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Environmental risks and sustainable development indicators: determinants of impact

Abstract. The concept of sustainable development brought new constraints for the old-fashioned business models. At the same time, it created new opportunities for those who have a forward-looking strategy and strive to overcome «the limits to growth», in other words, to ensure a long-term blended value creation with economic and non-economic benefits.

There are numerous sets of the sustainable development indicators and indices, but the weights of each particular component are different and need further clarification. Nowadays, the environmental risks in general and climate-related in particular are priced (e.g. environmental taxes) and have a strong impact on the social and economic relations by creating negative and positive externalities for our daily life. For this reason, economic agents are forced to become sustainable to the non-financial risks through switching to the new environmental and social business models. For this reason, better sustainable development indicators are crucial for an improved management of the non-financial risks and sustainable blended value creation.

Hence, the aim of this paper is to examine the role of environmental risks in shaping sustainable development conditions on the macrolevel and to elaborate the ways for a better management of the non-financial risks (Environmental, Social and Governance - ESG). For this purpose, the impact of the most important environmental risks on the main economic and social indicators has been examined (e.g. Human Development Index and GDP per capita). Such an approach allowed us to identify the extent to which specific environmental factors influencing social and economic development can reshape the sustainable development conditions.

In course of research, two sets of countries have been singled out to verify statistical significance of elaborated models. To achieve this goal, the authors have split an available dataset into two groups: EU and non-EU countries. The reason behind it is the fact that EU countries are among the leaders in the area of sustainable development and have already undertaken related environmental improvements in the last decades. Moreover, the above-mentioned countries are continuing such successful pathways today and with the new European Green Deal could go even far beyond this frontier.

The results of current research suggest that existing indicators cannot fully encompass all the aspects of sustainable development and should be revised. Such findings relate both to the composition of the indicators and the weights attributed to each particular component. The application of regression analysis showed that such factors as water and air quality and biodiversity have the strongest explanatory power - 67% of the fluctuations in GDP per capita and 87% in case of HDI. The R-squared is ranging from 0.7 to 0.8 in both cases and confirms consistency of the elaborated models. To verify the results achieved, the similar models have been prepared only for the EU countries. As a result, all independent variables demonstrated the same significant impact on GDP per capita also for the EU countries. However, in this case the R-squared is only 0.27 due to the fact that ESG indicators within the EU area are rather homogenous. The impact of environmental factors on the level of HDI for the EU countries is much stronger comparing to GDP per capita. An overall explanatory power of the model for the EU countries exceeds 0.45 (R-squared). The most influential factor is the quality of water resources. Other important independent variables in the model for the EU member states are biodiversity and air quality.

The authors argue that it is necessary to incorporate the above-mentioned environmental factors into the updated version of the Human Development Index as the most appropriate indicators of sustainable development. Consequently, the weights of the components should be recalculated to improve management of the non-financial risks on macrolevel, facilitating the blended value creation process.

Keywords: Sustainable Development; Environmental Risks; Blended Value Creation; Human Development Index; Environmental Performance Index
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Екологічні ризики та показники сталого розвитку: детермінанти впливу

Анотація. Метою даної статті є дослідження ролі екологічних ризиків у створенні умов для сталого розвитку на макрорівні та розробка рекомендацій, спрямованих на покращення менеджменту нефінансових ризиків (екологічні, соціальні та управлінські, або ЕСУ). З цією метою було проаналізовано вплив найбільш вагомих екологічних факторів на основні показники соціального й економічного розвитку (Індекс людського розвитку та ВВП на душу населення). Такий підхід дозволив ідентифікувати міру, до якої екологічні фактори впливають на соціальний та економічний розвиток та можуть змінювати умови для сталого розвитку.

Результати даного дослідження засвідчили, що чинні індикатори не дають можливості в повній мірі охопити всі аспекти сталого розвитку, а тому повинні бути переглянуті. Одержані результати стосуються як складу таких індикаторів, так і ваги, яку мають окремі їх складові. Застосування регресійного аналізу дозволило виявити найбільш суттєвий вплив якості води та повітря, а також біорізноманіття на коливання рівня ВВП на душу населення (67%) та Індекс людського розвитку (87%). Коефіцієнт детермінації в обох випадках варіюється між 0,7 та 0,8, що свідчить про прийнятність розроблених моделей. Для перевірки отриманих результатів моделі також було протестовано на показниках розвитку країн ЄС. У підсумку, всі залежні змінні продемонстрували подібний суттєвий рівень впливу на рівень ВВП на душу населення в країнах ЄС. Проте коефіцієнт детермінації становив лише 0,27 у зв'язку з тим, що нефінансові показники для цих країн є майже однорідними. Вплив екологічних факторів на рівень Індексу людського розвитку в країнах ЄС є більш відчутним у порівнянні з ВВП на душу населення. При цьому показник детермінації становить 0,45, а найбільш впливовим фактором є якість водних ресурсів. Також суттєвий вплив на показники соціального та економічного розвитку країн ЄС мають стан біорізноманіття та якість повітря.

