# SUSTAINABLE DEVELOPMENT: ECONOMIC EFFICIENCY OF ECOSYSTEMS

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**Abstract**

*To date, the generally recognized global trends have become the principles of sustainable development adopted by the UN, which are understood as the evolutionary development of civilization based on innovations while meeting the vital needs of the population of different states, including energy supply and environmental conservation. Being associated with a number of crises, the growing turbulence of the global economy and the political system of the modern world, constantly seeing an increase in the number of challenges to global trends towards sustainable development, it is worth reconsidering the approach to the concept of Sustainable Development. Attempts to undermine the significance of the UN 2030 Agenda for Sustainable Development adopted in 2015 under the influence of the COVID-19 pandemic quickly gave way to the importance of uniting efforts aimed at achieving the 17 Goals that are the basis of governance (SDGs). Efforts at many levels - from states and their regional entities to municipalities, corporations, or ultimately the level of specific people in society by and large. Attention to sustainable development issues is also growing against the backdrop of an obvious deterioration in the climate situation and the need to create energy security.*

**Keywords:** sustainable development**,** greenhouse**,** gas emissions, environmental challenges, environmental protection, advanced technologies

## I. Introduction

Modern technologies become part of any business and serve as a key factor in ensuring its competitiveness [1]. However, complex technologies have limitations that do not allow them to fully use their full potential to solve the problems of the ESG agenda. The first limitation is due to the fact that the use of advanced analytics technologies requires huge computing power, and this, in turn, leads to an increase in energy consumption and entails an increase in carbon dioxide emissions, negatively affecting the company's ESG indicators and the environment as a whole [2]. The second limitation is the ethical aspects of new technologies. Cloud computing can be one of the solutions to circumvent the above limitations. They respond to environmental challenges through more efficient energy management. The solution of the ethical aspects of new technologies in the clouds is achieved by standardizing the algorithms of the models used, using a huge amount of data, and constantly checking and validating the results. Now modern technologies are becoming a part of any business and serve as a key factor in ensuring its competitiveness. For example, with the help of advanced analytics, the most resource-intensive, complex and non-trivial tasks are already being implemented, the solution of which was previously impossible or impractical due to huge time and material costs [3]. Technologies allow you to analyze a huge amount of data in a short time, provide self-learning models and identify complex

relationships, build accurate forecasts, collect information and analyze, respond to changes in production indicators online, as well as securely store this data and much more. Digital tools based on sophisticated analytics are also applied to companies' internal processes to improve their efficiency. For example, advanced technologies are widely used in the world to solve problems in the field of ESG. In the Russian market, the share of penetration of modern technologies into ESG is small, however, according to a joint study by the audit consulting company Trust Technologies (hereinafter referred to as TeDo) and the Center for Sustainable Development of the SKOLKOVO School of Management, 65% of leaders of large Russian companies believe that without digital solutions it is impossible to implement ESG transformation. For example, in the field of ecology and climate (E), artificial intelligence technologies can achieve the goal of the agenda by creating smart and low-carbon cities, Internet-of-Things-based devices that can regulate electricity consumption. They also help improve the integration of renewable energy sources through smart grids and identify desertification trends through satellite imagery.

## II. Methods

As part of the social aspect (S), it becomes possible to create safer working conditions for employees. In the management part (G), thanks to the use of advanced technologies, reporting is automated, which becomes more transparent and accessible to the public. As the mentioned study shows, the following technologies have the greatest potential for achieving maximum efficiency in solving ESG problems [4]:

- artificial intelligence (29%);
- internet of things (23%);
- blockchain (14%).

However, it should be noted that for the implementation of specific digital solutions for ESG, combinations of these technologies are often used, which complement and enhance the effectiveness of each other. Let's consider the most common examples of using the technologies under consideration for the entire spectrum of tasks in the field of ESG.

