

BUILDING AN EFFECTIVE RELATIONSHIP "EDUCATION-SCIENCE-BUSINESS" - STRATEGIC OBJECTIVE AND MEANS FOR INCREASING THE EFFICIENCY OF HIGHER EDUCATION EXPENDITURES

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Abstract: In the modern conditions of knowledge-based economy, higher education has the extremely responsible task of preparing specialists with a high level of theoretical and practical knowledge, skills and competencies in the relevant professional fields. The processes of internationalisation and globalisation in education pose a number of challenges to higher education institutions in Bulgaria, expressed in improving the quality of education and the practical applicability of the acquired knowledge, increasing the applied research of the academic staff and the formation of students' research skills. The article examines the dynamics of key indicators for the higher education system in order to establish objectively formed regularities and trends and to assess the effectiveness of higher education costs.

Keywords: higher education, higher education expenditures, statistical analysis, trend models, structural changes.

JEL: I121, I122, I128, C10, C19.

Introduction

Education is the basis of personal development, building human capital and an important indicator of the progress of society, that is why it

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must be based on traditions and good practices, but also to constantly develop and modernise. In the modern conditions of knowledge-based economy, higher education has the extremely responsible task of preparing specialists with a high level of theoretical and practical knowledge, skills and competencies in the relevant professional fields. With increasing internationalisation and globalisation in all spheres of socio-economic life, the number of Bulgarian students studying at foreign universities is significantly increasing. Thus, the higher education institutions in the country compete not only with each other for the future students, but also with the foreign higher education institutions, which puts before them new requirements for higher quality of education, to increase the practical applicability of the acquired knowledge, skills and competencies, to increase the applied research of the academic staff and to form students' research skills. Higher education institutions in Bulgaria operate in a dynamic, highly competitive and rapidly changing external environment, and this requires measures to improve their position in European education. Achieving a good positioning of Bulgarian universities in this market is a significant long-term goal, requiring not only increasing competition among them in the national education market, but also stimulating the development of joint training programmes and research projects, thus the comparative advantages of the individual higher schools are used and their positions are strengthened and improved. The aim of the study is to track the dynamics of key indicators for higher education in order to identify objectively formed regularities, based on which to model the trend and assess the cost effectiveness of higher education.

The research is based on official information from the NSI through the information system INFOSTAT (NSI), as well as on various scientific publications and strategic documents. The time scope of the study includes the period from 2001 to 2019, as for this period a methodology for monitoring higher education has been used, ensuring comparability of data.

1. Analysis of the number and structure of the trained students by degrees of study and professional fields

Higher education aims to train highly qualified specialists upper secondary education and the development of science and culture according

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to Art. 2 of the Higher Education Act. The role of higher education in the formation of human capital with competitive characteristics puts before it the extremely significant tasks to upgrade the acquired knowledge and skills in secondary education, to provide the necessary skilled workforce for the needs of different sectors of the national economy, to provide opportunities for continuing education and lifelong learning and to support the development of science and research by making them an essential part of the learning process. The number of higher education institutions in Bulgaria for the academic year 2019/2020 is 54, of which the universities and specialised higher education institutions are 50. The total number of students by academic years decreased from 283236 in the academic year 2009/2010 to 220168 in the academic year 2019/2020, as the dynamics by degrees of education is presented in Fig. 1.

