The object of this study is the compliance of existing regulatory approaches to technology identification with the purpose of the EU sustainable development policy.

It has been established that the effectiveness of the European Union's sustainable development policy directly depends on the number of previously implemented technologies. It has been proven that such a dependence is both organizational and economic in nature. It has been determined that existing approaches to technology identification are not unified with the requirements of sustainable development policy. It has been proven that existing regulatory structures for defining technology do not contain restrictive means and therefore cannot be used within the framework of the European Union's sustainable development policy. The feasibility of introducing a special type of key technologies into EU regulations that can be used as a restrictive means to achieve sustainable development goals has been substantiated. A definition of key technology has been formed as one that is capable of contributing to the achievement of sustainable development goals in the EU. It has been proposed to give priority to key technologies for use and apply support and incentive measures to them. Proposals have been formulated to amend the provisions of such international treaties and agreements as the TRIPS Agreement, WIPO recommendations, UNCTAD recommendations, and the Horizon Europe Framework Program.

The study is aimed at forming general theoretical principles for improving the essence of the methods for identifying technology transfer for the purposes of sustainable development. The practical significance of the study results is that the results could be used in the formation of international regulatory acts, recommendations of international institutions, acts of national legislation, and serve as the basis for further scientific research on these issues

Keywords: technology transfer, sustainable development policy, technology transfer regulation, EU legislation

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IMPROVEMENT OF INTERNATIONAL TECHNOLOGY TRANSFER RULES IN THE EUROPEAN UNION THROUGH THE PRISM OF SUSTAINABLE DEVELOPMENT POLICY

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1. Introduction

The economic system of the European Union (hereinafter referred to as the "EU") is characterized by a significant degree of specialization, structuring, and institutionalization. Its main purpose is to combine and coordinate the interests and needs of both the EU member states and individual territories of this interstate entity. This is achieved both through the implementation of market self-regulatory mechanisms and through state regulation and management. The EU economy does not function autonomously and is a component of the global macroeconomic system. As a result, when forming management and regulatory mechanisms for influencing economic relations, the EU must take into account trends and patterns that exist throughout the world.

Given that most of the world's economies belong to the class of economic systems with centralized state intervention, the world community is actively implementing common mechanisms for such influence. The current stage of development of these processes is led by the United Nations (UN). The general concept of generalizing the common features of the regulatory influence of states on world economic relations has been termed the policy of sustainable development (PSD). The EU does not stand aside from these processes. On the contrary, the role of this intergovernmental entity within the framework of the formation and implementation of the PSD can be defined as key.

Many areas of PSD implementation are based on actions aimed at introducing new, energy-saving and knowledge-intensive technologies. It is with their help that it is planned to achieve the key goals of the policy of sustainable develop-

ment (SDGs). Such a calculation is not populist or one that is not based on relevant macroeconomic forecasts. Technology is an object of social and economic relations, endowed with unique potential. At the same time, it extends to both the macroeconomic level and the level of microeconomic relations.

However, public rules regulating technology transfer in the EU are episodic and do not have the characteristics of integrity. Most official regulatory acts refer to the recommendations of international institutions, define general forms of transfer and contain means of intensifying their implementation. Such an approach to regulatory policy is recognized by the participants in relations related to technology circulation as ineffective and negatively affecting the level of technology transfer. In particular, the current rules do not reflect the specificity of PSD and have not been modified in accordance with the SDGs implemented within the EU.

This determines, on the one hand, the relevance of scientific research on this topic, and on the other hand, it predetermines the need to formulate proposals for improving the current EU regulatory field. It is science that should formulate such proposals and thereby ensure an organic combination of public and private interests in technology transfer.

2. Literature review and problem statement

Issues related to determining the essence of PSD, SDGs, and the role of knowledge-intensive and advanced technologies in the system of means of their implementation have been addressed in many studies. They were carried out both at the level of economic and management systems of individual countries and within intergovernmental organizations, including within the EU. Thus, within the framework of work [1], the patterns between the introduction of new technologies and ensuring the achievement of SDGs at their expense within business relations are studied. In the course of studying international statistical data, using PLS-SEM methods in the statistical software SmartPLS, a direct pattern between the introduction of new (innovative) technologies and economic growth was proven. It is substantiated that only economically efficient entrepreneurship can become the basis for achieving SDGs. However, within the framework of the specified work, regulatory mechanisms for fixing the essence of technology were not studied, but only economic patterns and the dependence of SDGs on the efficiency of technology transfer.

