Country performance in e-sport: Social and economic development determinants

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Abstract. The article examines the cases of 18 countries that have been consistently ranked by Esports Earnings over the past ten years to find the social and economic determinants that may determine a country's success in the international e-sports arena. In the study, indicators of a country's cybersports success consider the annual volume of prizes won by its e-sportsmen, the ranking place in the world rankings and the total number of e-sportsmen. The hypothesis about the possible influence of a number of macroeconomic indicators, as well as the characteristics of the overall level of social stability on the development of e-sports within the country, was put forward and verified. The scientific landscape of research on cybersports, published in Scopus (by prevailing research topics, the geography of research network leaders, and the evolution of scientific search), was structured using the VOSviewer toolkit. By means of canonical analysis, pairwise relationships in the chain "economic development – social development – e-sports development," as well as determinants with strong intragroup and intergroup relationships, have been revealed; and these relationships were quantified in the aggregate by means of structural modeling. The results of the calculations showed that the economic stability of the country rather than social stability has a greater influence on its success in the international e-sports arena. The most relevant indicators of economic development,

considering success in e-sports, are GDP, unemployment rate and direct foreign investments, social development – poverty rate, population migration and Gini coefficient.

Keywords: canonical analysis, structural equations, eSports, social development, economic development, cross-country analysis

JEL Classification: G21, L26, O16

1. INTRODUCTION

The development of the IT sphere has formed new sectors of the economy, including e-sports. E-sports, as gaming competitions based on the use of computer technologies in virtual space, in the modern sense, is a global industry combining: traditional sports competitions (competitive component), entertainment (emotional and entertainment components) and the IT-sphere (technological component). Such a unique combination of different spheres explains the rapid development of e-sports and the increasing interest among millions of people and mass media. According to forecasts of analytical company Newzoo, in 2022, the world's e-sports audience will grow by 8.7% to 532 million people, and by 2025 it will exceed 640 million people.

Every year the e-sports market is growing by 5–17% and by the end of 2022, revenues from cybersports worldwide will be almost 1.38 billion U.S. dollars. According to the forecasts of analytical resource Statista in 2029, this value will reach 5.48 billion U.S. dollars.

Functioning of the eSports market is made up of various actors, the major ones being players and fans, game developers, competition organizers, clubs and e-sportsmen, streaming platforms and media, bookmakers and sponsors. They come together to form a single system that operates under market laws.

Monetization of cybersports comes from a variety of revenue sources, including digital copy sales, in-game purchases, services for recurring game subscriptions, and consumer spending on video games. Computer gaming revenue is also generated through merchandise and ticket sales, sponsorship deals and media rights from many annual e-sports tournaments.

The leading world countries actively support E-sports by building arenas, opening appropriate new specialties in universities and colleges, introducing scholarships for e-sportsmen. All of this can be called strategic steps taken to develop the industry and long-term investment, affecting the country's economy's future development.

E-sports organizations engage in commercial activities generating substantial revenues, but sponsors play a critical role. This industry has experienced rapid growth and development due to sponsorship. It should be noted that previously only hardware manufacturers of ASUS, Intel, HP were such sponsors. Currently, most eSports events are sponsored by RedBull, Visa, Mastercard, Mercedes-Benz, which are not related to the gaming industry.

The average age of participants in e-sports competitions is 22–29 years old. One of the significant attention-grabbing factors among young people to the sport is the size of the prize funds. The prize funds of e-Sports disciplines are growing every year and have reached millions of dollars: Dota 2 – 230.8 million, Counter-Strike: Global Offensive – $110.5 million, Fortnite – $99 million, League of Legends – $82 million, StarCraft II – $34.7 million.

The e-sports industry is part of the creative economy, created by the creative industries – music, film, entertainment software for slot machines, computer games. The UN Conference on Trade and Development (UNCTAD) defines the "creative economy" as a concept based on creative assets with the

potential to engender economic growth and development (Creative industry 4.0: Towards a new globalized creative economy, n.d.).

Given the rapid development of esports within the country, it is of scientific interest to look for the determinants of success or failure of a particular country in the international e-sports arena.

