# Higher education as factor for economic development: Lithuanian case

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**Abstract**

Authors of the article aim to show what role higher education play in economic development. They argue that modernization and transformation of the economy mostly depend on knowledge-based economy. Smart, sustainable, and inclusive economic growth are based and strongly related to higher education. When analyzing higher education, the share of the population with tertiary education (in the total population aged 15–64 years) was chosen to study. For the evaluation of these relations in Lithuania and the EU-28 the period of 2005–2013 was analyzed, and the year 2005 was chosen as the base year. The research results and calculated Pearson correlation coefficient revealed that the share of the population with tertiary education (in the total population aged 15–64 years) has a significant impact on the share of human resources in science and technology, research and development expenditure and real adjusted gross disposable income of households per capita in Lithuania and most other countries of the EU-28..

Keywords: Economic development, economic modernization, higher education, research and development expenditure;

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## 1. Introduction

On a global level, the growth of the economy is slowing down and due to the demographic aging, the workforce is decreasing too, so the capacity, education of workers, the development of innovations and productivity is crucial. One of the methods to solve this situation is to increase the education, also including higher education. According to the European Centre for the Development of Vocational Training (CEDEFOR) data, the need for higher education in the EU-28 will rise: The demand for workplaces, requiring higher education, will increase from 29% in the year 2010–34% in the year 2020. It is estimated that the demand for unqualified workforce will decrease at the same time from 23% to 18% (Rethinking Education: Investing in Skills for Better Socio-economic Outcomes, 2012, p. 3). One of the most important methods to solve the problem of Lithuanian higher education, as a factor of economic development, is (Leichteris and Stumbryte, 2008, p. 2) to strengthen the cooperation of science and industry. On the other hand, smart growth has to be based on knowledge and innovation. The knowledge and skills of employees depend on lifelong education and learning. Only one out of three 25–34 years old in Europe have a university degree in comparison with 40% in the USA and 50% in Japan. Expenditure of research and development (R&D) in Europe do not go above 2%, in the USA are 2.6%, in Japan 3.4% (Europe 2020, 2010).

Until 2020, the main goal Europe cooperation should be the support to further improve education and learning systems in member states, by which it is, seeks to maintain (New Priorities for European Cooperation in Education and Training, 2015):

• Self-realization and satisfaction of social and professional needs for all;
• To ensure sustainable economic growth and the opportunity to get employed, developing democratic values, social cohesion, active citizenship, and dialog of cultures.

The economic development of each country is related to the modernization of the country's economy. The modernization mostly depends on the knowledge-based economy and sustainable development. In Lithuania, the key element of economic development is people. This means that the future of economic development more and more depends on education and research. The problem of this paper is defined by the following questions: Does higher education and its increasing quality have an impact on a country's (R&D) expenditure, innovation level, and economic development? If so, what must be done for further country economic development?

### 1.1. Purpose of study

The aim of this paper is to show what role higher education plays on human resources in science and technology and R&D in knowledge-based economy, on economic development of the country, including real adjusted gross disposable income (RAGDI) of households per capita. To examine the impact of higher education on economic development, the changes of education levels are described and compared in all of the 28 European Union Member States (EU-28); the economic modernization is characterized in Lithuania as a smart, sustainable, and inclusive growth. Innovations as the primary driving force of successful economic development on micro- and macro-economic levels are characterized.

Education, including higher education, increases the competitiveness both on the microeconomic and macroeconomic levels and encourages economic growth. Better skills lead to the growth of productivity on all levels (microeconomic, regional, and macroeconomic). In the long run, better skills perfection creates innovations and the growth of the economy. Higher education development is happening on a worldwide scale, the internationalization and cooperation of higher education establishments are increasing (European Higher Education in the World, 2013).

