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Integration of Sustainable Development Principles into Engineering Management Practices: Analysing the Impact on Companies' Efficiency and Competitiveness

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ABSTRACT

The article examines the challenges and tasks related to integrating sustainable development principles into production and technological, engineering and technical, as well as managerial and economic processes. The author analyses the impact of these principles on the implementation of engineering management (particularly paing attention to its role on sustainable development strategies) and on the efficiency and competitiveness of enterprises, production systems, as well as on the image and reputation of companies. The need of integrating sustainable development principles into business processes is justified by means of analysis of experience employed by companies to improve operational efficiency. The study also applies universal scientific research methods, such as systematic approach, analysis, synthesis, comparison and generalization. As a result, the findings of the study draws up conclusions about the necessity to differentiate the impact on efficiency from the impact on competitiveness: the achievement of competitiveness is associated with competitive advantages, meanwhile the impact on efficiency leads to the growth of competitiveness of the company by proxy. The findings of the study are valuable for enterprises involved in elaboration of a sustainable development strategy.

Keywords: impact on sustainable development; engineering management; enterprise efficiency; competitiveness; sustainable development integration; production systems

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INTRODUCTION

The concept of sustainable development is a long-term oriented trend, which determines complex transformations of the world economy to achieve carbon neutrality, minimise environmental damage and maintain social stability. It is the transformation of the economic sphere in the fundamental processes of sustainable development, that plays a key role, with special attention to the development of sustainable ("green") competitive and efficient production systems. The latter are able to fulfill the basic functions and have a minimal negative impact on society and the environment, preserving it for future generations, at least in the form in which it exists nowadays. Since production (manufacturing, mining, electricity generation, etc.) accounts for the most significant share of emissions,[1] it should be given special attention within the framework of maintaining global sustainable development and the subsequent transition to a green economy with the implementation of the goals presented.

In this context, the task of integrating ESG principles[2] into the company's activities becomes relevant, which is a complex challenge for any manufacturing company and it requires systematic, strategically oriented transformations. When integrating these principles in the company, particular attention should be paid to the issues of engineering management, which is seen as an instrument to coordinate harmoniously the company's production, management, financial and economic objectives for implementing sustainable development policies. The professional responsibilities of engineering managers include supporting the sustainable development of the enterprise as a whole, as well as individual elements of the production system in particular. The rational organisation of activities of such specialists is assumed to lead to an increased efficiency and expansion of the competitive factors of their companies.

In view of the obvious importance of this issue, the aim of this research was to study the impact on the efficiency and competitiveness of companies by means of integrating ESG principles into engineering management practice.

The author used such methods as:

- analysis and synthesis of scientific publications covered by domestic and foreign
- authors on this topic, published in peer-reviewed scientific journals for the period of 2006–2023;
- content analysis to identify key aspects of the impact of integrating sustainable
- development principles on engineering management practice;
- comparative analysis to compare different approaches to assessing the impact of
- sustainable development on the efficiency and competitiveness of enterprises;
- as well as the method of logical modelling to develop a framework for assessing

the impact of sustainable development on the efficiency and competitiveness of enterprises.

To arrange the data obtained systematically in order to visualise the results, the information obtained was presented graphically in the form of diagrams and charts.

This approach helped to consider the problem in a comprehensive way and to formulate reasonable conclusions.

RESULTS AND DISCUSSIONS OF THE STUDY

Engineering management and its role in improving competitiveness

Engineering management is a relatively new direction of activity for the Russian economy, which implies the unification of engineering,

[1] The State Report "On the State and Environmental Protection of the Russian Federation in 2017". URL: https://gosdoklad-ecology.ru/2017/atmosfernyy-vozdukh/vybrosy-zagryaznyayushchikh-veshchestv/

[2] Environmental, social and governance principles of sustainable development.

information and communication, financial and economic management processes underlying the functioning of the production complex.

As was pointed out by T. A. Yakovleva and E. G. Doroshenko, specialists in this field should have the ability to think critically and analytically, make balanced decisions, as well as operate in the context and state of a particular production system and its resources [1]. In fact, the functioning of the engineering management system includes debugging and maintenance of the performance (productivity) of the business system simultaneously with the implementation of the development management objectives, as well as the achievement of performance factors and indicators and expansion opportunities related to competitiveness. In other words, engineering management and all its activities aim high at strengthening the company's position in the market in the conditions of a developing competitive struggle. This is achieved by implementing technical and technological, production, information, management, other mechanisms and solutions that can influence the competitive position of the company. Therefore, the tasks of increasing the efficiency and ensuring the competitiveness of the company are of primary importance in the practice of engineering management. M. A. Katanaeva, O. E. Podverbnykh and T. G. Okuneva call as a vivid example, the quality management system, which coordinates the technical side of the enterprise with the state standards and the needs of the target customers [2].

Such a system, according to these scientists, is linked to the provision of production systems with competitive personnel capable of meeting the growing demands and organising productively their own activities, supporting and maintaining the introduction and implementation of a sufficient number of standards in the field of quality. The latter is accomplished by means of developing an internal strategy, one of the directions of which can be the sustainable development. *Fig. 1* presents provisions and elements of its formation.