Study [2] analyzes the problems that stand in the way of achieving one of the SDGs, namely, ensuring universal access to affordable and clean energy. In the course of this scientific search, a generalized management model of economic policy aimed at achieving SDGs was formed. However, as a result of the work, no proposals were formed to improve measures for regulating technology transfer relations.

Study [3] examines the patterns of the implementation of the state's tax policy and how it affects the achievement of SDGs. It is concluded that fiscal policy measures should be subordinated to sustainable development goals. However, within the framework of the study, no generalized proposals were formed to improve the place of innovations within the framework of international sustainable development policy.

In the course of study [4], the economic regularities between investment in the processes of introducing new technologies and the degree of achievement of SDGs were studied. It was substantiated that effective investment in new technologies in the production domain of a certain economic system makes it possible to achieve the profile SDGs. In addition, it was proven that the positive effect of effective implementation does not end only in the industry or domain of social production where such technology was implemented. It also extends to other sectors of the economic system; thus, technology becomes the basis for achieving most of the SDGs defined by the UN. However, within the framework of the study, attention was not paid to the essence and features of the formation of regulatory structures. No proposals were offered to improve the existing official rules of technology transfer.

Within the framework of work [5], the dependence of the effectiveness and efficiency of investment processes on the availability and systematicity of regulatory structures within SDGs was investigated. It is substantiated that the current regulatory definitions are ineffective, as they are too unified in nature and do not take into account the specificity of the regional level of economic development. Successful cases of the G7, G20, BRICS countries in implementing certain regulatory structures within the framework of PSD are studied. The direct dependence of investment efficiency on regulatory approaches to its definition is proven. It is substantiated that the imperfection of these structures is a critical factor in efficiency and can be compensated exclusively by special management techniques. However, within the framework of the study, no directions for improving regulatory structures were proposed that could more effectively eliminate the identified shortcomings.

In the course of study [6], an assessment was made of the legal regulation of the concept of technology within the framework of EU law. It was proved that the current regulatory structures do not meet the needs of technology transfer participants and should be improved by amending EU regulatory acts. However, within the framework of the work, the fact of inconsistency of current regulatory techniques and methods of technology identification was only proven, but the need for their improvement did not take into account the principles of implementing PSD and SDGs.

In work [7], the issues of compliance of the regulation of means of intensification of technology transfer in the EU were investigated, the needs of economic policy and the requirements imposed on the participants of these relations. The inconsistency of existing regulatory approaches to determining the essence of technologies within the framework of EU law was proven. Relevant proposals were formulated to improve existing international acts. However, the principles and principles of SDGs were not taken into account within the framework of these proposals.

Study [8] analyzed the means of implementing SDGs in the EU. The fragmented approach of EU institutions in the course of activities aimed at achieving SDGs was substantiated. It is proven that the main reason for this is the interests of small and medium-sized enterprises, which form the basis of the EU economic system. It is proposed to compensate for the burdensome nature of measures to achieve SDGs by introducing advanced technologies and ensuring the functioning of the innovation infrastructure.

Within the framework of work [9], the prerequisites for the effectiveness of the PSD in the EU were analyzed. The relatively low level of effectiveness of existing PSD measures in relation to the implementation of SDGs was noted. It was proven that the lack of a holistic perception of PSD leads to

low effectiveness of management decisions and private law measures of influence. Because of this, there is no feedback between the state and public institutions, which deprives the EU institution of the opportunity to eliminate existing shortcomings. Proposals were made to change the regulatory structures of EU law acts, but they all concern the implementation of feedback mechanisms. And they do not concern aspects of improving existing regulatory mechanisms.

The above studies [1–9] indicate the focus of scientific research on solving the issue of increasing the effectiveness of PSD in the EU. Many scientists note the presence of economic dependences and patterns between technology transfer and SDGs. No works were found within which proposals were made to improve regulatory approaches to the place of technologies within PSD. But we can talk about the presence of many problematic aspects of the implementation of SDGs.

All this allows us to state that it is advisable to conduct a study aimed at formulating proposals for improving the regulatory structures of the status of technologies within the framework of PSD in the EU. The conclusions formed within the framework of this study could become the basis for both further scientific developments and the basis for the formation of promising interstate and state regulatory acts.

