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## A METHODOLOGICAL APPROACH TO DEVELOPING THE MODEL OF CORRELATION BETWEEN ECONOMIC DEVELOPMENT AND ENVIRONMENTAL EFFICIENCY ON THE BASIS OF COMPANY'S NON-FINANCIAL REPORTS

*Having reviewed the most widely used international non-financial reporting standards, GRI was identified as the optimal standard for the Russian context. The environmental component of the GRI G4 guidelines and the contribution of each aspect to the overall sustainability picture were analysed. Over time, the value of biological resources increases, and therefore, a company's economic development cannot continue in isolation. To determine the degree of harmony between economic development and ecological condition of the territories involved, new approaches and methods are required. Based on statistical methods, a model of correlation between economic development and environmental efficiency was developed that uses non-financial reporting data. The model can be used by oil and gas companies, and its general principles—by other industries. The results may interest stakeholders and serve as a platform for forecasting and making administrative decisions aimed at achieving harmony between economic development and environmental efficiency. The model was tested on the largest oil and gas Russian company "Surgutneftegaz" data. A positive correlation was shown between the two systems of its sustainable development: economy and ecology. The results obtained demonstrate the company's strong commitment to conservation. Further research may yield more profound results, contributing to broader sustainable development.*

**Keywords:** sustainable development, components of sustainability, non-financial reporting, social responsibility, correlation model, correlation coefficients, economic development, ecological footprint, forecasting, managing environmental impact

### Introduction

With the global population growth, the environmental issues are becoming increasingly important. The constantly growing society needs lead to an increase in industrial production accompanied by the negative impact on the environment [7]. In the last decade of active economic development, the negative effects on the economy of this extensive growth are increasingly being felt, such as a reduction in the resource-sufficiency, an increase in the influence of the changed environment quality on human health, an increasing number of natural ecosystems with a distinct lack of self-recovery potential. [8] The current focus is the interconnection between three basic dimensions of human development: economic, environmental and social. Achieving harmony between these components is called the sustainable development.

The concept of "sustainable development" refers to a stable socio-economic development that does not destroy its natural basis. The terms "stability" and "sustainability" are not synonymous. The stability of a system's development is determined by the indicators dynamics—a system can have a steadily unstable position and show the stability of its core development trends [14, p. 97].

The concept of sustainable development can be interpreted in different ways, but in its essence, it is an approach to development that balances different, often competing interests—environmental, social and economic.

Thus, the progress of economics emphasized the importance of taking into account the nature component<sup>1</sup>. As a result, there is a growing need on the part of investors, society and the state to be aware of the course and vectors of the companies' actions aimed at reducing the negative impact on the environment [6]. It is not enough to merely discuss environmental issues; there is a need to take in

<sup>1</sup> UNEP. Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication points the way to a green economy. (2011). Retrieved from: [https://sustainabledevelopment.un.org/content/documents/126GER\\_synthesis\\_en.pdf](https://sustainabledevelopment.un.org/content/documents/126GER_synthesis_en.pdf) (date of access: 10.05.2015).

account of and report on environmental efficiency. This is especially true for global companies, whose operations have a large-scale effect on the environment [15].

In the case of a negative impact on the environment resulting from the company's operations, the state regulation measures are used, which are still under development and therefore, do not cover all the natural resources that are harmed. Thus, for example, in the case of forest resources loss as a result of companies' actions (logging, wildfire), when applying the state regulation measures, it is necessary to take into account, in addition to the current market price of natural resources (wood), the indirect costs of using these resources. According to the World Bank's estimates, a tree growing in the forest is in 3–5 times more profitable than a tree felled<sup>2</sup>. As a result of applying modern methods of overall economic evaluation of bio-resources, it becomes clear that the value of biological resources will increase over time. Therefore, a company's economic development can no longer continue without the state control over its impact on the environment.

### Theory

To determine the degree of harmony between the economic development and the environmental state of the territory, where a company carries out its economic activities, it is necessary to carry out a correlation analysis of economic and environmental data for a certain period of time and to determine how close the correlation is, and then make scientifically valid conclusions. It is practical to use non-financial reporting as the information base for such analysis. When preparing non-financial reports, a company faces the problem of selecting a common approach (standard), which would combine rational principles of information disclosure, a meaningful set of indicators and a practically feasible preparation process. Let us carry out a review of existing standards of non-financial reporting and determine the most appropriate one to be used in the Russian context.

