

Independent Factors Simulation of the Influence on the Level of Sustainable Development in Intellectual Systems of Management

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Abstract

The research used regression modeling tools based on the least squares method, which made it possible to investigate the impact of foreign direct investment on the level of sustainable development of different countries. For modeling, independent indicators that have the most noticeable and significant impacts on the level of sustainable development are distinguished. The research covers the annual data for the period from 1991 (for some countries from 1992) to 2019. The already developed ranking of countries according to the SDG index was used as a basis for the selection of the researched ones. The methodology was tested on 9 countries: Norway, Denmark, Estonia, Greece, Canada, Mexico, South Africa, Singapore, and India, which are from different parts of the world and differ in their economic, ecological, and social development. This selection of countries that formed the basis of the analysis will make it possible to make the forecast on a global scale.

The results of the research made it possible to distinguish the main indicators that positively affect the level of sustainable development of countries and those that inhibit it, taking into account the features of economic, ecological, and social development of countries and their geographical location. The influence of foreign direct investment on the change in the level of sustainable development of countries with different characteristics is defined in the research. The results showed that for such countries as Estonia, Mexico, Singapore, India, and South Africa, an increase in investment will affect the level of the sustainable development index negatively, but for Norway, Denmark, Canada, and Greece, an increase in net foreign direct investment will be positive and contribute to increasing the index of sustainable development.

Keywords

Foreign direct investment; Sustainable development, Least Square

1. Introduction

With the rapid development of information and communication technology, the management system has also changed on a global scale, as the arsenal of tools produced by the ICT development – such as machine learning, artificial intelligence, Big Data, etc. – are driving the development of intelligent management systems. Innovative technologies allow for fast, efficient, and qualitative processing of large data sets, modeling the development of economic processes, and making accurate forecasts and strategies, which is a necessity of the present time. Indeed, in the current conditions of accelerated economic, technological, and social development, the issue of sustainable development is becoming more and more theoretical and practical at the global level. The importance of focusing the attention of the world community on this issue is due to those challenges that have a negative impact on the indicators of the main areas of sustainable development and act as barriers to achieving its goals.

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After all, sustainable development is a paradigm where the future is considered as a balance of its three components (economic, social, and environmental) [1].

Sustainable development is the development of countries and regions [2] when economic growth, material production, and consumption, as well as other types of societal activity, take place within the limits determined by the ability of ecosystems to recover, absorb pollution, and support the livelihoods of current and future generations [3].

The idea of improving the ecological situation, preserving the environment, fighting gender inequality, and improving the welfare of the population in poor countries lies in the basis of sustainable development and is transformed in the formulation of its main goals. In 2015, the 17 sustainable development goals were developed at the UN summit. The document “Transforming Our World: Agenda for Sustainable Development for the Period until 2030” was agreed upon by the leaders of almost two hundred countries, including Ukraine.

Actually, sustainable development has become a common idea by which the world agreed to live and change until 2030. However, the existing problems that are observed today like global climate change, the depletion of resources, space garbage, the loss of biodiversity, malnutrition, increasing poverty of the population of individual countries, the violation of gender equality, dying ecosystems, and the risk of unprecedented nuclear wars are the indicators that signal the need for a more thorough study of the issues and the development of appropriate measures that would provide an opportunity to avoid ecological and social catastrophe.

Sustainable development is only a defined concept that is constantly changing and enriched by different definitions and a combination of indicators that characterize each of its component areas and is different for different countries, depending on their special characteristics. The SDG dashboards highlight the strengths and weaknesses of each country in connection with 17 goals, presenting indicators by levels and trends. According to the definition of the UN International Commission on Environment and Development, sustainable development is defined there as development that “meets the needs of the present without harming the ability of future generations to meet theirs” [3].

To better understand the problems of sustainable development in different countries and its various aspects and to develop efficient measures that will contribute to increasing the level of sustainable development, it is necessary to determine the indicators that are characterized by the most significant positive and negative impact in increasing this level. The above-mentioned makes it necessary to carry out modeling to define those indicators that contribute destructively to increasing the level of sustainable development in countries with different characteristics. To develop this issue, the authors conducted regression modeling of the impact of independent indicators on the level of sustainable development on the example of different countries with their characteristic features. It is the determination of such indicators that will be a guideline for the development of appropriate measures, the results of which should have far-reaching consequences, in particular, to ensure sustainable development and preserve our planet for our world and future generations. This determined the relevance of this research.