Worldwide events, scientific conferences show that in economic growth, human capital is given a lot of attention. Studies show that education, especially higher, has an important role in creating new knowledge, modernizing economic activity, and creating workplaces and expanding entrepreneurship (Melnikas, 2011; 2014; Ciburiene, 2014). For the EU-28, it is crucial to (1) ensure adult participation in the learning process their whole lives and (2) increase the number of people with higher education. Taking into account the rising need of people with higher education and agreeing that professional education and teaching are equally important, the percent of 30–34 years old with higher education should be no <40% until the year 2020. In scientific literature (Permani, 2009), education is evaluated as a mechanism to store technological knowledge, as an accelerator of technological progress (Jones & Vollrath, 2013) and increase the effectiveness and productivity. Kwack and Lee (2006) characterized education as, first, direct impact on economic growth, second, complementarily with other factors, for example, the openness of the country economy. Scientific literature describes a third way: Indirect effects on economic growth, when education level in the country increases due to implementation other factors of economic development, for example, expansion of foreign direct investment (Narayan & Smyth, 2006). Mingat and Tan (1996) determined that the impact of primary and secondary education is greater in low- and middle-income countries, and the impact of higher education is more significant in high-income countries. Permani (2009) concludes that when the economy develops into a higher development stage, then higher education level is more important than primary or secondary education. The benefit from education, including higher education, can be analyzed according to different levels (The Returns to Various Types of Investment in Education and Training, 2005): (1) At an individual level; (2) at firm level; and (3) the society level, which include both economic growth and non-economic benefits, such as greater social cohesion in different regions of the country and among separate counties, lower crime, better health care services, and other. Education has a substantial effect on labor market results, such as earnings (Riddell & Song, 2012). Scientific researches (The Returns to Various Types of Investment in Education and Training, 2005; Yin-ying and Ya-xiang, 2013; Hadman, 2013) showed that regions with higher productivity and income can be accelerated by the concentration of better-educated labor force, including higher education and transnational higher education. The purpose of knowledge and higher education is to create innovations and the future, both the human capital, involved in science and technology, both the amount of R&D expenditure. On the other hand, since the beginning of the 21st century, the definition of knowledge paradigm as posted by Sveiby (1999) stated that the processes happening in the economy are the consequences of using knowledge. This means that the changes happening in various science disciplines: Economy, sociology, mathematics, and engineering are constantly forming new attitudes. Nowadays, multi-thematic and multidiscipline are encouraged and decide the innovations and modernize the economic activity of a country. Only the high growth of sustainable productivity could reduce the RAGDI of household's per capita gap among Lithuania and the EU-28 average. RAGDI of households per capita in Lithuania in 2013 consisted of 73% from the average level of the EU-28, when at the same time in 2005 consisted only 56%. In this respect, it is necessary to better utilize the main existing resources of the country such as human resources and to stimulate R&D and innovations in all spheres of activity. The demand for highly qualified labor force shows the link between education, knowledge, and economic development.

## 2. Method

Such general research methods were used to analyze higher education as a factor for economic development: Logical and comparative analysis and generalization of scientific literature, synthesis. The article is based on scientific literature, statistical (Lithuanian Department of Statistics, Ministry of

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Education and Science of the Republic of Lithuania, Eurostat data) both absolute and relative data and mathematical, statistical analysis. When analyzing higher education, the share of the population with tertiary education (in the total population aged 15–64 years) was chosen to study. The correlation method was used to characterize the impact of it on the human resources, R&D expenditure and RAGDI of households per capita. For the evaluation of these relations in Lithuania and in the EU-28 the period of 2005–2013 was analyzed and the year 2005 was chosen as the base year.

