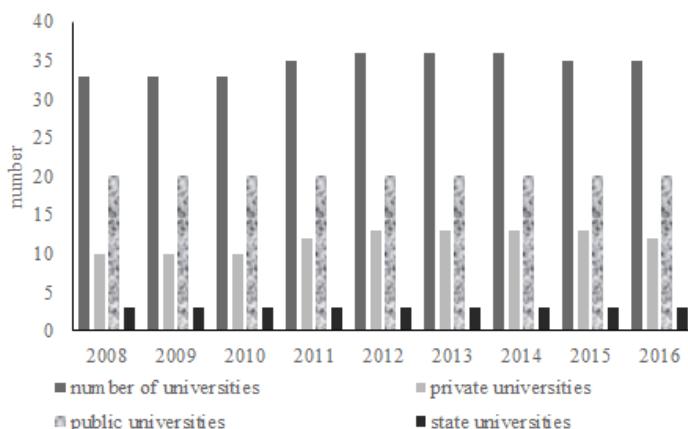
Table 1 Means, M and standard deviations, SD of numbers of students on the universities of Slovak Republic in the period 2013-2016

Universities/high schools	Abbrev.	M	SD
Numbers of universities	NU	35.50	0.58
Numbers of faculties	NFAC	130.25	1.50
Numbers of students	NST	122657	9027.9
No. students of SR	NSTSR	117140	9794.0
No. of students of SR -Females	NSTSFR	69238	6314.0
No. of new students in 1st class	STNEWS	45168	3542.1
No. of graduates	ABS	39083	1509.6
No. of PhD. students (total)	STDР	8676	1119.4
No. of students - employed	STEMP	39596	7720.5
No. of Students- employed females	STEMPF	24629	6395.0
No. of new students in 1st class-employed	NSTEMP1	12962	2336.2
No. of absolvents-employed	ABSTEMP	18811	4055.7
No. of professors and lecturers	PROFLECT	4190	102.51
No. of pedagogical employee total	PEDEMP	10627	126.27

Source: Statistical Office of the Slovak Republic, own processing.

Until 2011, there were 33 universities in Slovakia, the number of universities increased to 35 in 2012 and in 2013 the number of universities increased to 36 as a result of the increase of the number of private universities (picture 1). The changes did not reflect for the state universities, which are only 3 in the Slovak Republic and which manage by ministries.

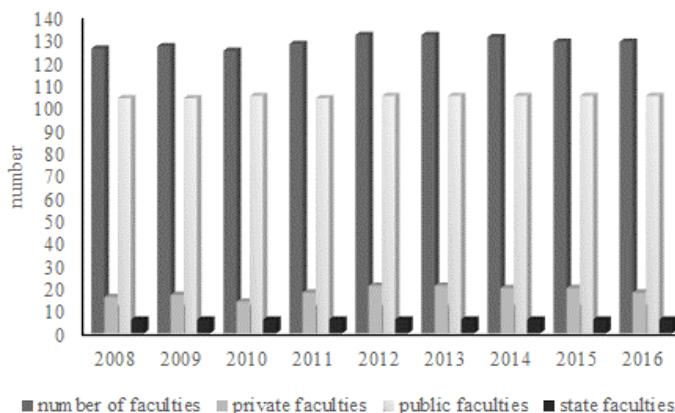
Picture 1 The structure and the number of universities in Slovak Republic in the period 2008-2016



Source: Statistical Office of the Slovak Republic, own processing.

A similar trend can be observed within faculties of universities (picture 2). In the period 2008 - 2012 it is possible to monitor the fluctuating development of the number of faculties of universities. As a result of the increase of faculties at the private universities, the total number of faculties increased in 2009 compared to the previous year. On the contrary, in 2010 there was a decrease of the number of faculties at the private universities, but at the same time the number of faculties at the public universities increased, but in the end total number of faculties decreased. In the next two years increased the number of faculties due to an increased the number of faculties at the public universities and at the private universities. In the period 2013-2015, the number of faculties did not change. The change occurred in 2016, when the number of private faculties decreased. The number of faculties in state universities has not changed throughout the analyzed period.

Picture 2 The structure and the number of faculties of universities in Slovak Republic in the period 2008 -2016



Source: Statistical Office of the Slovak Republic, own processing.