There are currently about 25 standards for non-financial reporting. The most widely used are the following four standards [12]:

- 1) the standard of non-financial reporting in the field of sustainable development from Global Reporting Initiative – GRI;
- 2) the standard of the British Institute of Social and Ethical Accountability AA1000;
- 3) the standard of environmental management ISO 14000;
- 4) the standard of social accountability SA 8000.

Let us review the essence of each standard.

The GRI standard of non-financial reporting reflects the full picture of a company's sustainability and generates reports based on the "triple bottom line" principle: the company's economy, production ecology and social policy.

The Standard of Social and Ethical Accountability AA1000 covers the full range of an organization's activity indicators (i.e. sustainability indicators) and is aimed at streamlining the company's social initiatives and improving their efficiency.

The ISO 14000 environmental management standard describes the company's social accountability for compliance with the environmental requirements in manufacturing, and aims at promoting the most effective and efficient environmental management practices.

The SA 8000 standard of social accountability specifies the requirements for social security, aimed at improving employees' working conditions and living standards.

Among all the non-financial reporting standards, the first 2 standards (GRI and AA1000) are universal.

Both standards stipulate preparing the report on the basis of a dialogue with stakeholders. However, the GRI standard has a number of advantages over the AA1000 standard. The GRI standard is clearly structured and enables organizations to use its recommendations stage-by-stage, i.e., a company that has just embarked on the path of non-financial reporting, may use an informal approach to applying the standard in accordance with its current capabilities. At the beginning it may use only the general principles of the document, preparing a report on one or more areas of the company's activity, consistently spreading to other areas. It should also be noted that most of the largest companies in Russia are representatives of oil and gas industry, which determines the specific character of the

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<sup>2</sup> WorldBank. Environmental sustainability: an evaluation of World Bank group support — evaluation summary. (2008). Retrieved from: [http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/08/08/000333038\\_20080808071944/Rendered/PDF/449480WP0RUSSI1ion0Summary01PUBLIC1.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2008/08/08/000333038_20080808071944/Rendered/PDF/449480WP0RUSSI1ion0Summary01PUBLIC1.pdf) (date of access: 20.05.2015).

Russian economy. In view of this fact, the GRI standard is more universal in terms of drawing up a balanced and meaningful picture of economic, environmental and social efficiency of a company, whereas the AA1000 standard is more focused on the social component.

Thus, after reviewing the available non-financial reporting standards, it is determined that the GRI standard is the most comprehensive, applicable and useful for the preparation of sustainable development reports in the Russian context because of its structuring, the possibility of gradual transition to applying the standard and its compliance with the requirements of the Russian economy.

The environmental dimension of sustainability concerns the company's impact on the living and non-living natural systems, including ecosystems, land, air and water. The environmental aspects reveal the company's results related to inputs (energy, water, raw materials), which are then converted to outputs (emissions, effluents, waste), as well as information on the company's efforts aimed at preserving biodiversity and other ecologically relevant information<sup>3</sup>.

To prepare the environmental part of the non-financial report in accordance with the GRI standard, a company needs to disclose information on the following aspects: materials, energy, water, biodiversity, emissions, effluents and waste, products and services, compliance with the requirements, transport, general aspects, environmental assessment of suppliers, and procedures for dealing with environmental complaints.

Let us determine the contribution of each aspect of environmental efficiency in the GRI international standard to the overall picture of sustainability.

In their activities, the majority of companies use raw materials that after production cycle completion can be converted to waste that cannot be disposed of or recycled to be used in other industrial processes. This is determined by the companies' advanced technologies and modern equipment that require certain financial investment. The information on companies' achievements in conserving the global resource base is disclosed in the "materials" aspect.

When carrying out the production process, a company uses energy resources. As it is known, energy consumption is accompanied by the emission of greenhouse gases, which leads to climate change [4]. The information about the company's energy consumption should be presented in the "energy" aspect.

Clean freshwater is becoming increasingly scarce, which can affect companies that require a large amount of water to carry out their production activities. However, some companies recycle the water they use. The information about the total amount of water withdrawn, the sources, and the degree of water recycling is reflected in the "water" aspect, which allows estimating the company's scale and significance as a water user.

In some cases, companies have to carry out their economic activities in the natural territories under mild protection regulations or near the areas with tight conservation regulations. To manage their impact on biodiversity and bioresources, companies need to monitor the state of terrestrial and aquatic ecosystems and to develop strategies aimed at reducing negative impacts. The information on the companies' efforts to reduce their impact on protected areas should be disclosed in the "biodiversity" aspect.