The purpose of the research is to investigate the impact of foreign direct investment on the change in the level of sustainable development of countries with different characteristics and to identify those indicators that have the greatest impact on it using intelligent management tools.

The main tasks for achieving the purpose set in the research are as follows:

- to propose methodological bases for the regression modeling of the impact of independent indicators on the level of sustainable development, based on the method of least squares;
- to investigate the impact of the main indicators on the change in the level of sustainable development of countries differing in their economic, ecological, social development, and geographical location;
- to determine the level and nature of the impact of foreign direct investment on the change in the level of sustainable development of different countries.

2. Related works

Today, in the conditions of global political and economic instability, more and more attention of scientists and practitioners is focused on the issues of sustainable development, which are relevant at

the global level. Popularity and practical significance provide opportunities for the development of a wide range of scientific publications. Studying the specialized literature on this issue, it is worth noting the scientific achievements that formed the basis of its development. In particular, back in 1968, Garrett Hardin, in his article “The Tragedy of the Commons”, expressed the opinion that common resources, such as air and water, cannot be effectively managed without the right incentives. Already in 1972, the book “Limits to Growth” was published, having been written by the Club of Roman Scientists, which popularized the idea that the uncontrolled growth of our economy and our population can lead to catastrophic results. And the report “Our Common Future” by the UN Commission on Ecology and Development in 1987 is considered an important document in the field of sustainable development. In 2009 in the scientific article “Planetary Boundaries”, the authors for the first time identified nine global boundaries that cannot be exceeded to ensure the sustainable development of the planet. These scientific developments became a strong basis for formulating the ideological foundation of sustainable development. These articles are very important in the history of the movement for sustainable development and contributed to the identification of its main components such as economic, social, and environmental ones.

Analyzing the current works of the scientific community and practitioners, it should be noted that there is a diversity of views of scientists, and the main attention is directed to the disclosure of narrow issues, in particular, related to a separate component of sustainable development. In particular, the scientist [4] believes that maintaining a green and clean climate for sustainable development is one of the biggest challenges today. Developing this issue, author [5] found in his research that technological innovation and renewable energy sources have a positive impact on the environment in China, reducing carbon emissions. In turn, the attention of scientists is also paid to the economic component of sustainable development. In particular, author [6] emphasized the role of economic policy and the environment in sustainable development. and the multiple authors [7] revealed the methodological foundations of causal forecasting of the processes of managing the development of economic systems in conditions of uncertainty, which directly affects sustainable development. During the development of the issue, the authors [8] proposed a mathematical model of the optimal rapid transition of the economic system to an efficient state, which will allow for the formation of scenarios on how to achieve the planned result in a short time. It is expedient to distinguish scientific works in which the issue of the impact of foreign investments on the growth of the level of sustainable development is raised in a separate group according to the direction of scientific interests. After all, foreign direct investment is considered a driving force for the introduction of innovations, increased productivity, and the creation of new jobs [9]. Developing countries in Asia, Africa, and Latin America believe that foreign direct investment has a positive impact on their development, modernization, income growth, and poverty reduction. In the last two decades, these countries have carried out reforms, creating favorable conditions for attracting foreign capital [10].

Corporate social responsibility and reporting on sustainable development are important because the global community demands transparency and openness in the activities of corporations and financial markets [11]. Compliance with sustainable development goals increases social responsibility and corporate image and creates value for companies. At the same time, the impact of foreign direct investment increases the effectiveness of sustainable corporate development [12].

Conflicting conclusions are observed when studying the impact of foreign direct investment on the state of the environment [13]. Environmental protection and economic growth are the global problems of humanity. Research has shown that economic development, GDP growth, and foreign direct investment have a negative impact on the environment if they do not meet environmental goals. However, if countries use a large share of renewable resources, this immediately reduces the overall risk of carbon emissions [14]. This correlates with the popular hypothesis – the environmental Kuznets curve (EKC), a U-shaped relationship that suggests that initially the greater the economic growth, the worse the ecological impact is on the environment, but at a later stage, when the economy reaches a certain high level of deve [15]. This is because the wealthy countries of the world will always invest in environmental projects to level and restrain environmental degradation. This is confirmed by the research that foreign direct investment has a negative and significant impact on CO₂ emissions in Tunisia [10]. because this country belongs to developing countries. However, the environmental Kuznets curve is criticized enough that not all countries show such a relationship [15]. It ignores the impact of environmental policies of developing countries, and that high economic growth alone will

not solve environmental problems. In fact, it is important that politicians do not encourage constant and continuous economic growth, motivating that with the achievement of such a high level of development, environmental problems will be solved by themselves, but immediately balance their goals according to the priorities of sustainable development [16]. The researchers claim that developing countries can benefit from foreign direct investment as a source of external financing in the private sector [17], while attention should also be divided to the issue of the shadow economy [18], which negatively some to attract foreign investment. Special attention should be paid to the study of scientific achievements regarding the role of intelligent management tools in sustainable development processes. In particular, Filho et al. (2022) examine the links between artificial intelligence systems and sustainable development.

