

The object of this study is the existing regulatory approaches to the definition of private law forms of technology transfer in the law of the European Union, international treaties, and agreements.

In the course of research and generalization of existing concepts, it was established that they are not unified and differ significantly. It has been proven that this does not meet the needs of technology transfer participants and destabilizes the technology transfer process. The expediency of improving the existing concept of defining private law forms of technology transfer by unifying them has been substantiated. Recommendations on the list of the main forms of technology transfer have been formed based on a systematic analysis of regulatory legal acts that determine the content of technology. A classification of the main private law forms of technology transfer has been proposed. Three main groups of private law forms of technology transfer were distinguished. The expediency of assigning each private law form of transfer to a certain group was substantiated. Directions for improving the current regulation of private law forms of technology transfer have been formed, by summarizing and supplementing them. The need to make changes to the provisions of such international treaties and agreements as the World Trade Organization Agreements, the Recommendations of the World Organization for the Protection of Intellectual Property, the Oslo Guidelines, the UNCTAD Recommendations, and the framework program "Horizon Europe" has been proven.

The research was aimed at the formation of general theoretical foundations for the improvement of regulatory methods of identification of private law forms of technology transfer. The research results can be used in the formation of international normative acts, recommendations of international institutions, acts of national legislation and serve as a basis for further scientific research on these issues

Keywords: legal regulation of technologies, forms of technology transfer, unification of forms of transfer, financing of innovations

DEFINING DIRECTIONS FOR IMPROVING REGULATION OF PRIVATE LAW FORMS OF TECHNOLOGY TRANSFER IN THE EUROPEAN UNION

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1. Introduction

The key to the economic prosperity of any country or territory is the level of gross domestic product produced within its borders. Under such conditions, the production sector of the economic system becomes an object of public state interest and special rules of its functioning are created for it. In turn, the efficiency of any production process directly depends on the level of technological equipment of the available means of production. Priority should be given to the use of fixed assets that will ensure the production of competitive products. Globalization of the world economy, intensification of processes of cross-border exchange of knowledge about production methods led to the emergence of technology transfer. The prevalence and scaling of technology exchange processes have become a key to the success and level of security of many economic systems. The special

role and purpose of production funds led to the formation of a special regulatory approach to the establishment of technology transfer rules and regulatory policy.

The macroeconomic efficiency of the implementation of production technologies is not the final manifestation of their impact on economic relations. Thus, most of the gross domestic product is produced within the private business sector. For business entities, the use of new technologies is a way to increase the level of competitiveness of their own products and a means of guaranteed increased profit. Most of the successful examples of technology transfer and diffusion are implemented in business relationships. Under such conditions, the rules for transmitting information about the means of production become a key subject of the regulatory policy of the state.

However, regardless of the high economic potential of technologies, the interest of business in the implementation of innovative projects of their implementation, the methods

of their regulatory determination are imperfect. Most of the international normative acts and agreements define only the general features of the forms and methods of technology transfer. Often, for this purpose, those means of regulation are used, which were developed for completely different purposes. In addition, inadequate attention is paid to the issues of private law regulation of algorithms, methods, mechanisms, technology transition.

The European Union ("EU") is no exception to this pattern. Often, generalizing the national approaches that have actually developed within the territory of the EU, its institutions recommend fundamentally different forms of technology transfer. For most targeted regulatory policies, the EU uses its own, special approaches to determining forms of technology transfer. Under the conditions under which all private law forms of technology transfer must take place exclusively on the initiative and on the terms established by their participants, such shortcomings of regulatory determination become significant. The shortcomings of the legal regulation of private law forms of technology transfer have an extremely negative impact on their scaling. In general, it is impossible to argue about the effectiveness of the forms of technology transfer without prior unification of the general approach to determining the forms of technology transfer.

This predetermines, on the one hand, the relevance of scientific research into this area, and, on the other hand, assigns to scientists the task of forming proposals for improving the existing structures of private law forms of technology transfer. It is science that should form such proposals and thereby stabilize and intensify technology transfer and innovation processes.

2. Literature review and problem statement

Issues related to the definition of the essence and features of the implementation of private law forms of technology transfer were studied both in general and in the section of their individual elements. Such studies were conducted both at the level of legal systems of EU member states and within the framework of international acts of EU law.

Thus, work [1] examines the effectiveness and efficiency of the private law form of technology transfer as a license agreement. It was determined that the legal constructions of the license agreement cannot ensure the effective transfer of technology within most of the existing forms of cooperation between universities in Portugal and the industrial business of this country. They are only able to regulate the basic forms of this cooperation. A number of prerequisites for the low effectiveness of the construction of the license agreement have been formed. As the main reason for the low level of effectiveness of this private law form of technology transfer, the discrepancy between the subject of this type of contract and the content of the technology is indicated. The necessity of using other private law forms of technology transfer is substantiated, however, their possible varieties and features of application have not been formed.