As it was noted above, energy resources consumption leads to greenhouse gas emissions that cause global warming [8]. Most companies do not have the opportunity to reject standard energy sources and switch to renewable sources. However, the implementation of complex monitoring allows reducing emissions, for example, through careful selection of energy-efficient equipment<sup>4</sup>. In medical and chemical industry and in laboratory work, there is a risk of ozone-depleting substances emissions, which are the main reason for ozone layer thinning. The quantitative evaluation of ozone-depleting substances emissions indicates the extent to which the company's activities comply with the legislation. Pollutants emissions lead to the deterioration of the sanitary-epidemiological condition of the atmosphere, which can provoke conflicts with residents. The information about the total amount of emissions and their composition is disclosed in the "emissions" aspect.

Companies that use a significant amount of water in the production process affect water bodies through wastewater disposal. The degree of impact is determined by the quantity and quality of the water discharged. Waste generated in the production process also has an impact on the environment.

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<sup>3</sup> Rukovodstvo po otchyotnosti v oblasti ustoychivogo razvitiya [GRI. Russian-G3-Reporting-Guidelines]. (2006). Retrieved from: <https://www.globalreporting.org/resourcelibrary/GRI-G3-Russian-Reporting-Guidelines.pdf> (date of access: 30.05.2015).

<sup>4</sup> Rukovodstvo po otchyotnosti v oblasti ustoychivogo razvitiya [GRI. Russian-G3-Reporting-Guidelines]. (2006). Retrieved from: <https://www.globalreporting.org/resourcelibrary/GRI-G3-Russian-Reporting-Guidelines.pdf> (date of access: 30.05.2015).

Recycling and reusing waste can increase the economic benefits and reduce the costs of its disposal. Spills of chemicals, oils, and fuel can have a significant negative impact on the environment<sup>4</sup>. From the financial point of view, spills lead to losses of raw materials, as well as entail different costs associated with their liquidation, fines and damage to the company's reputation. The information about the amount and quality of the wastewater discharged, about the amount of waste and its disposal, and about chemicals spills should be presented in the "effluents and waste" aspect.

After the manufacturing process is completed, the product life cycle continues. Often the scale of the product's impact at the stage of its exploitation (for example, electricity consumption by a refrigerator) is just as considerable as at the production stage. The significance of such impact depends on the technical parameters of the product. After the end of the product exploitation, another environmental problem arises — its disposal. The information about the company's efforts to create recycling systems to close the product life cycle is reflected in the "products and services" aspect.

When carrying out their economic activity, companies must comply with environmental regulations. Legislation on environmental protection is designed to regulate negative impacts. In the case of non-compliance with the legislation, the company incurs financial losses due to the payment of fines and damage to its reputation. The legislation infringement may also lead to the need to eliminate its consequences or to the imposition of other environmental liabilities entailing significant costs<sup>5</sup>. The company's management is responsible for compliance with the environmental legislation. The information about the company's ability to ensure that its operations conform to certain environmental efficiency parameters is revealed in the "compliance with the requirements" aspect.

Most companies' inventories list various transport necessary for transporting personnel or cargo. The negative consequences of the transport use can range from global warming to smog and noise. Thus, companies with well-developed supply and distribution networks can have a significant impact on the environment resulting from transport use<sup>6</sup>. The information on the impact of transport on the environment should be reflected in the "transport" aspect.

Corporate social responsibility in terms of solving environmental problems involves the company's actions aimed at reducing the negative impact of its activities on the environment. This requires the development of conservation measures programmes. As a rule, the implementation of such measures requires a financial investment. Comparing the costs of mitigation and prevention of negative impacts on the environment with the environmental efficiency helps evaluate the effectiveness of the company's resources use and contributes to improving the quality of the programmes developed. The information on environmental protection expenditure and investment is disclosed in the "general" aspect.

When carrying out production or other economic activities companies use third-party services. Selecting suppliers with a favorable environmental history may affect the company's reputation. At the selection stage, it is advisable to carry out the suppliers' environmental assessment and find out how serious the real and potential negative impact on the environment is in the supply chain. The selection results are reflected in the "environmental evaluation of suppliers" aspect, and inform the parties concerned about the number of new suppliers selected for contracting.

In most cases, disagreement with other people arises over environmental consequences of the company's activities. The following categories of complainants can be identified: internal stakeholders (e.g. employees), external stakeholders (e.g. suppliers, local communities), individuals or groups of people with specific social rights, such as the indigenous peoples of the North (Khanty, Mansi). Effective mechanisms for handing complaints play an important role in eliminating the consequences of the impact on the environment and help to fulfill the organization's environmental obligations<sup>7</sup>. The information about the number of complaints and their outcome should be disclosed in the "mechanisms to deal with environmental complaints" aspect.

