

Investment Attractiveness of the Global EdTech Industry: Demographic and Technological Factors

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Keywords

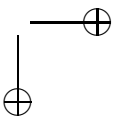
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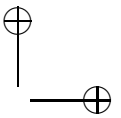
Abstract.

The global EdTech market development is largely dependent on venture capital investments. The dependence on venture capital investments reflects the high-risk status of educational technology projects and simultaneously provides new research opportunities based on investors behaviour. The connection of EdTech venture capital investments with demographic and technological factors was tested with mathematical models for China, India, the USA and the European Union in the research. It can be argued that the necessary technological and demographic prerequisites for the growth of the EdTech market have already been created and their contribution to the development of the EdTech market is no longer decisive. Authors assume that the state and public institutions' favourable conditions for online education are becoming the main exogenous factor of competition. This contributes to understanding the development strategy of the global and national EdTech markets as well as the perception of online education as complementing part of traditional education by governments.

1. Introduction

Online learning is a fast-growing sphere of education with significant demand for actual, up-to-date research and informational databases for further analysis. In recent years, several popular and widely cited studies conducted by different organisations and researchers to enlighten educational online technology from different views. The main points come along the lines of a better understanding of the future of the EdTech market, the potential impact on the educational system of countries around the world and the cost of traditional education, etc. Most of the discussions and citations in recent years have been about articles connected with the Covid-19 pandemic. The World Bank's research on How countries use EdTech (including online learning, radio, television, and

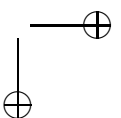


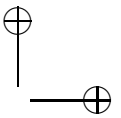


texting) to support access to remote learning during the COVID-19 pandemic displays the unreadiness and problems of developing countries’ governments to organize online education during the global pandemic (World Bank, 2021). The changing world of educational technology from a different perspective: present realities, past lessons, and future possibilities by Sanders and George (2017) focus on different reasons for the gap between theory and reality in the use of educational information and communication technology. Several authors concentrate their attention on the global impact of EdTech development and further worldwide access to cheap or even free education, especially in developing countries. It was analysed, for instance by Liyanagunawardena et al. (2014), and Hennessy et al. (2021). The authors argue about the effectiveness, benefits, and minuses of online educational programs, access to low- and middle-income countries, and the role of EdTech in the process of spreading affordable education generally.

The analysis conducted on global EdTech venture capital flow provides us with recent statistics of fast-growing venture investments to startups from developed and developing countries (HolonIQ, 2021a). Several Big 4 companies’ reviews were analysed as well. The KPMG paper related to The future of online education in a disruptive world presents the end of universities “golden age” as well as traditional education’s irrelevance in some points nowadays and in the perspective period (KPMG, 2021). One of the major causes is increasing students’ educational credit debts worldwide, particularly in the United States, the equality of online and traditional education ranks, and gaining recognition of online education courses by employers as stated in Student Loan Debt Statistics by Education Data (Hanson, 2023). The dynamics of online education market growth acknowledge the following global trend of massive digitalization of education methods presented in EdTech Market Research (Netology, 2022). In The Impact of COVID-19 on Education: insights from Education at a Glance 2020, where key factors and governmental actions are described, we also could observe the online education booster in the face of the pandemic and the perspectives of positive further market growth of the industry (World Bank, 2021). According to statistics on venture capital flow provided by HolonIQ (2021b), investors seem more reasonable to develop and support local EdTech startups oriented not just to extra courses and university courses for adults, but also for children from their first classes. The market mentioned rightfully could be named as one of the most promising, so we can observe the gain of Chinese and some North American startups.

Several important issues have been identified. First, according to World Bank (2021), there are questions on the effectiveness of online education and whether the teachers and students would have benefitted from using these new methods. The pandemic crisis has exacerbated digital inequalities worldwide as well as the over digitization of education has increased the risks of data surveillance and privacy loss (Hillman et al., 2021; Jordan et al., 2021). The next point relates to collecting data and the way of using it by EdTech startups. For a big number of companies, including EdTech ones, data has become “new oil” in the modern economy and existing market system, especially behavioural data which, by use of artificial intelligence, makes students’ education better and more flexible to help students achieve higher educational results according to Zuboff (2020). Gathered databanks could be, for instance, sold and it is one of the global risks of illegal personal data usage by unscrupulous companies.