The combination of artificial intelligence and the Internet of things is an indispensable tool for tackling climate and environmental issues, such as managing a company's carbon footprint. On the basis of artificial intelligence technologies, data are collected and consolidated reflecting the emission and absorption of greenhouse gases from production sensors in the context of individual processes. The specified array is further converted using machine learning into predictive models that allow high-precision assessment and optimization of the company's processes. According to Accenture research, more than 70% of companies report the effectiveness of digital emission reduction solutions implemented using artificial intelligence. Combining artificial intelligence with blockchain technologies makes it possible to more transparently track the carbon footprint formed by the components of the company's products throughout the supply chain and for all types of coverage (Scope 1, 2 and 3). An example of a digital carbon footprint management tool is a solution to reduce energy intensity implemented by a large steel company. Thousands of sensors collect data, which is then processed by artificial intelligence algorithms. This allows the company to accurately calculate and predict energy needs, and track and reduce emissions. Since implementing the solution, the company has implemented a number of initiatives that, according to BCG, resulted in a 3% reduction in carbon dioxide emissions, which is approximately 230 thousand tons of CO2 per year, and reduced costs by $40 million.

## III. Results

According to a McKinsey study, more than 20 examples of using artificial intelligence to improve the quality of life and health of company employees and 3 examples of gender equality stand out in order to achieve the sustainable development goals [5]. These goals are included in the social aspect of the ESG agenda. The most striking example of the use of artificial intelligence in the social sphere is the implementation of solutions that provide safe working conditions. On the basis of data received from

surveillance cameras, self-learning models are formed that recognize standard operating conditions and deviations from the norm. Further, the data from surveillance cameras is analyzed online and, using predictive analytics, hazardous work areas and risks are identified that can lead to incidents at the workplace in the future. For example, it is possible to track the movements of employees and identify potential hazards along their routes, such as the danger of tripping or the presence of loose equipment. With the help of such solutions, it becomes possible to set up notification of managers and staff about emerging risks and security incidents in the workplace, which allows them to be eliminated in a timely manner. Updating and processing data in real time allows you to monitor employees who violate established security rules. Internet of Things technologies complement and increase the efficiency of the digital solutions discussed above based on artificial intelligence. With the help of special sensors and thermal imaging cameras, data is collected about the environment surrounding the company's employees and its safety is assessed. For example, some companies are using machine vision to monitor employee safety in hot work areas. In particular, thermal imaging cameras can be used to detect "heat stress" in workers and provide them with the necessary assistance in the form of a cool down break or additional personal protective equipment. Sensors are also used to analyze the composition of the air in the working room [6]. They scan, analyze and immediately report the presence of harmful particles, pollutants or hazardous gases such as carbon monoxide. By collecting and analyzing air quality data and alerting anomalies, such systems help prevent the release of harmful pollutants into the atmosphere, while maintaining the safety and health of every employee. Additionally, with the help of artificial intelligence and the Internet of things, it becomes possible to create smart offices focused on maintaining the health, well-being and safety of company personnel. Occupancy sensors keep track of the number of people in the office at a given time. The visualization of such data enables flexible working formats, such as shared desk systems, and facilitates social distancing and prevents overcrowding in the workspace. Employees have access to this data to decide whether to visit the office. Also, office attendance data allows real-time implementation of office cleaning planning models that take into account their use. The level of air quality also affects the safety of personnel. A high amount of carbon dioxide in the air is associated with poor decision making, lack of concentration and drowsiness. Air quality sensors measure the level of carbon dioxide and volatile organic compounds and display the data on the dashboard to adjust the working environment of office workers accordingly. An industrial security video analytics project implemented by a large Russian company, which includes monitoring of hazardous areas, the use of PPE (personal protective equipment), collision risks and a number of other aspects, is an example of the implementation of a solution based on modern technologies in terms of the S-component. All collected data is analyzed in order to completely prevent accidents. In the near future, it is planned to equip employees with portable devices that allow monitoring biorhythms and monitoring critical health conditions, including pre-infarction and pre-stroke, which carry a great danger, especially when operating complex equipment, because in the event of an unexpected deterioration in health, the life of the employee himself is at risk, and his colleagues [7]. By connecting portable devices to the on-board computers of the technician, an instant stop of traffic will be provided, notification of those responsible for the site, and, most importantly, a call for an ambulance brigade, which upon arrival will have all the necessary data on the state of a person for prompt assistance.