Автори стверджують, що необхідним є включити зазначені у дослідженні екологічні фактори до оновленої версії Індексу людського розвитку. Також є потреба у перерахунку ваги складових індексу з метою покращення менеджменту нефінансових ризиків на макрорівні, а саме – покращити процес створення змішаної вартості з урахуванням поліпшення екологічних і соціальних результатів.

Ключові слова: сталий розвиток; екологічні ризики; створення змішаної вартості; Індекс людського розвитку; Індекс екологічної ефективності.

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Экологические риски и показатели устойчивого развития: детерминанты влияния

Аннотация. Целью данной статьи является исследование роли экологических рисков в процессе создания условий для устойчивого развития на макроуровне и разработка рекомендаций, направленных на улучшение менеджмента нефинансовых рисков (экологические, социальные и управленческие, или ЭСУ). С этой целью было проанализировано влияние наиболее значимых экологических факторов на основные показатели социального и экономического развития (Индекс человеческого развития и ВВП на душу населения). Такой подход позволил идентифицировать меру, до которой экологические факторы влияют на социальное и экономическое развитие и могут изменять условия для устойчивого развития.

Результаты данного исследования показали, что существующие индикаторы не могут в полной мере раскрыть все аспекты устойчивого развития, и поэтому должны подлежать пересмотру. Результаты касаются как состава таких индикаторов, так и веса отдельно взятых их компонентов. Использование регрессионного анализа позволило выявить наиболее существенное влияние качества воды и воздуха, а также биологического разнообразия на уровень ВВП на душу населения (67%) и Индекс человеческого развития (87%). Коэффициент детерминации в обоих случаях колеблется между 0,7 и 0,8, что свидетельствует о состоятельности разработанных моделей. Для проверки полученных результатов модели были протестированы на показателях развития стран ЕС. В итоге, все зависимые переменные продемонстрировали подобный существенный уровень влияния на ВВП на душу населения и на примере стран ЕС. В то же время коэффициент детерминации составил только 0,27 в связи тем, что нефинансовые показатели развития этих стран являются практически однородными. Влияние экологических факторов на уровень Индекса человеческого развития в странах ЕС является более существенным в сравнении с ВВП на душу населения. При этом показатель детерминации составляет 0,45, а наиболее влиятельным фактором является качество воды. Также существенное влияние на показатели социального и экономического развития ЕС имеют биологическое разнообразие и качество воздуха.

Авторы утверждают, что указанные в исследовании экологические факторы следует включить в обновленную версию Индекса человеческого развития в качестве наиболее важных показателей устойчивого развития. Также необходимым является пересчет весов для составляющих элементов индекса с целью улучшения менеджмента нефинансовых рисков на макроуровне, а именно – улучшить процесс создания смешанной стоимости с учетом экономических и неэкономических результатов.

Ключевые слова: устойчивое развитие; экологические риски; создание смешанной стоимости; Индекс человеческого развития; Индекс экологической эффективности.

1. Introduction

It is clear that anthropogenic factors do influence quality of the environment through emission of the greenhouse gasses (GHG), pollution of the air and water resources with the products of our daily activities (IPCC, 2007; Stern, 2006). Some authors investigated the impact of major macro-economic indicators (e.g. GDP and FDI) on the environment and the results proved that there is a strong correlation between the above-mentioned metrics (Hitam et al., 2012; Pao et al., 2011; Pazienza, 2015).

In turn, the environmental risks in general and climate-related, in particular, do affect social and economic development in different ways by creating negative and positive effects for our daily life. They could even reshape sustainable development conditions. The ways of such influence have been widely debated in the literature and available results prove that there is a clear and strong influence of the above-mentioned factors on the well-being of society and economic growth (Everett et al., 2010, Estrada et al., 2015). Such an influence is even more visible if the negative externalities are priced (e.g. carbon tax or certified emission allowances).