3. The aim and objectives of the study

The purpose of our study is to substantiate the directions for improving regulatory structures for technology identification in the EU. The results obtained might prove useful for improving the provisions of international agreements of the EU and the UN, and internal regulations of EU member states.

To achieve this goal, the following tasks have been defined:

– to identify the features of approaches to determining the essence and characteristics of PSD, taking into account the technological component;

– to formulate proposals for directions for improving methods for identifying technologies within the framework of the sustainable development policy of the European Union.

4. The study materials and methods

The object of our study is a set of regulatory, management techniques and tools for determining the location and purpose of technologies within the EU PSD.

The hypothesis of the study assumes that existing mechanisms for identifying the essence of technologies do not meet the requirements of PSD and therefore are not effective for achieving SDGs.

When conducting this study, it was assumed that the inconsistency of the existing regulation in identifying technologies negatively affects the degree of achievement of the EU SDGs.

During the conduct of this study, a simplification was accepted, within which the feasibility and necessity of implementing SDGs were not taken into account.

During the study, the provisions of regulatory acts of the EU, the UN, information from open sources were used. In addition, recommendations of leading international institutions, statistical information and public information were used.

When conducting the research, all general scientific theoretical methods were used, namely: deduction, analysis, synthesis, induction, comparison, abstraction, systemic and functional methods, modeling, formal and logical interpretation of the content of scientific and normative categories and concepts.

5. Results of the study of directions for improving the rules of international technology transfer in the European Union in order to achieve sustainable development goals

5. 1. Study of the features of approaches to determining the essence and characteristics of sustainable development policy taking into account the technological component

The basic concept of PSD as one of the ways of unifying the state's managerial influence on the economic system was scientifically substantiated in the 1950s by scientists from the Massachusetts Institute of Technology [5]. They were taken as a basis in the EU and the UN and were later transformed into a global system [2]. In 1972, within the UN (Stockholm Conference on the Problems of the Human Environment), it was formed as a global system designed for the optimal combination of individual and public interests [1]. In 1987, the UN World Commission on Environment and Development (hereinafter WCED) was established. It was the WCED that formed the main principles of the future PSD model, which was implemented in 2015, within the framework of SDGs approved by the UN [8].

Within the EU, the PSD concept developed in parallel [1]. Thus, the first stage of PSD development in the EU is the publication of the European Commission Communication "Integrating Sustainable Development into EU Policy: Review of the EU Sustainable Development Strategy for 2009" [10]. Within the framework of this regulatory document, the goals of SD policy were first formed, which were to be achieved as a result of joint management actions of all EU members. These goals included:

– transition to a low-carbon economy;

– formation of a low-cost economy;

– implementation and dissemination of energy and resource-efficient technologies;

– ensuring a stable logistics system (transport);

– formation of a sustainable consumption economy;

– activation of environmental efforts;

– promotion of wider involvement of public institutions in economic management processes;

– strengthening the ideas of sustainable development at the global level;

– combating poverty [10].

At the same time, PSD in the EU did not exist without the interrelationship with the recommendations that were formed within the framework of the WCED activities [11]. However, the EU was ahead of other countries and UN institutions in its progress in developing the PSD concept.

In 2010, the EU adopted the Framework Program "Europe 2020. A strategy for smart, sustainable, and inclusive growth" [12]. Within the framework of this regulatory act, the following management priorities were formed:

– development of an economy based on knowledge and innovation;

– promotion of an efficient, ecological, and competitive economy;

– promotion of an economy with a high level of employment [12].

However, the practice of implementing all the outlined tasks has proven the low level of their implementation [4]. A number of objective circumstances contributed to this. On the one hand, these were macroeconomic factors [1, 2]. However, these were often microeconomic problems [2, 9] and management errors [8].

The global concept of SDGs was approved by the UN in 2015 (New York session of the UN General Assembly, September 2005) and formed in the form of separate SDGs (Sustainable Development Goals) [13]. The main ones were:

– poverty eradication;
– hunger eradication;
– good health;
– quality education;
– gender equality;
– clean water and sanitation;
– affordable and clean energy;
– decent work and economic growth;
– innovation and infrastructure;
– reduced inequality;
– sustainable urban and community development;
– responsible consumption;
– climate change;
– marine conservation;
– terrestrial ecosystems;
– peace and justice;
– partnerships for sustainable development.

