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# HUMAN CAPITAL IN MODERN ECONOMY – IMPORTANCE, METHODS OF MEASUREMENT AND INVESTMENTS

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K e y w o r d s: human capital, methods of measurement, outlays on education.

A b s t r a c t

The paper aims at presenting human capital in the economy, drawing attention to the multitude of determinants of that factor and the investments in human capital. To achieve the intended objectives the statistics and studies by international organizations, data from the statistical yearbooks of the CSO, scientific publications and websites were used. Significant differences between countries in the funds allocated to financing the activities involved in human capital improvement are observed. In most cases investments in education and in research and development is mentioned. Poland spends USD 5.500 per year per 1 student, which ranks it in the last position among 24 OECD countries covered by the study. Availability of studies in Poland is the highest, although usefulness of studies for finding a job is the lowest. The expenditures on R&D activities represent ca. 0.56% of the GDP and they are among the lowest in the EU countries.

## KAPITAŁ LUDZKI WE WSPÓŁCZESNEJ GOSPODARCE – ZNACZENIE, METODY POMIARU I INWESTYCJE

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S ł o w a k l u c z o w e: kapitał ludzki, metody pomiaru, nakłady na edukację.

A b s t r a k t

Celem artykułu jest przedstawienie kapitału ludzkiego w gospodarce, zwrócenie uwagi na mnogość wyznaczników tego czynnika oraz na inwestycje w kapitał ludzki. Do realizacji zamierzonych celów wykorzystano statystyki i opracowania organizacji międzynarodowych, dane z roczników statystycznych GUS, publikacje naukowe oraz korzystano ze stron internetowych. Obserwuje się istotne różnice między krajami w zakresie środków przeznaczanych na finansowanie działań związanych z poprawą jakości kapitału ludzkiego. Najczęściej mówi się tu o inwestycjach w edukację i w sferę badawczo-rozwojową. Polska w przeliczeniu na 1 studenta wydaje 5,5 tys. USD rocznie, co plasuje ją na ostatnim miejscu wśród 24 badanych krajów OECD. Dostępność studiów w Polsce jest największa, natomiast przydatność ich do znalezienia pracy – najmniejsza. Wydatki na B+R stanowią ok. 0,56% PKB, są jednymi z najniższych w krajach UE.

## Introduction

The economy of the 21st century is defined as the knowledge based economy (KBE). Globalization of the economy and the involved liberalization of economic relations influence increase in competitiveness. Currently, the material production factors play a less important role in competition among countries. Skills, qualifications and experience of the people influence the possibilities of gaining competitive advantage by a country and prevent its marginalization. Educated society is becoming the "capital" possessing a specific knowledge allowing development of new technologies, products and services.

According to Krzysztof RYBIŃSKI (2006), during the 21st century "the economic power of the country will be built by the power of the minds and not the power of hands and machines". The educated human being becomes the "capital" necessary for achievement of economic goals.

## Defining of the human capital

Human capital is defined in different ways, which is a consequence of its multifunctionality within the frameworks of social sciences. One of the simplest definitions says that human capital consists of the people and their skills.

The term "human capital" is defined as the "synthetic characteristic of the working people" (WELFE 2000). The definition of "capital of the knowledge of the society" is the synonym of the notion of human capital (ZIENKOWSKI 2003), according to which human capital is narrowed to the capital of education that is the achieved level of education.

It is said that human capital is the "resource of knowledge, skills, health and vital energy contained in the society" (DOMAŃSKI 1993). Human capital encompasses all individual characteristics of a man that influence the effectiveness of his work: education, abilities, intelligence, health status, age and nature.

According to LUCAS (1988), human capital should be understood as the level of skills influencing productivity. The employee with capital can be substituted by two employees possessing the capital $^1/_2$ h as they are the "productive equivalent" for him.

Defining human capital we can say that it is the personified knowledge. Knowledge is just the information, which is a non-competitive product from possessing which no one can be excluded. Human capital, on the other hand is defined as a competitive and exclusive product (MAZUREK 2007). As opposed to the financial and material capital that can be allocated partially to different solutions, human capital at a given moment can be utilized for one application

only. Another characteristic of human capital is that it is not subject to market trading (it is impossible to change its owner) (PRZYBYSZEWSKI 2007). Human capital is not inherent, it is obtained through investing in the person.