The speed of digitalization and hybrid education system development is forcing us to move from “learning poverty” to “learning for everyone, everywhere” (Simmons, 2019). According to a World Bank (2020), most of the world’s population, especially children, are still facing difficulties with access to basic opportunities to study. A large proportion of children are not acquiring even fundamental skills, though 53 of every 100 ten-year-olds in low- and middle-income countries cannot read and understand an age-appropriate text. Additionally, the time spent in most of the schools in low- and middle-income countries is worth only half as much as in a high-performing system. Therefore, Filmer and Rogers discovered that 11.6 years of school is equivalent to a half, 5.7 quality-adjusted years (Filmer et al., 2020). Does it mean that the global transfer of education to the online level will change the situation? There are no currently direct answers. That is why all possible EdTech “catalysts” should be analysed to reveal interconnections, develop a statistic-based answer and understand the key factors of EdTech market growth, investments upflow and increase in investment attractiveness.

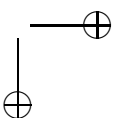
2. Methods

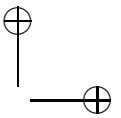
The EdTech market investment attractiveness depends on a wide number of affecting factors (Regan & Khwaja, 2019). The paper aimed to make clear whether the education technology market development and rise relate to macroeconomic factors. Specifically, with demographic and technological factors. Further methods of research closely outcome from the hypothesis considered above. It is quite obvious that the development of information and telecommunications infrastructure, and the simplification of the possibility of access to it, increases the number of users of Internet services, including educational ones. However, checking the sustainability of the relationship between demographic and technical factors and the development of the EdTech market requires additional research, especially in the context of a worldwide pandemic.

Methods of research consist of several stages. The first one is gathering the information stage using reliable sources. By reliable sources, the authors mean the official and trusted sources of world analytical organisations and international analytical centres such as the World Bank, HolonIQ, KPMG etc. Therefore, the statistics of venture capital investments from HolonIQ, made by venture investors from all over the world, from 2010 to 2021 were found. Collected information was compared on annual change to the past period from 2010 till 2020 and considered in dynamics.

A country’s education development estimation is widely connected with considering the economic development level as the main characteristic. Wherein, the EdTech companies development, first of all, aimed to increase access to education for all levels of the population in the world. So, the main role in the research highlighted demographic and technological factors because the current culture of startup development is based on future, long-term profit, and achieving sustainable goals first, which could be done if the startups and investors see the growing consumer base and their product accessibility. Therefore, a certain list of the main influencing factors was gathered, which includes:

- 1) Demographic factors: growth of population worldwide, the population of 15 - 65 years old increase dynamics, world adult population literacy rate (Our World In Data, 2021; World Bank Database, 2021a);





- 2) Technological factors: fixed broadband subscription statistics; secure internet servers; mobile cellular telephone subscriptions (World Bank Database, 2021b).

The further stage is about using mathematical and statistical methods. The least-squares method was applied to reveal the functional connection between the studied indicators. Moreover, statistical methods for checking the obtained estimates of the regression equation parameters are applied which are aimed to confirm the statistical significance of the used variables.

In addition, there are the Ramsey test and the Breusch-Pagan test performed. The first one was applied to confirm the selected model specification. The second one is used to examine the presence of random error heteroskedasticity in the regression model.

As a result of this stage, some evidence is formulated for the hypothesis that technological and demographic factors influence the development of the global EdTech market. However, it is necessary to check, firstly, how stable this dependence remains for individual countries, and secondly, these factors' strength of influence.

At the final stage of the study, to test the hypotheses put forward, the methods of multivariate statistical analysis were used, including the study of a fixed effect model, which allows for taking into account immeasurable individual differences in objects. For the study, a set of panel data was formed on statistical indicators of China, India, the USA and the European Union for the period 2010-2020.

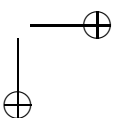
To test the proposed hypotheses using a fixed effects model, we will take into account not only the specific immeasurable features of countries but also the specific features of each of the periods. This is especially important for the period we are considering from 2010 to 2019, which is characterized by the development of the global economic crisis. In the model itself, we will use robust standard errors to level the autocorrelation of the explanatory variables. To test the specification of the model, we use the Hausman test when comparing a fixed effects model and a random effects model, as well as the Breusch-Pagan test when comparing a random effects model and a linear model, and the Wald test when comparing a fixed effects model and a linear model.