At the same time, for each of the formed SDGs, a certain number of detailed tasks were determined, the implementation of which should ensure a higher degree of effectiveness of the implementation of SDGs at the level of an individual country [13]. All the outlined SDGs concern most aspects of social and economic life, including the implementation of some of them, which was set from the prior implementation of technologies [2, 3]. Such a dependence was determined by the UN when forming SDGs, as well as those detailed tasks that complement them. Comparing the specified tasks, we can conclude about the role of technologies in PSD. SDGs, the achievement of which depends on the prior implementation of certain technologies, are given in Table 1.

As can be seen from Table 1, almost half of SDGs formulated by the UN in 2005 depend on the presence or absence of a certain technology with a specific purpose that corresponds to a specific SDG. Thus, it can be stated that in general, the possibility of achieving all SDGs would depend on the prior implementation of certain technologies. Thus, the implementation of SDGs requires the presence of regulatory rules that would determine the requirements for the implementation of social relations related to the creation, transfer of rights and implementation of technologies. The EU is no exception to this rule. The EU SDGs also depend on the presence of previously implemented technologies [2, 3, 8, 9].

The conclusions given in Table 1 regarding those SDGs that are based on the prior implementation of certain technologies reflect the content of the means and measures by which they should be implemented. A selection of detailed tasks illustrating SDGs allows us to establish the degree of involvement of technologies in such means. As can be seen from the data in Table 1, almost half of SDGs from their entire list require the prior implementation of certain technologies. This is evidence that technologies underlie most of the measures and methods for implementing SDGs. And such a degree of their involvement requires an adequate regulatory approach to determining their essence. The main advantage of determining the dependence of SDGs on previously implemented technologies is that they provide the potential to ensure their implementation. Only technologies are capable of ensuring a high level of economic growth and their identification within the SDG tasks is a successful way to achieve them. The main disadvantage of such a concept is that the regulation of technology transfer is not uniform and generalized. And each country, in the course of implementing PSD according to the same rules, will not be able to ensure their equally effective use due to a special interpretation of the content of the technology. The regional specificity of the determination of technology transfer is based mainly on the pragmatic aspirations of each country to gain dominance over technologies. The absence of unified global rules for international technology transfer is additional evidence of this.

The regulatory approach to defining technologies in the EU is ambiguous and fragmented [7]. Thus, the EU does not have its own definition of "technology". Instead, those approaches are used that are formed within the recommendations of international bodies. Among them, the following approaches can be summarized:

Table 1

Sustainable development goals, the achievement of which depends on the prior implementation of certain technologies

SDG No.	SDG content	Detailing tasks
1	Overcoming poverty	1.4 By 2030, ensure that all .... had equal rights to economic resources, as well as access to ..... new technologies .....
2	Overcoming hunger	2.a Increase investment, including through intensified international cooperation, in ..... the development of ..... technologies in the field of agricultural production
5	Gender equality	5.b Increase the use of highly effective technologies, including information and communication technologies, to promote women's empowerment
6	Clean water and proper sanitation	6.a By 2030, expand international cooperation and support for ..... improving water use efficiency, wastewater treatment and the application of recycling technologies .....
7	Affordable and clean energy	7.a By 2030, intensify international cooperation to facilitate access to research and technology ……. 7.b By 2030, expand infrastructure and modernize technologies for modern and sustainable energy supply .....
9	Innovation and infrastructure	9.4 By 2030, modernize infrastructure and re-equip industrial enterprises, making them sustainable due to ..... environmentally friendly technologies and industrial processes ..... 9.b Support development, research and innovation in the field of domestic technologies ..... 9.c Significantly expand access to information and communication technologies .....
14	Conservation of marine resources	14.a Increase scientific knowledge, expand scientific research and ensure the transfer of marine technology from .....
17	Partnership for Sustainable Development	17.7 Promote the development, transfer, dissemination and development of environmentally friendly technologies so that they are received by developing countries on mutually agreed favorable terms, including on preferential and preferential terms 17.8 To ensure the full-scale functioning of the technology bank and the mechanism for the development of science, technology and innovation in the interests of the least developed countries by 2017

The first: formulated by the World Trade Organization ("WTO"), in the Agreement on Trade-Related Aspects of Intellectual Property Rights (the "TRIPS" Agreement) [14]. Here, technology is identified with the totality of objects of intellectual property rights [14].

The second: is singled out within the framework of the functioning of the World Intellectual Property Organization ("WIPO") [15]. Here, technology is defined as a specific complex object of intellectual property rights [15].