In the course of study [2], the experience of the Kingdom of Norway regarding the activation and scaling of technology transfer with the participation of scientific institutions was analyzed. It was determined that the key stage in the development of this process was the adoption of updated rules for the transfer and distribution of technologies. Thus, instead of a license agreement, new private law forms of cooperation and interaction, based on long-term contractual cooperation,

regarding the joint conduct of scientific and research work have been formed. It was established that the updated concept of private law forms of technology transfer turned out to be more effective than the previous one. As the main advantage, greater compliance with the subject matter of the formed contractual mechanisms than existing license agreements was determined. However, in general, the work has a more generalizing nature and reports the study of the degree of effectiveness of individual private law forms of technology transfer. In the work, there are no generalized conclusions regarding the change in the general approach to determining the essence and types of private law forms of technology transfer.

Within the framework of work [3], the peculiarities of using such a private law form of technology transfer as a license agreement are investigated. The study was conducted taking into account the regulatory approaches of the EC law and the legislation of the Republic of Serbia. As a result of the study, it was determined that the license agreement has low efficiency in terms of ensuring technology transfer. The main disadvantage is that the author of the technology has no means of protecting his/her personal rights since s/he has no right to revoke the license, the terms of which are violated. In the course of the study, no proposals were made to improve the regulatory approach to the definition of all possible private law forms of technology transfer. Proposals have been made to improve the regulatory approach to the place and role of the license agreement within the framework of technology transfer.

Work [4] reported a study on the influence of such a separate type of private law form of technology transfer as a know-how transfer agreement, within the framework of infrastructure innovation support systems. Within the framework of the study, an assessment of the degree of effectiveness between such private law forms of technology transfer as a contract and organizational cooperation based on local acts was carried out. The conclusion was drawn that the means of contractual security are more effective as there are fewer regulatory barriers to their use. The expediency of replacing the process of entering into organizational interaction with appropriate contractual mechanisms, when involving technology transfer participants in the activities of infrastructure innovation centers in Italy, has been proven. It is substantiated that within the framework of contractual mechanisms for technology transfer, intermediary contracts occupy a special place. However, within the framework of the work, a generalized list of all permissible forms of private law technology transfer was not formed, and no changes to EU legal acts were proposed.

In the course of study [5], the patterns of intensification of technology transfer were analyzed under the condition of using agreements on the transfer of patents and agreements that provide for the protection and transfer of commercial secrets. The conclusion was drawn that technology transfer processes are reduced if such private law forms of their transfer as agreements on the transfer of intellectual property rights (patents) are used. On the contrary, it is determined that the transfer of technologies is intensified in the case of the application of such a private law form of their transfer as an agreement on the transfer of commercial secrets. However, within the scope of the study, a generalized approach to the unification of private law forms of technology transfer was not determined, and no proposals were made to change current international agreements.

When conducting research [6], criteria for the effectiveness of technology transfer were formed. Among the main factors on which the efficiency of technology transfer depends, the conditions under which such a transfer takes place were determined.

Under the conditions, the presence or absence of official (normative) rules and mechanisms for their transmission was determined. It was determined that if there is a system of forms of technology transfer established in regulatory documents, their efficiency increases significantly. However, in the course of the study, a generalized system of forms of technology transfer was not formed, and no proposals were made to improve the essence of private law forms of their transfer.

In the course of study [7], the effectiveness of regulatory barriers in the EU law on preventing criminal activity in the field of technology transfer was investigated. It has been established that EU law is not an effective safeguard to prevent misconduct. The main reason for this is the lack of identification of the form of technology transfer in the form of information. The expediency of making changes to EU legal acts was substantiated in order to fix the forms of technology transfer in its informational expression. However, no conclusions were formed regarding the improvement of regulatory structures to the generalization of private law forms of technology transfer.

In [8], a study of the degree of effectiveness of the most common forms of technology transfer was conducted. Partnerships based on local acts and license agreements (agreements) were identified as the main ones. It is substantiated that partnership is one of the more effective forms of technology transfer. The main advantage of partnership is a longer period of interaction between the owner of the technology and its recipient. However, there were no proposals for the generalization of existing private law forms of technology transfer.

All the works reviewed above [1-8] testify to the focus of scientific research on the improvement of certain private law forms of technology transfer. No studies were found within which proposals for improving the generalized regulatory constructions for the definition of private law forms of technology transfer would be formed. But we can argue about the presence of many problematic aspects of the implementation of technology transfer methods and a high level of interest in this phenomenon.

All this allows us to state that it is expedient to conduct a study aimed at forming a generalization of the existing private law forms of technology transfer and forming proposals for improving their essence. Formed proposals should ensure a higher level of technology transfer efficiency. The conclusions formed within the scope of this study could become the basis for further scientific advancement, as well as the basis for the formation of promising international and national regulatory acts.

3. The aim and objectives of the study

The purpose of our study is to determine the directions for improving the private law forms of technology transfer and to substantiate the directions for improving their essence in EU law. The findings may prove useful for changing the provisions of national regulatory and legal acts of the EU member states, EU legal acts.

To achieve this goal, the following tasks are defined:

- to analyze the basic approaches to determining the essence and identification of the types of private law forms of technology transfer, within the limits of EU law, to evaluate their shortcomings and advantages;
- to form a generalization of the existing system of private law forms of technology transfer and proposals for improving their essence.

4. The study materials and methods

The object of our study is a set of legal, regulatory, and normative methods and techniques for determining the content and essence of such a category as private law forms of technology transfer.