2. LITERATURE REVIEW

The analysis of scientific research papers in e-sports was carried out using the Scopus web service, a famous database of abstract and cited publications, covering more than 24,600 titles (books, journals, publications) and more than 5000 publishers.

The search was performed by the field "Article title, Abstract, Keywords," taking into account different forms of the word "e-sport" in English, by the complex query "esport OR esports OR e-sport OR e-sports." The total number of found publications is 1302.

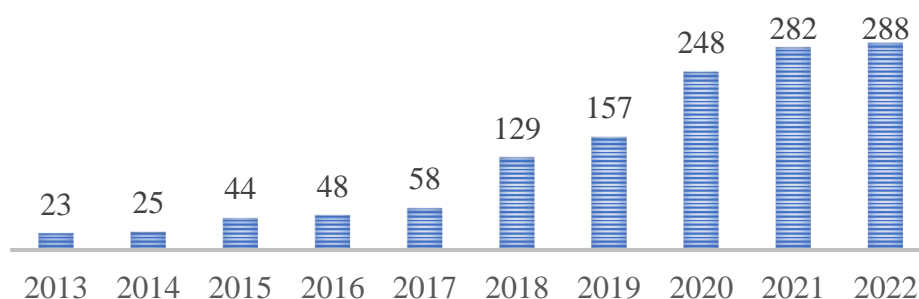Figure 1 shows the growth dynamics of scientific publications from 2013 to 2022.

Figure 1. Number of publications on "Esports" by year
Source: Scopus database

Bibliographic analysis of publications was performed using software visualization tools in the VOSviewer program. Based on the results of the mapping of the subject area "esports," the thematic focus of the publications was determined and a terminological map was constructed based on the words co-occurring in the titles, abstracts and keywords of the articles (Fig. 2).

To interpret the results in a simple way and focus on the most popular keywords, a limit was set: a keyword must occur at least six times – 97 words were selected out of a total of 3179 words downloaded from Scopus.

The constructed map visualizes the frequency of word usage (circle size), the closeness of the relationship (the closer, the tighter), and the different combinations of keywords within and between clusters.
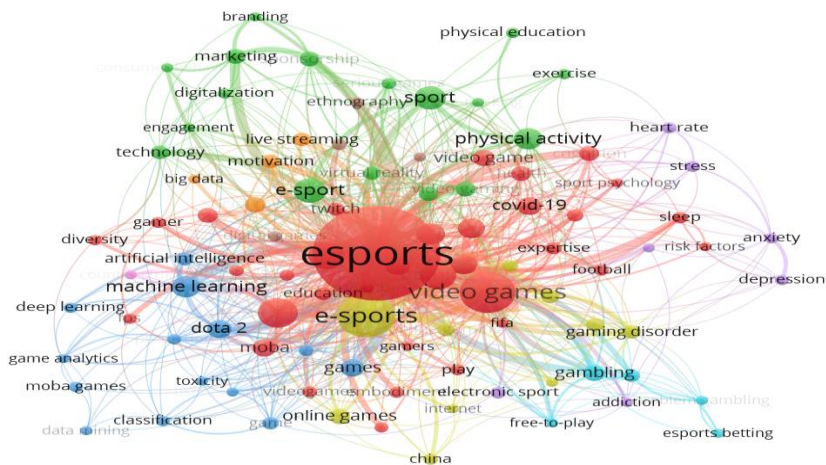
Figure 2. Map of keywords most frequently used in publications from Esports from 2013 to 2022,
grouped into clusters
Source: developed by the authors using Scopus database and VOSviewer toolkit

In the created graph, the nodes are clusters created by keywords that the authors shared in their publications on e-sports, and the edges demonstrate the relationships between the papers. The total number of keywords in the graph is 97 units with 725 edges and 9 clusters.

The constructed keyword graph summarizes the set of publications indexed in the Scopus database, devoted to the analysis of esports within countries worldwide in different fields of research: video games, machine learning, marketing, sponsorship, sport psychology, online games, live streaming, eye-tracking, artificial intelligence, game analytics, etc.

