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ORIGINAL

Investment approach of higher education institutions to the development of educational platforms

Enfoque de inversión de las instituciones de educación superior en el desarrollo de plataformas educativas

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ABSTRACT

Introduction: investment in education is a determining factor in improving its quality, especially investment in innovative tools such as modern educational platforms.
Objectives: the aim is to characterise the critical determinants of the investment approach of higher education institutions to develop educational platforms.
Method: the paper uses correlation and regression analysis, as well as analysis of secondary survey data.
Results: as a result of the study, the main determinants of the investment approach of HEIs to the development of educational platforms were characterised. These are the motivation for investment, student expectations, and the model and sources of investment. It was found that the efficiency, accessibility of education, and productivity of human capital are positively correlated with education expenditures, innovation, and the level of adaptation to online education. At the same time, the most substantial impact was observed from the adaptation of online education on the indicator of the human capital index (the HCI).
Conclusions: it was concluded that the efficiency, accessibility of education and productivity of human capital are the key goals and motivations for investment in education. Through the analysis of survey data, the critical expectations of students from learning on online platforms were identified. An international experience analysis has helped identify the most popular investment models.

Keywords: Investment In Education; Educational Platforms; Level Of Education; Human Capital; Online Learning.

RESUMEN

Introducción: el objetivo es caracterizar los determinantes críticos del enfoque de inversión de las instituciones de educación superior (IES) para desarrollar plataformas educativas.
Método: el documento utiliza análisis de correlación y regresión, así como análisis de datos de encuestas secundarias.
Resultados: como resultado del estudio, se caracterizaron los principales determinantes del enfoque de

inversión de las IES para el desarrollo de plataformas educativas. Estos son la motivación para la inversión, las expectativas de los estudiantes y el modelo y las fuentes de inversión. Se encontró que la eficiencia, la accesibilidad de la educación y la productividad del capital humano están correlacionadas positivamente con los gastos de educación, la innovación y el nivel de adaptación a la educación en línea. Al mismo tiempo, se observó el impacto más sustancial de la adaptación de la educación en línea en el indicador del índice de capital humano (HCI).
Conclusiones: se concluyó que la eficiencia, la accesibilidad de la educación y la productividad del capital humano son los objetivos y motivaciones clave para la inversión en educación. A través del análisis de los datos de la encuesta, se identificaron las expectativas críticas de los estudiantes con respecto al aprendizaje en plataformas en línea. Un análisis de la experiencia internacional ha ayudado a identificar los modelos de inversión más populares.

Palabras clave: Inversión en Educación; Plataformas Educativas; Nivel de Educación; Capital Humano; Aprendizaje en Línea.

INTRODUCTION

In today's context, investment in education is critical to improving the quality of teaching and developing human capital and skills.[1,2] This contributes to countries' long-term growth and international competitiveness.[3] Innovative solutions, such as modern educational platforms, are among the most crucial investment areas.[4] These solutions have potential to improve the efficiency of education and enhance its accessibility, inclusiveness and cost reduction.[5,6]

The current challenges faced by countries (in particular, the COVID-19 pandemic, armed conflicts, and restrictions on access to traditional education) are driving the development of new educational tools, including educational platforms.[7,8] Higher education institutions (HEIs) widely use such platforms, either existing or developed in-house or in partnership with suppliers.[9] These options require investment, which should be clearly defined and justified.

Thus, forming a HEI's balanced investment approach to develop educational platforms is an essential scientific and practical task. In the process of creating such an approach, the study proposes to apply the concept of the "golden circle"[10], which involves the development of such an approach through the answers to the questions "Why? What? How?". The answer to the question "Why?" is a crucial motivation for investing in educational platforms and, in general, is the primary goal of investment. The question "What?" specifies the goal and provides more information about what should be achieved through the investment, particularly the expectations of students from the educational platform. "How?" defines the main ways to achieve the goals, primarily the investment model and funding sources. Motivation, student expectations, and the investment model and sources are identified in this study as critical determinants of the investment approach of HEIs to the development of educational platforms.