The authors argue that the lack of a clear strategy for the development of artificial intelligence creates obstacles to its integration with the research of sustainable development. The use of digital technology is a powerful tool to study sustainable development, as it allows to work with large data sets and to model and predict sustainable development scenarios in different contexts. To follow up on this issue, the researchers in their study (Vinuesa et al, 2020) prove that artificial intelligence can both contribute to and hinder the achievement of sustainable development goals and tasks. However, despite the benefits, researchers (Ojokoh et al, 2020) demonstrate that the growing need for data security and the integration of different data sources are the problems in the application of advanced digital technology.

A thorough study of the specialized literature formed a basis of the formulation of the research hypothesis: let the authors assume that the impact of foreign direct investment on the level of sustainable development will vary depending on the economic, ecological, and social features of countries and geographical locations.

3. Methods / Methods and Materials

To achieve the goal and test the research hypothesis, it is necessary to investigate how foreign direct investment affects the level of sustainable development and whether the level and nature of the impact depend on the economic, environmental, or social characteristics of countries and their geographical location. It is advisable to conduct such research using the regression modeling method because it will make it possible to determine the impact of factors on the performance indicator, in particular, to determine the level and nature of the impact of various factors (foreign direct investment, the level of GDP, population growth, CO₂ emissions, the level of unemployment and the level of average wages) on the level of sustainable development. The calculation of the values of a regression equation can be found both analytically and with the help of special software packages, for example, Excel, Eviews, STATISTICA, etc. In this research, to find the results of the regression equation, it is suggested to use the Eviews software package [19]. The expediency of its use in this research is justified by the fact that it makes it possible to quickly identify statistical dependencies of the analyzed data and, using the obtained dependencies, to make a forecast of the studied indicators [20].

Regression modeling is carried out by the method of least squares. The least squares method is a form of mathematical regression analysis used to determine the line of the best fit for a set of data, providing a visual demonstration of the relationship between the data points. Each point of data represents a relationship between a known independent variable and an unknown dependent variable. It is the use of the method of least squares that will ensure the creation of a line of the best fit that explains a potential relationship between independent and dependent variables.

4. Experiment and Results

The nine countries were chosen for the research: Norway, Denmark, Estonia, Greece, Canada, Mexico, South Africa, Singapore, and India. This choice of countries is reasonable and not random because these countries are from different parts of the world and differ in their economic, ecological, and social level of development, so the results of their research will serve as a basis for making forecasts on a global scale. Two countries from each region were selected to compare how the well-being, location, and membership of various associations and domestic programs developed by their governments influence the level of sustainable development and what matters most. The already

developed ranking of countries according to the SDG index, which is contained in the Sustainable Development Report for 2019 [21], was used as a basis for selecting the countries under study. So, let the authors describe in more detail the characteristics that made it possible to select countries for research:

- Norway and Denmark are countries that have one of the highest levels of sustainable development, these countries are not part of the EU, but they have a very high standard of living.
- Estonia and Greece – these countries are EU member states, they are also located far from each other and the standard of living in these countries is different.
- Canada and Mexico are the representatives of the American region, these countries are radically different in terms of development and well-being but are located on the same continent and even belong to the same international organization – the USMCA.
- The Republic of South Africa – this country takes the last place in the ranking, which means that its economy and ecology are not adapted to sustainable development in any way, so it is necessary to determine why this is so and to investigate the impact of exactly which of the indicators has the greatest impact on the sustainable development of this country and predict the direction in which the country should move.
- India and Singapore are the representatives from the Asian region. These two countries are radically different in terms of the level of welfare and the type of policy pursued by their governments, and they also differ in size and have different priority directions in development.