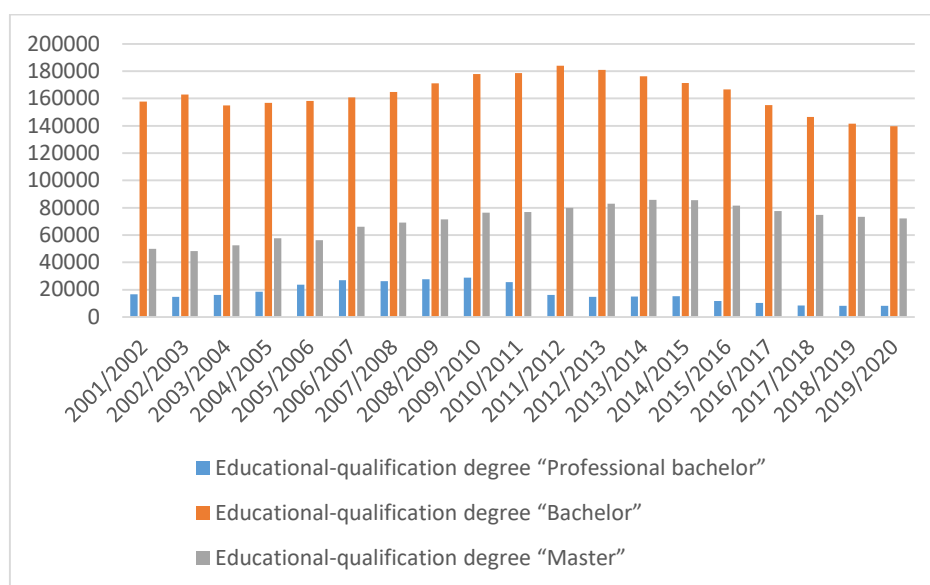


Figure 1. Students by educational-qualification degree

The total number of students increased until the academic year 2009/2010 and reached 283,236 and the average annual increase for the

period 2001-2010 was 2.95%. From the academic year 2010/2011 a process of reducing the total number of students began and this was becoming a lasting trend, caused both by the effects of the financial and economic crisis in the short term and by the decrease in the number of high school graduates and potential prospective students due to the deteriorating demographic situation in the country in the long run. How this decrease in the total number of students in the individual educational-qualification degrees is reflected is an important question from the point of view of highlighting trends and assessing the effects of the policy pursued in the field of higher education in recent years.

In all academic years, the largest number of students in the bachelor's degree, in the academic year 2011/2012 reached 187069, and its increase compared to the academic year 2001/2002 was 16.7% compared to the academic year 2001/2002. From the academic year 2012/2013 until now, their number was constantly decreasing, as the reasons for this were the increase in the number of Bulgarian students at universities abroad, the ongoing demographic processes in the country and the policy pursued by the Ministry of Education and Science to limit the mandatory admission plan in certain professional fields which were considered non-priority. As a result, the number of students in the bachelor's degree in the academic year 2019/2020 is 139711, and its decrease compared to the academic year 2011/2012 is 44358 or by 24.1%.

The number of students in the master's degree in the academic year 2013/2014 was 1.7 times higher than their number in the academic year 2001/2002 - respectively 85,823 and 50025. In the academic year 2019/2020 the number of trained masters decreased by 15.84% compared to the academic year with the highest admission. The number of students enrolled in the professional bachelor's degree was decreasing at the highest rates - from 28,947 during the academic year 2009/2010 to 8223 during the 2019/2020 academic year.

As a result of the modeling of the development trend in the studied indicators, it was found that the number of students in total and by educational-qualification degree has a similar change, expressed in a clear

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initial tendency to increase, then change the direction of change and indicators sustainably decrease. To describe this type of regularity, in principle, the parabola model is the most suitable and this is confirmed by the results of testing the competing models of straight line, parabola, cubic, logarithmic, exponential and power function. Based on the obtained characteristics of the models (Table 1), the parabola is considered to be the most suitable for describing the trends in the considered indicators.

*Table 1.
Models characterising the tendency of change in the number of students by educational-qualification degree*

Trend models	Coefficient of determination R^2	Adjusted coefficient of determination R^2_{adj}	Test adequacy F_{EM}
Professional Bachelor's Degree $\tilde{y} = 13819 + 2399,57t - 155,988t^2$	0.718	0.683	20.362
Bachelor's Degree $\tilde{y} = 140470,5 + 7413,296t - 393,097t^2$	0.724	0.689	20.937
Master's Degree $\tilde{y} = 36507,65 + 6586,538t - 245,477t^2$	0,927	0.918	101.561
Total $\tilde{y} = 190797,5 + 16399,4t - 794,562t^2$	0.865	0.849	51.421