Correlation analysis was done to check the relationship between the share of the population with tertiary education (in the total population aged 15–64 years) and human resources in science and technology, R&D expenditure and RAGDI of household per capita. Pearson correlation coefficient ($r_{xy}$) is calculated by the formula (Boguslauskas, 2004):

Where X and Y are indicators, which define correlation, and are the means of X and Y, $r_{xy}$ is the correlation coefficient between X and Y. Pearson correlation coefficient is a measure of the strength of the linear relationship between two variables and can get the values from −1 to 1. Such interpretations of the correlation coefficient are possible (Boguslauskas et al., 2009):
- From 0.9 to 1.0 (or from −0.9 to −1.0) – very strong positive (negative) linear correlation;
- From 0.7 to 0.9 (or from −0.7 to −0.9) – strong positive (negative) linear correlation;
- From 0.5 to 0.7 (or from −0.5 to −0.7) – average positive (negative) linear correlation;
- From 0.3 to 0.5 (or from −0.3 to −0.5) – weak positive (negative) linear correlation;
- From 0.0 to 0.3 (or from 0.0 to −0.3) – very weak positive (negative) linear correlation.

To test the significance of the linear relationship between variables, the following hypothesis will be tested: H0: $r_{xy}=0$ and H1: $r_{xy} \neq 0$. The hypothesis is tested by calculating student (t) statistics and the probability for student's t-distribution. The calculated probability is compared with the significance level that is chosen at 0.05. It indicates a 5% risk that the null hypothesis will be rejected when it is correct. The significance of Pearson correlation coefficient is made according to the rule: If the probability is <0.05, then a significant linear relationship between variables exist and if probability is more than 0.05, then significant linear relationship between variables does not exist. All the calculations are made with MS Excel and statistical software NCSS.

## 3. Results

Knowledge-based, including higher education, economy, and innovation, is the primary driving forces for successful country economic development, including their competitiveness under the current conditions of European economic integration and globalization. Human resources in science and technology, R&D expenditures are directly related with education, employment, open economy, small and medium business (SME) , and economic development. As a rule, small states are focusing on education and its quality, on the one hand, and on SME, on the other hand, so that innovation policy could permeate both of these sectors of public activity. The results of correlation analysis among the share of the population with tertiary education (in the total population aged 15–64 years) and human resources in science and technology, R&D expenditure and RAGDI of household per capita are presented in Table 1.

**Table 1**. Correlation among the share of population with tertiary education (in the total population aged 15–64 years) and human resources in science and technology, R&D expenditure and RAGDI of households per capita