For the conceptual bibliographic analysis over time, another format for a graph has been chosen – one based on a colored time scale – keywords for the last 3 years are marked with the corresponding color (Fig. 3).
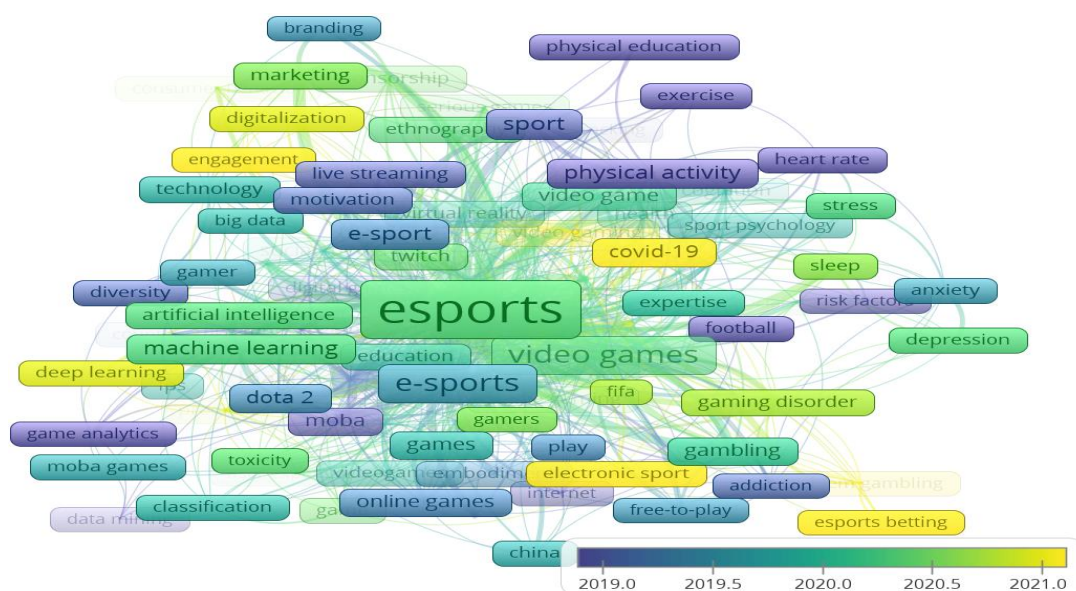

Figure 3. Graph of keywords most frequently used in scientific papers with "Esports" from 2013 to 2022,
classified by the publishing time scale.
Source: developed by the authors using the Scopus database and VOSviewer

The significance of e-sports to the world's economic system and in the context of marketing is explored in (Cunningham, 2016). (Scholz, 2019) described the principles of building a network of business models in e-sports, and also focused on innovation, e-commerce, and the future industry of e-sport competitions. Using the Logit-Probit model (Lopez-Cabarcos et al., 2020) analyze the relationship between financial (VIX, S&P GSCI Gold Index) and social (daily fluctuations in total COVID-19 deaths worldwide and Google's attention to coronavirus worldwide) variables as well as the revenue offered by the video game and e-sports exchange fund (ESPO). A study (Chyzmar & Hoblyk, 2021) provides a framework for the technological and economic development of e-sports, the performance of e-sports organizations with a franchise network in a formalized system to find the best solution for hardware upgrades.

The current global trend is the application of Big Data (Karaoulanis, 2018), blockchain technology (Lopez et al., 2019; Kibaroğlu, 2020) and integrated artificial intelligence systems (Bilan et al., 2022; Obeid et al., 2020; 2020) into different areas of life.

Information and communication technologies determine not only the development of companies but also the overall country's development (Dahmani et al., 2022; Iryna Roshchyk et al., 2022; Millia et al., 2022; Remeikiene et al., 2021).