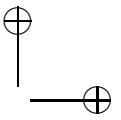
The whole process of calculations was developed using a cross-platform software package for econometric analysis Gretl.

3. Results

Global EdTech expenditure is expected to reach approximately 300 billion USD in 2022 and even at this level, digital spendings will only represent 4% of the total market. Therefore, the analysis of the current situation in the venture capital market can be interpreted as the growing interest of investors all over the world. The average annual growth of venture investments from 2010 to 2015 is about 57% with the highest point in the 2014-2015 period. Therefore, American and Chinese companies invested more than 3.5 billion dollars. From 2016 to 2020 average annual growth of invested venture money marked about 43% with the main destinations to companies established in the USA, China, India, and Europe.

Moreover, there are more than 10 billion invested in Chinese companies and about 2.5 billion dollars in American ones in 2020 (Figure 1). The positive dynamics of venture





capital flow are presented in charts for both India and Europe also. The Indian startups received 2.3 billion dollars and European ventures 0.8 billion in 2020. Further analysis of the Education Technology market continued with a search for the probable factors of impact on venture capital inflow and overall market growth.

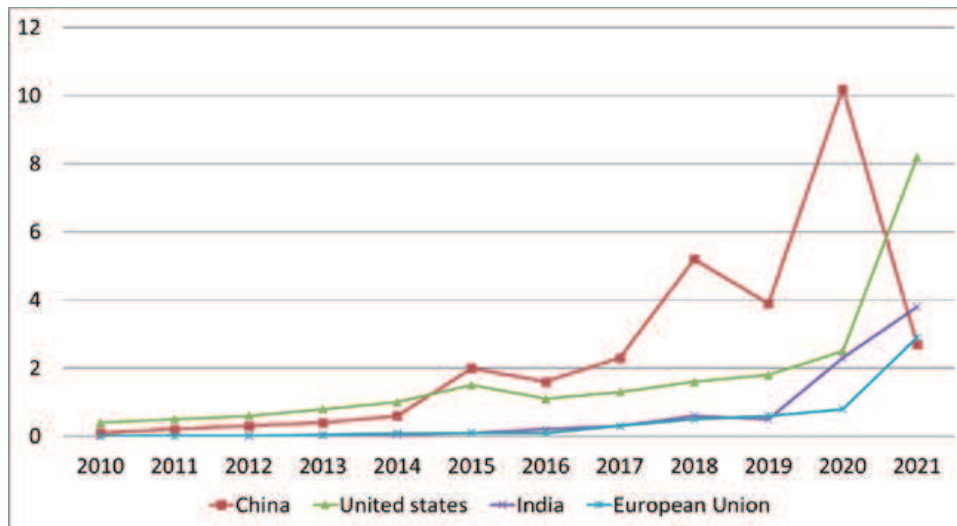
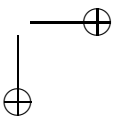


Figure 1: Venture investments dynamics in EdTech companies, billion USD.

The further stage of the research was conducted by the implementation of the least-squares method to reveal the functional connection between the dependent variable and the studied 6 variables mentioned from 2011 to 2020 period (Table 1). The dependent variable “ld_vench_fund” is the log difference for variable “vench_fund,” which describes venture investments in EdTech companies, in \$ billion; “ld_literacy” is the log difference for variable “literacy,” which describes the literacy rate of the entire adult population of the world (population over 15 years old), in % of the total world population; “ld_BB_Internet” is the log difference for variable “BB_Internet,” which describes access to broadband Internet (fixed broadband subscriptions), in billion people; “ld_servers” is the log difference for variable “servers,” which describes the number of secure internet servers per 1 million people, in thousands; “ld_w_mobile” is the log difference for variable “w_mobile,” which describes the number of mobile-cellular telephone subscribers in the world, in billion; “ld_young_pop” is the log difference for variable “young_pop,” which describes population dynamics between the ages of 15 and 64 of the total world population; “ld_population” is the log difference for variable “population,” which describes population growth in the world, in %. In the model, we will use HAC standard errors to level the autocorrelation of explanatory variables.