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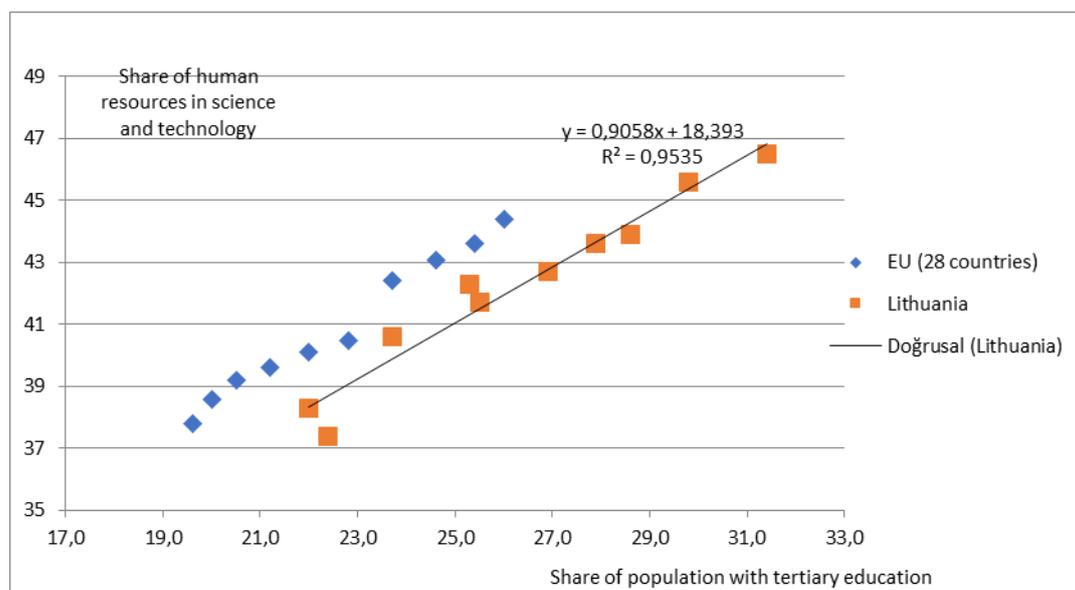| | Correlation between the share of population with tertiary education (in the total population aged 15–64 years) and | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | Human resources in science and technology | | R&D expenditure | | RAGDI of households per capita | |
| | Correlation coefficient | Probability | Correlation coefficient | Probability | Correlation coefficient | Probability |
| EU-28 | 0.9908 | 0.0000 | 0.9643 | 0.0000 | 0.9144 | 0.0002 |
| Belgium | 0.9854 | 0.0000 | 0.9697 | 0.0000 | 0.9582 | 0.0000 |
| Bulgaria | 0.9079 | 0.0003 | 0.9140 | 0.0002 | 0.9448 | 0.0000 |
| Czech Republic | 0.5138 | 0.1287 | 0.9495 | 0.0000 | 0.8999 | 0.0004 |
| Denmark | 0.6934 | 0.0262 | −0.0329 | 0.9282 | 0.1544 | 0.6703 |
| Germany | 0.8810 | 0.0008 | 0.9622 | 0.0000 | 0.9330 | 0.0001 |
| Estonia | 0.9643 | 0.0000 | 0.8333 | 0.0027 | 0.8068 | 0.0048 |
| Ireland | 0.9828 | 0.0000 | 0.8906 | 0.0005 | −0.0874 | 0.8102 |
| Greece | 0.9929 | 0.0000 | 0.8802 | 0.0008 | −0.8478 | 0.0019 |
| Spain | 0.9215 | 0.0002 | 0.3824 | 0.2754 | 0.2097 | 0.5609 |
| France | 0.9552 | 0.0000 | 0.9097 | 0.0003 | 0.9019 | 0.0004 |
| Croatia | 0.9611 | 0.0000 | −0.3860 | 0.2706 | 0.8487 | 0.0019 |
| Italy | 0.4283 | 0.2169 | 0.9660 | 0.0000 | 0.5712 | 0.0845 |
| Cyprus | 0.9905 | 0.0000 | 0.8198 | 0.0037 | 0.3304 | 0.3511 |
| Latvia | 0.8880 | 0.0006 | 0.3342 | 0.3453 | 0.4099 | 0.2394 |
| Lithuania | 0.9765 | 0.0000 | 0.8526 | 0.0017 | 0.9509 | 0.0000 |
| Luxembourg | 0.9867 | 0.0000 | −0.7953 | 0.0059 | 0.5324 | 0.1131 |
| Hungary | 0.9836 | 0.0000 | 0.9622 | 0.0000 | 0.9167 | 0.0002 |

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| Malta | 0.9770 | 0.0000 | 0.9196 | 0.0002 | - | - |
|---|---|---|---|---|---|---|
| Netherlands | 0.9003 | 0.0004 | 0.4647 | 0.1760 | 0.4977 | 0.1432 |
| Austria | 0.9484 | 0.0000 | 0.9126 | 0.0002 | 0.7322 | 0.0160 |
| Poland | 0.9948 | 0.0000 | 0.9632 | 0.0000 | 0.9931 | 0.0000 |
| Portugal | 0.9954 | 0.0000 | 0.5521 | 0.0980 | 0.7549 | 0.0116 |
| Romania | 0.9676 | 0.0000 | −0.1585 | 0.6618 | 0.8650 | 0.0012 |
| Slovenia | 0.9778 | 0.0000 | 0.9575 | 0.0000 | 0.7091 | 0.0217 |
| Slovakia | 0.7248 | 0.0177 | 0.9514 | 0.0000 | 0.8878 | 0.0006 |
| Finland | 0.9854 | 0.0000 | 0.2115 | 0.5574 | 0.9769 | 0.0000 |
| Sweden | 0.9937 | 0.0000 | −0.5406 | 0.1066 | 0.9123 | 0.0002 |
| United Kingdom | 0.9655 | 0.0000 | −0.1947 | 0.5900 | −0.6211 | 0.0553 |