Since increased variability is characteristic for the modern economy, it would be relevant to express solidarity with the points of view stated by A. V. Tebekin and A. A. Egorova, regarding the potential to address the challenges of adapting to particular niches, solutions, demands and modern peculiarities that determine the specificity of enterprise development management when coordinating system tasks [3]. The authors of the publication point out, that high dynamics of external environment determines the processes of market customisation, in the conditions, where the once existing models of competitiveness may lose their own effectiveness. At the same time, there occurs a need for new methods of production systems management, for example, to implement a circular management and decision-making scheme, to make a transition from functional managers to universal managers, etc., which has a significant impact on the approaches to the organisation of engineering management.

If we consider the theses presented, it is worth pointing out, that the goal of the latter and its related practices is to debug and develop the production system not only technically, but also make it economically and management-wise strong. The most important metrics (indicators) of any company's development in engineering management practice are efficiency and competitiveness, which reflect compliance with internal expectations, external requirements and activities of other market participants.

Integration of ESG principles into engineering management

Obviously, within the framework of the sustainable development paradigm and related principles engineering management also acquires a characteristic specificity based on the integration of ESG principles into production, techno-

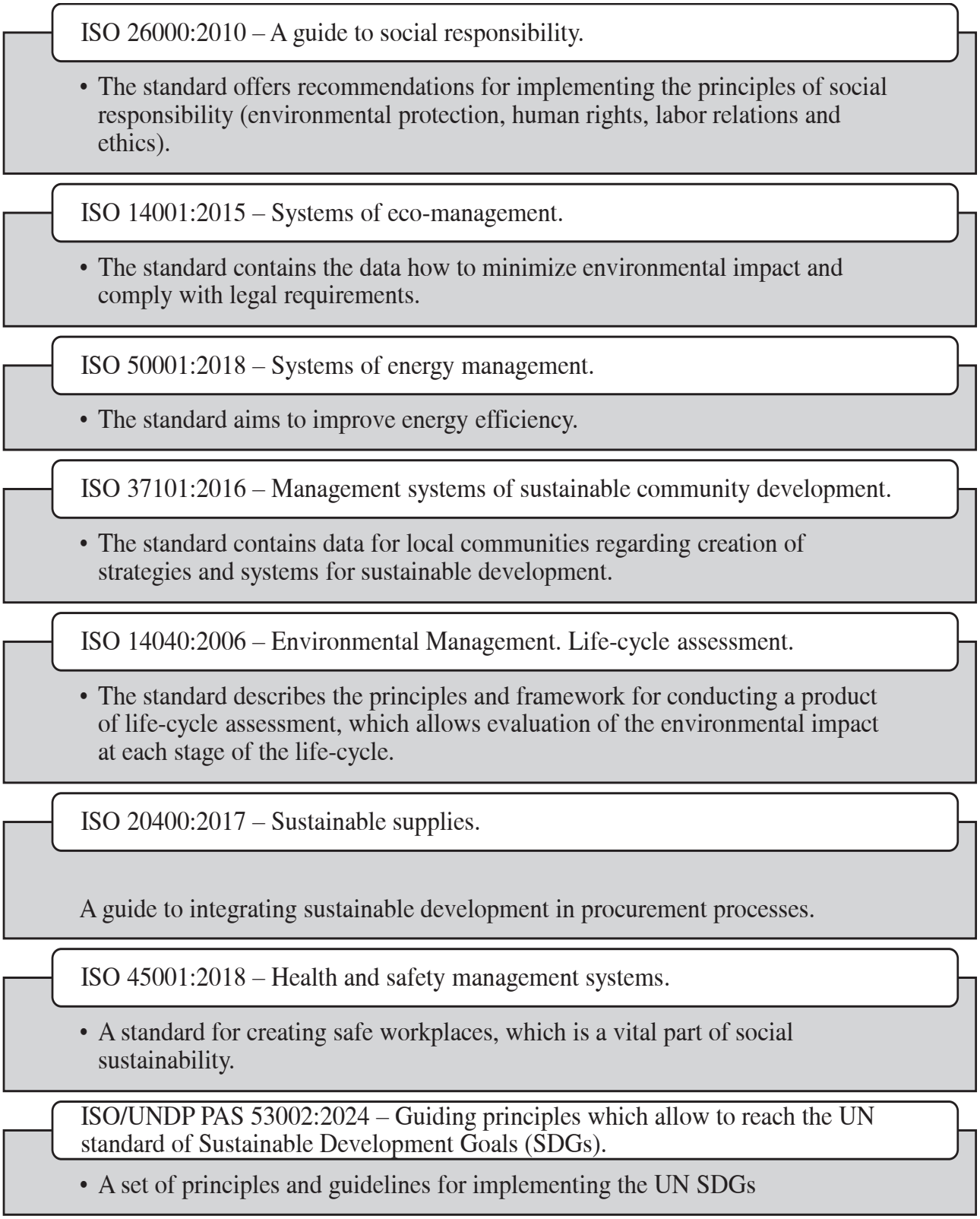

Fig. 1. **International ISO Standards in the Field of Sustainable Development**

Source: developed by the author based on ISO/UNDP PAS 53002:2024. URL: https://www.iso.org/standard/87945.html?utm_source=banner-sdgs&utm_campaign=sdgs-launch&utm_medium=organic-web