## Methods of human capital measurement

The necessity of valuation and assessment of the influence of the intangible factor on the development of economic processes causes that measuring the human capital becomes inevitable. There is, however, no universal measure of that resource. Different methods of defining the measure of human capital hinder investigating its influence on the economy.

The measurement of human capital, in the same way as capital in general, can be performed by applying the cost and/or income method. The third method given by (LE et al. 2003, ZIENKOWSKI 2003, WELFE 2007) is the method using the human resources and considering the level of education.

The cost method considers that the resource of the human capital is the discounted stream of outlays incurred in accumulating it decreased by the depreciation rate of that resource, which can be represented as follows:

$$hc_T = \sum_{t=0}^{T} C_t \, (1 + i - d)^{T-t}$$

where:

$hc_T$ – human capital per the working person,
$C_t$ – costs of investment in human capital considering alternative costs, e.g. loss of wages during the period of education,
$i$ – discount rate,
$d$ – depreciation rate.

In case of the cost method, it is difficult to determine the investment in human capital and the related costs. In practical terms the complete methodology represented by the above formula has not found a wider application. Its simplified form is applied for, e.g. analysis of the outlays on education and health or share of those costs in the GDP (*Gospodarka oparta na wiedzy* 2007).

In case of the income method the starting point is the assumption that the ultimate productivity of the groups of employees determines their wages. Employee wage is considered the measure of human capital. An example here could be the macroeconomic Mincer's equation (1970), in which the wages of

employees ($W_i$) depend on their acquired education and professional experience. The design of the aggregated measure of human capital is represented by the equation:

$$\mathrm{In}W_i = \alpha_0 + \alpha_1 S_i + \alpha_2 X_i + \alpha_3 X_i^2 + \varepsilon_t$$

where:
$W_i$ – wage of employee $i$,
$S_i$ – level of education of employee i (measured by the number of years of education),
$X_i$ – professional experience of employee i (measured as the number of years of work).

Another measure based on the Mincer's equation is the quotient of average wages in the economy (WAV) as compared to the wage obtained by an employee possessing no education (WNO):

$$hw = \frac{\mathrm{WAN}}{\mathrm{WNO}}$$

The obstacles to practical application of that method include, e.g. adjustments of the minimum wages or, in educated societies, overstating of wages of unskilled labor, which distorts the measurement of human capital.

Similar to the above presented is the following measure based on the macroeconomic data:

$$\mathrm{HKLZ} = \sum_{i=\min}^{\max} (W_i / W_{\min}) L_i$$

where:
$W_i$ – average wage of employees with $i$-level of education,
$W_{\min}$ – average wage of employees with the lowest level of education,
$L_i$ – number of employees possessing $i$-level of education (FLORCZAK 2006).

The presented methods of human capital measurement are applied in few studies on comparison of quality of that resource between countries. This results from the difficulties in obtaining the credible data.

Intellectual capital is treated as equivalent to protection of intellectual rights. Studies on that type of capital concern patents, e.g. the total number of patents or the number of patents per one employee (PRZYBYSZEWSKI 2007).

As presented by the subject literature, in macroeconomic terms the "capital of knowledge" is the basic notion for the analysis of human capital. The capital of knowledge consists of the aggregated scientific knowledge, that is the results of scientific research (R&D) and the knowledge level of the society. The knowledge of the society is expressed by the achieved level of education and it is referred to as the "capital of education".

Determination of the level of knowledge is a problem. The formal knowledge should be differentiated from the actual knowledge. The formal knowledge can be assessed on the base of the outlays allocated to achievement of a specified level of education. The actual knowledge is the actual skills of the employees achieved thanks to the completed education, it is linked to the phenomenon of functional illiteracy that is the situation when an educated person has difficulties with using the acquired knowledge in daily life, in correct writing or reading with understanding (ZIENKOWSKI 2003).

Health also belongs to the measures of human capital. A healthy man, physically and mentally fit, lives longer and a healthy child lives and achieves the age of its professional activity.

In empirical analyses the indicators of scholarization are used:

$$\mathrm{WSK}_i = \frac{S_i}{L_i}$$

where:

$S_i$ – number of people in the process of education at $i$-level of education (elementary, secondary, tertiary)

$L_i$ – total number of people in the age group corresponding to the statutory period of attending education at $i$-level of education.