Source: Author's calculations based on Eurostat data. RAGDI: Real adjusted gross disposable income, R&D: Research and development

Correlation between the share of population with tertiary education (in the total population aged 15–64 years) and human resources in science and technology. Correlation between the share of population with tertiary education and human resources in science and technology is very strong and significant in most countries of the EU-28 as both indicators are constantly growing. Two-thirds of the countries have a correlation coefficient greater than 0.95. The medium and not significant correlation is typical only for Italy (0.43) and the Czech Republic (0.51). It means that the higher share of the population with tertiary education increase the human resources in science and technology.

Lithuania does not differ from the largest part of the EU-28. The correlation between analyzed indicators is 0.98 here. However, it can be seen that the part of human resources in science and technology is lower in Lithuania than the average of the EU-28 at a certain level of the population with tertiary education. Moreover, recently, the share of the population with tertiary education in Lithuania is greater than the average of the EU-28 (Figure 1).

**Figure 1.** Scatter plot of the share of the population with tertiary education and human resources in science and technology

in Lithuania and the EU-28

The relationship between the share of the population with tertiary education and human resources in science and technology in Lithuania can be described by a linear regression model:
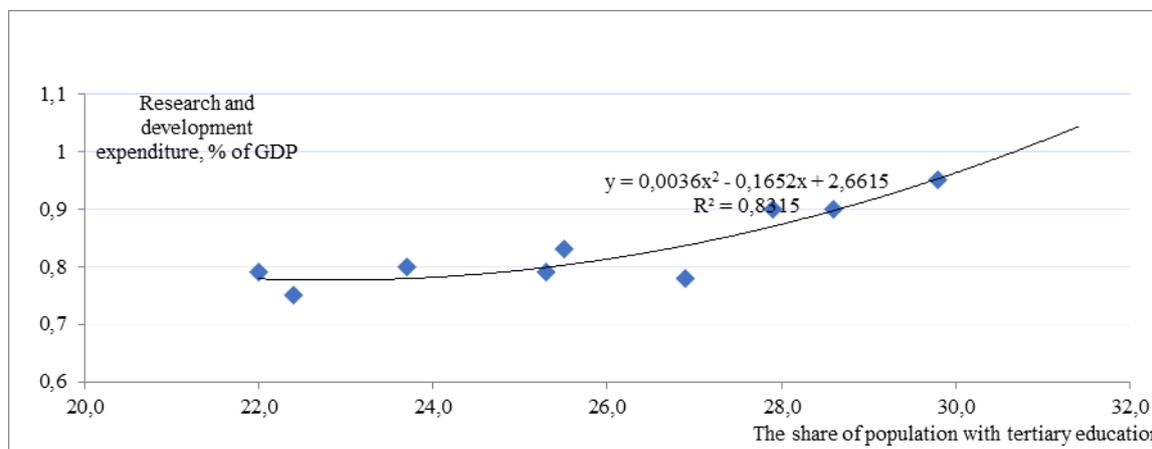
y = 0.9058x + 18.393,

There x is the share of the population with tertiary education in total population aged 15–64 years and y is the share of human resources in science and technology. The coefficient of determination of that model is 0.95, i.e., model precision is about 95%.

Correlation between the share of the population with tertiary education (in the total population aged 15–64 years) and R&D expenditure. The variation of the results of correlation analysis between the share of population with tertiary education (in the total population aged 15–64 years) and R&D expenditure is greater than the results presented in the previous section. Almost 61% of the EU-28 countries (17 of 28) have a positive and significant correlation between these indicators. It means that the higher share of the population with tertiary education is led by the higher expenditure for R&D in most countries.