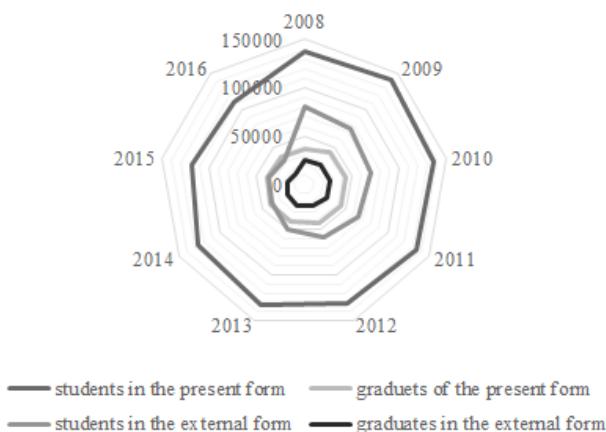
The development of the number of students in the present form are closely linked to the demographic development of the country. This is confirmed the development of the students in the daily form of study (picture 3). In 2009, compared with the previous year, there is a slight increased the number of students in the present form at universities (growth present 2.42%). However, from 2010 to 2012, we are experiencing an annual drop of the students in the present form of study. The number of the students in the present form grew slightly in 2013. From 2013 we can see the annual decrease of students in the present form of study. Compared to 2008 and 2016, the number of students in the present form dropped by 25 255 students, which represents a decrease of 18.39%.

A similar situation is also see in the external form of study. Under the conditions of Slovak universities, external study is paid and from 2013 is also extended from 5 years to 7 years. Bray (2002) in the study say that in Asia education system arguments in favor of fees at the tertiary level are partly based on the substantial private benefits that accrue to tertiary graduates and on the fact that tertiary education has high unit costs that cannot easily be borne solely by governments. Arguments favoring fees are also based on concern for equity. Among tertiary enrollments, students from rich families always form a much larger proportion than students from poor families, and it is widely considered unreasonable to subsidize rich families when that measure will reduce the resources available for

allocation to the poor. It is of course recognized that students from poor families also study in tertiary institutions, and that proportions of such students should be increased. However, since tertiary graduates in general receive greatly enhanced lifetime earnings, it is argued that even the poor can finance their studies through loans that can later be repaid.

This also affected the development of the number of students in the external form of study. Since 2008 their number is decreasing every year and after the amendment of the Law about Higher Education in 2013, which prolonged the external study, the number of students in this form of study dropped compared to the previous year one by 7 795 students, which represents a 13.43% decrease. Compared to 2008 and 2016, the drop of the students in the external study was 48 020 students, which represents 60.15% decrease (picture 3).

Picture 3 Development of the students and the graduates in the present and external form at universities in Slovak Republic in the period 2008-2016



Source: Statistical Office of the Slovak Republic, own processing.

The characterizations of Slovak universities on the form /types of sciences by numbers of various types' students are given by table 2.

Table 2 Means, M and standard deviations, SD of numbers of students on the various universities of Slovak Republic in the period 2013-2016, n = 4