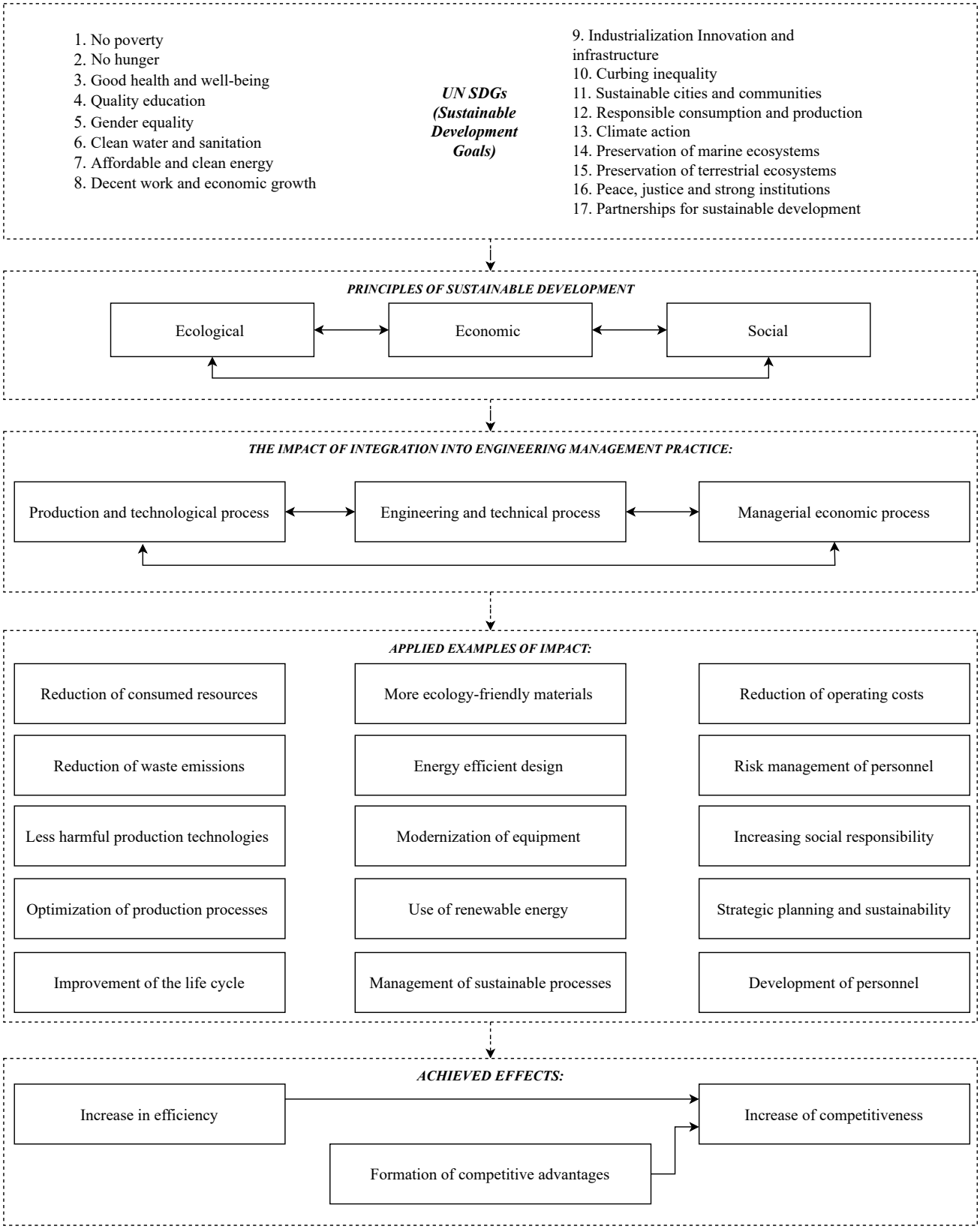

Fig. 2. **Principles of sustainable development and their impact on engineering management practice**

Source: developed by the author

logical, engineering and managerial-economic processes of the company. In this regard, the Sustainable Development Goals determined by the United Nations (UN SDGs) play an important role in business activity (*Fig. 2*).

The above-mentioned principles (see *Fig. 2*), when integrated into engineering management practice, lead to several directions to improve efficiency and competitiveness of the company. One can implement it in the following ways:

• A long-shot approach towards strategically-oriented transformations based on inevitability and consistency of impact of sustainable development on business systems and organisation of business processes and business models, as well as on the choice of material suppliers, customers, specific equipment, personnel development and many other aspects. In reality, sustainable development makes significant adjustments to many components of business and, when making decisions in the interests of the latter, it implies taking into account the factors of impact on its sustainability. This "makes" enterprises to at least implement certain sustainability practices and gradually transform their operational and modernisation strategies to include a mandatory social and environmental agenda.

• Proactive and preventive action of the company in response to the expected increase in government regulation, public pressure, etc. Since ESG principles are actively promoted (lobbied) by the community, enterprises have to demonstrate commitment and devotion to meet their demand. This looks like a compulsory measure aimed to avoid long-term negative consequences and negative impact on business from possible government decisions related to the environment. This also involves potential opportunities for attracting investments, obtaining government contracts and building productive interaction with the State and society.