The hypothesis of the study assumes that the regulatory mechanisms for identification of private law forms of technology transfer, which are already established in the relevant EU legislation, do not meet the needs of its participants, and therefore require improvement. When conducting this study, it was assumed that the inconsistency of the existing normative regulation in the identification of private law forms of technology transfer has a negative effect on the scale of their transfer.

During the implementation of the study, a simplification was adopted, within which the national peculiarities of the normative identification of the essence of technologies were not taken into account. The need for such use is due to the fact that most countries establish a unique regulatory regime for their use, the study of which is irrational, as it must be changed in the future.

In the course of the research, normative regulations in the legal acts of UN organizations, the European Union, and acts of the World Trade Organization, information from open sources were used. In addition, recommendations of leading international institutions, statistical information, and public information were used.

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

5. Results of investigating directions for improving the regulation of private law forms of technology transfer

5.1. Studying basic approaches to determining the essence of private law forms of technology transfer, within the limits of EU law

Technology, as the implementation of a method of processing one thing into another, based on scientific developments, was formed in work [9]. Technology is also commonly understood as the central object of innovative relations, the investment of which renews a complete property complex [10]. Technology as the basis of economic development is defined in work [11]. All of them became the basis for the development of the concept of identification of the regulatory approach to determining the essence of technology. Later, all these approaches were summarized in paper [12].

With the emergence of the identification of technology as a special object of social and economic relations, the first forms (methods) of its transfer from one subject of such relations to another arose. For a long period of time, the circulation of technologies took place within the framework of a general regulatory approach, characteristic of all types of things (objects).

The legal system of the EU does not contain any special regulatory rules, which would be formed exclusively for it, in order to identify the technology and establish the rules of their circulation. All EU regulatory approaches rely on two main levels of regulatory influence. On the one hand, these are acts of international law (international treaties and agree-

ments, and Soft Law acts). On the other hand, these are the national regulatory systems of EU member states.

The first international agreement that established the basic rules of technology transfer was the Agreement on Trade Aspects of Intellectual Property Rights (“TRIPS” agreement) [13]. This agreement was adopted within the framework of the World Trade Organization (hereinafter referred to as “WTO”) on April 15, 1994. The very provisions of the “TRIPS” agreement formed the basis of most EU regulations and the approach defined by it was the basis of other regulatory measures. This international act equates technology with objects of intellectual property law. As a consequence of this approach to determining the essence of technology, the main forms of technology transfer are the forms of transfer of rights to objects of intellectual property law. A systematic analysis of the provisions of the TRIPS agreement allows for the formation of a list of private law forms of technology transfer that can be applied within the EU. The list of private law forms of technology transfer in the EU under the TRIPS agreement is shown in Fig. 1.

In 2005, the World Intellectual Property Organization (hereinafter referred to as “WIPO”) formulated a number of recommendations on how technology should be identified at the level of the legal systems of participating countries [14]. In general, this approach coincides with the method of identification within the scope of WTO law and is reduced to a synthetic (collective) object of intellectual property law. The main private law forms of technology transfer are those contracts and agreements that can be concluded for the transfer of rights to objects of intellectual property law [14]. The list of private law forms of technology transfer in the EU, according to the recommendations of WIPO, is shown in Fig. 2.

Within the framework of the United Nations Conference on Trade and Development (hereinafter referred to as “UNCTAD”), a study of the main forms of technology transfer was conducted and a more extensive list of private law forms of technology transfer was formed [15]. The list of private law forms of technology transfer in the EU, according to the recommendations of “UNCTAD” is shown in Fig. 3.

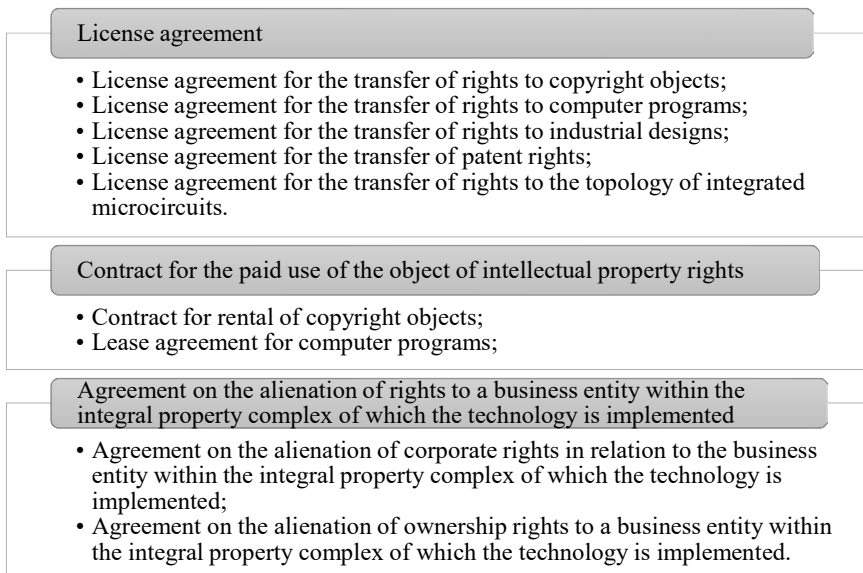


Fig. 1. List of private law forms of technology transfer in the EU, according to the TRIPS agreement [13]