With the emerge of sustainable development concept, importance of the non-financial risks (Environmental, Social and Governance, ESG) for the activities of different economic agents

has been increased. Hence, implementation of the financial policy sustainable to the non-financial risks and the management of related threats could be considered as a prerequisite for achieving stable rates of the economic growth and avoiding potential financial crisis caused by the ESG risks.

In fact, in the XXth century the non-financial risks became part of the economic activities and forced economic agents to overcome the limits to economic growth, transformed the world economy and financial markets (UNEP, 2017; UNEP, 2018; Zadek et al., 2018).

An introduction of the carbon pricing mechanisms activated efforts aimed at combating climate change, forced economic agents to shift from voluntary Corporate Social Responsibility (CSR) to the new business models. As a result, there is a wide range of successful cases in the area of environmental and social entrepreneurship. But important was not only to put price on carbon, but also to elaborate the market-based mechanisms and improved risk management indicators to maximize effectiveness of the GHG reduction efforts, facilitate the blended value creation process (encompasses economic and non-economic benefits). (Elkington, 2018; Emerson et al., 2014).

An implementation of the carbon pricing mechanisms was crucial to internalize environmental externalities. As a result, economic agents received an opportunity to take into account environmental risks while making their investment decisions and calculating financial results. On the macrolevel this influence could result not only in fluctuations of the main economic indicators (e.g. gross domestic product), but also impact the well-being or reshape conditions for the sustainable development in general.

2. Brief Literature Review

As it was already mentioned above, the impact of environmental risks on the economic and social development is an important aspect while analyzing sustainability of the national economy to the non-financial risks. With this regard, it is important to analyze existing researches where the impact of different environmental factors on sustainable development has been already investigated. Additionally, it is necessary to test the impact of each particular environmental factor on the economic growth and sustainable development in general. As a result, it will be possible to improve management of the non-financial risks on the macrolevel through elaboration of the better indicators of sustainable development.

In fact, climate change is an important environmental factor and lead to severe negative consequences that at the end could threaten a food security or even cause the deaths due to the extreme weather events or natural disasters (UNDP, 2018). For instance, in case of Pakistan, GHG emissions, as a specific environmental factor, are important for improvement of the Human Development Index (HDI) of the country (Wang, Danish, Thang, & Wang, 2018). Moreover, energy quality also affects HDI as this sector contributes the most to the overall GHG emissions. Hence, there is a clear evidence that support to the «cleaner fuels» could improve HDI at least in developing countries (Ray, Ghosh, Bardhan, & Bhattacharyya, 2016).

More comprehensive investigation on the influence of the GHG emissions on HDI has been conducted in different countries with the highest level of CO_2 emissions: China, US, India, Korea, Canada, Iran, and Saudi Arabia. This analysis was concentrated on the GHG emissions originated from agriculture, energy sector, bunker fuel, electricity production, fugitive, industrial sector, other manufacturing, transportation, waste management. The impact of the above-mentioned factors on HDI has been evaluated and the results suggest that there is a strong impact from almost all considered sectors on the human development and the healthy life expectancy (Mohmmed Li, Olushola Arowolo, Su Deng, & Najmuddin Thang, 2019).

There are other evidences where the impact of environmental indicators on the economic and social development is strong and, in some combinations, could be considered as a subject for urgent improvements to increase the level of HDI. For instance, a case of the Mexico province gives an example where improvements in the water-energy-food nexus could be used to increase the overall level of HDI by 4.3% (Martinez-Guido, Gonzalez-Campos, & Ponce-Ortega, 2019).

Since HDI encompasses economic and social components, the GDP per capita indicator has been additionally selected to evaluate the impact of environmental factors on this indicator. In fact, GDP is being used as a basis not only for measuring income distribution, but also for covering public environmental and social needs within the society.

The impact of different environmental factors on GDP shows that there are direct and indirect ways for the influence of the environmental indicators on the economic and social development

(Matviychuk-Soskina, Krysovatyy, Zvarych, I., Zvarych, R., & Ivashchuk, 2019). According to the recent publications, GDP and welfare are being affected by climate change in a negative manner through such channels as: health expenditures, labor productivity and agricultural yields. Indirectly, such negative impact on GDP could be identified via disutility of illness and mortality. On the global level, a huge amount of money is needed to implement related measures - compensate and prevent negative impact. For example, in 2015 related costs amounted to 3 trillion USD on the international level and could raise by 2060 up to 18-25 trillion USD (OECD, 2016).