Developed cyberspace contributed to a large number of scientific studies devoted to the search for factors and determinants of the reciprocal relationship between the digitalization of social relations and social development (Vinska & Tokar, 2021; Omran & Bilan, 2022). In (Mishchuk, et al., 2019), this relationship is explored through in the light of social inequality; in (Privara, 2022, Virak & Bilan, 2022), in the light of potential disparities in the labor market. A study (Csordás, et al., 2020) found a significant relationship between digital competence and unemployment rates, as well as a positive correlation between digital competence and corporate training rates. The research papers (Ruihui et al., 2020; Vorontsova et al., 2021; Ahmmed & Salim, 2019, Didenko et al., 2022) address new social challenges arising from the population's ability to move into the digital space, particularly through IT skills, quality of education, scientific activities, etc. Both integrated cognitive and non-cognitive skills are needed to participate fully in the digital economy's development (Yoshimori & Yoshimori, 2022). It should be noted that the attributes of information systems affect knowledge sharing and satisfaction of computer users (Zamir & Kim, 2022), human communication with the digital economy marketplace (Beyi, 2018).

A number of scientific works are focused not on the positive, but on the negative consequences of the active development of cyberspace, particularly because of the growth of cybercrime, increasing information vulnerability of the population. The works (Vasylieva, et al., 2020; Samusevych, et al., 2021) propose procedures to level these cyber risks through state regulation mechanisms, and the works (Lyeonov, et al., 2020; Kuzmenko, et al., 2021) propose personal financial protection mechanisms.

The powerful development of cyberspace has also prompted the emergence of scientific works that examine the relationship between digitalization and the determinants of economic development (Tudose, et al., 2022; Ključnikov, et al., 2022, Lyeonov, et al., 2021; Vasilyeva, 2021; al., 2021; Vavrek, et al., 2021). A number of academic papers consider the digitalization of society as an impetus for sustainable economic development (Melnyk et al., 2021, Navickas, et al., 2021), the growth of companies' competitiveness, job creation, etc. (Strilets et al., 2022; Kolodiziev et al., 2022; Melnyk et al., 2022), a shift in investment (Cicea & Marinescu, 2021, Govdeli, 2022). The attention of contemporary scholars is focused on exploring various aspects and opportunities for sustainable economic growth (Deineko, et al., 2022a,b; Oliinyk, et al., 2019; Pereira-Moliner, et al., 2021; Habanik, et al., 2019) in response to the challenges of Industry 4.0, focused on digitization and process sharing in the economy and the emergence of smart businesses and growth of large technology companies (Bethlendi, et al., 2022).

The results of studies (Pimonenko et al., 2021; Grenčíková et al., 2021; Andrei, et al., 2021, Altyar et al., 2020 Mills et al., 2020; Kumar et al., 2019, Chovancová & Tej , 2020) that theoretically consider and empirically prove the relationship between economic and social development are also of particular interest.

The debate about whether or not e-sports are a sport in the traditional sense does not cease. The main argument of the opponents is the lack of physical activity in e-sport competitions. But Olympic sports such as checkers, chess, and bridge also do not require physical exercise, besides they have a lot in common with organizational and economic issues (Yan, 2020; Andreas, 2020; Prykhodko, 2019; Vilma Čingienė, 2020; Chee & Kar) and psychological-emotional (Nufer, 2019; Lukowicz & Strzelecki, 2020). Gradually, play techniques are spreading to different spheres of human activity – recreation, learning, management, politics, communication, education, and technology (Kacerauskas et al., 2022; Vovk & Vovk, 2017; Worimegbe et al., 2020).

The relatively small number of publications in Scopus investigating the relationship between economic and social development and the performance of cybersport competitions makes relevant the need for additional research and economic-mathematical modeling.

Therefore, the purpose of this article is to verify the hypothesis about the possible influence of some economic indicators (GDP per capita, foreign direct investments, inflation, level of financial inclusion of young people, unemployment rate, export and import of services) and characteristics of the general level of social stability (life expectancy, level of social protection of young people) on the development of the e-sports in the country by means of canonical analysis and structural modeling on the example of 18 countries which are steadily ranked in the Esports Earnings for the last ten years.

3. METHODOLOGY

Step 1. Formation of the statistical research base

To test the hypothesis about the influence of the country's economic and social development on its performance in the world e-sports arena, 18 countries were selected: Canada, China, France, Germany, Japan, the Netherlands, the Russian Federation, the United States, Ukraine, the United Kingdom, Brazil, Denmark, Thailand, Vietnam, Australia, Indonesia, Malaysia, Sweden. This choice was based on the countries' stable representation over the past ten years in the rating (Esports Earnings). The World Bank data form the information base of the research.