## IV. Discussion

Modern technologies also make it possible to successfully implement solutions aimed at impartial evaluation of work and professional development of employees. With the help of big data analytics and artificial intelligence, a large financial holding has developed a personnel assessment system that solved the problem of biased feedback due to collusion between employees. This decision, based on the analysis of information about 25 thousand employees and more than 125 million emails, identified informal leaders who are most actively and effectively involved in decision-making and task completion. It was

found that the intersection of the list of candidates for promotion, compiled by employees, and opinion leaders, determined by the decision based on artificial intelligence, is only 60%. Thus, employees whose promotion is premature were identified, and in general, transparency and impartiality were added to the decision-making process on the promotion of employees. Artificial intelligence-based solutions aimed at training and professional development of employees allow the formation of personalized recommendations of the most relevant courses for an individual employee based on user clustering and training programs. The accuracy of the recommendations is achieved by analyzing the test results, personal profile, requirements for the position, as well as user experience. A similar solution is used by one of the largest banks in Spain. Another example of a more responsible attitude towards employees is the use of big data to prevent professional burnout [8]. The most striking example is the experience of a large construction company, which, using analytics and big data structuring, revealed that 14% of employees are in the last stage of burnout. The decision made it possible to apply employee support measures in a timely manner and reduce the level of staff turnover.

Good governance requires full transparency and accountability for key processes. With the help of artificial intelligence-based solutions, it becomes possible to automate the formation of key ESG indicators, which allows for a transparent, versatile and unbiased analysis of the company, eliminating the risk of human error in calculations, as well as their distortion. The main problem of automating the generation of ESG reporting is the heterogeneity of the required data sources. It is solved by using NLP (Natural Language Processing) algorithms, which allow machine learning to be applied to text written in natural language. Artificial intelligence-based solutions are already on the market, which, through full integration into company processes, allow collecting and processing data, calculating ESG metrics and comparing indicators with market averages. An additional reporting requirement under this aspect is to ensure the traceability of reporting and the possibility of its audit, which can be achieved through a combination of artificial intelligence with blockchain technologies. This decision allows you to confirm the immutability of the data reflected in the company's financial statements. All data stored on the blockchain platform can be verified by regulators or an independent party to confirm the company's compliance with the established standards and to verify that its statements, messages and advertisements correspond to its actual practice. For example, many corporations have committed to significantly reduce or eliminate their carbon footprint, which is reflected in corporate goals. Thanks to blockchain technologies, these goals can be compared with the organization's current carbon footprint. The above examples show that global problems in the field of sustainable development are currently being effectively addressed through the use of advanced technologies [9]. However, complex technologies have limitations that do not allow them to fully use their full potential to solve the problems of the ESG agenda. The first limitation is due to the fact that the use of advanced analytics technologies requires huge computing power, which leads to an increase in energy consumption and entails an increase in carbon dioxide emissions, negatively affecting the company's ESG indicators and the environment as a whole. In practice, training artificial intelligence models requires a huge amount of computing power, and some researchers argue that the environmental costs of applying advanced analytics outweigh the benefits. By some estimates, in just a few years, the digital industry will generate more carbon emissions than all road transport. Digitalization already accounts for 4% of global greenhouse gas emissions, according to EY analytics. The ecological footprint of the digital world is constantly increasing as energy consumption grows in parallel with the growth of the industry as a whole to meet the demand for technology. Some experts believe that by 2025 the technology sector could consume 20% of all electricity in the world. This growth from the current 7% is logical against the background of the development of complex technologies, such as artificial intelligence, which contribute to the demand for computing power. The second limitation is the ethical aspects of new technologies, in particular artificial intelligence. In most cases, historical data (often from a single company) is used to train artificial intelligence models, which can be limited and biased and lead to gender or racial inequality and discrimination from the decision based on such a model. An example is a scientific experiment led by researchers from Johns

Hopkins University, Georgia Institute of Technology and the University of Washington. Robots, functioning on the basis of artificial intelligence, were asked to distribute people into certain social roles and professions according to their appearance. The main conclusions of the study are as follows [10]:

- fair-skinned women in most cases were classified as housewives;
- black men were 10% more likely to be identified as criminals;
- Women were practically not assigned to medical professions.

This observation is a significant limitation for the use of new technologies in the field of the social aspect of the ESG agenda, since it directly contradicts the task of this aspect. Cloud computing can be one of the solutions to circumvent the above limitations. Cloud technologies respond to environmental challenges through more efficient energy management. The solution of the ethical aspects of new technologies in the clouds is achieved by standardizing the algorithms of the models used, using a huge amount of data, constantly checking and validating the results.

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