The impact of air quality on GDP and welfare could be quantified through the following indicators: work-loss days, school-loss days, quality of life, individual location decision, firm's location decisions, level of productivity, employment (Crocker & Horst, 1981). According to the existing findings, higher oxidant concentrations are associated with lower attendance at one recreational site. Higher carbon monoxide concentrations are associated with lower attendance at one site and higher attendance at another (Chapko & Solomon, 1976).

Additionally, in 2008 a regression analysis of the changes in population from 1990 to 2000 in California as a function of lagged exposure to Toxics Release Inventory (TRI) emissions has been conducted. As a result, increased exposure to TRI emissions has been identified with regard to the decrease in demographic counts (Banzhaf & Walsh, 2008). Air quality regulations have also an impact on the decision-making process of the companies while allocating their businesses. So, the first wave of scientific researches and studies typically did not find robust association between regulations and firm location. The second wave tended to find that regulations have a negative effect on the company's location (Greenstone, List, & Syverson, 2012).

The implemented regulations on the quality of air could also affect the level of costs and productivity in the real economy. According to the existing findings, pollution-intensive firms in non-attainment areas generally have higher air pollution abatement expenditures in comparison with other polluters, although the range and statistical significance of the results varies by pollutant and regression methods (Becker, 2005). The level of unemployment also dependents on the air quality and could lower earnings. In fact, higher pollution abatement expenditures are associated with lower earnings and employment, although the relationship is not always statistically significant (Duffy-Deno, 1992).

Obviously, there is a need in evaluating impact of the environmental factors on sustainable development (e.g. GDP per capita in particular) to identify the most influential of them. Having this done, could provide assistance while elaborating an effective package of measures aimed at improving sustainable development conditions, providing a set of related indicators - boosting economic growth and facilitating blended value creation.

3. Purpose and Hypothesis Development

The main goal of this paper is to identify to what extent different environmental components are influencing economic indicators on the macrolevel and sustainability of the economy to the non-financial risks. For this purpose, regression analysis will be applied to identify impact of the most important environmental factors on sustainable development at the national level. At a first stage of current research, the most popular and widely used indicators for measuring sustainable development conditions on the national level will be selected. Subsequently, the most suitable indicators are going to be used to quantify impact of the environmental factors on sustainable development.

H0. The existing indicators of economic and social development cannot fully measure the level of sustainability on the macrolevel.

Existing indicators for measuring sustainable development on the national level are limited both in terms of quantity and quality. The Gross Domestic Product (GDP) and Human Development Index (HDI) are the most popular measures for measuring sustainable development conditions. Even despite all the negative comments on the ability of GDP to measure different shades of blended value creation, it shows the overall result of the value created in the monetary terms. At the same time, different social, environmental and governance improvements cannot be captured by this indicator - there is no price for such components in the economy.

For this reason, another important indicator has been selected that reflects the overall sustainable development pattern - Human Development Index (short, HDI). This indicator has been developed and being updated on the annual basis by the United Nations Development Programme

(UNDP). Such index encompasses not only GDP, but also contains additional social parameters and is being used by the United Nations (UN) to evaluate the state of things in achieving Sustainable Development Goals (SDGs). Nevertheless, we have to keep in mind that HDI has a couple of bottlenecks - it doesn't contain explicit environmental component and does not give any information about the level of freedom within the society (Biggeri & Mauro, 2018).

Another indicator for quantifying sustainable development is the Index of Sustainable Economic Welfare (ISEW) developed in by H. Daly and J. Cobb in 1989 for the USA on the time horizon 1950-1986 (Daly & Cobb, 1989). In 2001 calculations of the ISEW have been updated from 1970 till 2010 by J. Hoffren (2001). An important advantage of this indicator is that alongside with economic and social parts it contains also a clear environmental component. But at the same time, there is only one general environmental component that describes the level of environmental degradation. Moreover, calculations are available only for limited number of countries. This fact does not allow conducting a comprehensive comparative analysis.

Additional important indicator of sustainability has been developed to measure the extent to which different countries were successful in achieving SDGs - the SDG Index. Even despite the fact that this index covers all the non-financial aspects of the sustainable development, there is no clear economic component (e.g. like GDP or GDP per capita) and therefore it provides no opportunity to measure ability of each specific country to generate blended value (UNSDSN, 2019, Bonini & Emerson, 2005). This feature is crucial to fit into the definition of sustainable development - to cover the current needs and not limiting interests of the future generations.