In order for the research to be objective, the same indicators were used to calculate the index of sustainable development in all the countries, in particular: GDP, population growth, foreign direct investment (net), CO2 emissions into the atmosphere, unemployment rate, and a salary level for an individual country. The dependent variable in the research is the dynamics of changes in the Sustainable Development Index/ Therefore, the authors will conduct the regression modeling of the impact of the above indicators on the level of sustainable development using the dynamic difference and the system generalized method of least squares.

Analyzing the dynamics of Norway’s indicators and conducting regression modeling based on the use of the least squares method, the results can be seen (see Fig. 1), from which it can be concluded that the Sustainable Development Index, which was calculated taking into account all the independent variables, increased during the studied period, however, the inflows of net foreign investment were unstable during the analyzed period.

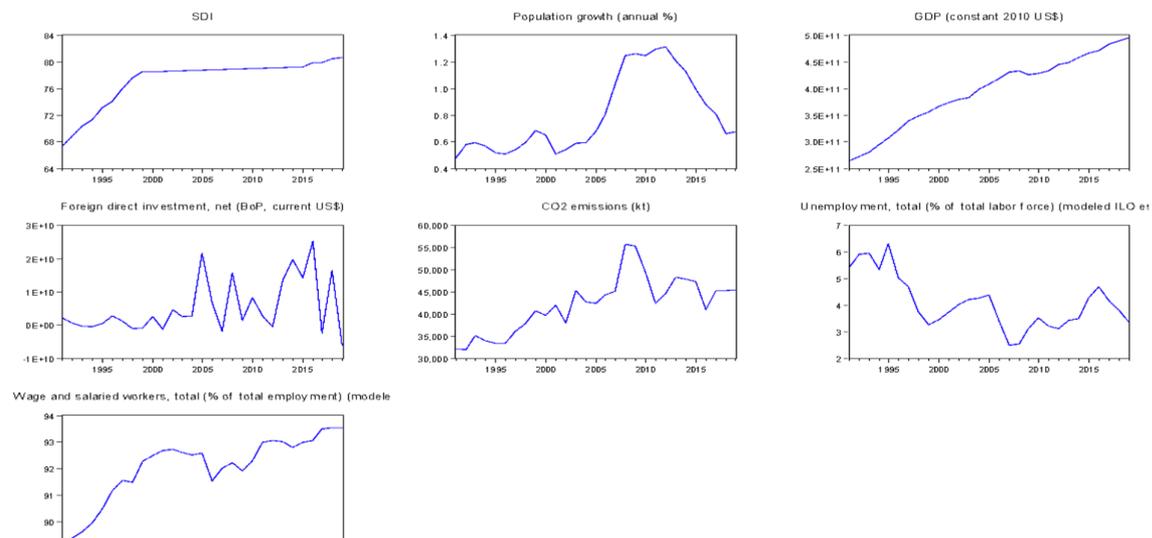


Figure 1: Variation of the level of sustainable development in Norway, due to the impact of independent indicator

The next step was to determine the correlation between independent indicators affecting the level of sustainable development in Norway. From the obtained results (Fig. 2), it is appropriate to note that the

correlation coefficient between the Sustainable Development Index and almost all the selected independent variables is higher than average.

	SDI	POPULATION_GROWTH_A_NNUA	GDP_CONSTANT_2010_US\$	FOREIGN_DIRECT_INVESTMENT_EN	CO2_EMISSIONS_KT	UNEMPLOYMENT_TOTAL_O	WAGE_AND_SALARIED_WORKER
SDI	1.000000	0.480813	0.888187	0.308010	0.748660	-0.787980	0.950019
POPULATION_GROWTH_A_NNUA	0.480813	1.000000	0.617910	0.316766	0.761411	-0.644196	0.428035
GDP_CONSTANT_2010_US\$	0.888187	0.617910	1.000000	0.424141	0.793889	-0.692701	0.899752
FOREIGN_DIRECT_INVESTMENT_EN	0.308010	0.316766	0.424141	1.000000	0.352646	-0.096832	0.322874
CO2_EMISSIONS_KT	0.748660	0.761411	0.793889	0.352646	1.000000	-0.778576	0.662919
UNEMPLOYMENT_TOTAL_O	-0.787980	-0.644196	-0.692701	-0.096832	-0.778576	1.000000	-0.689613
WAGE_AND_SALARIED_WORKER	0.950019	0.428035	0.899752	0.322874	0.662919	-0.689613	1.000000

Figure 2: Correlation results between the independent indicators affecting the level of sustainable development in Norway

It is negative only for population growth. With all independent factors, except the unemployment rate, the Sustainable Development Index has a positive coefficient. This shows that the specified economic and environmental indicators have a positive effect on the formation of Norway's Sustainable Development Index. The unemployment rate has a negative correlation coefficient, indicating that the higher the unemployment percentage in Norway, the lower the Sustainability Index.