The mobility of human resources has a significant influence on the level of human capital. During the recent period emigration both within and outside the country has been observed. Migrating individuals usually possess a high level of education both formal and informal.

## Statistical approach to investments in human capital – education and R&D outlays in the world, in Europe and in Poland

### Outlays on R&D

The outlays on research and development (R&D) are the most frequently given measure of investments in human capital. The majority of definitions interpret research and development activities as systematically conducted works aiming at increasing the resource of knowledge on the man, society and culture, which is to serve finding new possibilities for utilizing the knowledge. The bases for that definition of the R&D zone are provided by the OECD *Frascati Manual*, the publication that allows international comparisons (Portal Europa).

Within the frameworks of R&D activities three types of research are identified:

– Basic research – theoretical works within a specific scientific discipline that are not focused on achievement of specific practical goals.

– Applied research – research works undertaken to obtain new knowledge and to apply it in practice.

– Development works, which serve application of already existing knowledge to development of new or improvement of the existing products, processes or services.

The GERD (*Gross Domestic Expenditure on Research and Development*) expressed as the percentage of the GDP is the measure applied for comparisons and assessment.

The goal indicated by the European Union is to achieve 3 percent share of outlays on R&D in the GDP. Achievement of that goal, according to the EU recommendation should be financed $^2/_3$ from the private funds and only $^1/_3$ from the national budgets of the Member States.

Many authors (JONES, WILLIAMS 1999, STONEMAN 2003, LACH 2000, MŁODAWSKA 2001) mention the necessity of the active role of the state in the R&D domain, which is justified by unreliability of the market mechanism in allocation of funds to that use. Investment decisions of private entities are focused on profit and dependent on the related risk level. However, the social benefits of investments, which, although ineffective for an individual entity, might be socially useful should be remembered. The activity of the state in the area of basic research seems to raise the least doubts, among others, because it is believed that applied research and development works, which could generate profits for entrepreneurs would, sooner or later, be carried out. During the recent years an increase in public outlays on R&D activities has been observed

in the European Union countries while at the same time the outlays of enterprises for that purpose have not increased, which spreads the gap between the European and the American economy. In case of many countries support of private funds with public funds (the so-called *crowding out*) has been observed, which is a serious argument against financing of research and development activities by public institutions. There are works that enterprises would undertake without state subsidies and it happens that the state with its research gets ahead of the activities by private enterprises (CZERNIAK 2006).

The differences in the levels of outlays on R&D activities depend on the structure of the economy. Significant outlays are recorded in the countries with a high share of the processing industry, mainly high technology and countries in which large companies position their activities (the R&D outlays by large companies are generally much higher than those of small and medium enterprises). The other factors determining the levels of investments are, e.g. political, systemic and cultural factors. High levels of investments made by countries at a lower level of development are determined by extra-economic reasons. This is the situation in case of Belarus, Cuba and Pakistan. Post-communist countries as e.g. Poland, Slovenia and Rumania implement the principles of R&D funding that existed during the previous system (OKOŃ-HORODYŃSKA 2004).

The European Union is not nearing the assumed target of 3% outlays on R&D but in spite of that the level of those outlays there was three times higher there than in Poland. The outlays on R&D in 27 EU countries averaged 1.84% of the GDP (2006) and that level did not change as compared with 2005 and decreased as compared with 2000 when it was 1.86% of the GDP. In Poland the level of outlays on R&D in 2006 was 0.56% of the GDP[1].

Globally, the United States have the highest share in the R&D outlays (35%) followed by the 27 countries of the EU (24%) with Japan (14%) at the third place (OECD Science... 2008). Among the European Union countries the highest GERD/GDP ratios, exceeding the targets of Lisbon Strategy, were recorded in Sweden (3.82) and Finland (3.45). Those countries are followed by Germany (2.51), Austria (2.45) and Denmark (2.43). The countries with the lowest R&D outlays are Cyprus, Rumania, Bulgaria and Slovakia. Among the countries that joined the EU together with Poland that ratio is the highest in the Czech Republic (1.54) and Slovenia (1.59).

In Poland a decreasing trend is observed as concerns the R&D outlays. In 1994 that ratio was 0.82 and it decreased to 0.56 in 2006. This is the lowest value of that ratio since the beginning of the transformation period. That unfavorable situation may influence increasing the development gap between

[1] Own work based on the Eurostat data presented.

