

Standardization and certification in nanoindustry of the Russian Federation: economic and legal aspects in the context of neoindustrialization

Elena Inshakova
Volgograd State University,
Institute of Economics and Finance
Volgograd, Russia
inshakovaei@volsu.ru

Agnessa Inshakova
Volgograd State University,
Institute of Law
Volgograd, Russia
gimchp@volsu.ru

Anatoly Ryzhenkov
Volgograd State University,
Institute of Law
Volgograd, Russia
gimchp@volsu.ru

Abstract — The article argues the need, reviews the results and identifies the main objectives and directions of the development of the system of standardization and certification in the Russian nanoindustry under transition to a new technological mode. The system under consideration is seen as a regulatory and technical component of the institutional basis for introducing innovative nanotechnologies and nanomaterials into mass production, entering and free circulating competitive nanotechnology products in the domestic and foreign markets, establishing the necessary technological basis of the policy of neo-industrialization of Russian economy and its innovative modernization. The authors pose a legitimate question about the effectiveness of using standardization as a method of legal regulation of nanoindustry, taking into account its rigid nature, which contradicts the innovative specifics of this sector of the Russian economy.

Keywords — *nanoindustry, neoindustrialization, standartization, certification, standard, legal regulation, method of regulation*

I. INTRODUCTION

The implementation of the neo-industrial transformation of the Russian economy, based on the large-scale industrial application of advanced technologies, including nanotechnologies, is aimed at increasing the competitiveness of Russia and its regions under globalization. Therefore, the development of nanoindustry in the Russian Federation and the widespread use of nanotechnologies for the production of goods and services with fundamentally new or significantly improved consumer properties should be considered as a strategic direction of the ripened government policy of neo-industrialization of the Russian economy. This policy ensures

innovative modernization of the national economy as part of its transition to a new technological mode.

The “catching up” nature of nanoindustry in Russia in relation to the countries-leaders of the nanotechnology sphere, the adverse influence of the external environment because of the sanctions from the global competitors and the presence of unresolved internal problems of the nanoindustry [1] should be mentioned. Despite these facts, we can generally speak about the progressive development of this innovative sphere of the Russian economy, greater attention to it from investors and manufacturers, and expanded scale of the national market for nanotechnology products. However, the existing development potential of the domestic nanoindustry is far from being fully realized.

According to the Fund for Infrastructure and Educational Programs (FIEP) of the JSC RUSNANO, about 500 nanotechnologies are developed in Russia every year, while only a small part of them are actually being introduced into production [2]. The most important condition for the successful production use of the new nanotechnologies is the regulatory and technical support for the life cycle of a new product: from development to mass production and market launch within the framework of national metrology, standardization and certification system created in nanoindustry of the Russian Federation and obtaining the necessary permits.

Standardization in the field of nanotechnology should cover the parameters and properties of nanomaterials and nanotechnology objects to be measured, as well as the terms that describe them and their definitions. Certification should provide confirmation of the compliance of the parameters and

properties of objects, materials, technological processes, instrumental and measuring base with the requirements of the technical regulations, standards and other regulatory documents. However, the quantitative basis of standardization and certification is metrology, which ensures the uniformity of measurements, when measurement results are expressed in the legal units and measurement errors are known with a given probability [3].

The forward-looking appearance of standards, certification and confirmation of the safety of new materials based on metrological assurance of nanoindustry products will create the necessary institutional foundation for the introduction of innovative nanotechnologies and nanomaterials into mass production.

II. MATERIALS AND METHODS (MODEL)

Solving the tasks of the study is mainly based on the use of the evolutionary approach methodology in examining the complex problem of formation of a system of standardization and certification in nanoindustry of Russia. However, standardization, on which the authors had rightly focused their attention, is seen as a method of regulatory support for the development of this innovative sphere of Russian economy in the context of the imperatives and priorities of its neoindustrialization and digitalization and creation of the necessary conditions for transition to the VI technological mode.

The study is based on creative applying and synthesis of a system of the general scientific research methods. Among them temporal and spatial, structural and functional, comparative and documentary, formal logical and formal legal, interpretative, method of expert estimations, as well as selected techniques of statistical and graphical analysis, and authors' own calculations using data from the JSC RUSNANO and the Fund for Infrastructure and Educational Programs official reports.

III. RESULTS AND DISCUSSION

Standardization and certification of goods and services, as well as management systems at nanoindustry enterprises,

based on the application of developed national and interstate standards, organizational standards, technical conditions, etc., create the necessary conditions for the entering and free circulation of competitive nanoindustry products in the Russian and foreign markets.

The use of a system of national standards and mandatory certification procedures is also necessary to ensure the protection of national manufacturers and the domestic market of nanotechnology products from their large-scale imports from abroad

In this regard, on the one hand, the importance of activating and coordinating actions for the development, adjustment and approval of national standards and mandatory certification procedures is increasing. On the other hand, a reasonable question arises: is using standardization as a method of legal regulation of nanoindustry effective enough, taking into account its rigid nature, which contradicts the innovative specifics of this sector of the Russian economy?

A. Development of system of standardization and certification in Russian nanoindustry: results, tasks, and directions

Standardization and certification in the field of nanomaterials and nanotechnologies are designed to regulate the quality of products by developing appropriate norms, benchmarks and standards. The institutional support of the emerging national system of standardization, certification and metrology in nanoindustry of the Russian Federation is reflected in table I [4, 5, and 6].