After analyzing the table of correlation, it was decided to remove the indicators that have a high correlation coefficient with their dependent variables to avoid the problem of multicollinearity, which negatively affects the formation of the results of a regression equation.

It is also important that from the equation results, it can be seen that there is no problem of multicollinearity since the signs of the coefficients of the regression equation correspond to the signs in the table of correlation. According to the results of the regression equation for Norway, the following conclusions can be drawn: all the coefficients are significant, as the significance index (Prob.) for all is less than 0.05, which indicates that the selected independent variables are significant and affect the Sustainable Development Index. It is also interesting that when CO2 emissions increase by 1 unit, the Sustainable Development Index will increase by 9.54E-05 units. In case of the increase in net foreign direct investment by \$1, the Sustainable Development Index will increase by 1.38E-11 units. With the increase in population growth by 1%, the Sustainable Development Index will increase by 1.418775. And the opposite is the situation with the unemployment rate, because if the unemployment rate increases by 1%, the Norwegian Sustainable Development Index will decrease by 0.844874 units. If the average wages increase by 1%, the Sustainable Development Index will increase by 2.084001 units. After all, if the independent variables listed above are equal to 0, Norway's Sustainable Development

Index will be 54.00543 units, and from these results, it can be noted that the used economic independent indicators explain the change in the Sustainable Development Index by 93.3154%.

Dependent Variable: SDI
 Method: Least Squares
 Sample: 1991 2019
 Included observations: 29

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CO2_EMISSIONS_KT	9.54E-05	5.79E-05	1.646469	0.0133
FOREIGN_DIRECT_INVESTMEN	1.38E-11	2.58E-11	0.536129	0.0070
POPULATION_GROWTH_ANNU				
A	1.418775	0.991710	1.430635	0.0060
UNEMPLOYMENT_TOTAL	-0.844874	0.338574	-2.495394	0.0202
WAGE_AND_SALAR_WORKER	2.084001	0.220141	9.466649	0.0000
C	54.00543	20.69801	-5.510402	0.0000
R-squared	0.945090	Mean dependent var		77.25903
Adjusted R-squared	0.933154	S.D. dependent var		3.613122
S.E. of regression	0.934161	Akaike info criterion		2.883655
Sum squared resid	20.07109	Schwarz criterion		3.166544
Log likelihood	-35.81300	Hannan-Quinn criter.		2.972252
F-statistic	79.17416	Durbin-Watson stat		1.266398
Prob(F-statistic)	0.000000			

Figure 3: Results of regression modeling calculation of the impact of changes in independent indicators on the level of sustainable development in Norway

Similarly, the regression modeling of the impact of independent indicators on the level of sustainable development of the countries selected for the research using the least squares method was carried out. The results of the calculations are presented in Table 1.

The results of the calculations presented in Table 1 reflect the level and nature of the impact of each indicator on the country's Sustainable Development Index. However, it is appropriate to give conclusions on the obtained results of the regression modeling for each country; in particular, the authors will focus on the analysis of the impact of foreign direct investment on the change in the level of sustainable development.

Denmark has one of the highest indicators of sustainable development among the countries studied. The results of the regression modeling show that the signs of the coefficients of the regression equation correspond to the signs in the table of correlation, which indicates that there is no problem of multicollinearity. It is also clear that all the selected indicators are significant because the significance level (Prob.) for all the coefficients is less than 0.05, which indicates that the selected independent variables affect the sustainability index.

If all the variables are equal to 0, the sustainable development index of Denmark will be 40.50007 units. The analyzed indicators have a 79.0021% influence on the change in the Sustainable Development Index.

The relationship between foreign direct investment and the sustainability index for Denmark exists and is quite significant when compared to other indicators. If net foreign direct investment increases by \$1, the sustainable development index will increase by +6.37E-11 units.

Estonia. According to the obtained correlation model for Estonia, the authors can talk about the following results: the correlation coefficient is positive with population and GDP growth. With all the other indicators, the correlation coefficient is negative, and with the unemployment rate, the correlation coefficient is almost equal to 0, which suggests that there is no relationship between these indicators. That is why it was decided to remove some indicators for the regression equation to avoid multicollinearity. If the independent variables listed above are equal to 0, the sustainable development index of Estonia will be 79.12091. The selected economic independent variables explain the change in the sustainable development index of the analyzed country by 75.7185%. As for the impact of foreign

direct investment, Estonia has a similar situation as Norway, since while the index of sustainable development was increasing foreign direct investment was unstable throughout the studied period. If net foreign direct investment increases by \$1, the sustainable development index will decrease by 4.05E-09 units.