Negative correlation between the share of population with tertiary education (in the total population aged 15–64 years) and R&D expenditure is typical for Denmark (−0.03), Croatia (−0.39), Romania (−0.16), the United Kingdom (−0.19), Sweden (−0.54), and Luxembourg (−0.80), as the expenditure for R&D is volatile or even decreasing during the past 10 years. The correlation coefficient for Luxembourg is significant as the expenditure for R&D decreased for 27% within a decade in this country.

The R&D expenditure during the analyzed period of 2005–2013 has grown by 126.7% in Lithuania, but in the year 2013 has achieved only 47.3% of the average level of the EU-28. The growth of R&D in Lithuania caused the positive correlation between the share of the population with tertiary education and the R&D expenditure (0.85). Nevertheless, the turnover from the innovation in Lithuania in the

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year 2012 was only 56.7% from the level of 2004, when in the EU-28 this indicator was 86.3%. Total turnover from innovations in Lithuania in 2012 was less by 216.4% in comparison with the average indicator of the EU-28. The relationship between these indicators is given in Figure 2.



**Figure 2.** Scatter plot of the share of the population with tertiary education in total population aged 15–64 years and the

research and development expenditure in Lithuania with regression curve

The relationship between these indicators can be best defined by the second-order polynomial function:

y = 0.0036x2–0.1652x + 2.6615,

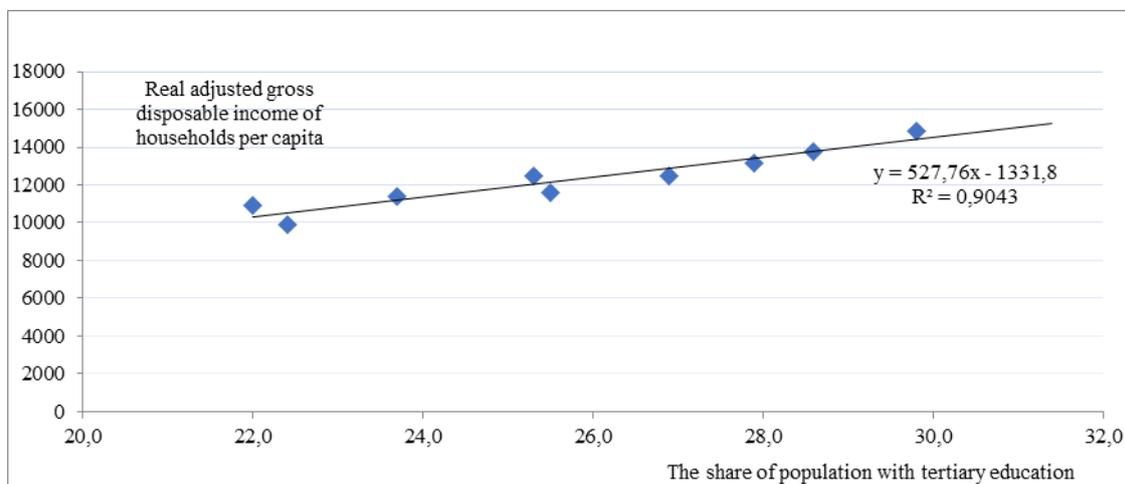There x is the share of the population with tertiary education in total population aged 15–64 and y is the R&D expenditure. The coefficient of determination of that model is 0.83.

The calculation shows that the greater share of the population with tertiary education helps to encourage increasing levels of R&D expenditure and provide a stimulus to the country's competitiveness.

Correlation between the share of the population with tertiary education (in the total population aged 15–64 years) and the RAGDI of households per capita. The correlation between the share of population with tertiary education (in the total population aged 15–64 years) and the RAGDI of households per capita also differs among countries. The correlation coefficient varies from −0.85 in Greece to 0.99 in Poland but is positive in most countries. It means that tertiary education increases the RAGDI of households per capita.