For the purpose of current research, GDP per capita and HDI will be selected as dependent variables to measure the impact of environmental factors on the economic and social development on the macrolevel. Both indicators cover time period of 1990-2017 for 149 countries and show the current status of improving sustainable development conditions for our daily life.

H1. The water and air quality factors are influencing the most sustainable development conditions of the country.

According to the existing estimations of the World Economic Forum (WEF), climate change and water crisis are the most influential non-financial threats for the world economy, both in terms of probability and the extent of impact on the economic activities (WEF, 2020). Moreover, climate change has a wide range of related negative consequences such as extreme weather events and natural disasters. Taking this into account, we can suggest that almost all top-ten risks from the WEF Global Risk Report could be attributed to the climate or environmental components.

Important is the fact, that water crisis is being considered by WEF as a top-five threat in terms of its impact on the economic relations within the time period 2015-2019. However, as it was already mentioned above, other threats (e.g. extreme weather events, natural disasters) are often associated with negative impact on the water quality.

H2. Selected environmental components from Environmental Performance Index (EPI) should be added to the HDI and the weights within this indicator should be recalculated.

To capture various environmental factors for different countries and on the long-tern run, the Environmental Performance Index (EPI) is going to be used for further calculations. Due to the existing limitations of the available indicators for measuring sustainable development conditions, the impact of different environmental components on the ability to cover current needs without harnessing the interests of the next generations - generate economic and social values, will be identified. On the basis of the obtained results, the most important of them will be selected and the ways for integrating specific environmental components into the new updated version of HDI will be suggested.

4. Methodology and Data

To assess the impact of environmental parameters on the economic and social development in different countries, a regression analysis will be applied as a very popular statistical method for estimating quantitative interconnections between different events or processes. In the current research, a regression analysis will provide a mathematical support to quantify a purely theoretical relationship between environmental indicators, economic and sustainable development of the countries from different regions (with specific emphasis on the EU countries). Obtained regression

models will provide an answer to the question: how changes in independent variables could explain variations of the selected target variables in elaborated models?

As dependent variables and possible indicators of sustainable development, the two key performance indicators will be considered: GDP per capita and HDI. GDP per capita is the most popular and widely accepted economic performance indicator in the macro-statistics that describes country's ability to generate blended value. HDI is a composite indicator that encompasses three components of the human development: standards of living, longevity and knowledge. The standards of living are measured by GDP per capita and adjusted to the purchasing power parity. The longevity is measured by the life expectancy and knowledge - is a mix of the adult literacy and the mean years of staying in school (Islam, 1995).

As a mathematical indicator, HDI is a geometric mean of the normalized indices for the above-mentioned components. The HDI calculation procedure consists of two steps: three components have been calculated and normalized; all HDI components are averaged by the geometric mean transformation (UNDP, 2016).

As the independent variables, components of the Environmental Performance Index (EPI) will be used - being annually calculated by the Yale Center for Environmental, Law & Policy and produced in collaboration with the World Economic Forum (YCLP, 2018).

EPI could be described as a hierarchically structured indicator to estimate environmental performance of the country. This index ranges from 0 to 100 and consists of two sub-indicators: Environmental Health and Ecosystem Vitality (each of them has its own structure).

The Environmental Health in 2018 consisted of three basic indicators: (1) air quality, (2) water and sanitation, (3) heavy metals. Before 2018, the components of the Environmental Health sub-indicator were (1) health impacts, (2) air quality (3) water and sanitation. The Ecosystem Vitality consists of the six basic indicators: (1) water resources, (2) biodiversity and habitat; (3) agriculture, (4) forests, (5) fisheries, (6) climate and energy. Each basic indicator is based on the specific environmental scores of the particular country.

5. Results

To describe relations between EPI and the country`s socio-economic (sustainability) performance, two regression models have been elaborated with HDI and GDP per capita as dependent variables. These two models represent GDP per capita and HDI as the key performance indicators for different countries. The obtained regression models could be displayed with the following equations:

$$GDP\_\log = \alpha + \beta_1 \times EH\_AQ + \beta_2 \times EH\_WS + \beta_3 \times EV\_BH + \varepsilon \quad (1)$$

and

$$HDI = \alpha + \beta_1 \times EH\_AQ + \beta_2 \times EH\_WS + \beta_3 \times EV\_BH + \varepsilon\,, \quad (2)$$

where:
GDP_log - value of GDP transformed by logarithm function; obtained from IMF, modified by authors;
HDI - value of Human Development Index;
EH_AQ - EPI Environmental Health sub-indicator «Air Quality»;
EH_WS - EPI Environmental Health sub-indicator «Water and Sanitation»;
EV_BH - EPI Ecosystem Vitality sub-indicator «Biodiversity and Habitat».