Life expectancy at birth (years); poverty level of $3.65 US per day (%), Gini coefficient, the prevalence of malnutrition (% of the population), probability of death among children aged 5-9 (per 1000), availability of education, number of people using at least basic sanitation (% of the population), migration movement, the rate of infants with low birth weight, age dependence ratio, youth (% of working-age population) described the country's social development in this study.

The following indicators were chosen to characterize the country's economic development in this study, namely inflation, GDP deflator (annual %), unemployment rate, percentage of the population aged 15 and over with an account at a financial institution or mobile money service provider, GDP per capita (constant LCU), foreign direct investment, net (current US dollars), imports of commercial services (current US dollars), exports of commercial services (current US dollars).

The annual prizes won by representatives of e-sports teams of a certain country, US dollars; the ranking of the team in the global eSports standings and the number of eSports players in the country were indicators characterizing the country's performance in the world e-sports arena.

Step 2. Extrapolation of indicators for which there is no data for 2020-2021.

The following steps of the research require the statistical data meet the comparability condition, i.e., they are available for the same periods. Some indicators in the information base of the World Bank are

rarely updated, but their elimination will lead to the loss of the multifactorial feature of the research. Thus, depending on the general development trend, three different methods of extrapolation will be chosen, namely by the average value, if the actual data for previous periods fluctuate around a constant; by average growth (if there is a linear trend); by the average growth rate (with an exponential trend).

Therefore, with the help of the average value extrapolation (1), the forecast values for 2020 and 2021 were calculated for the indicators: poverty level ($3.65 per day), the prevalence of malnutrition, probability of death among children aged 5-9, number of people, who use at least essential sanitation services. The values of these indicators measuring the population's life quality for most countries had a constant value for the period 2012-2019 with minor deviations from the average (Yarenko, 2015).

Such indicators as population migration, the Gini coefficient, and the availability of education were calculated through the average increase extrapolating according to formula (2) (Yarenko, 2015).

By applying average growth rate extrapolation (3), predicted values were calculated for only some countries for indicators of poverty level ($3.65 per day) and availability of education(Steel, D. 2007).

$$y_{n+1} = \frac{\sum_1^n y_i}{n} \tag{1}$$

$$y_{n+1} = y_n + \frac{y_n - y_1}{n - 1} \tag{2}$$

$$y_{n+1} = y_n \cdot \frac{y_n}{y_1} \tag{3}$$

where, y_{n+1} – first predicted value, y_1- the first known value of the time series, y_n - the last known actual value of the time series.

Thus, using various methods of data extrapolation, data which was not enough to identify the relationships between the social and economic development of the country, as well as its performance in the world e-sports arena in 2021, was predicted.

Step 3. Analysis of dependence between social and financial and economic spheres. The condition of the multi-criteria review was observed for a qualitative study of interrelationships. Since if we consider only life expectancy at birth and the poverty level, they can indicate a relatively good state of affairs in the country, but the indicator of the probability of death among children aged 5-9 years, on the contrary, can be high. Then it is difficult to characterize the state of social development and the population's quality of life because every indicator is important. On the other hand, qualitative description of the state of life quality only in absolute terms is a difficult process. A similar situation arises with the assessment of the country's performance in the world e-sports arena: on the one hand, the greater the number of prizes won and the place in the general rating, the better; on the other hand - if in one country it is achieved by a large number of players compared to a small number of cyber athletes in another country, the average or individual efficiency of athletes should be considered. The use of integral indices eliminates the multifactorial nature of the model and does not consider the variance of each variable. Therefore, it is more appropriate to take into account the variability of each indicator using canonical analysis based on the null hypothesis about a relationship between two sets of variables (4):

$$a_1x_1 + a_2x_2 + \dots + a_9x_9 = b_1y_1 + b_2y_2 + \dots + b_6y_6 \tag{4}$$

where x_i – set of variables corresponding to the country's social development; y_j - set of variables corresponding to the country's economic development, a_i, b_j – weighting coefficients of canonical analysis.