• Improving the company's image and reputation while levelling a similar set of risks and challenges. Thus, the company maintains its image as a responsible, sustainable and rational business entity that remains committed to unified prospective goals and its initiatives are associated with the ideas and trends of social development. This component is particularly relevant in terms of the efficiency of the company, because it is associated with the productivity of its current relationships with consumers, suppliers, and other partners (stakeholders). In essence, integrating ESG principles can contribute to the implementation and maintenance of the enterprise's relevance, its adaptation to market trends and external environmental influences. Since the sustainable development policy is recognised of a global significance, it would be wise to consider the impact on internal subsystems. This also stimulates the need to launch of planned transformations and transition to the implementation of previously highlighted standards related to sustainable development.

In the given context, E. V. Shcherbina and T. K. Nguyen pointed out noteworthy ideas regarding the need to develop methodological approaches to the implementation of ESG-principles [4]. For example, both researchers cite a set of fundamental positions in the implementation of sustainable business development with a focus on ensuring the sufficiency of resources (their availability). They also take into account the dynamics of expenditure and limitations of resources, the characteristics of the current infrastructure and the problems associated with its changes, maintaining a balance between environmental, financial and economic, production and technological, social and other influential factors. Therefore, the researchers propose not just "blindly" follow the ESG-principles and implement effective solutions related to them, but also develop ways to implement transformations in the vector of sustainable development that take into account the state of the internal environment. This would combine the commitment to this policy and meanwhile avoid decreasing

competitiveness and economic efficiency or other negative changes.

Likewise, D.S. Kondaurova shares a similar opinion, that a comprehensive reflection of this position means implementing a sustainable development management mechanism adapted to the company's specifics features [5]. The author suggests coordinating such mechanism into a number of directions (*Fig. 3*), so that the coordinated action along these directions could provide an opportunity to transform towards sustainable development and allow for the concentration of the resources necessary for successful functioning. In other words, the aim is to coordinate the mechanism, internal tasks and philosophy of the company with the process of supporting the implementation of sustainable development. In our opinion, such approach is possibly quite productive: it implies that attention paid to such procedures as coordination of ways and directions of sustainable development, forecasting their effectiveness in the context of specific metrics and indicators that are most appropriate for a particular company. At the same time, N.V. Shandova gives somewhat different points of view and ESG-principles in her research, which are applicable in manufacturing companies, including the principles of connectivity, productivity, innovativeness, environmental friendliness, safety, etc. [6].

It is also important to take them into account, when implementing transformations towards sustainable development, which is accompanied by supplementing quantitative performance indicators and criteria with qualitative metrics that cannot be determined by traditional measurements (for example, this would require research work, involvement of experts, etc.).

Besides, it is important to point out, that the policy of sustainable development partially brings some adjustments to the existing strategic plans of company's development. Among other things, it is able to provide additional advantages in economic and financial activities, implementation of mechanisms and integration of principles of sustainable development of the company, not restricted to the framework of abovementioned "compulsory" benchmarks of efficiency improvement. A vivid example of this is the transition to new elements of organisational culture, as described in the publication by S.V. Ponomareva and N.V. Koryushov [7]. Both researchers determine organisational culture in this case as a set of certain ideas, philosophy, values and rules established in companies both formally and informally. Subsequently, the authors consider, that organisational culture makes a direct impact on the development of companies, including the ability to minimise costs, reduce the level of risks, increase the re-

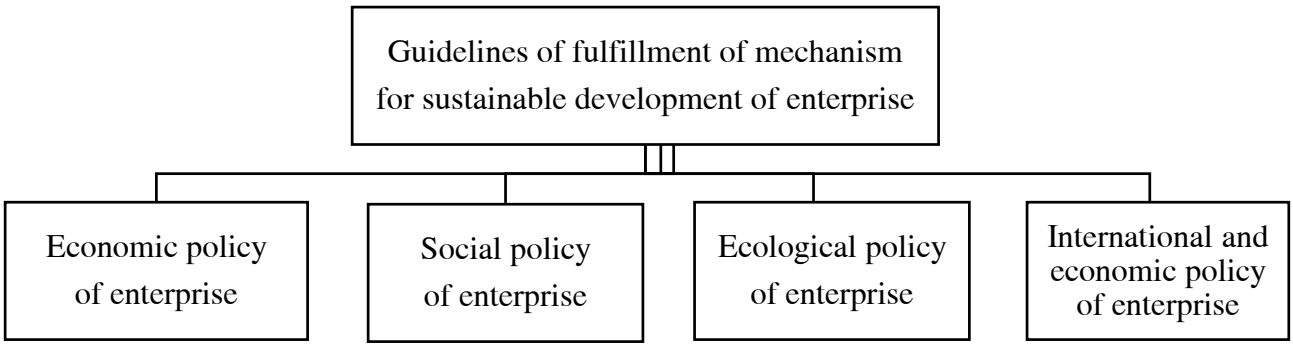

Fig. 3. **Directions for implementing the enterprise transformation mechanism under the influence of sustainable development**

Source: developed by the author based on [5].

sponsibility of employees for the sake of the optimum result etc. In this way, the nature of internal management is changed. In this way, it shapes the nature of internal and external interaction, the correctness of the response to certain manifestations. The basis for organisational culture in the paradigm of sustainable development inculcates its values, characteristic principles and beliefs among employees and management.