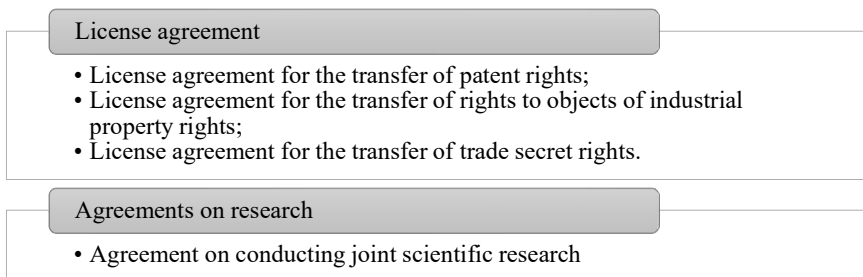


Fig. 2. List of private law forms of technology transfer in the EU, according to the recommendations by “WIPO” [14]

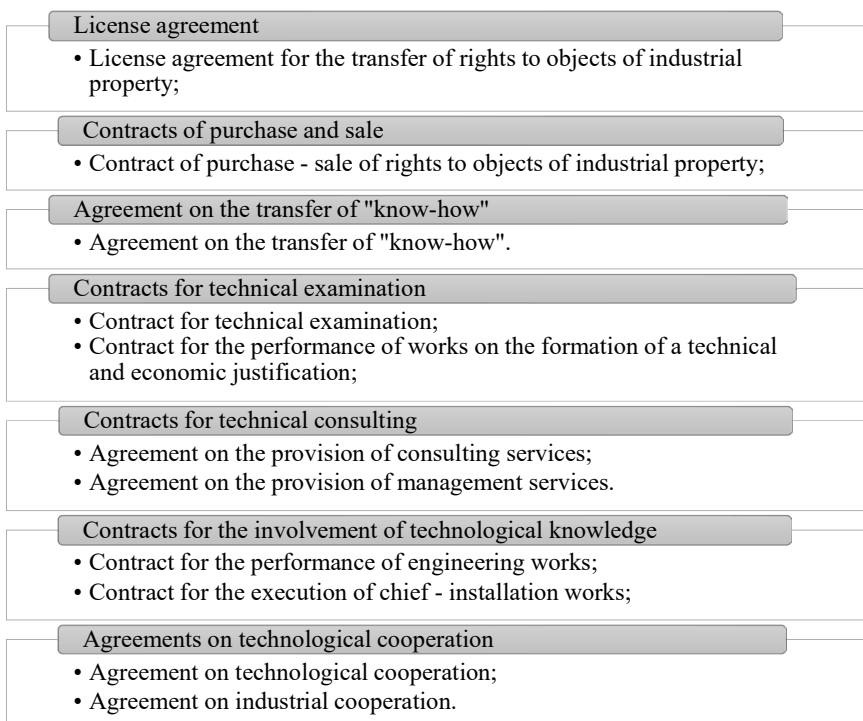


Fig. 3. List of private law forms of technology transfer in the EU, according to the recommendations by “UNCTAD” [15]

Soft law acts formed within the scope of the activities of the Organization for Economic Cooperation and Development (hereinafter referred to as “OECD”) are also used in EU law. In 2018, “OECD” recommendations on the formation, circulation and use of innovations were formed – Frascatti Handbooks - Oslo Guidelines [16]. The peculiarities of the “OECD” recommendations are that they provide a classification of private law forms of technology transfer, depending on the basis of their occurrence. The first group of private law forms of technology transfer was formed due to their ability to become the subject of a special type (type) of contract. The second group is based on possible forms of cooperation based on local acts and other ways of regulating these relations. The generalized list of private law forms of technology transfer in the EU, according to the recommendations of the “OECD” (Frascatti Handbooks - Oslo Guidelines) is shown in Fig. 4.

The approach to determining the essence of private law forms of technology transfer in EU law is further complicated by the fact that within certain sectors of the EU economy, special methods of their interpretation are used. Thus, within the framework of implementation of innovative support means, the EU uses a unique approach to the forms of technology transfer that can be supported. Thus, the Framework Program “Horizon Europe” (approved by the European Parliament) was adopted in EU law [17]. This regulatory act is the main document defining the basic principles of those forms of technology transfer that can claim support measures from EU institutions and at the expense of EU funds. System analysis of the Framework Program “Horizon Europe” allows to form a special list of private law forms of technology transfer. Designation of such forms of technology transfer indicates their legality and recognition as such, which can be used in relations between business entities within the EU.

The list of private law forms of technology transfer in the EU, defined by the Horizon Europe Framework Program, is shown in Fig. 5.

Thus, for the purposes of financial support, a wider list of private law forms of technology transfer is compiled within the EU law. Despite the narrow sectoral specialization of the given list of forms of technology transfer, they are allowed to be implemented within the limits of regulatory influence in the EU.