It is possible to identify relationships between two sets of variables via canonical analysis. Therefore, we will research the relationship between the social and economic development of the country and its success in the world e-sports arena in pairs. The Statistica Portable application program package was used to conduct a canonical analysis of cause-and-effect relationships between the country's economic and social development. A cross-correlation matrix C was constructed using the Multivariate Exploratory Techniques/Canonical Analysis module, which has the form (5). The number of canonical roots resulting from the study equals the minimum value of the number of variables separately in each set, i.e., the minimum value of 6 and 8 – 6 canonical roots. The search for these roots occurs by maximizing the correlation value when constructing the matrix (6).

$$C = (R_{11} \ R_{12} \ R_{21} \ R_{22}) \tag{5}$$
$$Z = R_{11}^{-1} R_{12} R_{22}^{-1} R_{21} \tag{6}$$

where R_{11} – correlation matrix of six variables characterizing the country's economic development, consisting of six rows and six columns, R_{22} - correlation matrix of 8 variables characterizing the level of social development in the country and has a dimension 9x9, R_{21}, R_{12} – correlation matrices of mutual correlation of the country's economic and social development, R_{11}^{-1}, R_{22}^{-1} - inverse matrices to R_{11}, R_{22}.

Step 4. Structural modeling

The structural equation systems continue canonical analysis because they assess the relationship between complex structures quantitatively. When setting up the research with structural equations, explicit variables were used. These are features of the complex systems and were selected due to the canonical analysis.

In particular, the latent variable ECON, which describes the country's economic development, will contain explicit indicators, namely the unemployment rate (Unempl), the level of GDP per capita (GDP) and foreign direct investment (For_invest).

The SOC latent variable, which characterizes the country's social development, contains indicators of the poverty level (in USD 3.65 per day) (Pov_gap), the Gini coefficient (GNI), population migration (Migr).

The ESPORT latent variable, which characterizes the country's success in the global eSports arena, includes such indicators as the annual amount of prizes (Prise), the team's ranking in the world standings (Numb) and the number of eSports players

The constructed structural model (7) has the form:

$$\begin{cases} Pov_{gap} = a_1 Soc + \delta_1, \\ GNI = a_2 Soc + \delta_2, \\ Migr = a_3 Soc + \delta_3, \\ GDP = a_4 Econ + \varepsilon_1, \\ For_{invest} = a_5 Econ + \varepsilon_2, \\ Unempl = a_6 Econ + \varepsilon_3, \\ Prise = a_7 ESport + \varepsilon_4, \\ Numb = a_8 Esport + \varepsilon_5, \\ Place = a_9 ESport + \varepsilon_6, \\ Econ = a_{10} Soc + z_1, \\ Esport = a_{11} Soc + a_{12} Econ + z_2. \end{cases} \tag{7}$$

where $a_i, i = 1..12$ – unknown coefficients, $\delta_{1,2,3}, z_{1,2}, \varepsilon_{1-6}$ – model errors and free coefficients of the corresponding equations of the structural equations system.

4. EMPIRICAL RESULTS AND DISCUSSION

As a result of the application of the Multivariate Exploratory Techniques/Canonical Analysis module, the cross-correlation matrix C (5) was constructed, the canonical roots were calculated by maximizing the correlation value when creating the matrix (6), and the canonical analysis coefficients presented in Table 1 were obtained.Thus, when carrying out the next steps of the research, we will consider indicators of social development as exogenous variables, and economic development indicators - as endogenous variables. Table 1 presents the factor structure of loadings on the first canonical roots to determine the correlation of a separate indicator with the corresponding canonical one.