Source: NSI and author's calculations

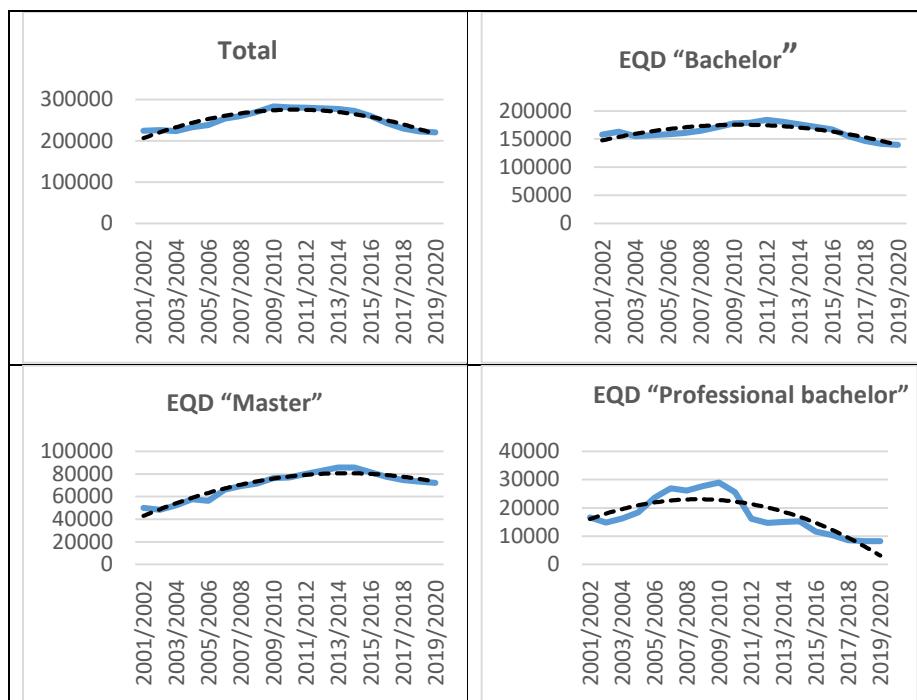


Figure 2. Trend models

The structure of students by **educational-qualification degree**, as well as by professional direction, is a reflection of the country policy in higher education. The increase or decrease of the share of the individual educational-qualification degrees or professional directions leads to a change in the structure of the students. The share of students in the bachelor's degree is the highest and during the period is between 63% and 72.1%, followed by the share of students in the master's degree – between 21.4% and 32.9%. In the structure of students by educational degrees, the share of students in the professional bachelor degree is the lowest, which decreases from 10.6% to 3.7%. It is evident that, the degrees "bachelor" and "master" are determining the structure of students (Fig. 3.)