The least squares results can be interpreted as a close connection and the impact of “BB_Internet” and “young_pop” increase the dynamics on the variable “vench_fund”. The “BB_Internet” variable is about 7.29 (at a significance level of 0,1%) and the dynamics of the “young_pop” have the strongest influence 445.04 (at a significance level of 1%).



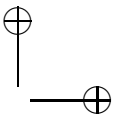


Table 1: The least-squares method results.

	Coefficient	Std. Error	t-ratio	p-value
ld_literacy	-183.424	49.7408	-3.688	0.0211**
ld_BB_Internet	7.29106	0.703681	10.36	0.0005***
ld_servers	-0.633000	0.138626	-4.566	0.0103**
ld_w_mobile	-7.45819	1.44753	-5.152	0.0067***
ld_young_pop	445.034	108.382	4.106	0.0148**
ld_population	-78.2115	12.9089	-6.059	0.0037***
R-squared=0.881636			Adjusted R-squared=0.733680	

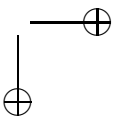
Additionally, the Regression Equation Specification Error Test (RESET), a procedure used in econometrics to test the functional form (specification) of a model, is applied within research. According to the presented results, the statistical value is less than critical and the functional form (specification) of the model is acceptable. Further the Breusch Pagan test reveals the heteroscedasticity in the regression model applied. The linear dependence of the variance of random errors on a certain set of variables was checked. According to the results of the applied test, there is no heteroscedasticity revealed.

Thus, a statistically significant relationship was revealed between venture flows in EdTech, on the one hand, and demographic and technical factors, on the other hand. The results obtained are limited by the set of variables used and the period. Therefore, the transition from the global level to the country level requires additional research.

In addition, the results obtained are not a causal relationship between the dependent and explanatory variables. The Granger causality test showed that only the variable “literacy” is the Granger reason for “vench_fund”. All other variables are not Granger reasons for “vench_fund” and there may be other explanatory variables.

To test the hypothesis that technological and demographic factors influence the development of the EdTech market in specific countries, a fixed effects model was used. At the same time, the dependence on the first lag for the dependent variable in terms of the volume of venture investment was introduced into the model. The constructed model is better than the random effects model according to the results of the Hausman test. The coefficient of the variable denoting broadband access is significant and positive (at a significance level of 5%), and the coefficient of the variable denoting the first lag in the volume of venture financing is significant and negative (at a significance level of 10%). At the same time, the coefficients for demographic variables, as well as dummy time variables, are not significant and were removed from the model (Table 2).

The change in the EdTech market in our model is explained by the technological factor and the volume of venture investment in the past period. This can be interpreted as follows. Improving the technological infrastructure in the country directly affects the number of Internet users, that is, the potential size of the EdTech market and helps



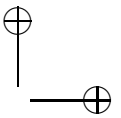


Table 2: The fixed effect model results.

	Coefficient	Std. Error	t-ratio	p-value
Const	0,535583	0,0979290	5,469	0,0120**
ld_BB_Internet	1,95771	0,448785	4,362	0,0223**
ld_vench_fund_1	-0,523483	0,191831	-2,729	0,0720*
LSDV R-squared	0,437533			

attract new investment in the industry. At the same time, the already attracted volumes of investments should be effectively spent on the development of EdTech companies, which in the short term somewhat limits the possibility of attracting new investments to those companies that have just completed an investment round.

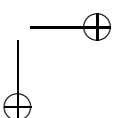
Despite the findings, in our model, R-squared is only 0.43. This means that our model explains a small fraction of the variation in the dependent variable and is not good enough. There are other explanatory variables that we did not take into account and which strongly influence the variation of the dependent variable.

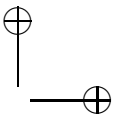
4. Discussion

The EdTech market development highly depends on venture investments, which reflect the high-risk status of educational technology projects. However, on the other hand, it provides new research opportunities based on investor behaviour. The research outcomes of the venture capital dynamics characterise the current state of the market as growing. Investors are highly involved in looking out for a new “EdTech unicorn” therefore the “bet-stars,” according to research statistics, are the USA, China or India-originated startups. China is a key driver of growth in EdTech venture capital investment, making up more than 60% of all global EdTech venture capital in 2020. It requires a deeper analysis of the event catalysts in the face of demographic and technological factors.