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<sup>5</sup> Rukovodstvo po otchyotnosti v oblasti ustoychivogo razvitiya [GRI. Russian-G3-Reporting-Guidelines]. (2006). Retrieved from: <https://www.globalreporting.org/resourcelibrary/GRI-G3-Russian-Reporting-Guidelines.pdf> (date of access: 30.05.2015).

<sup>6</sup> Rukovodstvo po otchyotnosti v oblasti ustoychivogo razvitiya [GRI. Sustainability Reporting Guidelines G4, Implementation Manual]. (2013). Retrieved from: <https://www.globalreporting.org/resourcelibrary/GRIG4-Part2-Implementation-Manual.pdf> (date of access: 10.06.2015).

<sup>7</sup> Rukovodstvo po otchyotnosti v oblasti ustoychivogo razvitiya [GRI. Sustainability Reporting Guidelines G4, Implementation Manual]. (2013). Retrieved from: <https://www.globalreporting.org/resourcelibrary/GRIG4-Part2-Implementation-Manual.pdf> (date of access: 10.06.2015).

Thus, having analysed the environmental component of the GRI G4 guidelines on non-financial reporting, it should be noted that environmental efficiency is a tool to reflect the effectiveness of administrative decisions in the field of environmental protection and to provide information to stakeholders.

Environmental materials of the report are the basis for the identification of the company's economic activity positive or negative impact on the environment, as well as for collecting information that can be used to monitor environmental changes and to identify the relationship between economic development and environmental efficiency, and to influence the company's policy and strategy in the field of environmental protection.

To prepare the economic component of the non-financial report in accordance with the GRI standard, a company should disclose information on the following aspects: economic indicators, market presence, indirect economic impact, procurement practices.

Having reviewed the available information support for the correlation model of economic development and environmental efficiency, it should be noted that the main source of it should be reports on sustainable development based on the GRI international standard.

Sustainable development and its analysis require a unified approach, since with technological progress accelerating, considering environmental and economic components of sustainable development separately does not give a full picture [5]. They are closely interrelated, and a change in one of them is inevitably reflected in the other. In addition, another detail appears: a single indicator of sustainability for individual companies. Building up such an indicator will allow analysing the various economy sectors separately, without mixing performance indicators in oil and gas industry with those in mechanical engineering.

In this regard, models and indicators for analysing sustainable development at macro level are represented by aggregated variables and cover urbanized cities or entire regions [11]. Moreover, the current focus of sustainability analysis is on renewable energy sources and their relationship with economic variables [13].

As a result, interesting questions arise: is there a possibility to single out the independent components of sustainability and to determine their correlation with other factors. If yes, how? Furthermore, can it be done at the level of individual companies?

### **Data and Methods**

The answers to the questions above are assumed to be positive. To confirm this opinion, a correlation model has been developed to identify the relationship between two components of sustainable development: economy and ecology. These systems are interrelated, since ecology is the environment where a company carries out its economic activity. But in the context of sustainability, it becomes obvious that the latter includes both economic activity and environmental efficiency.