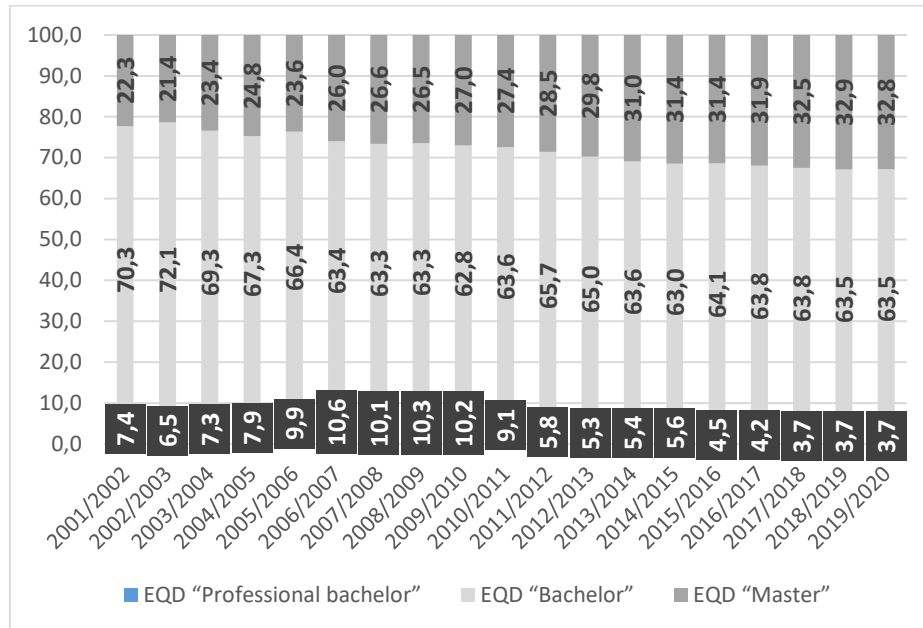


Figure 3. Structure of students by educational-qualification degree

The intensity of the occurred changes in the structure of the students is established by the integral coefficient of structural changes K_S , calculated at a permanent base of the academic year 2001/2002 and at a chain base (Table 2). Given the basic structure of the academic year 2001/2002, the biggest changes in the structure of students by educational-qualification degree occurred in the academic year 2018/2019 - $K_S = 0,128$, but as a whole significant changes occurred after the academic year 2013/2014. The calculated coefficients show a significant change in the structure of students by educational-qualification degrees and distance from the basic structure. This change in the structure is understandable, as the period covers years in which there is a transformation in the policy pursued in higher education and a decrease in the number of those who wish to study at the professional bachelor's degree, the reduced demand for staff with such education and the subsequent reduction of state admission plan in it.

Table 2.
Integral coefficient of structural changes by educational qualification degree

academic years	integral coefficient of structural changes	
	at a constant base	at a chain base
2001/2002	-	-
2002/2003	0.021	0.02
2003/2004	0.015	0.036
2004/2005	0.038	0.024
2005/2006	0.047	0.024
2006/2007	0.084	0.040
2007/2008	0.085	0.004
2008/2009	0.085	0.003
2009/2010	0.091	0.007
2010/2011	0.084	0.015
2011/2012	0.076	0.041
2012/2013	0.092	0.015
2013/2014	0.108	0.018
2014/2015	0.116	0.008
2015/2016	0.110	0.016
2016/2017	0.117	0.007
2017/2018	0.122	0.008
2018/2019	0.128	0.005
2019/2020	0.127	0.001

Source: NSI, INFOSTAT and author's own calculations

The integral coefficient of structural changes with a chain base shows that the changes in the structure of the students by educational-qualification degree are much less pronounced and occur in the academic year 2006/2007 $K_S = 0,04$ and in the academic year 2011/2012 $K_S = 0,041$. The results of the analysis show very slight changes in the structure of students by educational-qualification degree (EQD) compared to the structure of the previous year, which means that there is a relatively stable structure. Therefore, the more distant in time the basis for comparison, the more pronounced are the changes in the structure and vice versa.

The structure of students can be analysed on the basis of the **distribution by narrow areas of education** (Classification of Education Fields of Education and Training - 2008). The available information on the distribution of students is by academic years from 2001/2002 to 2016/2017. The results show that throughout the study period the largest relative share in the bachelor's degree have students in "Economic Science and Administration" – between 26,6% and 21,5%, followed by "Technical Science and Professions" – between 19,2% and 15,1%, "Sciences of Society and Human Behaviour" – between 15,2% and 11,6%, "Teacher training and education science" – between 11,6% and 7,4%, "Humanities" – between 7,5% and 5,5%. In these areas of education there is a tendency to reduce the number of students and, accordingly, to reduce their share in the structure of students in narrow areas of education. The dynamics of the number of students in them does not show a lasting trend, moreover that their distribution is not a direct expression of market demand, but is a result of the size of state quota for each of them, as this is the main way to conduct state policy in the sector and to comply with the needs of staff with higher education in the labour market. Since the changes are caused by administrative decisions, and not so much by changes in the attitudes of prospective students, the derivation of trend models is of little usefulness and is not necessary.

Greater interest and with a higher degree of usefulness for characterising the general picture in higher education is the analysis of the dynamics and structure of the students in the master's degree by narrow fields of education. Here things are on a very different basis, because in most cases the state quota for training is low or non-existent, as a result of which the preferred areas for training are clearly distinguished, as they are in a paid form of training and is financed by students.

To establish the intensity of the changes in the structure of the students in narrow fields of education, the integral coefficient of structural changes K_s is also used, calculated at a permanent base in the academic year 2001/2002 and at a chain base (Table 3).