However, this is not limited to the internal level: a company can introduce its own corporate values and standards to its suppliers, partners or customers by means of information campaigns or through relevant actors. According to the CDP report,[3] partners and suppliers of sustainable companies often generate significantly more CO_2 emissions than their sustainable companies themselves (11.4 times more in supply chains than in the company itself) [8]. This is why, this direction, related to the introduction of organisational culture and its resulting impact at the external level, should be in fact considered as a prospect not only for integration into the processes of sustainable development, but also for the transition to a global, conscious and unified vector of implementation of the environmental agenda. Any sustainable change among partners is able to potentially generate more productive conditions for cooperation and, consequently, improve the company's efficiency.

Thus, the research made by E. V. Erokhina and D. S. Alutina indicates comprehensively the transition to the resource-saving mode of operation carried out within the framework of the described above policy [9]. The authors of the article point out, that sustainable development can be implemented in several conceptually related directions. The latter are determined both by the development of production and other systems of companies through innovation and investment, as well as by changing the current structures without major investments (which implies revision of approaches to the company's activity, changes in its order, methods of remuneration, organisation of working space, methods of production output, reuse of materials, etc.). Such approach reveals the company's commitment to sustainable development policies, it also emphasises the integration of these principles into the business (and thus gaining the necessary benefits), as well as it stimulates efficiency gains by enabling some costs to be shifted on to the end user etc. In a way, we visualise the ideas of lean production close to the principles of sustainable development, which emphasises the need to increase customer value while minimising losses, but it is important to have the proper conditions in place. The same opinion is shared by A. A. Abrosimova and P. S. Shalabaev: some decisions taken during transformations, even being in line with lean production, may lead to negative changes [10]. The reason for this is, in particular, poorly planned hasty introduction of methods and mechanisms, the lack of validity and strategic consistency of transformations, ignoring integrated management of the production system.

Taking into account all of the above, it is important to specify the impact of sustainable development tools and its related practices for the integration of relevant principles into engineering management practice, which is reflected in *Fig. 4*.

ASSESSING THE IMPACT OF SUSTAINABLE DEVELOPMENT ON EFFICIENCY AND COMPETITIVENESS

In our point of view, when ESG principles are integrated into engineering management practice, the impact of sustainable development on business efficiency is conceptually expressed in a number of systemic effects, which:

[3] CDP — Customer Data Platform, a programme which collects customer data from various online and offline sources into a single database.

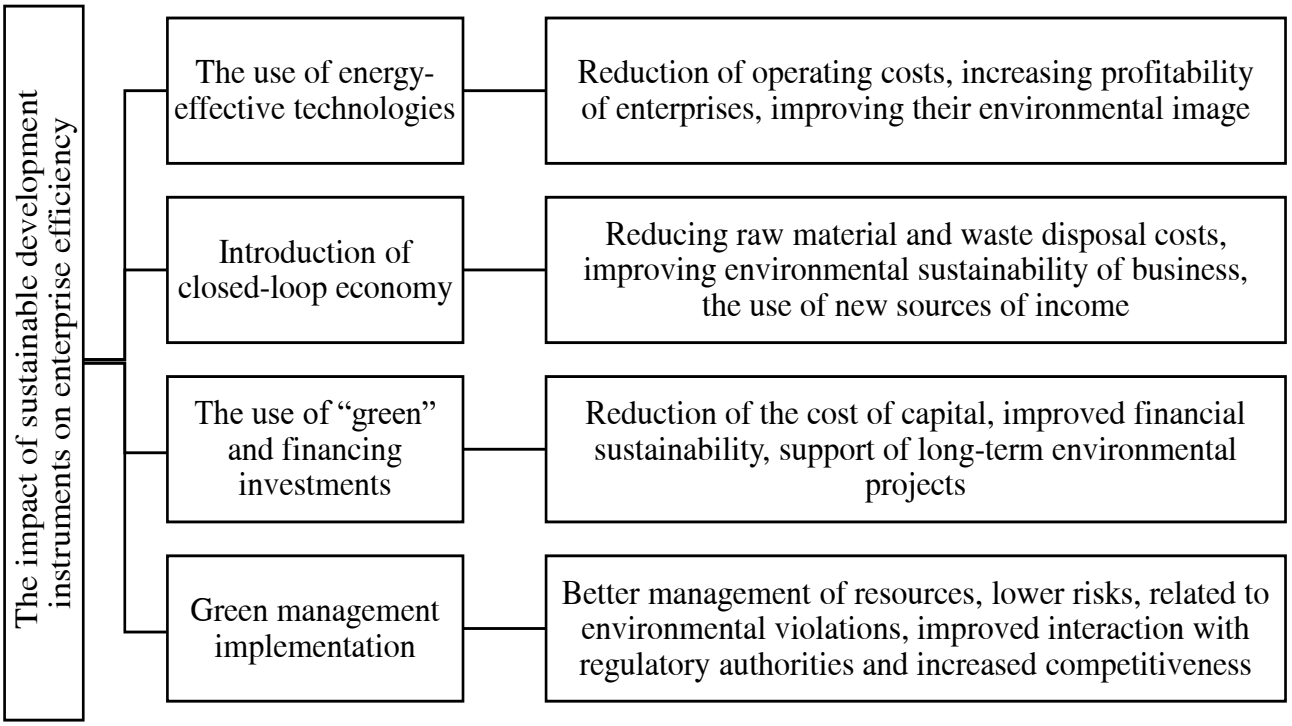

Fig. 4. **Impact of sustainable development tools on enterprise efficiency**

Source: developed by the author.