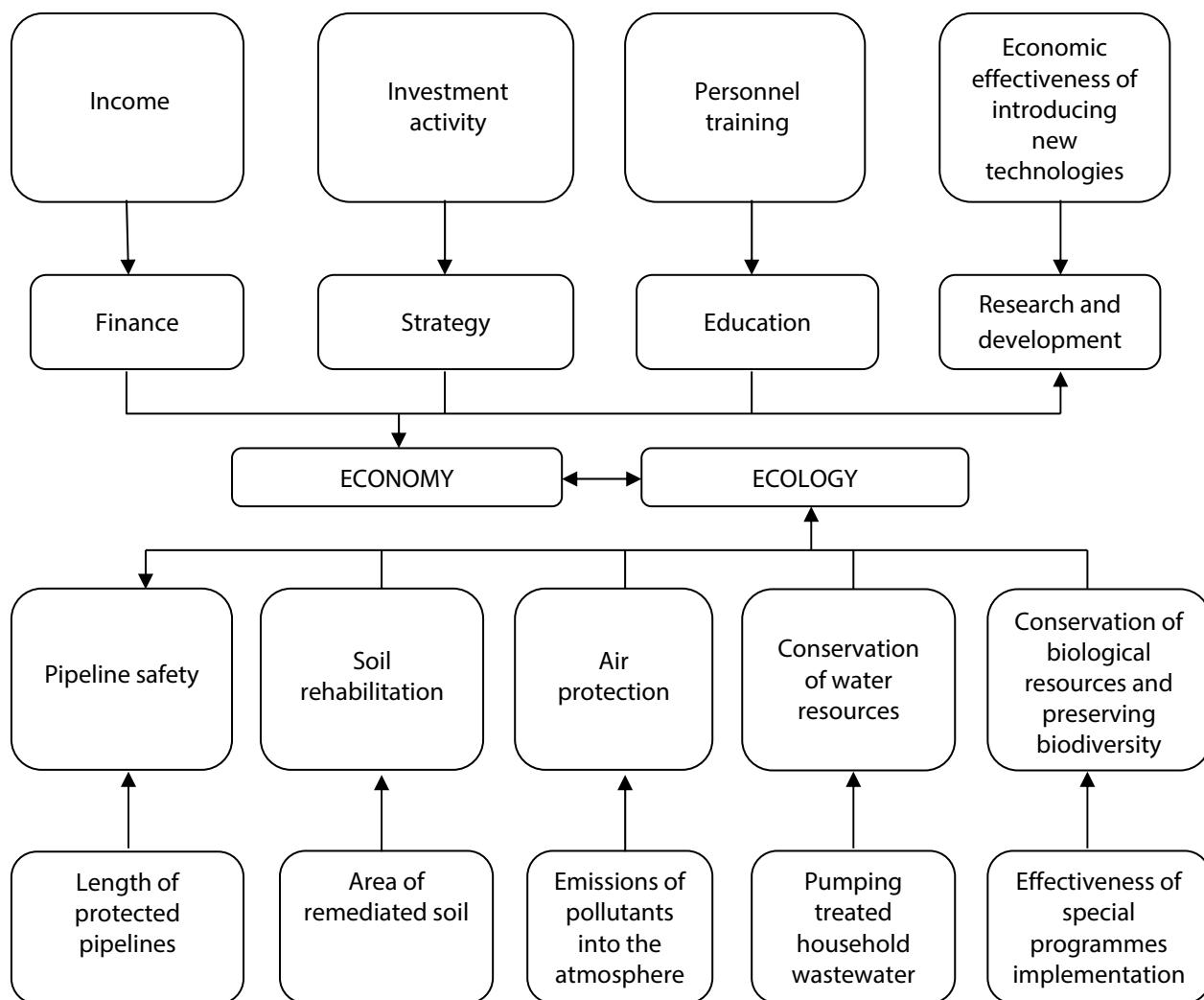
There are also political and social systems, but they are difficult to aggregate within individual companies [16].

The model includes quantifiable variables and reveals the correlation between a company's economic development and environmental efficiency. Figure 1 shows the general structure of the model for companies involved in extracting and transporting hydrocarbons.

The correlation model is based on the assumption that economy and ecology are connected and influence each other. The main purpose of this study is to identify the correlation between ecological indicators of the previous year and the current year economic indicators. If a company has achieved good results in terms of ecology, will this lead to an improvement in its economic performance? The aim is to prove this assertion, not only theoretically, but also practically, using quantitative methods.

The national statistics use relative information indicators in their analyses, such as the proportion of emission gases and waste water treated in compliance with the standards, the proportion of remediated soil in the total area of disturbed land, the number of accidents per 1 kilometer of the pipeline. But within individual companies, it is possible to work only with the existing data, disclosed in ecological reports, and aggregate them into a single index.

Environmental sustainability of a company is determined by the negative impact of its activities on the environment. The safer (more reliable) is the company's activity, the lower is its negative impact. Not only the results of a given year are important, but also the trend within which the index is analyzed since sustainability implies stability.



**Fig. 1.** General structure of the correlation model

The components of sustainability are difficult to represent in the same unit of measurement. Therefore, the model uses a proxy-approach to determine sustainable development components.

The ecological part of the model is composed of 5 components:

- 1) preventing accidents with pipelines;
- 2) soil rehabilitation;
- 3) air protection;
- 4) conservation of water resources;
- 5) conservation of biological resources and preserving biodiversity.

*Pipeline safety.* The level of environmental safety of oil and gas companies is considered to be largely determined by the number of accidents with oil and gas extraction facilities<sup>8</sup>. The length of pipelines with corrosion protection coating is used as an indicator (km)<sup>9</sup>.