The motivation for investment in education, students' expectations of distance education, and models of investing in digital platforms are relevant topics of many studies. In their works, Konrad et al.[11] and Zahoretska et al.[12] noted that using educational platforms as additional educational tools improves the quality of student training and the potential workforce. Voitko et al.[13] note that investments in educational platforms may be motivated by the university's desire to enter the markets of other countries. Several studies have focused on the global role of investment in education, such as the impact on the development of the national economy.[14,15,16] Some studies have investigated performance factors[18,19] and the main concerns of students regarding distance learning.[20,21,22]

Komljenovic[23] identifies three main models of investment in educational platforms by HEIs. HEIs can act as rentiers and pay a licence fee to use the platform. HEIs can partner with a platform provider and act as a rentier in the case of the development of their platform. However, researchers often note that HEIs mainly use existing solutions such as Zoom, Google Meet, Google Classroom, etc.[24] As for the financing of distance learning, different countries use different approaches. Funding for distance learning can come from students' funds, public funds, international assistance, etc.[25]

The review shows a lack of proposals for developing HEIs' comprehensive investment approach to creating educational platforms. This study aims to characterise the critical determinants of the investment approach of HEIs to the development of educational platforms. Objectives of the study:

- to outline the motivation for investing in education as a critical determinant of the investment approach of HEIs to the development of educational platforms;
- to reveal the needs of the target audience as a determining factor in the context of choosing an investment approach;

- describe models and sources of investment.

METHOD

Type of study: applied research.

The sample of countries for the study consists of 27 European Union countries and the following indicators: Education Index, Human Capital Index, Education Expenditures (% of GDP), Global Innovation Index, Individuals doing an online course (of any subject) or using online learning material.[26,27,28,29,30] The criteria for including countries were their membership in the European Union, and the criteria for including indicators were data availability, relevance to the research objective, and international comparability.

Study variables

The dependent variables in the analysis are the Education Index and the Human Capital Index. The former measures the level of education and access to it. At the same time, the latter focuses on human capital's productivity and potential economic contribution by assessing health and education. The other indicators are independent variables that characterise the spending on education, innovation, and the level of adoption of online education, as shown by the share of the population taking online courses.

In the second stage of the study, secondary data from a student survey were used.[31] In addition, at this stage, international experience based on data from Poland, the Czech Republic, Slovakia, Hungary, Romania, Croatia, Estonia, Lithuania, Latvia, Germany, and the United States of America was studied.

Data collection methods and instruments

Data for the study was collected from the following sources: Index Mundi (2020), WIPO (2023), World Bank Group (2023), Eurostat (2024), World Population Review (2024), Pangarkar (2024). The key tool for data processing and calculations was the Excel software environment.

Statistical techniques and procedures

The correlation analysis was used to analyse the relationship between indicators related to the effectiveness of education and indicators describing the financing, innovation and adaptation of online learning. The Education Index and the Human Capital Index are associated with the effectiveness of education. The second group of indicators is represented by Education Expenditures, the Global Innovation Index (GII), and Individuals doing an online course. The correlation and regression analysis allowed to identify the impact of several variables on the dependent indicators. In this case, the dependent indicators were indicators of educational effectiveness. The analysis of secondary survey data made it possible to identify the critical expectations of students from classes using educational platforms.

Ethical parameters

All study participants provided written informed consent, ensuring their voluntary participation in the study. The data were anonymous, ensuring their confidentiality.

RESULTS

The correlation and regression analysis was conducted to identify the impact of Education Index and HCI on the studied indicators. Table 1 shows the regression results for the Education Index (as a dependent variable) and the Education Expenditure and Innovation Index.

Table 1. Regression results for the education index, education expenditure and innovation indexes

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	0,668419	0,055241	12,10001	1,05E-11	0,554407	0,782431	0,554407	0,782431
Education Expenditures, % of GDP 2021	0,01939	0,012521	1,548574	0,134571	-0,00645	0,045233	-0,00645	0,045233
GII Score	0,002302	0,001521	1,513439	0,143227	-0,00084	0,005442	-0,00084	0,005442

Source: Authors' calculations based on data from [27,28,30]

The Education Expenditure and Innovation Index indicators do not demonstrate a statistically significant impact on the dependent variable. A statistically significant relationship is observed between the Education

Index and Intercept, which may indicate the influence of other variables not included in the model. Table 2 shows the regression analysis results between the HCI as the dependent variable and the indicators of education expenditures and the Innovation Index.