According to the findings of the first model, the environmental factors such as air quality, water quality and biodiversity have the strongest impact on GDP per capita. However, this set of factors explains only 67 percent of the overall changes in GDP per capita (see Table 1). At the same time, water quality influences the most fluctuations of GDP per capita. Hence, the changes in water quality by 1 per could lead to the fluctuations in GDP per capita by 0.044 percent. This is, approximately, 10 times higher in comparison to the impact of air quality or biodiversity (second and third important environmental factors) on the selected dependent variable.

The results of elaborated models provide an opportunity to assess importance of different environmental performance indicators for the social and economic development (sustainability) of selected countries. The impact assessment results of the EPI components on GDP per capita are presented in Table 1.

The quality of water has direct impact on such components like human health, agricultural productivity, biodiversity, fisheries stocks and etc. This point has been also confirmed by the results of the second model equation (see Table 2). This model explores interrelations between environmental parameters and HDI (as one of the main socio-economic development indicators).

The findings suggest, that air and water quality, as well as biodiversity explain 87 percent of the changes in the level of country's HDI. Moreover, the water quality has once again the strongest impact also on HDI, greater than the impact on GDP per capita. According the results of the second model, changes in the water quality by 1 percentage could lead to the changes in the level of HDI by 0.57 percent.

This means that the quality of water determines to a great extend the quality of life. As a result, the authors argue that importance of this environmental factor is underestimated today. Moreover, as it has been already indicated in the first model, the water quality is also important to explain generation of the GDP per capita (Figure 1).

The first model showed that the air and water quality, biodiversity are statistically significant. Overall variation of these tree factors explains variation of the target indicator by 67%. From the above-mentioned 67% of the explanatory power 64.5% could be attributed to the water quality, 1.58% - to the air quality and 1.49% - to the biodiversity.

In the second model, with HDI as a dependent variable, the overall explanatory power of the independent variables is even higher. In this case, the selected factors explain variation of the target indicator by 87%, where 84.1% could be attributed to the variation of the water quality, 1.75% - to the air quality and 1.67% - to the biodiversity (Figure 1).

Having this in mind, it is necessary to find out whether the environmental indicators have equal impact on the social and economic variables for developed and developing countries or not. For this purpose, the identified independent variables have been used to estimate their influence on the dependent variables for the EU countries (GDP per capita and HDI). As a result, all independent variables have the same significant impact on GDP per capita in the EU countries. But in this case, the R-squared falls from 0.67 to 0.27 due to the fact that ESG indicators within the EU are more or less homogenous. As it has been already mentioned above, the most important component in elaborated models is the quality of water resources and an access to the drinking water. This means that the ration of improvements in selected dependent variables could lead to the changes in GDP as 1 to 4.

Table 1:
Results of the multiple regression model for GDP per capita

GDP_log	β coeff	Std. Error	t value	Pr(>|t|)
- intercept	4.5278523	0.1178750	38.412	< 2e-16
EH_AQ	0.0086689	0.0013117	6.609	5.14e-11
EH_WS	0.0437867	0.0008263	52.992	< 2e-16
EV_BH	0.0049616	0.0009638	5.148	2.93e-07
Multiple R-squared:	0.6741			
Adjusted R-squared	0.6735			

Notes:
β coeff - impact coefficient;
Std. Error - standard error of impact coefficient;
t value - an indicator of the accuracy of the factor, calculated as the ratio of the impact coefficient to its standard error;
Pr(>|t|) - the probability that the impact coefficient is zero;
Multiple R-squared - the coefficient of multiple determination;
Adjusted R-squared - the adjusted coefficient of multiple determination.

Source: Calculated by the authors, 2020

Table 2:
Results of the multiple regression model for HDI

HDI	β coeff	Std. Error	t value	Pr(>|t|)
- intercept	1.887e-01	8.710e-03	21.663	< 2e-16
EH_AQ	7.360e-04	9.283e-05	7.928	4.20e-15
EH_WS	5.754e-03	5.908e-05	97.381	< 2e-16
EV_BH	4.921e-04	6.792e-05	7.245	6.74e-13
Multiple R-squared:	0.8747			
Adjusted R-squared	0.8745			

Source: Calculated by the authors, 2020

At the same time, significance of other independent variables (air quality and biodiversity) in the elaborated models is five and four times lower (respectively) than the quality of water.