Only three countries, i.e., Greece (correlation coefficient is −0.85 and strong negative), the United Kingdom (correlation coefficient is −0.62, but average negative), and Ireland (correlation coefficient is −0.09, but very weak negative) fail to increase the RAGDI of households per capita when the share of population with tertiary education is growing. This was caused by the prolonged crisis. Almost all of the EU-28 countries (except Slovakia, Poland, and Denmark) have experienced the decrease of RAGDI of households per capita in the year 2008 or 2009, but it rose again later. Contrary to these, the decrease of RAGDI of households per capita has protracted in Ireland and the United Kingdom, while it still strongly declines in Greece.

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The correlation between the share of the population with tertiary education and the RAGDI of households per capita in Lithuania is positive and very strong linear (0.95). The relationship between them is shown in Figure 3.



**Figure 3.** Scatter plot of the share of the population with tertiary education in total population aged 15–64 years and the real

adjusted gross disposable income of households per capita in Lithuania with regression curve

The relationship between these indicators can be defined by a simple linear model:

y = 527.76x–1331.8,

There x is the share of the population with tertiary education in total population aged 15–64 years and y is the RAGDI of households per capita. The precision of that model is 90%.

Hence, it is obvious that the growth of the share of population with tertiary education increases the RAGDI of households per capita in Lithuania. RAGDI of household per capita in Lithuania during the period of 2005–2013 has increased by 150.4%, when in average in the EU-28 – by 115.3%. The share of RAGDI of households per capita in Lithuania in the year 2013 was 73% of the average RAGDI of households per capita in the EU-28.

## 4. Conclusion

Smart, sustainable, and inclusive economic development are the main tasks and goals of economic development both in Lithuania, both in the EU-28. Smart development is based on knowledge and innovation; sustainable – on economical use of resources and competitiveness and inclusive – on a high level of employment and social cohesion among regions and countries. All three of these priorities of economic development are related to education. The processes of all these economic transformations and modernizations are based on education, including higher education.

The analysis of scientific literature shows that higher education has a variety of forms and criteriuos, described in the scientific literature, through witch influence not only economic growth but also social cohesion, better health-care services, tolerance, and nondiscrimination and other. Higher education has a significant influence on labor market outcomes, such as employment level, RAGDI of households per capita, longevity, and other opportunities for people.

Analyzing the higher education the share of population with tertiary education (in total population aged 15–64 years) was chosen to be studied to check the relationship among the share of the population with tertiary education (in total population aged 15–64 years) and human resources in science and technology, R&D expenditure and RAGDI of household per capita, the correlation analysis was done.

The calculations revealed that the growth of the share of the population with tertiary education (in the total population aged 15–64 years) increases the human resources in science and technology in Lithuania and the EU-28. Correlation between the share of the population with tertiary education and human resources in science and technology is very strong and significant in most countries of the EU-28 as both of the indicators are constantly growing. The growth of the share of human resources in science and technology in Lithuania and the EU-28 has caused a very strong positive correlation between the share of the population with tertiary education and the human resources in science and technology, accordingly, 0.98 and 0.99.

The determined correlation coefficient has shown that the greater share of the population with tertiary education (in the total population aged 15–64 years) helps to encourage increasing levels of R&D expenditure and provide a stimulus to the country's competitiveness. The R&D expenditure during analyzed period of 2005–2013 has grown by 126.7% in Lithuania, but in the year 2013, it achieved only 47.3% of the average level of the EU-28. The growth of R&D in Lithuania caused a strong positive correlation between the share of the population with tertiary education and the R&D expenditure (0.85). This relation in the EU-28 is very strong positive (0.96).

The growth of the share of the population with tertiary education (in the total population aged 15–64 years) increases the RAGDI of households per capita in Lithuania even more than on average in the EU-28.

Summarizing the results of the research, it can be stated that the share of population with tertiary education (in total population aged 15–64 years) has a significant impact on the share of human resources in science and technology, R&D expenditure and RAGDI of households per capita in Lithuania and most other countries of the EU-28.

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