Poland and the European countries (HELLER, BOGDAŃSKI 2005). The national outlays on research and development activities are in many cases lower than the outlays for that purpose allocated by multinational companies.

It is worth looking at the sources of funds for research and development and the ways of spending them. The state budget carries the main burden of financing scientific research, which is contrary to the proposal of the Lisbon Strategy. In 2006, the business entities incurred $^1/_4$ of the outlays on research and development. In 2007, the percentage share of the state budget increased by 1 percent point while the share of enterprises in financing research and development activities decreased by 0.6 percent point. Two countries, the USA and Japan represent the reference point for the EU Member States. Also South Korea achieves a high level of outlays on research and development and a satisfying structure of funding such activities.

In 2004, the share of outlays on R&D was 2.67% of the GDP and the private sector financed 64% of all the outlays in that field (1.70% of the GDP. In Japan that ratio was 3.17% and in South Korea 2.99% and in both those countries the private sector covered 75% of the total outlays. Against that background the results of the European Union were not very optimistic. In 2005, in the outlays representing 1.84% of the GDP the share of the private sector was 1.0% of the GDP and the public sector 0.64% of the GDP.

The division of funds between the basic research, applied research and development works influences the effectiveness of utilization of funds allocated to R&D. According to the traditional approach the basic research should be characterized by relative regularity while development works and applied research are of major importance for increasing the level of innovation and competitiveness in the short-term. It is said that the following proportions should be maintained for that purpose: one unit of outlays for basic research should be matched with two units of outlays for applied research and three units for development works. It should not be forgotten that basic research can unexpectedly translate into practical effects and their role for the development of science as discipline as well as performance of the educational, informative and culture-creating functions should also be remembered (TOMTAS-ANDERS 2007).

Countries of Central Europe, including Poland, focus their activities on basic research, which is a result of the systemic transformation as well as lack of experience in trade in advanced technologies, lack of motivation for obtaining patents for the achievements and preferences in the field of academic activities. In case of Poland, funds allocated for basic research exceed such funds allocated by Western countries (KLINCEWICZ 2005). Among the three types of research the development works are important from the perspective of enterprises. Closeness to market, i.e. the share of funds allocated for development works allows determining how science supports production.

Considering the structure of outlays in Poland, it can be noticed that a significant proportion of funds is allocated to studies that have no application in the economy. As of 2000, a decrease in the share of basic research in total outlays has been observed. In 2006, it was observed that the outlays for development works were the largest at 38.8%. During the last year for which the data is available again the unfavorable change in the form of an increase in the share of current outlays allocated to basic research and a decrease in the share of funds allocated to the development works to 38.3% was observed.

In addition to the data showing the scope and structure of outlays on research and development the qualitative assessment of the expenditures incurred deserves attention. The achievements of scientific institutions according to the studies of 2002, cover mainly publications as well as obtaining scientific degrees and titles. In case of tertiary schools and the Polish Academy of Sciences this is almost 90% of their activities. And which is the most important, only 20% of total scientific achievements of all the assessed scientific units was useful in economic practice (OKOŃ-HORODYŃSKA 2004).

In subject literature opinions can be found that the sector of research and development is lagging behind and has not been subjected to decisive transformation. The R&D sector is characterized, among others, by concentration outside enterprises, organizational structure different from that dominating in the developed countries and dependence on the economic standing of the public sector (JASIŃSKI 2006). The majority of outlays are incurred by public institutions and there is too much focus on the basic research.

Poland, using the experience of other European countries, among which the economic changes in Finland should be noticed, as guidelines, should transform the implemented scientific and research policy. An important argument for strengthening the R&D sector in Europe is the increase of employment and improvement of human capital effectiveness. It is necessary to take actions concerning, among others, increasing the interest of young people in scientific career and assuring the potential for development of such careers as well as increasing the mobility of the scientific personnel (BUDZYŃSKA 2005).

## Outlays on education

Education determines the social status, decides participation in the labor market and taking an appropriate position there. In the majority of developed and developing countries education is an important investment in the society. In all the OECD countries the percentages of people that participate in the process of education increase. As a consequence the share of outlays on

education in the budget plays an important role. Public outlays on all the levels of education average 13.2% of their total expenditures for all the OECD countries, which represents 5.4% of the GDP. The available data on outlays on education incurred in 2005 by selected European Union countries are presented in Figure 1.