*Soil rehabilitation.* The remediation of soils disturbed during construction or contaminated by spills of oil and oil-containing liquids reduces the negative impact on the environment significantly. This component was taken as a proxy parameter. The area of contaminated soil that is remediated (hectares) is used as the indicator.

*Air protection.* Reducing pollutants emissions is the main issue for each industry. The pollutants emissions amount (tons) is used as the indicator.

*Conservation of water resources.* Clean freshwater is becoming increasingly scarce. Therefore, the rational use of water is the main objective for any company. Considerable fresh water saving is achieved through recycling it in the manufacturing process. The amount of treated wastewater pumped (thousand m<sup>3</sup>) is used as the indicator.

<sup>8</sup> OAO Surgutneft. Ekologichesky otchyot za 2013 god ["Surgutneftegaz" JSC. Sustainability Report 2013]. Retrieved from: <http://www.surgutneftegas.ru/ecology/reports/> (date of access: 20.06.2015).

<sup>9</sup> Despite the fact that this indicator mostly characterizes production safety, it is included in the company's environmental reporting.

*Conservation of biological resources and preserving biodiversity.* It is important to preserve the biota diversity at the level providing for sustainable existence of all living creatures and sustainable use of biological resources, ensuring efficient production and the formation of the environment optimal for human life. For oil and gas companies, the territorial principle is important, aimed at the preservation of natural ecosystems and their diversity within the licensed deposits. The effective development and implementation of special programs aimed at reducing the negative impact on biological resources and biodiversity (number of species) is used as the indicator.

The economy is represented by 4 components: finance, strategy, education and technology. The model is not financial, as the emphasis was placed on economic efficiency.

*Finance component.* Revenues are the main indicator of business success.

*Strategy component.* Investment activity related to oil and gas mining was taken as a proxy parameter. The reason is that investment activity is directly connected with the present and future and represents the company's strategic vision. The parameter is based on the assertion that if major exporting companies have not established ecological safety, investment will be used for this, and vice versa, with good environmental performance investment can be used to acquire profitable assets not related to the environmental safety of the enterprise.

*Education component.* More qualified personnel contributes to increasing the company performance. In addition, staff training related to environmental protection issues improves the company's environmental efficiency.

*Technology component.* Advanced technologies help reduce negative impacts on the environment. The indicator of the economic efficiency of introducing new technology was taken as a variable of the model, as it is presented in quantitative terms.

When trying to determine the relationship between ecology and economy, the problem of integrating components into a single unit of measurement arises. The economy is represented in monetary units, whereas environmental science uses its own units. In a simple regression or correlation model, different units of measurement are not a problem, since it does not affect the result. However, in our model the components are summed up in a single index, and using different measurement units (km, hectares, tons, m<sup>3</sup>, number of species) is illogical. To come to a common unit of measurement, the data were presented in the form of natural logarithms. Thus, the following formula for describing environmental efficiency of companies engaged in extracting and transporting hydrocarbons was obtained:

$$IEenv = 0,1\ln(PP) - 0,1\ln(RS) - 0,5\ln(PE) + 0,3\ln(TWP) + 0,3\ln(CBPB), \quad (1)$$

where *IEenv* is the environmental efficiency index; *PP*—the length of protected pipelines; *RS*—the area of remediated soil; *PE*—the amount of pollutants emissions into the atmosphere; *TWP*—the amount of treated household wastewater pumped; *CBPB*—the effectiveness of special programmes aimed at reducing negative impact on bioresources and biodiversity.

There is an assumption that each component of the index has its degree of significance. This causes differences in the variables' weighting. As a rule, air and water pollution issues, preservation of valuable kinds of bioresources and biodiversity, have a more global importance than the protection of pipelines and soil rehabilitation. Therefore, these components were given higher weights.