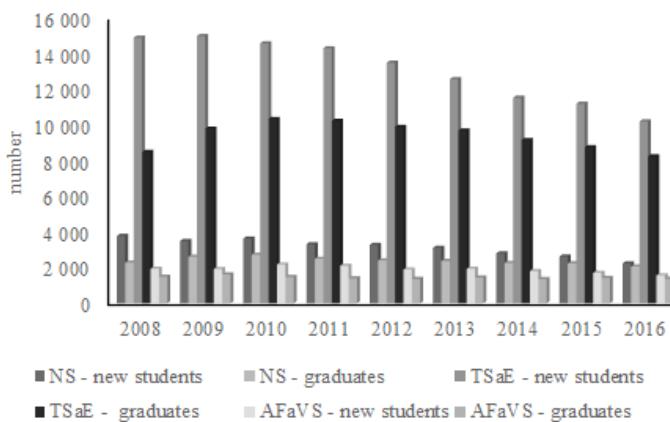
University/Sciences	AbbrSci	AbbrST	M	SD
1 Natural science	1NS	NST	2700.30	363.00
1 Natural science	1NS	ABS	2243.00	129.19
1 Natural science	1NS	NSTEMP	142.50	52.65
1 Natural science	1NS	ABSTEMP	243.25	92.77
2, 3 Technical science and education	2TSaE	NST	11404.00	981.23
2, 3 Technical science and education	2TSaE	ABS	8982.50	614.21
2, 3 Technical science and education	2TSaE	NSTEMP	969.25	206.35
2, 3 Technical science and education	2TSaE	ABSTEMP	1055.50	239.29
4 Agricultural, forestry and veterinary science	3AFaVS	NST	1760.30	156.88
4 Agricultural, forestry and veterinary science	3AFaVS	ABS	1402.30	41.14
4 Agricultural, forestry and veterinary science	3AFaVS	NSTEMP	409.00	90.78
4 Agricultural, forestry and veterinary science	3AFaVS	ABSTEMP	370.25	75.90
5 Medical and pharmaceutical sciences and education	4MaPSaE	NST	3342.30	509.59
5 Medical and pharmaceutical sciences and education	4MaPSaE	ABS	2423.80	207.51
5 Medical and pharmaceutical sciences and education	4MaPSaE	NSTEMP	972.25	81.18
5 Medical and pharmaceutical sciences and education	4MaPSaE	ABSTEMP	1890.50	724.90
6, 7 Humanities science and education	5HSaE	NST	23654.00	1882.00
6, 7 Humanities science and education	5HSaE	ABS	21611.00	1117.20
6, 7 Humanities science and education	5HSaE	NSTEMP	9608.00	1900.60
6, 7 Humanities science and education	5HSaE	ABSTEMP	13832.00	3098.70
8 Science and education about culture and art	6SaECaA	NST	1245.30	72.75
8 Science and education about culture and art	6SaECaA	ABS	1141.00	96.71
8 Science and education about culture and art	6SaECaA	NSTEMP	98.25	36.22

University/Sciences	AbbrSci	AbbrST	M	SD
8 Science and education about culture and art	6SaECaA	ABSTEMP	132.25	39.34
9 Military and Security Sciences and Instruments	7MaSSal	NST	1062.50	158.41
9 Military and Security Sciences and Instruments	7MaSSal	ABS	1128.80	156.40
9 Military and Security Sciences and Instruments	7MaSSal	NSTEMP	762.25	94.26
9 Military and Security Sciences and Instruments	7MaSSal	ABSTEMP	875.75	162.32

Source: Statistical Office of the Slovak Republic, own processing.

Before 1989 in the Slovak Republic had predominantly role agricultural sector, heavy and armament industry. Within the transformation of the economy, Slovak republic started to create the conditions for the industrial production, especially on the automotive industry. Kotulič et al. (2014) say that the economic situation in the sectors and industries in Slovakia is not the same, similarly it is in individual regions, where are recorded significant regional disparities. However, this sector is struggling with a lack of qualified workforce. That is why we analysed the students' interest of technical, scientific and agricultural studies. Every year, most students choose technical focus. Nevertheless in the years 2008 - 2016, with the exception of 2009, their number declined each year (pictures 4). Although the number of students enrolled in the first year fell down, the number of graduates of this type of study increased. A similar trend can be observed in the study of natural sciences. Another trend is related to the study of agricultural, forestry and veterinary sciences. Compared to the other study programs, in 2016 compared to 2008 the drop in enrolled the number of students in the 1st year at the agriculture, forestry and veterinary science was the lowest (371 students, which represent 19.08% decrease). The largest drop of students in the first year study in 2016 compared to 2008 had natural sciences - 1541 students, which represents a 40.67% decrease.

Picture 4 Development of the students and graduates according to the study focus in Slovak Republic in the period 2008-2016



Legend: NS – natural science, TSaE technical sciences and education, AFaVS – agricultural, forestry and veterinary sciences.

Source: Statistical Office of the Slovak Republic, own processing.

In Table 3 are presented Pearson correlations between the numbers of main types of students of analyzed universities in Slovak Republic in the period 2013-2016 years. Correlations were highly statistical significant.