• are caused by positive changes in the functioning of existing systems leading to cost reduction through rational of costs by means of redesign of work processes, orientation towards lean approaches, etc., improvement of productivity, speed of operations, creative work of employees, etc.;

• are related to the revision of the global business development policy (strategy), but do not imply current changes, as they lead to image development, attracting additional investments, maintaining the company's openness, creating conditions for employees' commitment to global goals, etc.;

• directly occur from the actual activity, e.g. implementation of equipment, allocations in development, etc. and they lead to indicators' changes of environmental impact, productivity of manufacture systems, cost reduction in waste management, etc.

At the same time, the factors of achieving systemic effects are often the efficiently made management decisions coordinated with the characteristics of the enterprise, as well as the results of using such an asset as intellectual capital: innovative ideas and their development, ensuring their viability, etc. According to E.A. Ilyina, no less important are the issues of development and gradual implementation of the sustainable development strategy of the company, which will include specifically the set goals, as well as the means and directions that will ensure their achievement within the specified timeframe, relatively agreed upon with the objectives of sustainable development and certain time frames [11]. As E.A. Ilyina points out, generating specific ways to ensure sustainable development is the start of integration of ESG principles into business, which is associated with a stronger potential to improve the image, to attract investment and innovation opportunities.

In addition to the strategy itself, it is advisable to ensure an appropriate, effective system

of interim and final evaluation of its implementation, which should include the following:

- at the strategy development stage, it is important to develop indicators that take into account preliminary results and rates of movement towards planned (projected) values, as well as external influences and factors, meanwhile allowing to compare the final results of the implementation of sustainable development strategies for a certain period of time (for example, within the last three years against the planned period);
- develop solutions, recommendations and reveal cause-and-effect link for achieving or failing to achieve the planned results.

Subsequently, such a system will allow the company to specify and improve the strategy of current sustainable development and to proceed systematically towards achieving the goals.

In order to assess the results of the implementation of the strategy and the concept of sustainable development, scientists use to analyse various methods. For example, the research work of A. I. Gribanov suggests the approach towards the all-round performance of the enterprise and traditional performance indicators [12]. In particular, the scientist's evaluation system is supported with balance and production indicators of sustainable growth, such as profitability, current assets, liquidity, etc. The scientist analyses the indicators in relationship to the achieved benchmarks of the sustainable development strategy: economic value, impact of financial risks, CO_2 emissions, investments in environmental projects and initiatives, etc. As sustainable development is based on the implementation of ESG principles, A. I. Gribanov primarily suggests taking into account economic, social and environmental indicators, which help assessing the dynamics of the activity of a given company and the results it has achieved.

Similar ideas regarding the impact of sustainable development on the efficiency of the enterprise are available in the research work by A. Rakhimov [13]. The author has developed a whole system of indicators of social, environmental and risk sustainability. He also pointed out the initial objective to determine the factors that characterise the indicators, then as a follow up to bring them to a single value by the method of integral assessment and, subsequently, form a comprehensive indicator of the company's sustainability. It should be noted, that this approach may be used, among other research work, for comparative analyses of several companies, including subsidiaries, or divisions, which potentially expands the application range of its scenarios. In addition, the sustainable development can be assessed in comparison with traditional economic efficiency indicators. It makes it possible to coordinate purely economic objectives of the activities and development of production systems with those objectives that are of top-priority for sustainable development [13].

The research work of M. G. Salko, E. P. Kiselitsa and N. N. Shilova offers a slightly different approach towards assessing the impact of sustainable development on the efficiency of the company [14]. According to the scientists, such an assessment should be carried out within the framework of different projects aimed at the introduction of appropriate technologies, solutions, implementation of transformations, etc. in a given area. No doubt, such an approach has an obvious advantage for evaluation of a narrow area, when it specifies and analyses in detail the procedure itself. In addition, a company can align such projects and their performance evaluation indicators with the all-round development strategy, which increases the potential impact on efficiency by means of ensuring a more precise management and accumulation of resources for the project. The authors of the publication under review suggest a whole set of indicators, with specific focus on the following groups of indicators:

• social effectiveness indicators — the project's impact on the life of the population;
• indicators of the all-round social orientation of the project;
• traditional indicators of socio-economic effectiveness;
• environmental effectiveness indicators;
• indicators of innovation effectiveness;
• economic, environmental and innovation efficiency indicators;
• indicators of the expenditures;
• financial and economic indicators.

Moreover, the use of such method implies the presence of its own metrics within each of the groups of indicators, and each of them are assigned appropriate weights. This makes the assessment both more comprehensive and more balanced.