Table 3.
Integral coefficient of structural changes

Academic years	Narrow fields of education (Classification of Education Fields of Education and Training - 2008)			
	Bachelor's Degree		Master's Degree	
	permanent base	chain base	permanent base	chain base
2001/2002	-	-	-	-
2002/2003	0.032	0.032	0.208	0.113
2003/2004	0.054	0.036	0.291	0.085
2004/2005	0.070	0.027	0.364	0.052
2005/2006	0.084	0.026	0.385	0.093
2006/2007	0.090	0.032	0.429	0.050
2007/2008	0.105	0.027	0.457	0.287
2008/2009	0.124	0.041	0.459	0.031
2009/2010	0.165	0.071	0.417	0.048
2010/2011	0.168	0.015	0.428	0.026
2011/2012	0.144	0.036	0.427	0.047
2012/2013	0.152	0.019	0.433	0.035
2013/2014	0.164	0.020	0.470	0.045
2014/2015	0.169	0.023	0.458	0.069
2015/2016	0.180	0.017	0.452	0.094
2016/2017	0.186	0.023	0.457	0.092

Source: NSI, INFOSTAT and own calculations

The biggest changes in the structure of students in narrow fields of education compared to the basic structure of the academic year 2001/2002 for the bachelor's degree occurred in the academic year 2008/2009 - $K_S = 0,186$, and for the master's degree - in the academic year 2013/2014 $K_S = 0,459$. In general, the changes compared to the basic structure in narrow fields of education are much more pronounced for the master's degree and the obtained coefficients clearly show a tendency to change compared to the basic one from the academic year 2006/2007 until the end of the studied period. It is logical for the changes in the structure by fields of education to be more significant for the master's degree, because in a

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significant part of the specialties in the field of education the number of students does not depend on the determined state admission, but is financed by the students and then in the choice of specialty leading are the opportunities for successful realisation and career development, salaries, prestige, family traditions, etc.

It is known that the education system is conservative and changes in it are slow, so the structural changes are more pronounced when the structure adopted as a base is more distant in time, and when considered in relation to the structure of the previous year, the changes are minimal. The values of the integral coefficient of structural changes with a chain basis show that the changes in the structure of students in narrow fields of education are much less pronounced for the bachelor's degree - the coefficient is between 0.01 and 0.07, while for the master's degree the coefficient is between 0.03 and 0.287. The results show that there is a relatively constant structure of students in the fields of science in the bachelor's degree and a more dynamic structure in the master's degree.

Another aspect of the study of the number of students is according to their distribution among higher education institutions by **form of ownership**. During the study period, between 80% and 86% of the students enrolled in the bachelor's degree are in public universities. In the academic year 2001/2002 the number of students in the bachelor's degree was 135717, and in the private universities it was 22008. During the period, the largest number of trained bachelors was in the academic year 2011/2012 - 34720, but in the following years their number decreased and in the academic year 2019/2020 it was 19609.

During the analysed period, there was a tendency to increase the number of students in the master's degree in public universities from 46462 for the academic year 2001/2002 to 75216 for the academic year 2014/2015, as in the following academic years it decreased to 65170 for the academic year 2019/2020. The trend is similar in the change of the number of students in the master's degree in private universities, as the difference is in the scale - initially it increased from 3563 during the academic year 2001/2002 to 11532 in the academic year 2013/2014, after which it decreased and in the academic year 2019/2020 it was 7054. The analysis clearly outlines the regularity of development in the change of the number of students according

to the educational-qualification degree and the ownership of the university and it is best described by an equation of a parabola. The relative share of students enrolled in public universities in individual years is between 77% and 87%, and of students enrolled in private universities it is between 13% and 23% (Table 4). The relative share of students in bachelor's degree in public universities is between 80% and 87%, as despite the changes during the years, it is preferred due to the possibility for 4-year training, financed by the country. There was a tendency to increase the relative share of students in the master's degree in private universities - from 7.7% in the academic year 2001/2002 to 14.3% in the academic year 2012/2014, and despite its decrease in the next years to 11.2% it was a sign of increasing interest in master's programmes in private universities.