Table 1

The results of regression modeling of the influence of independent indicators on the Sustainable Development Index of the countries analyzed

Countries	GDP	population growth	emissions of CO2 into the atmosphere	unemployment rate	salary level	foreign direct investment (net)
Norway	+54.00543	+1.418775.	+9.54E-05	-0,844874	+2,084001	+1.38E-11 units
Denmark	+40.50007	+3.447010	- 0.000172	-0.843907	+3.696688	+6.37E-11 units
Estonia	+79.12091	+1.047496	-0.001781	-0.597312	-2.927732	-4.05E-09 units
Greece	+27.06971	+1.273623	+0.000260	-0.474137	+0.862943	+3.07E-10 units
Canada	+71.90812	+0.961431	+1.71E-05	-0.469847	+0.385025	+1.46E-11 units
Mexico	+42.04642	-8.029465	+6.55E-05	-	+1.670717	-3.76E-11 units
Singapore	+78.07075	-1.178476	-	-1.293918	+1.209166	-3.62E-10 units
India	+74.04931	-2.592425	+1.06E-05	-	+3.273721	-1.54E-10 units
RSA	+59.94340	-6.435125	+1.17E-05	-0.497089	+1.713778	- 2.12E-10 units

Greece. From the obtained correlation analysis, the authors can conclude that the trends of the relationship between the indicators for Greece are similar to the results of Norway, as a negative relationship is observed only for the unemployment rate, and for all the other indicators the coefficient is positive. It was decided to take into account all independent variables because there are no reasons for possible multicollinearity. The significance index (Prob.) for all coefficients is less than 0.05, which indicates that the selected independent variables are significant and affect the sustainability index, and the economic independent variables explain the change in the sustainability index by 76.5684%.

Analyzing the impact of net foreign investments on the level of sustainable development, it can be seen that if they increase by \$1, the index of sustainable development will increase by 3.07E-10 units.

Canada. According to the results of the correlation model of Canada, a characteristic feature is that the sustainability index has a positive correlation with all the indicators except the unemployment rate. That is, there is no need to ignore any of the constant indicators.

The analysis of the results of the regression equation for Canada indicates that the significance level (Prob.) for all the coefficients is less than 0.05, indicating that the selected independent variables are significant and affect the sustainability index. Assuming that the independent variables listed above are equal to 0, the index of sustainable development of Canada will be 71.90812 units. And it is also worth noting that the economic independent variables explain the change in the sustainable development index by 74.6773%.

The research on the impact of foreign direct investment showed that if net foreign direct investment increases by \$1, the index of sustainable development will increase by 1.46E-11 units.

Mexico is the first country under study whose population growth has a negative impact on the growth of the sustainable development index. Also, net direct investment has a negative impact, like in Estonia. The level of unemployment was not included in the regression equation, as it has almost no relationship and impact on the index of sustainable development of Mexico and this will help to avoid the problem of multicollinearity, in particular. The significance indicator (Prob.) for all the coefficients is less than 0.05, which indicates that the selected independent variables are significant and affect the sustainable development index. If the above independent variables are equal to 0, Mexico's sustainable development index will be 42.04642 units, and it is also worth noting that the economic independent variables explain the change in the sustainable development index by 89.5325%. This indicator is one of the highest, compared with the already analyzed countries.

The results of the modeling showed that Mexico's sustainable development index was increasing, but throughout the studied period, net direct investment was unstable but had a decreasing trend. If net foreign direct investment increases by \$1, the sustainable development index will decrease by $-3.76E-11$ units.

Singapore. According to the results of the correlation model, it is worth noting that Singapore has similar trends to Mexico. After all, a positive correlation between the GDP, the level of salary, and CO2 emissions can be observed, while the correlation has a negative value for the level of unemployment, net foreign direct investment, and population growth. It was decided that the CO2 emission coefficient does not need to be considered in the regression equation, as it has a low correlation value with the sustainable development index and this will help avoid the collinearity problem. The significance index (Prob.) for all the coefficients is less than 0.05, which indicates that the selected independent variables are significant and affect the sustainable development index. The situation when the independent variables listed above are equal to 0, the sustainable development index of Singapore will be 78.07075 units. The economic independent variables explain the change in the sustainable development index by 49.0811%. Among the studied countries, this value is one of the smallest, so here also an interesting question arises, which indicators should be taken into consideration to more accurately assess the level of sustainable development achieved by the country.