The third: was defined within the framework of the activities of the United Nations Conference on Trade and Development, UNCTAD [16]. Here, technology is identified as information that can exist in the following forms:

– all forms of industrial property;

– know-how and technical expertise;

– results of services for the engagement of technical advisory and management personnel;

– technological knowledge;

– technological content of agreements on industrial and technical cooperation [16].

Fourth: defined for the purposes of supporting and scaling technologies, within the framework of the EU Framework Program "Horizon Europe" [17]. Thus, in this regulatory act, technology is defined as an object that can be implemented in the form of:

– results of scientific and research and development works;

– experimental design of technology;

– integral property complex of a small (medium) enterprise;

– intellectual knowledge and developments, information on the sequence of technological operations;

– information on technology.

Systematization of the main formulations for defining the essence of technologies in the EU is shown in Fig. 1.

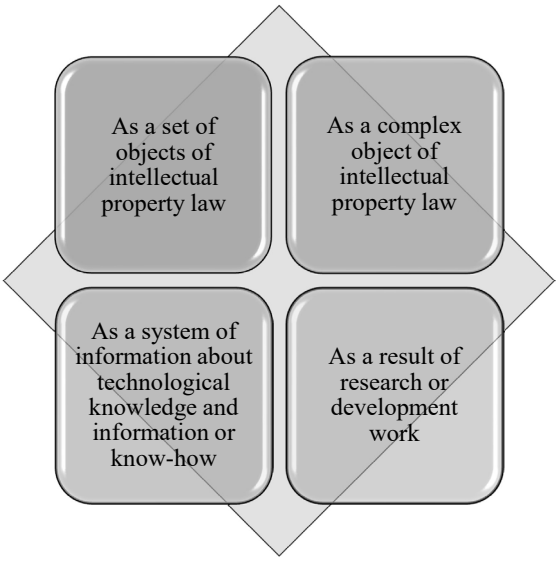

Fig. 1. Systematization of the main formulations for defining the essence of technologies in the EU

Given that technology is a very specific object of social and economic relations, it can take on a variety of forms in them. Thus, technology can play the role of a means of production, be a certain product or object of intellectual property rights, or an innovation. The special internal nature of this object also determines the presence of several points of view on how it is appropriate to define it within the framework of regulatory influence. The current stage of regulation of technology transfer relations is characterized by a tendency to generalize and compile all existing formulations. The main components of such generalization are defined in Fig. 1. The most common is the definition of technology as a certain set or system of objects of intellectual property rights. At the same time, such a system is subordinate to a general and common goal and purpose. This system, thanks to a common combination, makes it possible to achieve a unique result. The main advantage of this approach is that all components of technology can receive the same protection and support since they are endowed with the features of other objects of social relations. The main disadvantage of this approach is that some of the components of technology do not find their protection since they do not correspond to the content of the objects of intellectual property rights. Identification of technology as a result of research or development work allows one to cover all the components of the technology, which is its main advantage. However, the disadvantage of this way of understanding is the insufficient level of formal expression of information about the technology, as well as the relative level of industrial suitability for implementation in the production sector. Identification of technology through a system of information about technological knowledge and information and know-how, surpasses previous approaches in that it covers all its components at the appropriate level. However, it is not able to meet the needs of business entities if the technology has already been implemented in the form of certain equipment, machinery, or mechanisms.

A systematic study of existing approaches to defining the essence of technology within the EU allows us to establish that it can exist in the form of various objects of economic and social relations. However, none of the existing regulatory approaches provides for any special requirements regarding the content or essence of technology that would contribute to the achievement of SDGs. It is precisely because of the lack of special regulatory approaches to the specificity of technology transfer intended to achieve SDGs that their use is not effective [6].

The main way to eliminate the shortcomings of existing regulatory formulations of technology is to form a unified regulatory structure for its definition. It should encompass all existing approaches and be based on optimal ways of combining them. Also, it is advisable to supplement such a definition with possible property forms (thing, product, equipment, etc.). The main advantage of such an approach is the combination of already familiar ways of identifying technology, which are already known to participants in economic relations. Therefore, its implementation will not lead to radical changes in existing social relations. The main disadvantage of this approach is the degree of optimality of the methods of combining existing approaches. This degree is based on evaluative concepts and does not have fully known and understandable boundaries.