Table 4.
Relative share of students in higher education institutions according to the form of ownership

Academic years	Relative share of students (%)					
	Total		Bachelor's Degree		Master's Degree	
	public	private	public	private	public	private
2001/2002	86.9	13.1	85.9	14.1	92.3	7.7
2002/2003	86.0	14.0	85.0	15.0	90.7	9.3
2003/2004	85.0	15.0	83.9	16.1	90.9	9.1
2004/2005	82.9	17.1	82.3	17.7	90.1	9.9
2005/2006	80.6	19.4	81.8	18.2	90.0	10.0
2006/2007	79.6	20.4	81.7	18.3	92.0	8.0
2007/2008	78.5	21.5	80.6	19.4	91.4	8.6
2008/2009	78.0	22.0	80.9	19.1	90.2	9.8
2009/2010	77.3	22.7	80.5	19.5	88.2	11.8
2010/2011	79.2	20.8	82.5	17.5	87.4	12.6
2011/2012	81.0	19.0	81.1	18.9	86.7	13.3
2012/2013	81.9	18.1	82.8	17.2	85.7	14.3
2013/2014	83.2	16.8	84.6	15.4	85.8	14.2
2014/2015	84.2	15.8	85.6	14.4	87.0	13.0
2015/2016	85.2	14.8	85.3	14.7	87.0	13.0
2016/2017	85.9	14.1	85.9	14.1	87.1	12.9
2017/2018	86.6	13.4	86.3	13.7	87.7	12.3
2018/2019	87.0	13.0	86.5	13.5	88.4	11.6

Source: NSI and author's calculations

The main reason for the smaller number and share of students enrolled in private universities is the amount of tuition fees and that it is much higher than the fees in public universities for training in the bachelor's degree. In the training in the master's degree, financed by the students, the difference between the fees in the public and private higher schools is not so big, and two or three semesters are paid, and then besides the financial factor, many other factors become important: the offered portfolio of master's programmes; the educational content of the included disciplines; the inclusion of proven experts from the practice in parts of the educational process; the offered forms of education; the use of ICT achievements in education; the image of higher education institution among employers; the realisation of graduates; the issuance of internationally recognised certificates, etc.

2. Analysis of the higher education expenditures

The financing of higher education is an important factor for its development and is closely related to the principles of financing and the criteria for determining the subsidy of public higher education institutions, because through it the state policy in this area is conducted (Ministry of Finance). At the same time, it is necessary to study the efficiency of the expenditures, the final result and the reasons for the insufficient results. During the analysed period, the expenditures for higher education represent between 29% and 34% of the total expenditures for education in Bulgaria.

During the period there are no significant changes in the structure of educational expenditures - there is a relatively stable structure of expenditures by levels of education. Compared to the basic structure of education expenditures since 2001, the largest changes in the structure were found in 2013 - $K_S = 0,091$, i.e. as the distance in time between the compared structures increases, the differences between them also increase. The results of the analysis of the changes in the structure of expenditures compared to the structure of the previous year show that the largest

structural changes were registered in 2010 - $K_S = 0,074$ and then in the academic year 2014/2015 - $K_S = 0,051$.

The analysis of the dynamics of the expenditures for higher education shows a clear tendency to increase, which is described precisely enough by a linear model of the type $\tilde{y} = 426543 + 54101t$, which is adequate and with a coefficient of determination of 0,9022. The expenditures of higher education per student also show an increasing trend, but the rates at which this indicator increases are higher and are presented with a model of exponential function of the type $\tilde{y} = 2131,8e^{0,0568t}$ and a coefficient of determination of 0.9066. The comparison of the two models shows that there is an intensive model of increasing the higher education expenditures, associated with an increase in the financial resources provided, but with a decrease in the number of students, as this approach is related to the implementation of the current strategy for higher education.