The growth of the population worldwide is one of the concerns of governments. From 2010 to 2020 world population increased by an average of 1.16%. More inhabitants mean more jobs, affordable medical care, insurance, and most important, available education for everyone which are part of the United Nations’ sustainable development goals. EdTech industry prosperity could be one of the key factors in the way of providing all available education, affordable to less economically developed countries with the same level of quality. Moreover, as justified above, the increase in the global population ages of 15-65 is the possible direct reason for market growth and venture capital inflow.

EdTech startups have a general competitive advantage of non-dependence from borders despite the technological restrictions of the current territories. The main risks of EdTech companies could be the low rate of secure internet servers, the prevalence and availability of mobile cellular telephones and fixed broadband internet. According to the UN database (n.d.), the number of secure internet servers for 1 million people is rising yearly. In 2020 more than 11,515 secure internet servers for 1 million inhabitants





counted. Fixed broadband subscriptions increased from 532 million in 2010 to 1.178 billion in 2020, more than half. Considering mobile cellular telephone subscriptions, it must be noted that, there are more than 8 billion subscriptions with an increasing tendency in the forecasts. All these are necessary conditions for access to online services, including educational online services. As a result, the potential audience of the EdTech market is growing dramatically. This is largely why venture capital increase in recent years is in high connection with certain of these factors which are approved by the mathematical methods mentioned above.

It’s not just demographic and technological factors that affect the EdTech market. Moreover, based on the results of the research conducted, these factors do not have a decisive influence on the EdTech market. What factors are driving the EdTech market? We assume that political factors and the black swan factor need to be taken into account.

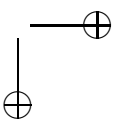
There is a list of political factors which may be considered as both catalysts and risks for EdTech’s prosperity. It is difficult to quantify them, but it is possible to assess the qualitative impact on the EdTech market. Consider the example of the United States, India and China.

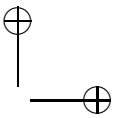
The US government indicates in the politics of the open market and open competition (Thomas & Nedeva, 2018), the rising costs of traditional education, upskilling requirements and the new vision of education by the new generation of millennials boost startup growth (Regan & Khwaja, 2019). Additionally, more companies choose a way of building their internal educational system. Nevertheless, such steps work on market boosting.

The Indian way of EdTech supports, probably, one of the systemic ones. Officials consider economic and demographic problems and choose the direction of building a hybrid system of education, first in general school grades (Burch & Miglani, 2018). The new online and offline education methods are planned to be implanted into the education system (Joshi et al., 2020).

The Chinese EdTech market is one of the resultative with a big number of rising companies according to Fairlie and Loyalka (2020). The Chinese government’s open and soft policy of education control changed in the summer of 2021. The newsletters shared the information that China will prohibit tutoring companies from raising capital through IPOs. The document also prohibits listed companies from raising capital to invest in academic training agencies. Thereafter market capitalization of the number of public EdTech companies plummeted. For example, TAL Education with a 49.1 billion market capitalization fell to 14.6 billion dollars (overall 70%) within a few days, EdTech giant New Oriental Education’s market capitalization plummeted from 27.9 to 11.6 billion dollars (overall 58%) etc. Therefore, some government decisions could do severe harm to EdTech’s investment attractiveness.

The modern world in the context of globalisation offers international society new, even more, unpredictable calls. Nassim Nicholas Taleb named them Black Swans and first presented the theory in his book *The Black Swan: The Impact of the Highly Improbable* (Taleb, 2008). The Covid-19 pandemic is one of the Black Swans. Global lockdown in 2020 proposed the opportunity for EdTech and the sharpest increase in venture funding





happened in the mentioned year. This is widely seen as a factor in accelerating digitalization and thus increasing venture capital investment in all online education-related businesses.

In other words, favourable demographic and technical conditions are necessary, but not sufficient factors for the development of the EdTech industry in the country. Moreover, as a result of our research, we can state with great confidence that the necessary technological and demographic prerequisites for the growth of the Edtech market have already been created and the favourable conditions created by the state and public institutions are becoming the main exogenous competitive factor.