5. 2. Research on directions for improving the techniques of identifying technologies within the framework of the sustainable development policy of the European Union

The modern concept of sustainable development is a special technique of regulatory influence on social and economic relations, in which there is a combination of restrictive and permissive measures. The object of restriction is the private absolute interests of an individual subject of relations, in order to achieve socially useful goals and objectives. At the

same time, the measures of such restriction should be optimal, that is, based on a reasonable degree of restriction, so as not to put such a subject in a disadvantageous position in advance [2, 3, 8, 9]. The global model of PSD acts as a benchmark to which all countries should compare themselves when forming their state policy and regulatory influence. At the same time, the most debatable is the choice of the degree of "reasonableness" of restrictive measures, since it is a question of reviewing the personal guarantees that countries provide to their citizens (subjects).

Technology occupies one of the key places within the EU economic system. Because of this, in the official acts of this intergovernmental organization, there are a large number of regulatory measures to stimulate and intensify technology transfer [6]. Analysis of the level of EU spending on supporting technology transfer allows us to establish a direct relationship between the level of such spending and the degree of achievement of SDGs. Thus, according to Eurostat, on average, over the past 10 years, from 2.09 to 2.22 % of the total gross domestic product (GDP) has been spent on technology support in the EU. Detailed statistical information on the ratio of funds spent in the EU on technology implementation to the size of GDP is given in Table 2.

Table 2

Amount of money spent in the EU to support technology adoption, over the period from 2014 to 2023

Region /Time period	2023	2020	2017	2014
	% GDP	% GDP	% GDP	% GDP
European Union – 27 countries (from 2020)	2.22	2.28	2.14	2.09
Euro area – 20 countries (from 2023)	2.25	2.31	2.16	2.12
Euro area – 19 countries (2015–2022)	2.25	2.31	2.16	2.12
Belgium	3.32	3.37	2.68	2.36
Bulgaria	0.79	0.85	0.74	0.79
Czechia	1.83	1.95	1.75	1.94
Denmark	2.99	2.97	2.94	2.92
Germany	3.11	3.09	2.99	2.82
Estonia	1.84	1.73	1.25	1.41
Greece	1.49	1.49	1.15	0.85
Ireland	–	1.12	1.21	1.48
Spain	1.49	1.4	1.2	1.23
France	2.19	2.27	2.2	2.22
Croatia	1.39	1.24	0.84	0.77
Italy	1.31	1.5	1.36	1.33
Cyprus	0.68	0.83	0.54	0.51
Latvia	0.83	0.76	0.53	0.71
Lithuania	1.05	1.12	0.9	1.03
Luxembourg	1.03	1.1	1.24	1.22
Hungary	1.39	1.58	1.31	1.34
Malta	0.61	0.6	0.53	0.68
Netherlands	2.08	2.27	2.14	2.15
Austria	3.29	3.21	3.07	3.11
Poland	1.56	1.37	1.03	0.95
Portugal	1.69	1.61	1.32	1.29
Romania	0.52	0.46	0.51	0.38
Slovenia	2.13	2.16	1.88	2.39
Slovakia	1.04	0.89	0.88	0.87
Finland	3.09	2.93	2.75	3.16
Sweden	3.57	3.5	3.39	3.12
Iceland	2.53	2.49	2.08	1.94

The degree of implementation of SDGs in the EU is constantly researched and studied by Eurostat [18, 19]. Summary indicators of the degree of achievement of SDGs are shown in Fig. 2.

According to Eurostat data on the assessment of the degree of achievement of SDGs, the EU has achieved significant progress, substantial and insignificant progress in achieving certain SDGs [19]. Thus, significant progress is observed in relation to SDGs No. 8 and 10. Significant progress has been achieved in relation to SDGs No. 1, 2, 4, 5, 9, 11–14, 16, 17. Insignificant progress has been achieved within the framework of SDGs No. 3, 6, 7, 15. However, the overall level of achievement of SDGs in the EU is progressive. At the same time, within the EU in 2014, 2.09 % of GDP was spent on technology support, and in 2023, 2.22 %. Thus, statistical data indicate that there is a relationship between the amount of funds spent on supporting technology transfer and the achieved SDGs. This relationship can be characterized as such that an increase in spending on supporting technology implementation processes leads to an increase in the level of achievement of SDGs.