The impact of environmental factors on the level of HDI for the EU countries is much stronger than in case of GDP per capita - the second model supports such findings. The explanatory power of the second model for the EU countries is over 0.45 (R-squared) and the most influential factor is again the quality of water resources. The next important independent variable in the second model for the EU member states is biodiversity and the third - air quality. It is necessary to note that in the letter model importance of the water quality is higher that the air quality by thirteen times (Figure 2).

6. Conclusions and Perspectives for Further Discussion

As a result of the current research, it has been proved that certain environmental parameters have direct impact on the sustainable development conditions at macrolevel. The strongest

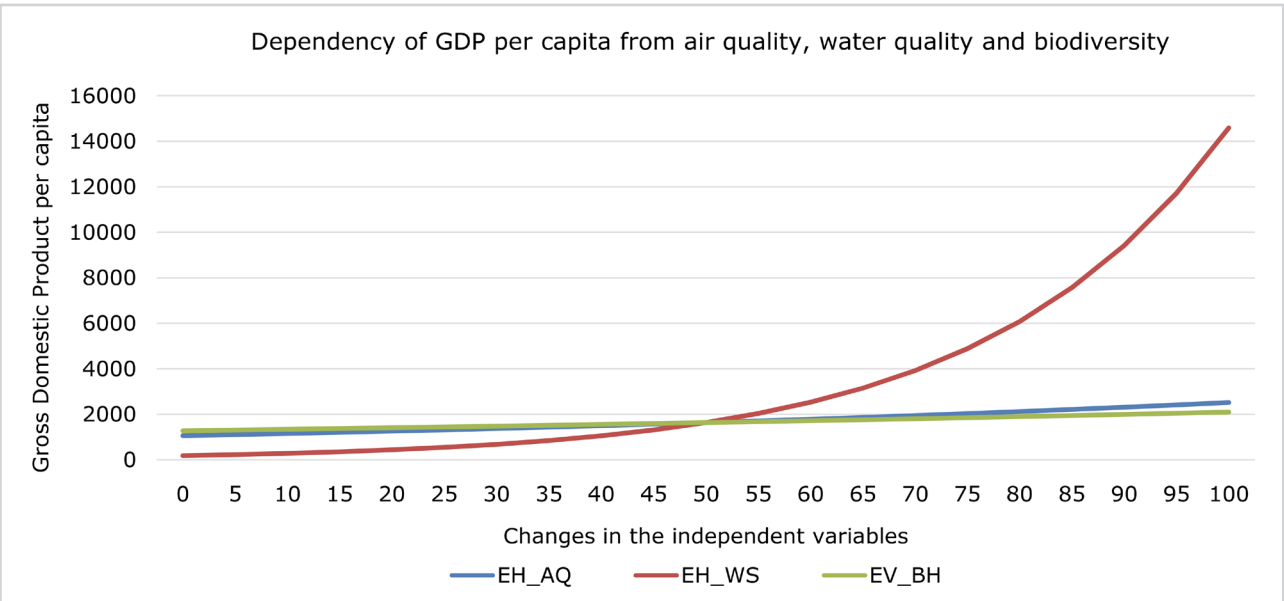

Figure 1:
Graphical interpretation on the environmental factors impact on GDP per capita
Source: Calculated by the authors, 2020