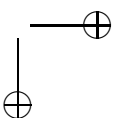
5. Conclusion

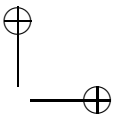
The conducted research allows several conclusions in the terms of EdTech investments connections with demographic and technological factors, which were tested with mathematical instruments. The following conclusions may be drawn based on the results. First of all, the general influence of Covid-19 on every market, including EdTech, must be noted. Worldwide lockdown during the ovid-19 pandemic speeds up remote work style and pushes companies to transform their structure to the new reality. Online services and work tools for companies, universities, and schools became more necessary than ever as well as online education platforms. At the same time, the EdTech market is developing unevenly in different countries of the world. In some countries, you can see a faster and wider spread of EdTech solutions compared to others.

The second one is the escalating crisis of traditional education and at the same time the growth of the population worldwide, including the young-active population of 15-65, especially in developing countries. Moreover, the rising cost of traditional education in developed countries gives the reason for the population, most of whom are millennials, to turn face to alternative ways of studying. The popularisation of online education, mass acceptance of this form of education by employees, and public control of the knowledge quality at a high level could be some of the catalysts in the way of achieving UNDP goals of sustainable development and all available education.

Thirdly, the accelerated development of information and telecommunications infrastructure is practically all over the world. EdTech market development and, overall, any goal achievement cannot be considered in any way without a broadcast internet connection of the population. Broadcast internet subscriptions are rising nowadays as well as the number of secure internet servers and mobile-cellular subscriptions. The target audience of EdTech platforms have their mobile phones so could transform it into an online classroom with interactive exercises. That is the most likely reason why venture capitalists believe in EdTech and are still investing.

Fourth, technological and demographic factors have played a key role in the development of the EdTech market. These factors are important but not the only ones in the development of EdTech. It is important to understand that many other factors affected and will affect EdTech development (e.g., political factors, the black swan effects, cultural etc.). However, the authors assume that favourable conditions for online education created by the state and public institutions are becoming the main exogenous factor of competition.





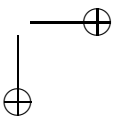
The results obtained and the assumptions made contributed to understanding the development strategy of the educational market for investors and EdTech startups. In addition, the results obtained allow national governments to notice the relevance of measures to support and stimulate online education and to harmoniously complement traditional education with online forms.

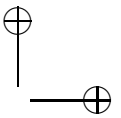
Acknowledgements

The study was supported by the Russian Foundation for Basic Research (RFBR), project No. 20-310-70023.