Conversely, in the example of Ukraine, another dependence can be seen. Thus, due to the military aggression of a neighboring state and the imbalance of its economic system, a decrease in spending on scientific research and technology transfer, in 2024, this country lost 5 positions within the Global Innovation Index 2024 [20]. In any case, the statistical data provided indicate the existence of an economic dependence between the degree of technology implementation and the level of SDG achievement. This, in turn, necessitates an assessment of the compliance of regulatory structures with the conditions for achieving SDGs in the EU.

The inadequacy of the general regulatory approach to identifying the essence of technology in the EU has a significant negative impact on the degree of implementation of SDGs [5]. The most appropriate way to eliminate the identified shortcomings is to formulate proposals to improve existing regulatory provisions by supplementing them with missing structures. All proposals should be based on ways to eliminate the identified shortcomings and contribute to their elimination.

The main direction of improving EU regulatory acts should be the introduction into their system of a special concept of technologies that are intended (or capable of) contributing to the achievement of SDGs. The approximate name of such a type of technology is proposed as "key technologies". The essence of this regulatory structure should be reduced to a variety of technologies intended (suitable) for achieving SDGs. The introduction of such a type of technology would make it possible in the future to implement special support measures, to distinguish them from other objects of social and economic turnover and to focus appropriate management decisions around them.

Given that the essence of the proposed definition of key technologies does not affect the existing approach to defining their essence, such a definition can be painlessly included in the existing EU regulatory acts. It seems appropriate to include the following in such a list of regulatory acts in force in the EU:

– TRIPS Agreement [14];
– WIPO Recommendations [15];
– UNCTAD Recommendations [16];
– Horizon Europe Framework Program [17].

Fig. 2. The degree of achievement of SDGs in the EU for the period 2014–2023

However, the systematic and stable implementation of SDGs directly depends not only on regulatory structures. Further management activities carried out by EU institutions, state and local authorities are also effective [5]. It is because of this that an additional direction for improving the status of technologies intended for achieving SDGs is the introduction of special restrictions when making relevant management decisions. We are talking about the introduction of those principles and principles that, under any conditions, should be guided by officials of government bodies or certain EU institutions when making decisions on or about key technologies. The most thorough is the introduction of restrictions that will be imposed on these persons, guided by the principle of priority when making decisions on key technologies. In other words, if a certain technology requires intervention or support from the EU institutions or authorities of the EU member states, then such an advantage should be given first of all to key technologies. And other technologies (ordinary or conventional) will receive this kind of support after key technologies. It is advisable to make such changes to the provisions of the Horizon Europe Framework Program [17]. Such expediency is determined by the fact that this program is the main regulatory act that determines the legal status of technology within the EU [21].

The main advantage of the proposal to fix the definition of key (special) technologies is the potential ability to form a special regime for their circulation and use on their basis. If a certain object of economic or social relations is endowed with the features of technology, it can be identified as one that makes it possible to achieve one or more SDGs. This will make it possible in the future to establish a certain individual regime for the processes of supporting its implementation and intensification of the processes of its use. Without the application of a special division of technologies into key and ordinary (regular), such a result cannot be achieved. The main disadvantage of this proposal is the uncertainty about the entity that, within the existing rules for making management decisions, will give a certain technology the status of key. This shortcoming can be compensated by the existing mechanisms in the EU for stimulating and supporting technology transfer, where most decisions on providing (or not providing) such support are made collectively. Given the practice of operating technology transfer infrastructure entities in the EU, a similar procedure for granting key technology status may be effective.

6. Discussion of results based on the study of directions for improving the regulation of innovative investment

Our research results and the developed approach to determining the essence and place of technologies within the framework of PSD are explained by the need to address the identified shortcomings of its implementation in the EU. The proposed areas of improvement solve most of these shortcomings. The essence of the proposals also follows from the special purpose of PSD, which was formed within the UN. Thus, the identified SDGs are those restrictive prohibitions that are introduced into the rules of the functioning of the EU with a single goal. Such a goal is to implement the optimal restriction of absolute personal freedom and interests for the sake of achieving public benefit. Such a special role of PSD in the EU also determines that the technology that makes it possible to achieve SDGs must receive such a regime of its transfer and use that will be aimed at satisfying public interests. At the same time, an optimal (balanced) restriction of private rights and interests of technology transfer participants will be allowed.

Existing approaches to defining technologies within the EU (Fig. 1) are ambiguous. Moreover, they are not endowed with features of complementarity, but on the contrary are often mutually exclusive. Each of the existing approaches has its own advantages and disadvantages [7]. Their comparison is not part of the subject of this study. However, the information shown in Fig. 1 makes it possible to establish that none of the existing approaches to determining technology reflects the role assigned to them within PSD.