According to the results of the correlation model, a negative correlation value for net foreign direct investment can be observed. If net foreign direct investment increases by \$1, the index of sustainable development will decrease by $3.62E-10$ units.

India. Evaluating the dynamics of change in India's indicators, it can be concluded that it is the only country where most of the studied indicators have a clear tendency either to increase or decrease. Thus, the index of sustainable development is growing steadily, along with it is growth in the GDP and the level of salary, but there is a downward trend for net foreign direct investment during the entire period under study. In India, according to the results of the correlation model, the same trends as in Singapore and Mexico can be observed, as the correlation between population growth, unemployment, and FDI is negative. Therefore, it was decided not to include in the regression equation those indicators with which there is a large negative relationship to avoid the problem of multicollinearity. The significance indicator (Prob.) for all the coefficients is less than 0.05, which indicates that the selected independent variables are significant and affect the sustainability index. If the independent variables listed above are equal to 0, India's sustainable development index will be 74.04931 units. Also, based on the results of the regression equation, it can be stated that the economic independent indicators explain the change in the sustainable development index by 95.2173%.

Thus, the index of sustainable development is steadily growing, but for net foreign direct investment, there is a downward trend throughout the entire period under study. If net foreign direct investment increases by \$1, the index of sustainable development will decrease by $1.54E-10$ units.

The Republic of South Africa. The modeling results showed that the dynamics of change in the indicators for South Africa have the most dubious trends, compared to the previously studied countries, namely, there is the stabilization of the sustainable development index, and the stable growth of GDP, but the inflow of net foreign direct investment fluctuated throughout the studied period. According to the results of the correlation model, it can be concluded that South Africa has trends that are characteristic of Mexico and Singapore because there is a negative correlation between population growth, unemployment, and net foreign direct investment. However, there is a positive correlation between the GDP, CO2, and salary level. It was decided not to use the GDP indicator in the regression equation to avoid the problem of multicollinearity. The level of significance (Prob.) for all the

coefficients is less than 0.05, which indicates that the selected independent variables are significant and affect the index of sustainable development. If the independent variables listed above are equal to 0, the index of sustainable development of South Africa will be 59.94340 units. Interestingly, these economic independent variables explain the change in the index of sustainable development by 96.7276%, that is, all constant indicators are important for the calculation of the index of sustainable development for South Africa.

The results of the research showed that when net foreign direct investment increases by \$1, the index of sustainable development will decrease by $2.12E-10$ units.

Having analyzed the data that were selected to calculate the impact of macroeconomic indicators on the index of sustainable development, it is difficult, unfortunately, to come to an unequivocal conclusion. However, it is worth noting that all the selected indicators are significant and in one way or another affect the index of sustainable development, therefore, a relationship between the index of sustainable development and net foreign direct investment is proven, but this impact is not positive for all the countries. Most of all, this is related to the level of attractiveness of the country for investment and the amount of investment of the countries abroad.

5. Discussions

The research results made it possible to state that direct foreign investments have different effects on the level of sustainable development of different countries. To a large extent, this is explained by the different levels of economic, ecological, and social development of different countries.

The research has shown that foreign direct investments are unevenly distributed among countries with different economic development and have different effects on sustainable development. To a large extent, this is due to the fact that, according to the World Economic Outlook of the IMF, low-income countries account for 8.4% of the world's population, but currently account for less than 1% of global investment (2019). Lower-middle-income countries make up 42.9% of the world's population but account for only 15% of the investment. High-income countries, by contrast, account for 15.8% of the world's population but account for about half of the global investment. Economically developed countries represent 49% of the world's rich population, they account for more than 80% of global investments. This can be partially explained by the fact that foreign investors pay attention to the level of domestic investments when depositing in the country's economy. If the domestic investment is high enough, it signals to foreign investors that there is low uncertainty and a good investment climate [11]. The results obtained in this research also confirm this – an increase in net foreign direct investment will negatively affect the sustainable development of Mexico, India, Estonia, and South Africa, which is explained by the more difficult conditions of doing business in developing countries. As for the negative impact on the sustainable development of foreign direct investment in Singapore, it can be justified by higher labor costs, the peculiarities of legislation, mentality, and the geographical location of the country. Singapore is open to the infusion of foreign capital; however, this applies mainly to science-intensive fields and activities. Given its highly innovative development, Singapore itself is a large foreign investor, in particular in the countries such as Malaysia, Thailand, and Indonesia [22, 23, 24]. Significant fluctuations in the selected indicators were characteristic of Singapore during the period under study, so it is recommended to take other indicators into account to more accurately assess the country's level of sustainable development. This grounds the need to determine a relationship between foreign direct investment and the indicators of sustainable development of rich and poor countries.