References

- [1] Burch, P. & Miglani, N. (2018). Technocentrism and social fields in the Indian EdTech movement: formation, reproduction and resistance, *Journal of Education Policy*, 33(5), 590-616. <https://doi.org/10.1080/02680939.2018.1435909>
- [2] Cuban, L. & Jandrić, P. (2015). The dubious promise of educational technologies: Historical patterns and future challenges, *E-Learning and Digital Media*, 12(3-4), 425-439. <https://doi.org/10.1177/2042753015579978>
- [3] Fairlie, R. & Loyalka, P. (2020). Schooling and Covid-19: lessons from recent research on EdTech. *npj Science of Learning*, 5(1), 13. <https://doi.org/10.1038/s41539-020-00072-6>
- [4] Filmer, D., Rogers, H., Angrist, N. & Sabarwal, S. (2020). Learning-adjusted years of schooling (LAYS): Defining a new macro measure of education, *Economics of Education Review*, 77, 101971. <https://doi.org/10.1016/j.econedurev.2020.101971>
- [5] Hanson, M. (2023). *Student Loan Debt Statistics*, Education Data Initiative. Retrieved May 13, 2023, from <https://educationdata.org/student-loan-debt-statistics>
- [6] Hennessy, S., Jordan, K., Wagner, D. A. & Team, E. H. (2021). Problem Analysis and Focus of EdTech Hub’s Work: Technology in Education in Low-and Middle-Income Countries.
- [7] Hillman, V., Martins, J. P. & Ogu, E. C. (2021). Debates about EdTech in a time of pandemics should include youth’s voices, *Postdigital Science and Education*, 1-18. <https://doi.org/10.1007/s42438-021-00230-y>
- [8] HolonIQ. (2021a). *Global EdTech market to reach \$404B by 2025 - 16.3% CAGR*, Retrieved May 13, 2023, from <https://www.holoniq.com/notes/global-education-technology-market-to-reach-404b-by-2025/>
- [9] HolonIQ. (2021b). *Global EdTech Venture Capital Update - Q1 2021*, Retrieved May 13, 2023, from <https://www.holoniq.com/notes/global-edtech-venture-capital-update-q1-2021/>
- [10] Hsu, Y. C., Hung, J. L. & Ching, Y. H. (2013). Trends of educational technology research: More than a decade of international research in six SSCI-indexed refereed journals, *Educational Technology Research and Development*, 61(4), 685-705. <https://doi.org/10.1007/s11423-013-9290-9>
- [11] Jordan, K., David, R., Phillips, T. & Pellini, A. (2021). Education during the COVID-19: crisis Opportunities and constraints of using EdTech in low-income countries, *Revista de Educación a Distancia (RED)*, 62, 65. <https://doi.org/10.5281/zenodo.3750976>
- [12] Joshi, A., Vinay, M. & Bhaskar, P. (2020). Impact of coronavirus pandemic on the Indian education sector: perspectives of teachers on online teaching and assessments, *Interactive Technology and Smart Education*. <https://doi.org/10.1108/ITSE-06-2020-0087>
- [13] KPMG. (2021). The future of higher education in a disruptive world, *KPMG*. Retrieved May 13, 2023, from <https://assets.kpmg/content/dam/kpmg/xx/pdf/2020/10/future-of-higher-education.pdf>
- [14] Liyanagunawardena, T. R., Williams, S. & Adams, A. A. (2014). The impact and reach of MOOCs: a developing countries’ perspective, *eLearning Papers*, 38-46.
- [15] Netology. (2022). *EdTech Market Research 2022*. Retrieved May 13, 2023, from <https://research.edmarket.ru/>
- [16] Our World in Data. (2021). Population growth rate by level of development, *Our World in Data*, Retrieved May 13, 2023, from <https://ourworldindata.org/grapher/population-growth-rate-by-level-of-development>





- [17] Regan, P. M. & Khwaja, E. T. (2019). Mapping the political economy of education technology: A networks perspective, *Policy Futures in Education*, 18(8), 1000-1023. <https://doi.org/10.1177/1478210318819495>
- [18] Sanders, M. & George, A. (2017). Viewing the changing world of educational technology from a different perspective: Present realities, past lessons, and future possibilities, *Education and Information Technologies*, 22(6), 2915-2933. <https://doi.org/10.1007/s10639-017-9604-3>
- [19] Simmons, E. M. (2019). *EdTech in Emerging Markets: Investing for Impact* (Doctoral dissertation).
- [20] Taleb, N. N. (2008). *The black swan*, Penguin Books.
- [21] Thomas, D. A. & Nedeva, M. (2018). Broad online learning EdTech and USA universities: symbiotic relationships in a post-MOOC world, *Studies in Higher Education*, 43(10), 1730-1749. <https://doi.org/10.1080/03075079.2018.1520415>
- [22] World Bank Database. (2021a). *Literacy rate, adult total (% of people ages 15 and above)*, (n.d.), Data. Retrieved May 13, 2023, from <https://data.worldbank.org/indicator/SE.ADT.LITR.ZS>
- [23] World Bank Database. (2021b). *Individuals using the internet (% of the population)*, (n.d.). Data. Retrieved May 13, 2023, from <https://data.worldbank.org/indicator/IT.NET.USER.ZS>
- [24] World Bank. (2020). *Realizing the future of Learning: From learning poverty to learning for everyone, everywhere*, World Bank. Retrieved May 13, 2023, from <https://www.worldbank.org/en/topic/education/publication/realizing-future-of-learning-from-learning-poverty-to-learning-for-everyone-everywhere>
- [25] World Bank. (2021). *Remote learning during COVID-19: Lessons from Today, principles for Tomorrow*, World Bank. Retrieved May 13, 2023, from <https://www.worldbank.org/en/topic/edutech/brief/how-countries-are-using-edtech-to-support-remote-learning-during-the-covid-19-pandemic>
- [26] Zuboff, S. (2020). The age of surveillance capitalism: The fight for a human future at the New Frontier of Power, *PublicAffairs*. <https://doi.org/10.1080/07352166.2021.1939586>

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(Received May 2022; accepted: March 2023)