Public expenditures on all the levels of education in the EU countries average 5.3% of the GDP. The average level of outlays on tertiary education at 1.3% is similar to the outlays allocated to tertiary education in Poland (1.2%).

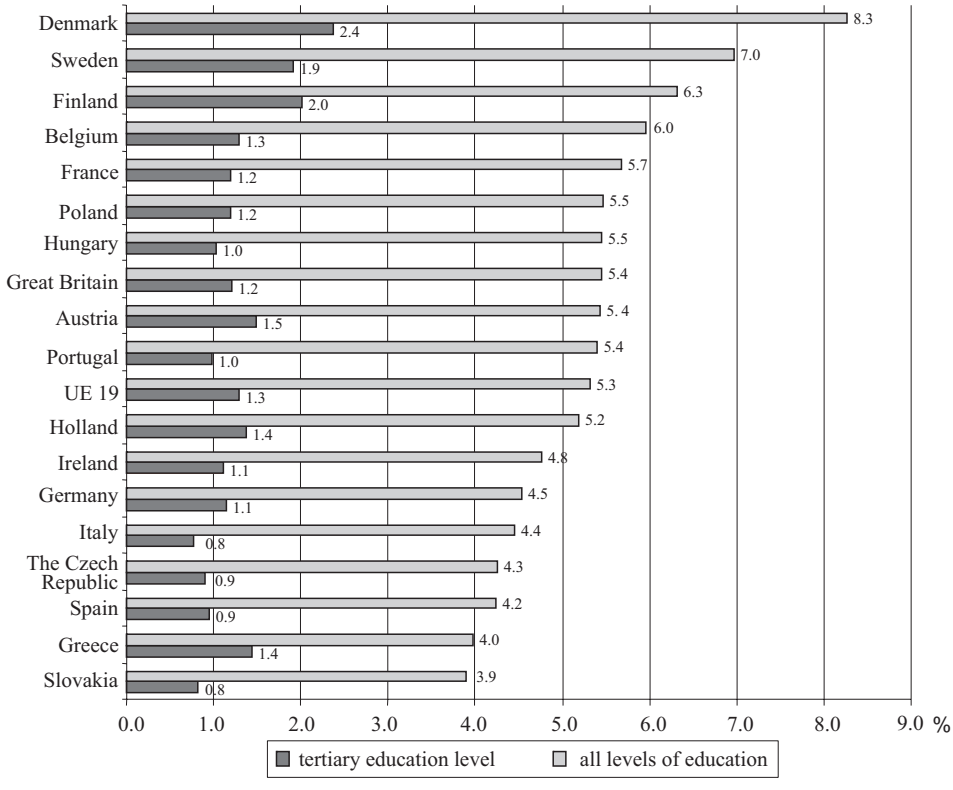


Fig. 1. Public outlays on education as % of the GDP in selected EU countries in 2005
*Source:* own work based on the OECD data in Education at a Glance (2008).

In the OECD countries the state carries the main burden of financing the educational institutions. In 2005, public sources covered 85.0% of those outlays. The largest public funds in relation to the GDP are spent on education in Denmark, Sweden and Finland. The funds allocated to all levels of education there represent 8.3%, 7.0% and 6.3% of their GDP respectively. Additionally,

those are the countries where the highest share of public funds in total outlays on education is recorded at 92.3%, 97.0% and 97.8% of the total outlays respectively, which means that financing of education from private funds plays a marginal role in those countries.

Significant private funds are allocated to education in countries such as the United States (32.7%), Korea (41%), Australia and Japan (25% each). Among the EU countries, the highest share of private funds in total outlays on education was recorded in the United Kingdom (20%), Germany (18%), Slovakia (16%) and Spain (11.4%) (OECD Education. 2008).

The index of investments per one student/pupil is an important measure of the investments in education. The estimated outlays for one student of tertiary studies and a secondary school student expressed in US dollars are presented in Figure 2.