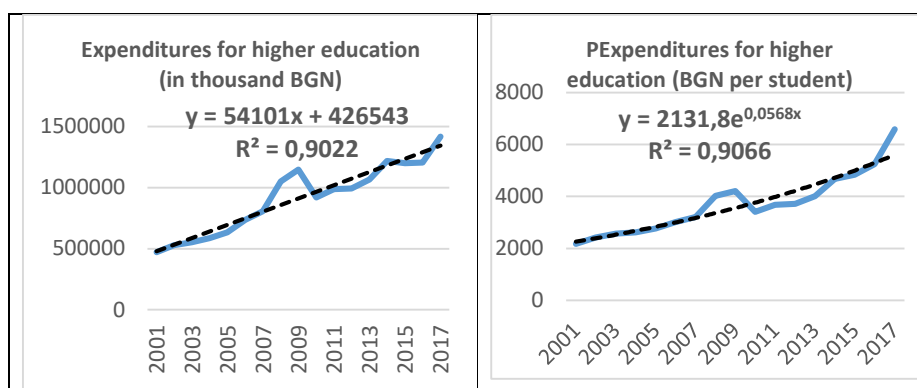


Figure 4. Trend models

In addition to the above, higher education policy must be in unison with the objectives of the Europe 2020 strategy for smart growth and the knowledge-based economy (European Commission, 2020). Achieving these goals is impossible without the simultaneous implementation of policies to reduce the relative share of early school leavers and to increase the share

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of people with higher education, especially in the age groups up to 40 years. The key indicator is the relative share of the population aged 30-34 with completed higher education, which in 2007 for Bulgaria was 26% and increased to 33.7% in 2018, as the average increase for the period was by 0.7 percentage points. A steady upward trend is established, which is best described by a linear trend model, and based on it it is found that while maintaining the development model until 2020, the share of 30-34 year-olds with higher education will not reach 35% and the set national target (36%) will not be met. The implementation of this indicator is important because by increasing the share of people with higher education, the quality of human capital increases and preconditions for reducing imbalances in the labour market are created. Such an approach is the basis of priority goal 7. Building an effective relationship "education-science-business" of the Strategy for Development of Higher Education 2030 (MES, 2020). Achieving this goal requires an integrated approach involving all stakeholders such as:

- establishment of lifelong learning centers at higher education institutions;
- to reduce the share of young people working in a position that does not require higher education, but to increase the share of employees in the specialty they have graduated from;
- constant updating of the educational content of the disciplines in accordance with the latest achievements of science and technology;
- improving the status and pay of academic staff in order to attract outstanding students to participate in research and further training in doctoral studies and teaching work, as good opportunities for career development and to reduce "brain drain";
- improving the cooperation between universities and business, as the main user of staff and realising its real involvement in updating the curricula and including more disciplines of a practical-applied nature;

- development of joint projects between universities and representatives of business and branch organisations, ensuring the application of scientific achievements in practice;
- to popularise the results of scientific research and to turn a significant part of them into innovations in practice.

Conclusion

In conclusion, public spending on the higher education system has largely achieved the objectives for which it was allocated, but overall the results can be further improved because for many years the focus has been on financing secondary education and its reform, but the need to engage the state in solutions and significant financial support for the reforms in higher education in order to achieve the desired results – competitive educational product, opening universities to cooperation and developing joint programmes with Bulgarian and foreign universities, building working and effective relations with business representatives and all users of staff, improving the quality of education and research, stimulating the participation of the academic community and business in joint actions and work on projects of practical and applied nature, building a functioning system for students' access to practical training, internships and part-time work in the specialty, for the transformation of higher schools into regional and national centers, contributing to local and national economic development.

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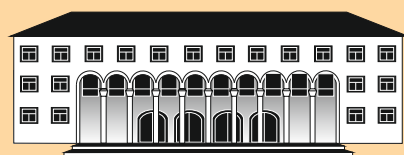
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ISSN 0861 - 6604

BUSINESS management



1/2021

PUBLISHED BY
D. A. TSENOV ACADEMY
OF ECONOMICS - SVISHTOV

BUSINESS management 1/2021

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Submitted for publishing on 19.03.2021, published on 23.03.2021, format 70x100/16, total print 40

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BUSINESS
management

D. A. Tsenov Academy
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Year XXXI * Book 1, 2021

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