Table 1

Factor structure of canonical analysis for economic and social development

Social development	Root 1	Root 2	Economic development	Root 1	Root 2
Life_expect2021	-0,768123	-0,026733	Inflation2021	0,211363	0,432401
Pov_gap_3.652021	0,394352	0,077581	GDP2021	0,749474	0,058026
GNI2021	0,880373	0,153377	For_invest2021	-0,368834	0,583029
Undernour2021	0,767131	0,015990	Unempl2021	-0,907423	0,031071
dying5-9_2021	0,834875	-0,033260	imports 2021	-0,460698	-0,695551
Edu2021	-0,424316	0,340709	export2021	-0,535799	-0,503002
bas_san2021	-0,793880	0,182084			
Migr2021	0,557718	-0,520870			

Source: Authors' calculations

The analysis of Table 1 allows us to determine the indicators that have the largest intergroup correlation. In particular, the social development indicators include the Gini coefficient, the probability of death among children aged 5-9, the number of people using at least basic sanitation, and the percentage of the population with widespread malnutrition. Each root is two weighted sums, separately for each set of values, which are presented in formula (8) in the form of coefficients for the corresponding variables and characterize the contribution of the variable to the value of the canonical variable. The economic development indicators, namely the unemployment rate and the level of GDP per capita, have a high intergroup relationship. Next, according to the canonical analysis algorithm, it is necessary to determine the weighting coefficients of the canonical regression, which are given in formula (8).

$$-0,27x_1 - 0,26x_2 + 0,43x_3 + 0,2x_4 - 0,15x_5 - 0,2x_6 - 0,68x_7 - \tag{8}$$
$$-0,25x_8 \approx 0,13y_1 + 0,45y_2 + 0,07y_3 - 0,84y_4 + 0,0003y_5 + 0,2y_6$$

The analysis of weight coefficients of the canonical analysis presented in formula (8) determines the factors that contribute most to intragroup variance. Such social development indicators include the percentage of the population using at least basic sanitation, the country's Gini coefficient, and life expectancy at birth. Among the indicators of economic development, these include the level of GDP per capita, the level of unemployment and the volume of exports of commercial services. Moreover, if the weight coefficient has a positive value, then the relationship between the canonical root and the studied factor is direct; if it is negative, it is inverse.

With a similar methodology, a canonical analysis of cause-and-effect pairwise relations was carried out "parameters of the country's economic development - indicators that determine the country's place in the world e-sports arena" and "parameters of the country's economic development - indicators that determine the country's place in the world e-sports arena". The results of this analysis are presented in Table 2.

Table 2

Results of canonical analysis

	Social development	Economic development
Correlation	0,97945	0,90738
Pearson's criterion (χ^2)	51,348	37,693
Level of significance	0,00319	0,00427
Excessive indicators	75,5853%/12,9904%	69,3436%/41,7017%
Esports indicators (high intergroup connection)	annual amount of prizes, number of e-sportsmen	annual volume of awards, ranking place of the team
Indicators of the relevant field (high intergroup connection)	Life expectancy at birth, population migration	Imports of commercial services, foreign direct investment, net
High intragroup connection	Annual amount of premiums	annual amount of premiums
Indicators that have a strong impact on the relevant field	The poverty level of $3.65. per day, Gini coefficient, population migration	Imports of commercial services, foreign direct investment, net

Source: Authors' calculations

The analysis of the results presented in Table 2 indicates the influence of social and economic development on the level of e-sports, which is confirmed by the value of the correlation heading to 1 (respectively 0.98/0.91), sufficiently high levels of the Pearson test (respectively 51 .3/37.7) at a significance level lower than the critical 0.05 (respectively 0.003/0.004). In addition, the excessive values for eSports development level indicators explain the variance of economic and social development indicators by 69.3%/75.6%, respectively. In particular, a stronger total two-way connection is observed between indicators of economic development and the country's place in the world e-sports arena. Also, with the help of canonical analysis, it was possible to identify precisely the sets of indicators with the greatest influence on intergroup and intragroup relations. Such indicators of economic development include the Import of commercial services, direct foreign investments, net; among indicators of social development - a poverty level of 3.65 dollars. US per day, Gini coefficient, population migration, number of people using at least basic sanitation, life expectancy at birth.