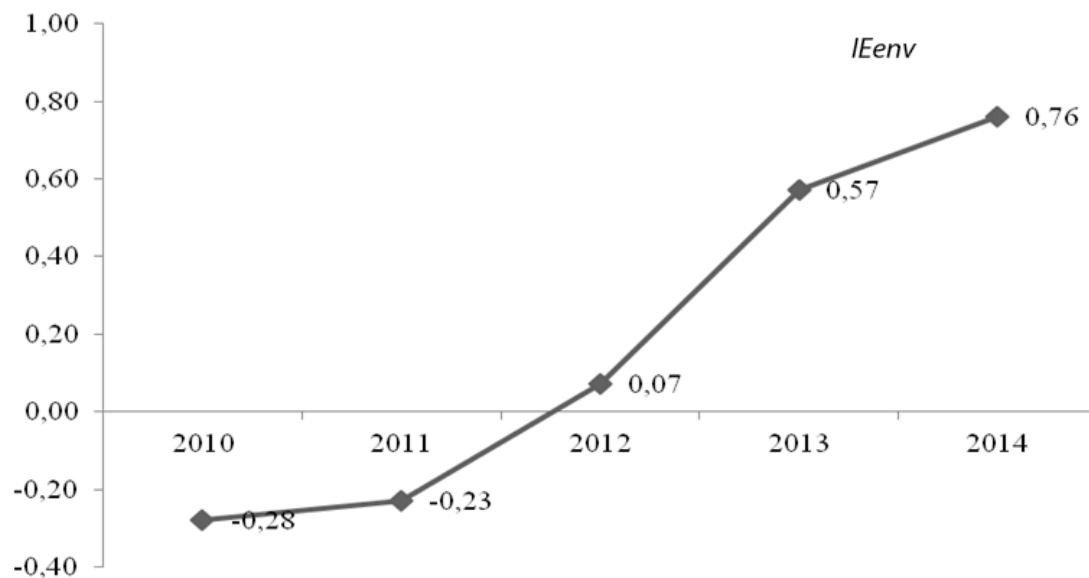
The education component of the 'economy' part requires converting data to natural logarithms. The remaining three components—finance, investment, technology—are presented in monetary terms, and could be left like this. Nevertheless, trained personnel is as important as an investment, and has an impact on the company's earnings in the long run.

Thus, the following formula for economic development was obtained:

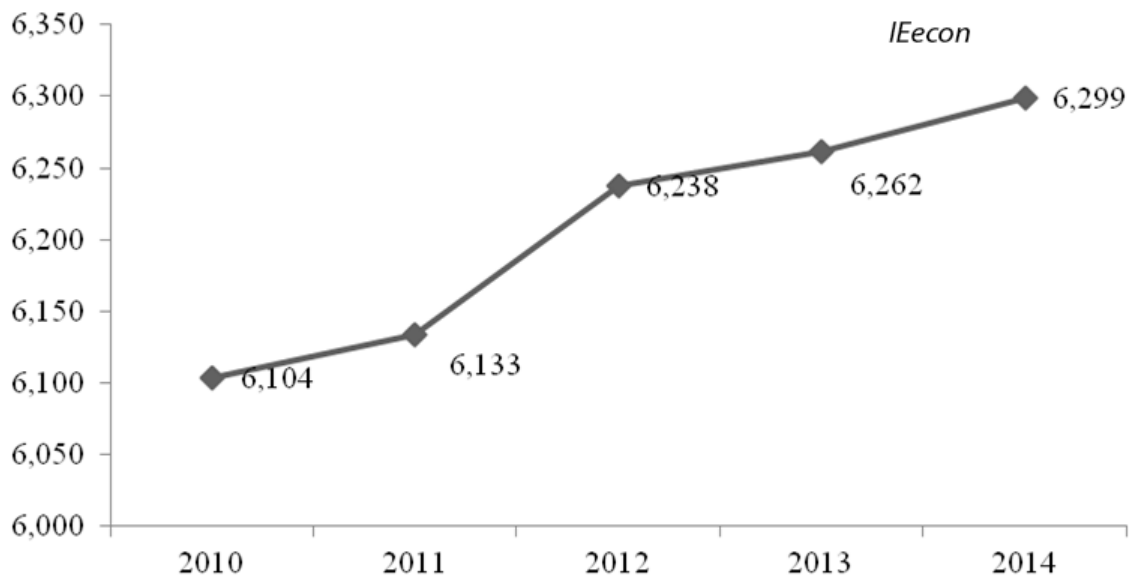
$$IEecon = 0,3\ln(F) + 0,3\ln(Inv) + 0,2\ln(Ed) + 0,2\ln(Tech), \quad (2)$$

where *IEecon* is the index of economic development; *F*—finance component; *Inv*—investment component; *Ed*—education component; *Tech*—technology component.

Just like in the *IEenv* index, each factor has its own degree of influence. Revenues and investment are more important strengths of the company's economic development, while staff training and introducing technologies require a long time to produce results. Therefore, higher weights were given to the components of 'finance' and 'investment'.