Table 2. Regression results for the HCI indicator and education expenditure and innovation index

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	0,512565	0,045513	11,26183	4,6E-11	0,41863	0,606501	0,41863	0,606501
Education Expenditures, % of GDP	0,004986	0,010316	0,483265	0,633287	-0,01631	0,026277	-0,01631	0,026277
GII Score	0,004085	0,001253	3,259434	0,003325	0,001499	0,006672	0,001499	0,006672

Source: calculated by the author according to [26,27,28]

The GII Score and Intercept variables statistically impact the HCI indicator. Accordingly, the HCI indicator is significantly influenced by innovation but may also be affected by variables not included in the model.

The next step is to check how the models obtained will change if a new variable is introduced that characterises the level of adaptation of online education. This is the proportion of countrywide individuals who attend online educational courses or use online learning materials. The correlation of the last mentioned indicator with the Education Index is 0,543364, and with the HCI – 0,656683, i.e. the strength of the relationship is positive and significant. The regression results for the Education Index with the introduction of the new variable are shown in table 3.

Table 3. Regression results for the education index with the introduction of a new variable into the model

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	0,678498	0,053462	12,69115	7,17E-12	0,567903	0,789093	0,567903	0,789093
Education Expenditures, % of GDP	0,02103	0,012082	1,740516	0,095133	-0,00396	0,046024	-0,00396	0,046024
GII Score	0,000698	0,001737	0,402085	0,691334	-0,00289	0,004292	-0,00289	0,004292
Individuals doing an online course (of any subject) or using online learning material	0,001878	0,001096	1,71392	0,099991	-0,00039	0,004144	-0,00039	0,004144

Source: Authors' calculations based on data from[27,28,29,30]

Comparing the results in tables 1 and 3, there is a significant decrease in the GII Score. This can be explained by the fact that the GII partially reflects the adaptation of the educational model to digital platforms, so it loses its unique significance by introducing a new variable. This may prove that individuals' use of online learning (including educational platforms) is essential to the modern innovation environment. In addition, after introducing the new variable, the Education Expenditures indicator slightly approached the level of statistical significance ($p<0,1$). Therefore, it can be assumed that integrating online learning may contribute to the increased importance of total education expenditures, improving accessibility and efficiency of education. Table 4 shows the regression results for the HCI by introducing a new variable into the model.

Comparing the results in Tables 2 and 4, it can be concluded, that adding the new variable slightly increased the importance of Education Expenditures and significantly decreased the GII Score. At the same time, the impact of the new variable itself (the share of people attending online educational courses or using online learning materials) is significant. Thus, it can be assumed that online education, to some extent, compensates for the impact of innovation on human capital, positively influencing its productivity without a significant increase in costs. The estimated R^2 for this model is 0,529372, meaning it can explain about 53% of the variation in the dependent variable.