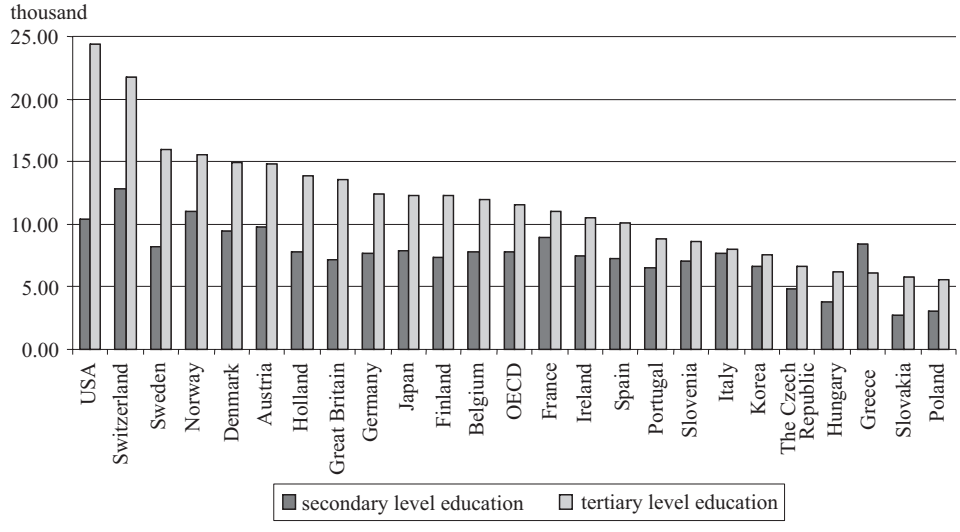


Fig. 2. Year outlays per one student/pupil in USD according to the PPP in 2005
*Source:* own work based on the OECD data in Education at a Glance (2008).

During the last 10 years the outlays on education in the OECD countries increased by over 20%. The largest outlays on education are recorded in the United States where the outlays per student amount USD 24,000. The US is followed by Switzerland at USD 21,000. Finland allocates USD 12,000 for education of one student and it educates an increasing number of engineers recognized worldwide. Poland looks the weakest as concerns outlays per student at USD 5,500 per year. This amount is five times lower than in the USA and two times lower than in Germany.

Underinvestment as compared to other countries is also observed in case of secondary schools where the outlays per 1 student amount USD 3,000, i.e. more than two times less than the OECD average.

The smallest differences between Poland and the OECD countries are found in case of outlays at kindergarten level. Year outlays on 1 kindergarten pupil in Poland represent 84% of the average for the OECD countries.

The key problems for Poland are, first, underinvestment in education and second oversize administration to which significant volumes of funds are allocated and, as a consequence, an increasing focus not on the market needs of sciences but on less capital intensive humanities. Doctor Jerzy Lackowski from the College of Pedagogies of the Jagiellonian University computed that every fourth zloty from the educational payroll is allocated not to the wages of teachers but to the funding of the work of clerks (KULA, ROŻEK 2008).

## Summary and conclusions

Human capital is considered a modern production factor in post-industrial economy that is subject to extensive processes of globalization it has become the inevitable factor of development. Rational development and utilization of it play the key role in preventing the divergence of economies.

On the base of the analysis of available materials the nature of human capital and methods for measurement of that factor were presented. The basic determinants of the human capital, i.e. education and investments in knowledge as well as outlays on the R&D activities were presented. On the base of the aggregated research material the following conclusions can be formulated:

1. Human capital as the fourth production factor next to the land, labor and capital is strongly correlated with the economic growth. It is becoming the engine of development, increase of production and production effectiveness in both macro scale and in the scale of the individual organization.

2. There is need to measure human capital in both the organization and in macro scale to be able to assess the influence of that factor on the economy.

3. It is considered that the research-development activities conducted by scientific institutions are of little use in practical economic activities. It is worth pointing out that the funds should be allocated to activities of practical application. It is necessary to increase the funds allocated to development works that are the most important from the market perspective.

4. Polish state allocates 1.2% of the GDP on education at the tertiary level and 5.5% of the GDP on all levels of education. Year outlays per 1 student amount ca. USD 5500 which is five times less than in the USA and two times less than in Germany. The outlays per one secondary student amount USD

3,000, which is two times less than the average for the OECD countries. This shows the scale of underinvestment in the sector, which can be considered one of the causes for the insufficient quality of the Polish system of education.

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