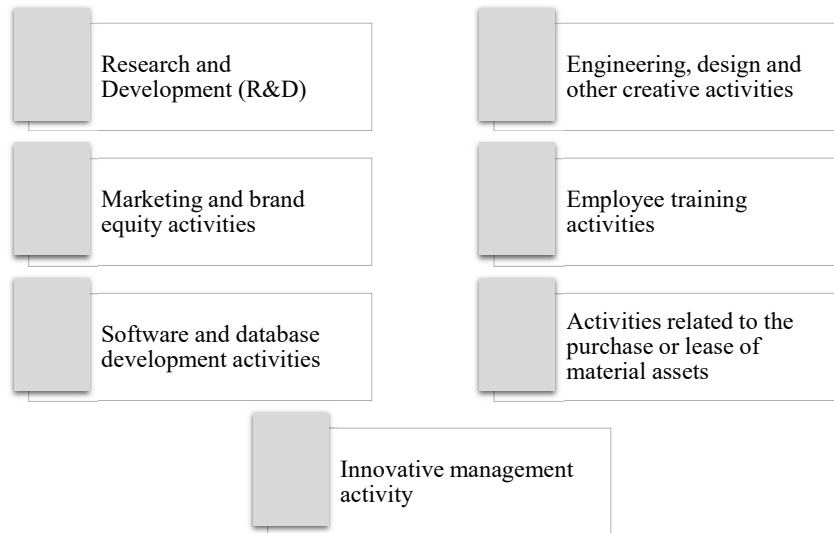


Fig. 4. Generalized list of private law forms of technology transfer in the EU, according to the recommendations by “OECD” (Frascatti Handbooks - Oslo Guidelines) [16]

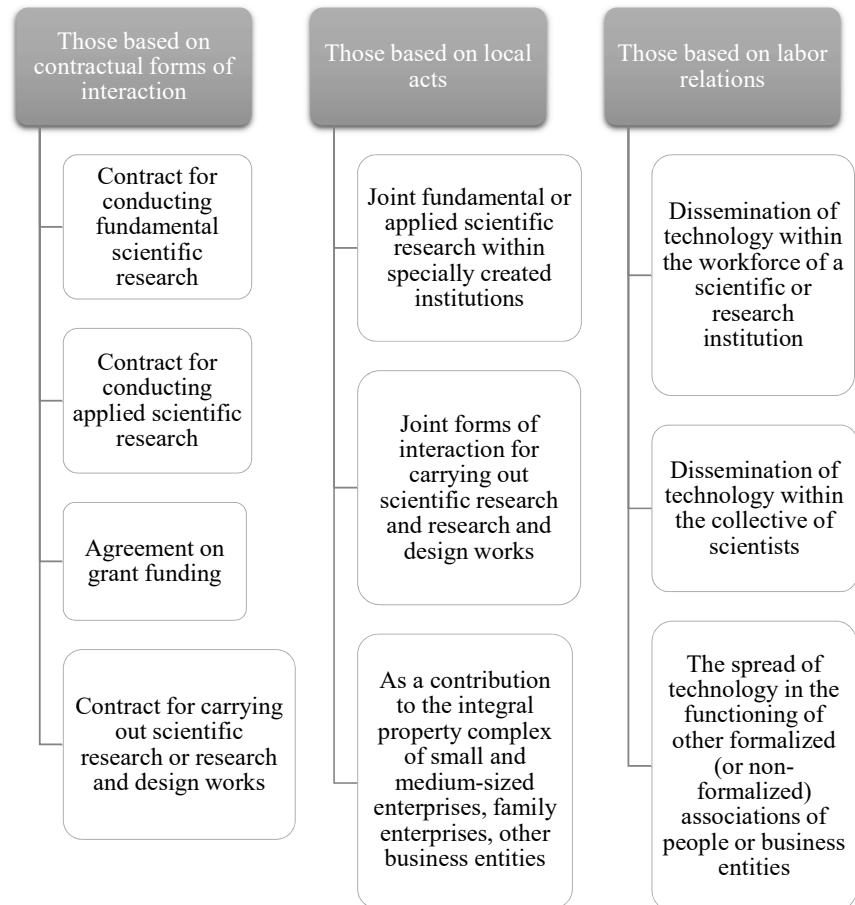


Fig. 5. List of private law forms of technology transfer in the EU, defined by the Horizon Europe Framework Program [17]

5. 2. Proposals regarding generalization of the system of private law forms of technology transfer in the EU and improvement of their essence

As a result of a systematic study of the content of regulatory documents operating within the framework of EU law, it is possible to draw a conclusion about the absence of a uniform

interpretation of the content and forms of private law technology transfer. Thus, within the framework of the TRIPS agreement, the identified private law forms of technology transfer are equated with the contractual interaction of two entities regarding the transfer of rights to objects of intellectual property law that are part of them. At the same time, within the framework of the recommendations of “UNCTAD”, “OECD” (Frascati Guides - Oslo Guidelines) and the Framework Program “Horizon Europe”, these forms have already been expanded. This expansion took place due to the addition to the existing forms of private transfer of technologies, cooperation based on intra-firm, organizational, labor principles. At the same time, all of the above sources of determining the forms of private law technology transfer are not mutually exclusive. They complement each other, defining a single, common list of forms of technology transfer, but are not unified among themselves. As a result of a systematic analysis of all identified forms of private technology transfer, it is possible to form a generalized list of them. Generalization of the main forms of private technology transfer in the EU is shown in Fig. 6.