Within the framework of the problems discussed, P. S. Shpak and E. G. Sycheva made an important contribution in the study. They substantiate the importance of not only the research of the framework of sustainable development management and its impact on the

Traditional economic indicators and metrics of sustainable growth	Asset profitability
	Liquidity
	Level of CO_2 emissions etc.
Integrated system of sustainability indicators	Index of social ecological risk sustainability
	Integral sustainability (index)
	Index of corporate-social responsibility etc.
Assessment of individual projects of sustainable development	Social efficiency
	Economic efficiency
	Ecological efficiency, innovations etc.
Focusing on economic efficiency	Profitability
	Cost recovery
	Marginal profit etc.
Risk analysis and priorities in management	Level of financial risk
	Penalty prevention ratio
	Risk compensation ratio, etc.
The use of balanced system of financial indicators	Balanced financial indicators
	Balanced indicators of internal business processes
	Balanced ecological indicators, etc.

Fig. 5. **Methods and indicators for assessing the impact of sustainable development on enterprise efficiency**

Source: developed by the author

relevant spheres of activity, but also the need to specify primarily how to ensure economic efficiency [15]. To support this factor, the researchers suggest that sustainable development works exclusively with economic efficiency. At the same time, economic efficiency means return on investment, profit generation, creation of direct and indirect economic benefits, etc., provides an opportunity to allocate some funds and resources for self-financing of current initiatives and even changes directly related to sustainable development. The authors [15] suggest their own model of strategic management of innovative development of the company. The model employs assessment of profitability and efficiency of management of economic resources, which are considered as important factors influencing sustainable development and implementation of its principles in the activities of economic entities.

However, S. G. Vegera, E. B. Maley, E. Y. Afanasyeva and O. A. Sushko point out that in some cases, like the implementation of sustainable development some components of direct economic efficiency can be overshadowed by more obvious and significant impact risks [16]. The authors pay attention to industrial waste management as an example to point out that penalties imposed on enterprises and the associated financial consequences may exceed the level of costs of effective waste management and recycling, despite the fact that this item is a potential element of the formation of stranded costs for sustainable business development. Nevertheless, the scientists present the system of environmental, economic and social indicators to ensure analytical support for sustainable development in the field of waste management and to avoid potential losses caused by penalties.

Based on the above-mentioned studies, which deal with assessing the impact of sustainable development on the company's efficiency, below is the draft summary to classify and specify the possible ways of assessing the impact (*Fig. 5*).

Notably, business efficiency of a company defined in the context of its objectives usually deals with specific, measurable and predictable indicators, determined by the company aimed at its particular activities, etc. However, due to its abstract nature and different approaches to understanding it, the impact of sustainable development on competitiveness is cumulative and somewhat more complex to define. A vivid example confirming this thesis is the accumulated experience of implementing ESG principles in Russia and abroad presented in the research work of A. R. Akhmetshina and T. N. Gubaidullina [17]. Both researchers distinguish the following basic ways in which the principles under consideration can make an impact on the competitiveness of enterprises:

- costs reduction through justification of energy consumption, waste management, minimising cost;
- joint efforts to ensure innovation and intellectual capital, improving processes in terms of sustainable development;
- expanding markets and potential customers, who are only interested in products manufactured by sustainable companies;
- image opportunities (externally — with consumers; internally — with shareholders, employees, partners, etc.);
- avoiding risks caused by changes in legislation, etc.

However, this needs to be verified: the impact on competitiveness as measured by researchers in terms of the accumulation of benefits is not of a direct nature in relation to the impact on efficiency.

In particular, when considering the effects of cost reduction by means of a rational approach to the consumption of energy resources and waste management, the issues of cost minimisation of their impact on competitiveness are largely related to the efficiency of the financial

and economic activities of the company. The growth of the company causes a transformation of its activities, which gradually leads to internal improvements, which in turn influence competitiveness. However, it is hard to guarantee this result. This is confirmed by the work of F. Flachenecker, who claims, that it is really possible to ensure the growth of competitiveness in the long term by moving the company towards environmental sustainability, which is achieved through the management of operational efficiency by means of measures to rationalise resource consumption, resource conservation, proper waste management [18]. At the same time, Y. Wang, S. Zhang and S. Xu revealed that the implementation of effective resource management methods in the context of sustainable enterprise development does not always have a guaranteed effect on competitiveness, as it depends on the level of the company's innovation culture and human resource management approaches [19].

Focusing on innovation, intellectual capital and improving processes from a sustainability perspective may not always have a direct impact on competitiveness either. In particular, A. Parmentola and I. Tutore point out, that, indeed, focusing on intellectual capital leads to creation of effective sustainable innovations able to help solving competitiveness problems. However, as the researchers found out, the degree of involvement of this type of capital in this process remains uncertain and often depends on the extent to which the current management system is able to transform know-how into specific activities, projects and effective solutions [20].

In line with the ideas of the above-mentioned authors, the current research work can assume that investments in sustainable development through the development of innovations and intellectual capital will not always serve as the real efficiency indicator, or they will not be justified.