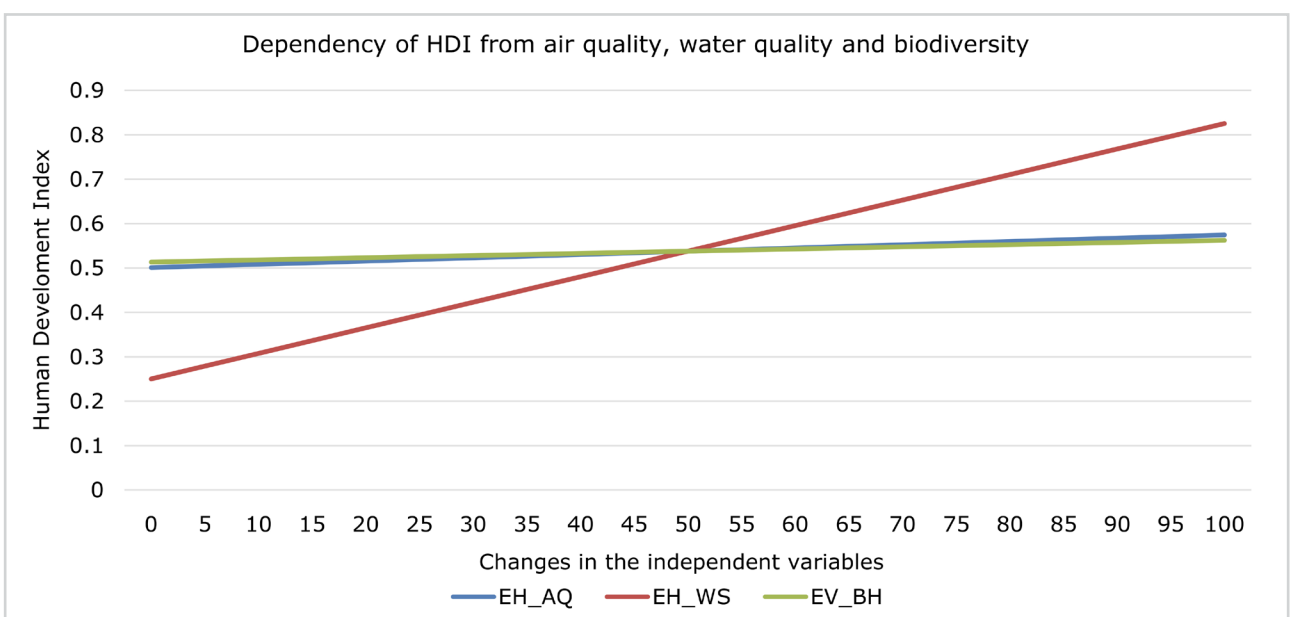

Figure 2:
Dependency of HDI from air quality, water quality and biodiversity
Source: Calculated by the authors, 2020

impact on the GDP per capita and HDI (as the most appropriate indicator for sustainable development) is being generated by the quality of water resources and the air we breathe. Additionally, the third important environmental factor that determines social and economic performance is the biodiversity. Such findings are relevant for all countries from the selected data set.

In the elaborated models the influence of environmental factors on the two specified target-indicators of the sustainable development conditions has been investigated. It has been identified that the most influential factor in both elaborated models is the water quality and an access to the drinking water. With this regard, it is important to look more precisely at improvements in the quality of water that we use to increase the level of dependent variables.

The findings of current research suggest also that the water and air quality, biodiversity should be taken into account while elaborating strategic development programs and key sustainability performance indicators (KPIs). This could facilitate assessment of the sustainable development in general and the blended value creation process, in particular.

Additionally, two sets of countries have been separated to verify statistical significance of elaborated models. To achieve this goal, the authors have split available dataset into two groups: EU and non-EU countries. The reason behind it is the fact that EU countries are among the leaders in the area of sustainable development and have already undertaken related environmental improvements in the last decades. Moreover, the above-mentioned countries are continuing such successful pathways today and with the new European Green Deal could go even far beyond this frontier. So, after having done it, the findings have been tested on a broader set of data - the influence of selected independent variables on the sustainable development conditions has been investigated.

The results of estimations suggest that an updated sustainable development indicator on the basis of HDI should be elaborated. Due to the fact that environmental factors (especially, «quality of the water» and «an access to the drinking water») are important for economic and social development (sustainability) of the country. Hence, there is an urgent need to add environmental components to an updated version of HDI where the highest weight should be attributed to the quality of water. Such an updated indicator could be able to capture economic, environmental and social components of the value created and provide more information on the sustainability to the non-financial risks.

These findings provide a wide perspective for further researches. First of all, it is necessary to improve existing HDI - recalculate the weights of the components with regard to the findings of current paper. Also, there is a need to elaborate the tools and new institutional framework to measure environmental and social value created - facilitate evaluation of the intangible assets.

Secondly, to implement all the necessary measures and improve the most important environmental indicators (such as water and air quality), it is necessary to mobilize sufficient amount of the green and sustainable finance. For this purpose, implementation of the innovative financial instruments and schemes (e.g. water bonds, catastrophe bonds, etc.) should be supported. Finally, the appropriate IT-tools (e.g. Distributed Ledger Technologies) should be applied to facilitate financial and informational flows, improve quality of the risk management and reduce related transaction costs. All those steps are important to boost blended value creation process and support sustainable development - achieve the Sustainable Development Goals.

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