In the course of summarizing all defined forms of private transfer of technologies, it can be determined that they are divided into three conditional groups. Such division is determined by the peculiarity of the regulatory mechanisms on which one or another form of technology transfer is based. According to this criterion, it is possible to distinguish those forms of private law technology transfer based on contractual mechanisms, local acts, and labor relations.

The identified approaches to determining the essence of private law forms of technology transfer indicate the need for their systematization and further improvement. Systematization is expedient for the purpose of streamlining disparate legal regulations and stabilizing the intentions of technology transfer participants. Improvement is necessary due to the fact that even an extensive system of private law forms of technology transfer still does not satisfy all the needs of the participants of these relations. Directions for improving private law forms of technology transfer should be based on

already identified shortcomings of regulatory structures. The first direction of improvement should be the consolidation of a generalized list of private law forms of technology transfer. The number and diversity of fixed forms, in itself, has a destabilizing effect on the transfer of technologies [4]. The key to the effectiveness of establishing a generalized list of forms of private law technology transfer is their fixation at the level of major international treaties and agreements on this issue. Such contracts are:

- TRIPS agreement;
- WIPO recommendations;
- Oslo management;
- UNCTAD recommendations;
- EU framework program “Horizon Europe”.

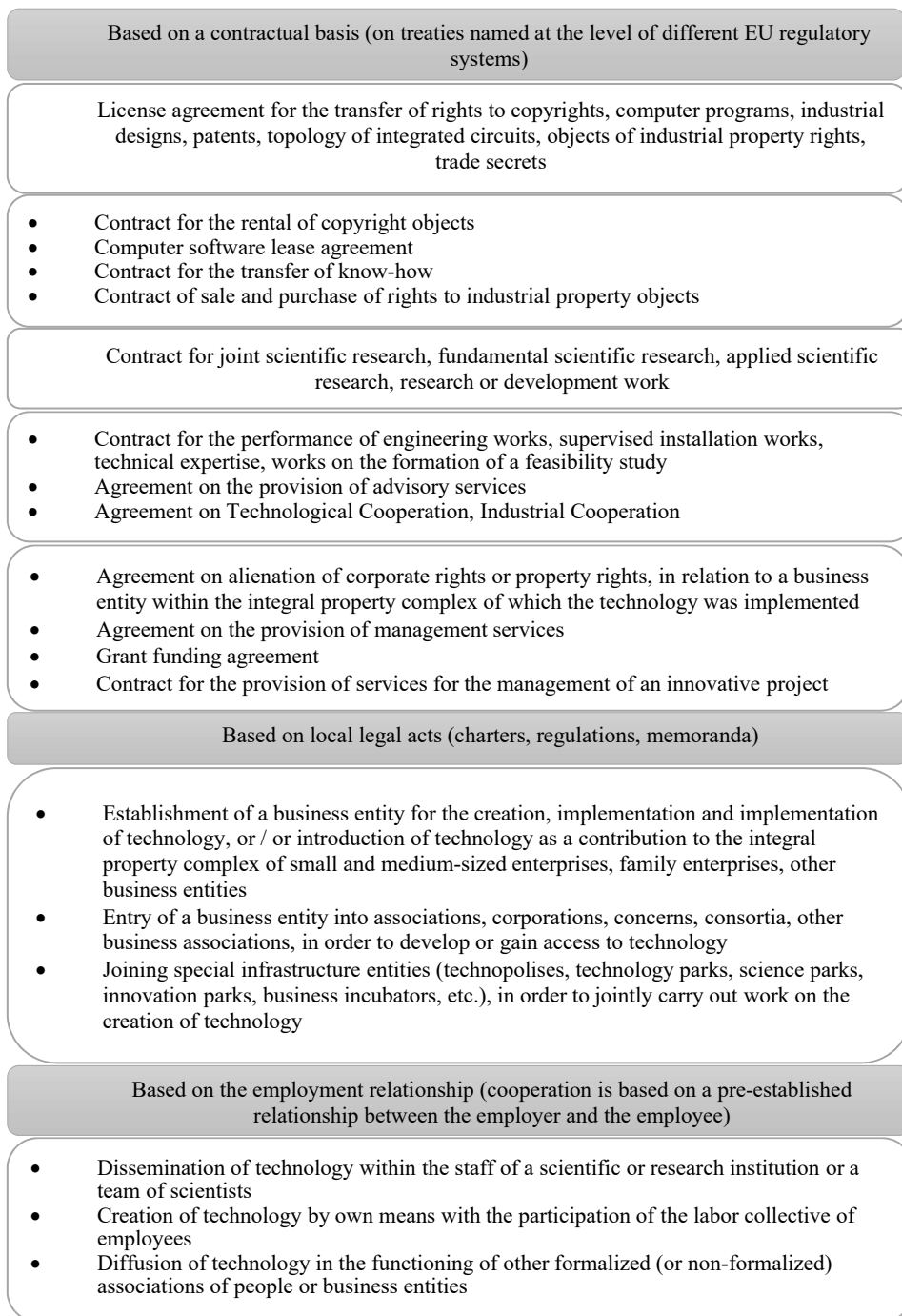


Fig. 6. Generalization of the main forms of private technology transfer in the EU

The second direction for improving the regulatory approach to the determination of private law forms of technology transfer is the expansion of possible forms of its transfer. Within the contractual means of regulating relations in the EU, there are a large number of treaties capable of mediating the transfer of technologies. However, they are not defined within the existing lists and therefore are not used by technology transfer participants. Among the existing forms of technology transfer under private law, it is appropriate to include such contractual structures as commercial concession (franchising) [5], agreements on the transfer of scientific and technical information [7], concession agreements.