More positive prognosis in terms of impact on competitiveness rather deal with the impact on sustainable development on the expansion of market outlets and the number of potential buyers oriented exclusively towards the products manufactured by sustainable enterprises. Recent statistical studies confirm such hypotheses. The Deloitte[4] survey indicates that by 2023, over 46 per cent of consumers have bought a "sustainable" product at least once. Consumers are willing to spend 27 per cent more simply because such products are made by the company, which adheres to sustainability principles and policies.[5] In addition, according to the research made by M. Majeed, S.B. Azumah and C. Asare, a part of consumers generally prefer companies that publish open, transparent reports, and this makes a strong factor for increasing loyalty and growing brand positions [21]. However, such surveys have an obvious drawback: they depend on a particular region, the specifics of the products manufactured, the sales market etc. At least, the socio-economic status of the respondents is important, since this may predetermine the priorities in purchasing products of certain categories. Besides, the country of residence and the cultural traditions of consumption are also important for a more precise analysis.

Probably, another strong factor is the geography of the survey: the respondents represent not only developed but also developing countries. BCG[6] has surveyed 19.000 respondents from the USA, Japan, Germany, France, Italy, China, India and Brazil. As to Deloitte, it has surveyed more

[4] Deloitte — an international accounting and consulting company with a global network of offices; it is one of the "Big Four" accounting firms and the largest in terms of staff (312.000 people).

[5] Green products come of age. URL: https://www2.deloitte.com/us/en/insights/industry/retail-distribution/consumer-behavior-trends-state-of-the-consumer-tracker/sustainable-products-customer-expectations.html

[6] BCG — Boston Consulting Group, international company specialised in management consulting; it is one of "The Big Three" major companies by revenue.

respondents from the European Union, namely 22.600 people from Australia, Belgium, Brazil, Canada, China, Denmark, France, Germany, India, Italy, Mexico, the Netherlands, Poland, South Korea, Saudi Arabia, Spain, Sweden, the UAE, the UK and the USA. Obviously, the wealth, standard of living and consumer habits of the respondents were so different, which influenced the results[7].

As to the inhabitants of our country, according to the survey conducted by the NAFI Analytical Centre, 90 per cent of them focus on iconic brands and products. At the same time, 82 per cent of them mention, that a key factor to buy a product is the cost[8]. In cases where sustainable products are more expensive, citizens are likely to show a relatively little demand for them. Nevertheless, despite the importance of price factor, environmental issues are starting to play a certain role in the choice of Russian consumers too. According to NielsenIQ, 68 per cent of Russians believe that environmental catastrophe is inevitable if mankind does not change its habits. By the year of 2021, 49 per cent of respondents were willing to change their habits to improve the environment, but by 2023, this figure dropped to 43 per cent[9]. It is therefore appropriate to take into account regional specific aspects and preferences in the area of consumption, as well as the socio-economic situation, the level of well-being of the population and many other factors.

The other similar identified method of the impact of sustainable development on the competitiveness of the company is the creation of image opportunities, since the degree of its implementation directly depends on the region in which the company operates and the conditions of its activity.

As for the management of sustainable development risks, the research work by A.A. Burdina [22] confirms, that it is extremely difficult to establish a direct link between the risks and the level of competitiveness. Likewise, it is hardly possible to predict and prevent the risks due to the changes in legislation. Thus, it cannot be fully attributed to the factors related to sustainable development.

In line with the mentioned above, it is important to determine the impact of sustainable development on the components of the company's competitiveness which is expressed in the opportunities to differentiate and reach a narrowly focused consumer segment and to obtain profitable investments. Thus, the key influence factor of the integration of the principles of sustainable development on the competitiveness of the company is the direct competitive advantages created by the implementation of the sustainable development policy. This factor should be always under consideration in the context of a specific market, segment, consumer niche, etc. In this context, it is worth mentioning the ideas of A.S. Bednyakov [23] regarding the acquisition of infrastructural opportunities due to the implementation of sustainable development policy:

- use of green financial mechanisms;
- attracting green investments characterised by their long-term nature, lower interest rates and directed exclusively to sustainable projects and innovations;
- participation in state projects, including through public-private partnership.

CONCLUSIONS

To sum up the results of the study, it is important to focus attention to the fact, that the tasks of integrating the principles of sustainable development into engineering management prac-

[7] Less than 7 per cent of consumers pay a premium for sustainable products and services today, but 40 per cent could be convinced to make sustainable choices. URL: https://www.bcg.com/press/13september2022-consumers-sustainable-choices

[8] Trends of food consumption in Russia. URL: https://nafi.ru/projects/potrebitelskoe_povedenie/trendy-potrebleniya-rossiyanami-produktov-pitaniya/

[9] Consumer Behaviour in Russia and the World: Development Trends. URL: https://world-food.ru/ru/media/news/2024/january/29/potrebitelskoe-povedenie/

tice imply a systemic impact on the functioning of the company, which influences production-technological, engineering-technological and managerial-economic processes. The author of this article have conceptually distinguished the impact of integrating the principles of sustainable development on efficiency and competitiveness, and this has become an element of scientific novelty of the current research work. Thus, the impact on efficiency deals with acquisition of measurable benefits, generation of additional opportunities or prevention of risks (direct effects of sustainable development). As to competitiveness, its growth is purely the result of acquisition of competitive advantages by means of integration of ESG principles into the practice of technical management of the company, which is regarded, among other things, as an increase in efficiency. Such a distinction and its validity, confirmed indirectly in modern scientific literature, denotes the expediency to study these issues in the future. The theoretical significance of this research work is the development of theory and applied problems to justify the integration of the principles of sustainable development into the practice of engineering management.

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