The liberalization and globalization of the world economy put pressure on developing countries; foreign investors are primarily interested in developing their resources and opportunities to achieve their goals [25]. Underdeveloped countries and developing countries, even when attracting foreign direct investment, usually experience difficulties as a result of their low socio-economic development.

The research [26] provides strong evidence that investors from developed and developing countries view investment opportunities differently, resulting in different factors influencing foreign direct investment inflows. Foreign investors from countries with developed economies are attracted by how economically open the country is, whether business rules are transparent, the absence of corruption, and the presence of a qualified workforce. At the same time, for investors from developing countries, the most critical factors are market size and good governance.

Scientists say that the decrease in the volume of foreign direct investment in developing countries can be related to their insufficient digital progress. The global business activity of corporate investors makes full use of new digital technologies, which significantly improves their management efficiency. Developing countries face numerous obstacles in the development of digital technologies due to a lack of resources, skills, infrastructure, and digital security. All this creates additional risks for the infusion of foreign direct investment [27]. Also, the foreign direct investment of multinational companies has been negatively affected by the economic trends caused by COVID-19 [28].

The real challenge is not simply to attract a large amount of foreign direct investment, but quality FDI that helps, not hinders, sustainable development. For this, countries need appropriate policy and legal instruments to ensure that foreign direct investment is directed into sectors related to Sustainable Development Goals in an environmentally and socially responsible manner.

6. Conclusions

The study was conducted using intelligent management tools that allowed modeling of the impact of independent factors on the level of sustainable development. Therefore, the study analyzes the impact of independent indicators on the level of sustainable development of the countries that are different by their economic, ecological, and social level of development. In particular, special attention is paid to the analysis of the impact of foreign direct investment on the change in the level of sustainable development.

The nine countries were chosen for the research which are completely different in terms of their geographical location and different by the level of development of those fields that are decisive in increasing the index of sustainable development (economic, ecological, and social). In particular, the countries Norway, Denmark, Estonia, Greece, Canada, Mexico, South Africa, Singapore, and India were included in the analysis. The results of the analysis of these countries will form a basis for the implementation of global forecasts.

The research carried out regression modeling of the impact of independent indicators on the level of sustainable development of countries with different characteristics. These indicators were chosen soundly based on the main 17 goals of sustainable development. The modeling results showed that the significance level for all the coefficients is less than 0.05, which indicates that the independent indicators selected for the research are significant and affect the index of sustainable development of the countries. In particular, for Norway, the independent economic indicators explain the change in the Sustainable Development Index by 93.3154%, for Denmark – 79.0021%, for Estonia – 75.7185%, for Greece – 76.5684%, for Canada – 74.6773%, for Mexico – 89.5325%, for India – 95.2173%, and for South Africa – 96.7276%, which is the highest value that demonstrates that the selected independent indicators form the level of the sustainable development index. A different situation is observed in Singapore, where the independent indicators selected for the analysis explain the change in the sustainable development index only by 49.0811%. Among the studied countries, this value is the lowest, so further research is needed on those indicators that have a significant impact on the level of sustainable development of this country.

Special attention was paid to the analysis of the impact of foreign direct investment on the level of sustainable development. The obtained results showed that there is a correlation between these indicators, which confirms the research hypothesis. However, in different countries, this impact has a different nature and significance. In particular, for Norway, Denmark, Greece, and Canada, when net foreign direct investment increases by \$1, the sustainable development index increases. For the countries of Estonia, Mexico, Singapore, India, and South Africa, foreign investments negatively affect the level of sustainable development, because when foreign investments increase by 1 dollar, the country's sustainable development index decreases. Thus, the authors can state that the purpose of the research has been achieved, and the task has been completed.

The results of this research will be useful for the governments of countries when developing the Sustainable Development Strategy, as well as for the relevant ministries of countries to develop measures to increase the level of their sustainable development.

7. References

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