6. Discussion of results of investigating directions for improving the regulation of innovative investment

The results of our study and the defined list of generalized private law forms of technology transfer are explained by the need to solve the identified shortcomings of their effectiveness. Formed proposals solve most of these shortcomings.

Technology is a complex, multifaceted phenomenon and the object of numerous economic relations. This should be taken into account when forming means of regulation of private law forms of its transfer. At the same time, existing regulations and agreements within EU law do not contain a generalized approach to determining the essence of technology [18, 19]. And this, in turn, indicates the need to continue scientific research on the issues raised within the scope of our study.

The degree of prevalence of private law forms of technology transfer is confirmed by the volume of private law financing of technology transfer within the economic systems of the EU countries. Thus, according to the results of 2021, the share of technology transfer financing based on private capital within the EU amounted to 57.65%. Within the Eurozone countries, the same indicator reached 58.12%. In terms of individual EU countries, such indicators also indicate the importance of the share of private law forms of technology transfer. Thus, within the economic system of Belgium, this indicator reached 64.42%; Germany – 62.78%; Italy – 53.91% of the total amount of financial resources involved in the field of technology transfer [20]. The given economic indicators show that among all existing forms of technology transfer, private law forms occupy the main share of the EU economic system. A large number of business entities, scientific and research institutions, and transnational corporations are involved in this process. The effectiveness of their functioning affects the level of economic development not only of the EU but also of the Eurozone countries and many other countries of the world. The presence of a stable regulatory approach will contribute to the greater spread of private law forms of technology transfer and will have a positive impact on the economic development of this region.

The method of identifying private law forms of technology transfer, formed within the framework of the TRIPS agreement and WIPO recommendations (Fig. 1, 2), consists in identifying them with contracts for the transfer of intellectual property objects. This regulatory approach is not able to satisfy all the needs of technology transfer participants, which is why it is considered ineffective [1, 2, 5–7]. Its one-sidedness is the main drawback. When it is used, the participants of technology transfer are not able to regulate

all social relations that arise during the transfer of component technologies. Although, for example, such elements as information about technology, experimental construction of technology, require adequate contractual protection. This is especially important for the scientific field, in which the intellectual achievements on which the technology is based have not yet received any legal protection [1]. The main advantage of the specified method of identification of private law forms of technology transfer is its reinforcement by unique means of protection of rights and legitimate interests guaranteed by the state [1, 2].

The method of identification of private law forms of technology transfer formed within the UNCTAD recommendations (Fig. 3) is broader than previous approaches. However, it cannot satisfy all the needs of technology transfer participants [5–7]. The main drawback of this approach is that it does not provide for the expansion of legal grounds for the transfer of technologies, but only contains an increased number and varieties of contractual forms of such transfer. Its main advantage is that it supplements the previously established list of private law forms of technology transfer. Another advantage is that it contains more regulatory tools to protect the rights and legitimate interests of technology transfer participants. Because of this, it can be defined as more effective compared to the approach within the framework of the TRIPS agreement and WIPO recommendations.

The list of private law forms of technology transfer recorded within the OECD recommendations (Frascatti Handbooks - Oslo Guidelines) and the Horizon Europe Framework Program (shown in Fig. 4, 5) is different in its structure. Thus, within these lists, the forms of private law technology transfer are no longer identified by name. These regulatory acts already use references to certain forms of coordinated cooperation that can be regulated within existing private law forms of technology transfer. The main advantage of this approach is that it is significantly broader than all previous ones and allows identifying most of the available forms of technology transfer. However, the indicative way of defining the list of private law forms of technology transfer has a greater disorienting effect on the participants of these relations. The complexity of this method of determination is the main drawback of this approach. However, the significant expansion of sectors of the economy and social relations that, thanks to this approach, have become subject to technology transfer is more effective than others. As a result, it is this approach that should be the basis for further research into unification and improvement of the system of private law forms of technology transfer.

The formed generalized list of private law forms of technology transfer (Fig. 6) is justified by the need to systematize the provisions of various regulatory acts and is aimed at eliminating the shortcomings of imperfect regulatory influence. It is based on all previous provisions of those regulatory acts and international agreements that are used to identify possible forms of private technology transfer. The advantage of the formed method of unification of private law forms of technology transfer is the level of stabilization of regulatory influence. In the case of implementation of such a generalized list to the provisions of regulatory acts, a set of available methods (forms) of technology transfer will be determined in advance for the participants of technology transfer. The main drawback of the proposed direction is that any list will always differ from those of real social rela-

tions. Public relations are always primary in relation to regulatory influence. And the state, forming measures of such influence, should focus on the actually existing social relations. It is appropriate to consider that such a shortcoming should be compensated for by means of a separate approach to the formation of means of regulatory influence. Such a technique is the fixation of an open (unlimited) generalized list of private law forms of technology transfer.