The feasibility of making changes to the provisions of the TRIPS agreement, WIPO recommendations, UNCTAD, and the Horizon Europe Framework Program is substantiated. Thus, a prerequisite for the effectiveness of the implementation of the proposed changes is that they must be included

in the relevant international treaties and agreements. Such regulatory acts should be those documents that determine the status of technology. Taking into account the approaches defined in Fig. 1, it is appropriate to include the following:

– TRIPS Agreement [14];

– WIPO Recommendations [15];

– UNCTAD Recommendations [16];

– Horizon Europe Framework Program [17].

The results could be used within the regulatory methods of forming provisions of other official acts of the international and national level. Further study of the research issues will make it possible to obtain scientific results of practical orientation.

The proposal for the introduction of a special design of the key technology is based on the modeling method, which minimizes the need for a radical change in the existing regulatory approach. As can be seen from Fig. 1, there are four such approaches and they are not complementary. Proposals for improving regulatory measures are formed within the framework of this study in such a way as not to change the content of existing approaches. The issue of changing the general definition of technology is very problematic and requires extremely active preparatory actions. Because if all technology designs are included in the structure, signs of their verification for compliance with SDGs, such changes will only further complicate the process of technology transfer.

The main advantage of our study is that its results could be used within the regulatory methods of forming provisions of official acts of the international and national level. Further study of the research issues will make it possible to obtain scientific results of practical orientation. In the case of forming on its basis a process of improving the essence of technologies, the recommendations formed will require further refinement. However, in any case, all previous scientific studies [1–9] either did not form similar proposals or investigated only individual aspects. Various options for solving the issue of the existing ineffective regulatory approach to determining the essence of technologies in the context of PSD in the EU were proposed. However, all these results do not have signs of integrity and are not aimed at all participants in innovation relations.

During the study, directions were formed, solutions to most of the current problems that exist when determining the issue of compliance of technologies with PSD in the EU. The main advantage is that they are aimed at creating conditions for more effective implementation of technology transfer and achievement of SDGs. The formed proposals offer more effective mechanisms for solving existing problems with increasing the efficiency of identifying forms of technology transfer than was proposed in [1, 2, 6–9].

The results of this scientific study contain conclusions that could become the basis for the formation of official regulatory rules, promising regulatory legal acts. The possibility of their implementation within the framework of official regulatory rules is their advantage over similar studies.

This study is characterized by limitations that are due to the sources of collected information. Information about existing innovations and forms of their transfer is limited in access since it is often a commercial secret of business entities.

The main disadvantage of the study is the episodic nature of systematized information about successful cases of technology transfer. Another disadvantage is that it is theoretical in nature, since during its implementation there is no possibility of experimental verification of the formed results.

Further development of this research may consist in the development of legal mechanisms for fixing the concept of innovation. Based on this research, further scientific research in the field of state regulation and regulatory influence can be conducted. The main difficulties in the further development of this research will be the regional specificity of defining the essence of technologies and different national approaches to defining PSD.

7. Conclusions

1. It was determined that the existing regulatory methods of technology identification in the EU do not meet the requirements of PDS, nor contribute to the achievement of SDGs. Thus, their content is focused exclusively on the protection of the absolute rights and freedoms of technology transfer participants and does not contain any socially beneficial restrictions. This generally makes it impossible to implement a sustainable development policy.

2. Recommendations were formulated to improve regulatory methods of technology identification within the framework of PDS in the EU:

– introduction of the category of key technologies;

– formation of a definition of key technologies as those capable of achieving SDGs in the EU;

– giving priority to key technologies for use and applying support and incentive measures to them.

It has been determined that the main direction of improving EU regulatory acts should be the introduction into their system of a special concept of technologies that are intended (or capable of) contributing to the achievement of SDGs. The approximate name of such a type of technology is proposed as “key technologies”. The essence of this regulatory structure should be reduced to a type of technology intended (suitable) for achieving SDGs. The introduction of such a type of technology could make it possible in the future to implement special support measures, to distinguish them from other objects of social and economic turnover, and to focus appropriate management decisions around them.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial, personal, authorship, or any other, that could affect the study, as well as the results reported in this paper.

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Data availability

All data are available, either in numerical or graphical form, in the main text of the manuscript.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

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