Table 3 Pearson correlations between numbers of students on the universities of Slovak Republic in the period 2013-2016

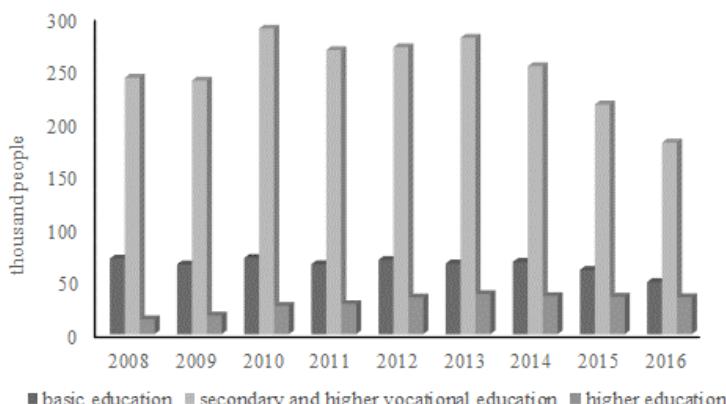
Traits	NST	ABS	NSTEMP	ABSTEMP
NST	1	0.9963**	0.9184**	0.9049**
ABS		1	0.9370**	0.9227**
NSTEMP	** ≤0.01		1	0.9956**
ABSTEMP				1

Source: Statistical Office of the Slovak Republic, own processing.

Shortage of qualified staff and constant struggle for talents along with the retention of most valuable employees belong to the hottest personnel issues for the majority of organizations nowadays (Urbancová and Hudáková, 2017, Várkoly et al. 2012). Higher education gives high prerequisites for employability in the labor market. Nevertheless, it can be observed, that even though this group of

unemployed is the smallest, in the period 2008 - 2013, the number of unemployed with university education increases year-on-year (picture 5). This increase was the result of the economic crisis, which was also reflected in the conditions of Slovakia during this period. At the present time, the majority of students at universities prefer to study humanities science whose employability on the labor market is much smaller compared with the technical sciences. And this may also be one of the reasons for the increasing of the number of the unemployed with university education. The biggest category of unemployed is unemployed with secondary and higher vocational education. It is a bit of a paradox, because many job positions requiring this type of education, employers cannot filled.

Picture 5 Development of unemployment people according to education in Slovak Republic in the period 2008-2016



Source: Statistical Office of the Slovak Republic, own processing.

The results from multivariate statistical analysis (MANOVA – multivariate analysis of variance and Cluster Analysis) of the current situation of total 36 universities in the Slovak Republic in the period between 2013-2016 years (structure of universities by various traits, e.g. numbers of students of various classes, numbers of graduates number of PhD. students, number of employed students and their graduates) showed that there are differences between analysed universities of on the basis of their study focus (Table 4)

Table 4 **The Hotelling test (Bonferroni adjustment test) from two factor multivariate analysis of variance (Sciences, Years), n = 4, Error term based on the Pooled covariance matrix, with df=18, on the significant alpha level = 0.05**

Science	NST	ABS	NSTEMP	ABSEMP	Homogeny groups		
2TSaE	11403,50	8982,50	969,25	1055,50	A		
5HSaE	23653,50	21611,25	9608,00	13832,00		B	
4MaPSaE	3342,25	2423,75	972,25	1890,50			C
1NS	2700,25	2243,00	142,50	243,25			C
7MaSSal	1062,50	1128,75	762,25	875,75			D
6SaECaA	1245,25	1141,00	98,25	132,25			D
3AFaVS	1760,25	1402,25	409,00	370,25			D

Means with a common letter are not significantly different ($p > 0,05$)

Source: Statistical Office of the Slovak Republic, own processing.

The medical/physician and natural universities create the common class, and greater class create military, cultural and agricultural universities. The differences between analysed traits by years are not significant. The Cluster Analysis by method K – means showed on the similar situation.

4 Conclusion

The analysis showed that the number of students at university in both daily and external form is annually decreasing. The reason for the decline is demographic changes in society, but also the fact that a big part of graduates of secondary school are leaving to study abroad. Another reason is the insufficient employment of graduates in the labor market in the focus who they studied. Absent links between universities and practice to resulting in discrepancy in supply (the structure of studies programs and competency profile of graduates) and demand (employers' demands) in the labor market.

The results of multivariate statistical analysis showed that there are differences between analysed universities of on the basis of their study focus. Also the analysis show, that the number of students in the technical and natural science decrease, despite the fact that their application on the labor market is much higher compared with the students of humanities science.

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