All formed proposals regarding the generalization of private law forms of technology transfer can become an effective means of solving existing problems only if they are included in regulatory acts. Taking into account the fact that EU law is a special legal system based on acts of different levels, the place of fixation should be international treaties and agreements. The main advantage of this method of fixation is that all EU member states depend on the decisions made by the governing bodies of the Union level. In the event that proposals are fixed at the level of an international agreement, they will automatically, over time, become part of national legal systems. It is appropriate to include key acts and agreements in the list of international treaties and agreements, in which a generalized list of private law forms of technology transfer should be reflected. Namely: TRIPS Agreement, WIPO Recommendations, Oslo Guidelines, UNCTAD Recommendations, Horizon Europe framework program.

Additional evidence of this is the dynamics of the development of private law forms of technology transfer within the EU. Thus, the gradual unification of the definition of such methods of technology transfer contributes to the increase of their number of successful examples. In particular, for the period from 2011 to 2021, the share of funding of private law forms of technology transfer within the EU increased from 56.26 % to 57.65 %. In the countries of the Eurozone, the same indicator increased from 56.81 % to 58.12 % of the total amount of financial resources involved in technology transfer. In terms of individual EU countries, the trend is the same. Thus, for the period from 2011 to 2021, the level of financing of private forms of technology transfer in Belgium increased from 60.15 % to 64.42 %; in Spain from 44.31 % to 50.24 %; in Italy from 45.09 % to 53.91% [20]. The general trend of increasing the number of financial resources within private law forms of technology transfer is a consequence of the process of generalization and unification of their essence. During 2011–2021, there is a unification of regulatory approaches in EU law due to the adoption and implementation of framework programs (“Horizon 2020”, “Horizon Europe”, etc.). In the case of strengthening the processes of unification and generalization of private law forms of technology transfer, the trend of economic growth should scale up and accelerate.

The proposed directions for improving private law forms of technology transfer are our perspective on this issue. They are based on other studies [1–8] and take into account those aspects of the implementation of individual private law forms of technology transfer that are discussed in scientific research. In general, these directions are suitable both for use within the definition of normative rules of technology transfer and for its further scientific development.

The main advantage of our research is that its results can be used within the framework of the legal technique of forming the provisions of normative acts of international and national legislation. Further research of the outlined issues will allow obtaining scientific results of a practical orientation. If the process of improving the forms of technology transfer is formed on its basis, the proposed concept will need to be refined. However,

in any case, all previous scientific studies [1–8] either did not formulate similar propositions or investigated separate aspects. Various options for solving the issue of the existing inefficient regulatory approach to determining the essence of private law forms of technology transfer were proposed.

In the course of the research, directions were formed, solutions to most of the actual problems that exist in the identification of private law forms of technology transfer. The advantage is that they are aimed at increasing the level of efficiency of technology transfer. The proposed proposals offer more effective ways of solving existing problems than were proposed in works [1–3]. Also, research results solve problems formed within the framework of works [2–8], in which their authors only outlined the main regularities of the existing state.

This study is subject to limitations due to the sources of the collected information. Information about existing technologies and forms of their transfer is limited in access. Scientific technologies are protected by the legal regime of commercial secrecy. Information on dual-purpose or defense technologies, restricted by establishing a state secret. The same legal regime of limited information is established for forms of technology transfer. The lack of open access to this information leads to a too high level of abstraction of conclusions about the role and place of technology in the modern economic system.

The main drawback of our study is the episodic nature of systematized information about examples of technology transfer that have already taken place. Another drawback is that it is theoretical in nature since there is no possibility of testing the generated results experimentally. Regional methods of technology identification had a negative impact during the study. The difference of such approaches determined the essentiality of the generalization of the conclusions that were included in the research results. This shortcoming of the research must be taken into account in the case of further study of the research subject.

The results of our study contain conclusions that can become the basis for the formation of official regulatory rules, prospective normative legal acts. The possibility of their implementation within the limits of official regulatory rules is their advantage over similar studies. The further development of this research may consist in the development of legal mechanisms for fixing the forms of technology transfer. On the basis of this study, it is possible to conduct further scientific research in the field of state regulation and regulatory influence. The main difficulties on the way to the further development of this research will be the regional specificity to the definition of the essence of technologies and technology transfer and different national structures of state regulatory policy.

7. Conclusions

1. It was determined that within the existing approaches to the definition of private law forms of technology transfer there is no uniformity, and the wide use of evaluation categories is characteristic. It is substantiated that this causes a destabilizing effect on the participants of technology transfer.

2. Recommendations on the generalization of the main private law forms of technology transfer have been formulated:
– based on contractual principles (on contracts named at the level of various regulatory systems of the EU);

– based on local legal acts (statutes, regulations, memoranda);

– based on labor relations (cooperation is based on pre-established relations between the employer and the employee).

In addition, proposals were made to improve the list of private law forms of technology transfer, by summarizing, systematizing, and expanding it. Amendments to the provisions of such international treaties and agreements as the TRIPS Agreement, WIPO Recommendations, Oslo Guidelines, UNCTAD Recommendations, and the framework program “Horizon Europe” have been proposed.

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Data availability

All data are available in the main text of the manuscript.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial,

Use of artificial intelligence

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

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