The results of the conducted canonical analysis indicate a close relationship between the economic and social development of the country, because the value of the canonical correlation of 0.988 goes to 1, as well as the corresponding value of the Pearson test $\chi^2 = 99,36$ is sufficiently large at the significance level p=0.00002<0.05. The corresponding value of Wilks' lambda is calculated as the ratio of the determinants of the within-group variance matrices and the total covariance matrix. It came out in the range of 0.231-0.471 for the three groups of the studied variables, indicating the sufficient quality of the division into groups because the value is closer to 0 than 1. Therefore, the quality of the conducted canonical analysis is adequate. Let's move on to the interpretation of the results: the redundancy of the set corresponding to economic development is 74.06%, i.e., quality of life indicators explain 74.06% of the dispersion of selected indicators of the economic sphere and vice versa - there is a redundancy of social development (68.36%) in explaining the variability of economic development indicators of countries in 2021. The results of the canonical analysis show that the relationship between social and economic development is high in both directions, exceeding 50%, but it is stronger for economic development.To determine the values of the coefficients $a_i, i = 1..12$, equation systems (7), Structural Equation Modeling was used in in the package of application programs STATISTICA, the result of which is given in the system of structural equations (9):

$$\begin{cases} Pov_{gap} = 0,69Soc + 0,52, \\ GNI = 0,4Soc + 0,84, \\ Migr = Soc + 0, \\ GDP = Econ + 0,61, \\ For_{invest} = -0,76Econ + 0,77, \\ Unempl = -1,19Econ + 0,43, \\ Prise = ESport + 0,04, \\ Numb = 0,89Esport + 0,24, \\ Place = -0,7ESport + 0,53, \\ Econ = 0,41Soc + 0, \\ Esport = 1,18Soc - 1,84Econ + 0,23. \end{cases} \qquad (9)$$

The analysis of the obtained results makes it possible to conclude about a directly proportional relationship between latent variables characterizing social development with indicators characterizing the economic development and positioning of the country in the world e-sports arena; on the contrary, an inverse relationship between the indicators of economic development and the success of e-sports. In particular, an improvement in the integral level of social development by 0.41% is followed by an improvement in the integral level of economic development by 1%. An improvement in the integral level of social development by 1.18% and a decrease in the integral level of economic development by 1.84% is followed by an increase in the level of prosperous countries in the world e-sports arena.

The impact of each key factor is also quantified.

So, in particular, the improvement of the integrated level of social development by 1% will be a consequence of the growth of individual indicators: the poverty level - by 0.69%, the Gini coefficient - by 0.4%, and population migration - by 1%.

The integral level of economic development will increase by 1% due to a 1% change in GDP, by 0.76% - a change in the volume of direct investment, and by 1.19% - in the unemployment rate.

The country's overall success level in the world e-sports arena will change by 1% with an increase in the total amount of prizes by 1%, the number of tailors - by 0.89 and an increase in the rating position by 0.7.

The test of the constructed model adequacy proved that the level of the entire model significance approaches 0; the calculated significance levels are less than the critical 0.05 for 15 coefficients out of 19 calculated. The iterative process of finding relationships converged after 26 iterations. The maximum value of the deviation function in the iterative process equals 0, indicating an ordinary course of the search. The process showed zero values of redundant parameters, constraints and maximum cosine of residuals, indicating the successful completion of the iterative procedure. Also, the ICSF and ICS criteria go to zero, corresponding to the property of the constructed model of stability to a constant scale factor. The Pearson test value is 84.37 with 24 degrees of freedom, which exceeds the critical value of 36.42. The model's overall quality is also sufficient because 0.046<0.05. Therefore, according to all the listed characteristics, the model is adequate and describes real processes sufficiently qualitatively.

5. CONCLUSION

Canonical analysis with the identification of pairwise relationships and structural equation modeling are convenient and effective tools for assessing the impact of social and economic determinants on the development of eSports.

Canonical analysis confirmed the hypothesis that macroeconomic indicators, as well as characteristics of the general social stability, affect the development of eSports. It was found that a strong cumulative two-

way relationship is observed between the level of economic development and the country's performance in the world e-sports arena. Indicators that have the greatest impact on intergroup and intragroup relations among the economic development indicators include import of commercial services, direct foreign investment; in the social sphere - poverty rate, Gini coefficient, population migration, number of people using at least basic sanitation services, life expectancy at birth.

The verification of the formed model demonstrated that the parameters are within the permissible limit values, which confirms the adequacy of the model and the quality of the real objects.

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