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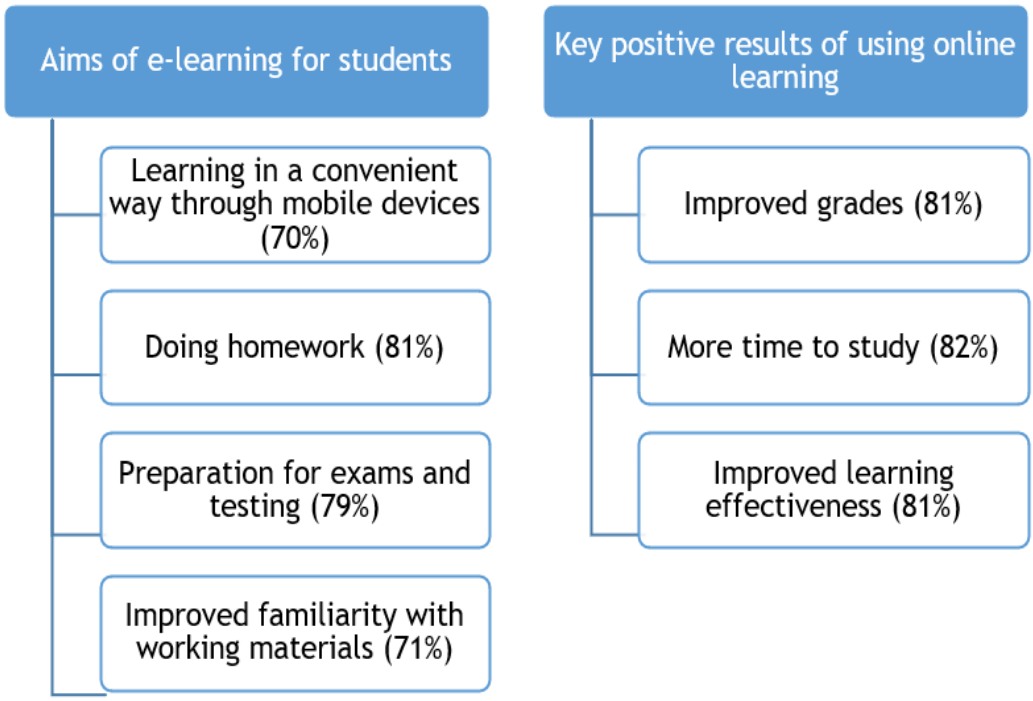
Table 4. Regression results for HCI with the introduction of a new variable into the model

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0,522469	0,042843	12,19502	1,6E-11	0,433842	0,611096
Education Expenditures, % of GDP 2021	0,006597	0,009682	0,681304	0,502482	-0,01343	0,026626
GII Score 2023	0,002509	0,001392	1,802615	0,084569	-0,00037	0,005389
Individuals doing an online course (of any subject) or using online learning material	0,001845	0,000878	2,10168	0,046736	2,9E-05	0,003661

Source: calculated by the author according to[26,27,28,29]

The results indicate the importance of strategic investment in online education in the context of HEIs' investment approach to developing educational platforms. This is especially evident in the impact of the share of online learners on the HCI without a significant increase in educational costs. Thus, investments in online platforms are motivated and aimed primarily at increasing the productivity of human capital and increasing the efficiency and accessibility of education in general.

When developing a specific investment approach for HEIs in developing educational platforms, it is essential to consider the existing positive experience. Thus, it is advisable to consider the assessment of the implementation of online platforms by students themselves. Figure 1 shows the main objectives of e-learning for learners and the vital positive results obtained from online learning through digital platforms.



Source: compiled by the author based on data from[31]

Note: The share of respondents who agreed with the proposed goals and outcomes is indicated in parentheses.

Figure 1. The primary purposes of e-learning and the key positive results obtained from online learning through digital platforms.

In addition, the approach to developing educational platforms should consider the following aspects: students' readiness for paid learning through the platform, adaptability to learning objectives, and personalisation. These aspects are essential to consider when developing platform functionality, which, in turn, affects the calculation of the amount of funding required. The next step is to study successful international experiences in implementing digital platforms in the educational process (table 5).

Table 5. International practice of implementing and using educational platforms

Country	Platforms and services used
Poland	In the context of COVID-19, the country introduced a transition to learning on educational platforms and unique services. The platforms and services used include: - Campus platform - for sharing educational materials and messages; - Microsoft Teams - for online classes and file sharing; - Moodle - for the exchange of educational materials, communication between students and teachers, and the use of an electronic journal; Google Hangouts Meet, Google Classroom, and Learn Online are for distance learning and access to educational materials. In addition, the Centre for Information Processing (a public research institute) in Poland has proposed the Navoica platform, which offers various online courses.
Czech Republic	The Moodle platform and BOOKPORT online libraries are widely used.
Slovakia	The following electronic resources are popular: Moodle, Microsoft Teams, Zoom, and Socrative (for creating various tests).
Hungary	Moodle is actively used, along with the organisation of exams using their own NEPTUN system.
Romania	The Ministry of Education, Research, Youth and Sports launched the free educational platform Digital.
Croatia	Active use of Microsoft Teams.
Estonia	Microsoft Teams, TalTech Moodle and Wooclap are used to implement interaction in the classroom.
Republic of Lithuania	Microsoft, Moodle, Zoom, Skype, BlueJeans, VMA virtual learning environment (provides access to information, virtual lectures and tests).
Republic of Latvia	Cisco Webex, Zoom, Microsoft Teams.
Germany	Moodle and Mahara.
United States of America	EdX, Canvas, Zoom Meeting, Google Meets.