**Fig. 2.** "Surgutneftegaz" JSC environmental efficiency



**Fig. 3.** "Surgutneftegaz" JSC economic development

### Results

The correlation model was tested on the data from non-financial reports of the largest Russian oil and gas company "Surgutneftegaz" JSC. The data presented in the reports for the five-year period (2010–2014) was studied.<sup>10</sup>

The chart in figure 3 shows "Surgutneftegaz" JSC environmental efficiency.

The graph represents the IEenv trend for 5 years and shows that the company has made significant progress in recent years, mainly due to a significant reduction in the area of oil-contaminated soil, its remediation and increased pumping of treated wastewater.

The chart in figure 3 shows "Surgutneftegaz" JSC economic development.

The graph presents the IEecon trend for 5 years and shows that the company's economic development was successful mostly due to finance and investment components increase.

Let us identify the main principles of the correlation model:

1. *Importance*. The composition of the components is determined in accordance with the industry problems.

2. *Interdependence*. Intercorrelation and influence of the components on each other (proxy-approach).

3. *Comparability*. Integrating components into a single unit of measurement.

<sup>10</sup> The 'Conservation of biological resources and preserving biodiversity' component was not involved in the calculation, as it is not presented in quantitative terms in the report.

4. *Significance*. The components must be given appropriate weighting according to the impact scale.

5. *The context of sustainable development*. The trend to include information about efficiency in the broader context of economic and environmental limits and restrictions.

The next step of the research is to determine how close the correlation between the two indices is using statistical correlation.

Two types of correlation were used in the calculations: the Pearson product-moment correlation coefficient and the Spearman rank correlation coefficient.

Karl Pearson, a great biometrician and statistician, proposed a mathematical method for measuring the linear correlation between two variables. This is a widely used practical technique known as the Pearson correlation coefficient ( $r$ ) [1]:

$$r = \frac{COV(x,y)}{\sigma_x \times \sigma_y} \quad (3)$$

Spearman's formula gives the correlation coefficient between two ordinal or rank variables. It evaluates how close the correlation between two variables is and can be described by a monotonic function. If there is no repeat of the values, the ideal Spearman correlation ( $\rho$ ) +1 or -1 occurs when each of the variables is an ideal monotonic function of the other one [10]:

$$\rho = 1 - \frac{6 \sum D^2}{n(n^2 - 1)}, \quad (4)$$

where  $D$  is the difference between two ranks;  $n$  is the number of observations.

Table 1

**Data for correlation coefficients**

<i>IEecon</i>	<i>IEenv</i>	Rank 1	Rank 2
6,104	-0,23	1	1
6,133	0,07	2	2
6,238	0,57	3	3
6,262	0,51	4	5
6,299	0,76	5	4

Calculation results for the two correlation coefficients are given in Table 2 and Table 3.

Table 2

**Pearson correlation coefficient**

	<i>IEecon</i>	<i>IEenv</i>
<i>IEecon</i>	1	
<i>IEenv</i>	0,94	1

Table 3

**Spearman correlation coefficient**

	Rank 1	Rank 2
Rank 1	1	
Rank 2	1	1

Both tables demonstrate the existence of a strong positive correlation between economic development and environmental efficiency of the largest oil and gas company in Russia, "Surgutneftegaz" JSC, which operates on the territory of Khanty-Mansiysk autonomous district—Yugra. The results show a high level of social responsibility of the company studied in terms of environmental protection, which is important for the northern region, whose bioresources suffer the most powerful human impact from oil and gas industry.

There are additional correlation methods that allow covering the connection between these variables, such as the Granger causality test, a procedure for checking causal links between time series.

The Granger test shows whether it is possible to forecast one variable from another, and whether it is possible to perform a simple regression model [9, 2]. But other models require a larger amount of historical data; in addition, other statistical issues may arise, such as heteroscedasticity and autocorrelation.

## Conclusion

Thus, the correlation coefficients prove the assumptions that have been put forward at the beginning of the practical part of the research—the relationship between the company's economic development and environmental efficiency. Account should be taken of the type of company within which the correlation analysis was performed—it is an exporting company. For large exporting companies, the goal of implementing international reporting standards is of paramount importance, other companies, however, may not have such a goal, and their environmental data can be represented by other components.

Summarising the results of the study, it should be noted that non-financial reports prepared in accordance with the GRI international standard should provide the information support for the model of correlation between a company's economic development and environmental efficiency. The calculation of the model showed a strong positive correlation between the two components of a company's sustainable development. Therefore, further research in this area may yield more profound results that would be of interest to stakeholders and other users, and can also be used for forecasting and making managerial decisions not only within companies, but also in the entire industry. This, in turn, will contribute to broader sustainable development.

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