Source: summarised by the author according to [24]

In general, universities can use different investment models by creating their platforms or in partnership with other entities and by purchasing licences for existing platforms. Table 8 shows that the most common approach is to use existing platforms. It is worth noting that compared to public HEIs, private universities usually have more flexibility in attracting investment.

DISCUSSION

This paper investigated the impact of education expenditure and innovation on the accessibility and quality of education and human capital productivity as the primary motivations for investment. Habibi and Zabardast[14] and Maneejuk and Yamaka[15] proved that education can significantly contribute to economic growth. Similar to our paper, the latter study uses public spending on education as one of the variables. According to the authors, it is directly related to economic growth. Pomi et al.[16] and Hanushek and Woessmann[17] have also highlighted the importance of the population's aggregate cognitive skills, which are closely linked to long-term economic growth. In this study, the population's skills are analysed through the HCI indicator, which is significantly influenced by the level of adaptation of online education in countries.

Al Salman et al.[20] and de Souza et al.[21] found that one of the problematic aspects of distance education is the level of students' information and communication technology skills. Fidalgo et al.[22] identified motivation, time management, and English language proficiency as the main problems of students. Cicha et al.[18] noted that self-efficacy and satisfaction with the learning process are essential indicators of the effectiveness of distance education for students. Unlike these studies, the author's article specifies the benefits students expect from distance learning.

In contrast to this work, where educational platforms are considered solely a tool for providing educational services, Komljenovic[23] sees an educational platform as an economically valuable asset. This allows platform owners to act as rentiers and collect rent themselves. Niskhodovska[25] notes that there is a tendency worldwide to reduce the cost of distance education compared to traditional education. Our observations prove that increasing distance education's adaptation level does not significantly increase costs. The study's findings allowed to improve the investment approach of HEIs to develop educational platforms. Using the proposed determinants when making investment decisions will help increase their effectiveness.

The study's limitations lie primarily in using data from developed European countries. Thus, the results for other regions may differ. This motivates further research using different datasets.

The following recommendations can be made based on the analysis:

- Increasing the amount of funding for education and innovation, which, according to correlation analysis, have a positive impact on the accessibility and efficiency of education and human capital development;

- ensuring the integration of online learning, which, according to the regression analysis, not only affects the increase in human capital productivity but also does not lead to a significant increase in education costs;
- expanding access to educational resources in digital form, which meets the requirements of modern students, positively influencing the amount of time spent studying, doing homework, tests, etc.; adaptation to market requirements through the use of online platforms. The investment approach to platform implementation may involve creating one's platforms and acquiring a licence for existing ones. The determinants proposed in this paper may be taken into account.

CONCLUSIONS

According to the study, one of the critical predictors of the investment approach of HEIs to the development of educational platforms is a clear motivation for investment. As shown in the first and second sections of the paper, HEIs' investments in educational platforms are motivated by increasing the workforce's productivity. In addition, they contribute to improving the efficiency and accessibility of education without significantly increasing costs.

Considering the target audience's needs, namely students and teachers, is crucial to developing educational platforms. The paper's last subsection outlines students' goals when studying online and the expected outcomes. However, each university can adapt these outcomes to its conditions, particularly by conducting surveys of its students and teachers.

The choice of investment model is another determinant of the investment approach to developing educational platforms. Having outlined the costs and knowing its capabilities and regulatory requirements, the university can choose an investment model. As highlighted in the paper's third section, European universities often use existing platforms.

The study results can be helpful for higher education institutions by using the proposed and substantiated determinants in investment decision-making. Further research directions should determine the system for evaluating investment performance. This involves identifying key indicators that can be used to assess the effectiveness of investments, such as the number of students enrolled, the number of international students enrolled, changes in grade point average, the amount of expenditure, etc.

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CONFLICT OF INTEREST

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