The following data confirms the urgency of solving the problem of development of such a system and enhancing the effectiveness of its functioning.

According to the Rosstat and the JSC RUSNANO information, in 2017, 560 enterprises and organizations, including 240 scientific and educational organizations, and 2 high-tech companies producing materials for nanoindustry enterprises, manufactured products related to nanotechnology [5, p. 37].

TABLE I. INSTITUTIONAL PROVISION OF THE PROCESSES OF STANDARDIZATION AND CERTIFICATION IN NANOINDUSTRY OF THE RUSSIAN FEDERATION IN 2011–2017, CUMULATIVELY (UNITS)

Indicator	2011	2012	2013	2014	2015	2016	2017
Number of nanotechnology production types, for which the minimum necessary set of regulatory and technical tools for steady market entry and safe circulation of the manufactured products in the market is formed	20	30	50	71	92	112	133
Number of developed standards – total, among them with the FIEP's financial contribution	46 30	108 64	166 100	228 147	285 171	337 197	370 218
Number of issued documents of compliance with the quality and safety of nanoindustry products (certificates, expert judgements)	20	60	120	214	327	456	533
Number of developed and certified measurement methods and nanomaterials standard samples	24	56	94	130	169	195	211
Number of product types that received the Mark "Russian Nanotechnology Products"	–	–	–	37	73	99	138
Number of certificates issued for the "green" products and environmental management systems at nanoindustry enterprises	–	–	–	–	–	11	29
Number of developed "green" standards in the field of environmentally friendly products of nanoindustry	–	–	–	–	3	14	24

At the same time, at the beginning of 2019, 1511 enterprises producing 190 types of nanotechnology products (81 types in 2016) have been included in the Register of manufacturers of nanotechnology products created in the framework of implementation of the FIEP's project "StartBase. The system of support and promotion of innovations" [7].

The Fund for Infrastructure and Educational Programs is actively engaged in formation and development of the standardization system in Russian nanoindustry (Fig. 1) [6].

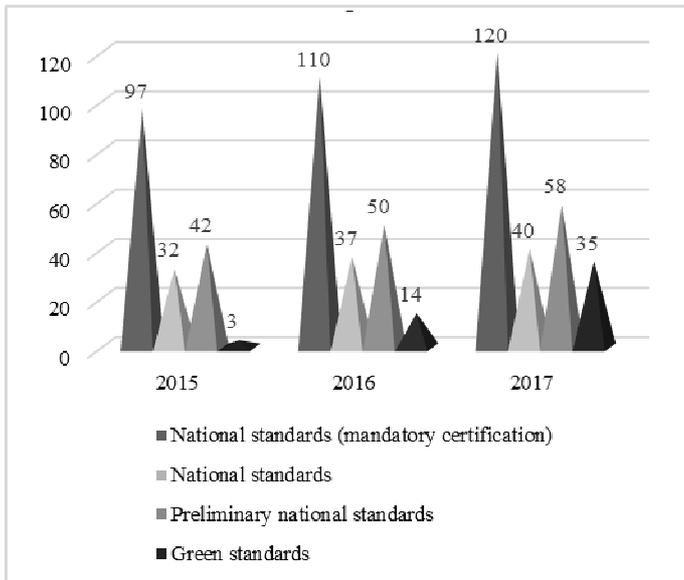


Fig. 1. Development and updating of standards in Russian nanoindustry with the participation of FIEP, 2015-2017

With the FIEP participation 370 national (including "green") standards for the innovative nanotechnology products (among them 218 – with the FIEP's financial contribution), have been officially approved in the Rosstandard and included in the Register of the developed national standards in nanoindustry [8]. In addition, 533 certificates of conformity and permits were issued to ensure the circulation of nanotechnology products on the market. Besides that, 211 methodologies for measuring the characteristics of nanoindustry products and standard samples of the composition and properties of substances and materials were developed, as well as two methods and carbon footprint calculation for five domestic companies [5, p. 39; 6, pp. 74-75].

At the same time, the number of types of nanotechnology production, for which the minimum necessary regulatory and technical basis for the market entry and safe circulation of the manufactured products in the market has been developed, reached only 133 in 2017, although it increased almost 6.7 times compared to 2011 [4, p. 63; 6, p. 19].

Comparison of the above data, as well as empirical studies confirm the limitations of the fund of standards and regulatory documents in the field of nanotechnology and nanomaterials.

The formation of regulatory and technical support for the production, promotion and safe market circulation of goods and services of nanoindustry in Russia does not meet the urgent needs of both producers and consumers of nanotechnology products.

The standards developed are not enough to protect the market for the final products of the nanoindustry enterprises in Russia and give impetus to its development. The development of standards should be based of the principles of collaboration [9] with the large companies of the national nanoindustry that produce goods and services with applying nanotechnology and nanomaterials.

Formation and improvement of a mechanism of metrological support adequate to the development of nanoindustry continues to be a pressing task. It is reasonable to develop it in the two main areas [10]: a) improving the accuracy of existing methods for measuring the characteristics of macroscopic objects to the nanoscale, b) development of new methods for measuring the characteristics of nanoscale objects in those areas where special properties of a substance that are not specific to the macroscopic objects are beginning to manifest themselves.

Certification of nanotechnology products and management systems at nanoindustry enterprises is becoming an effective mechanism for increasing the competitiveness of goods and services of nanoindustry and their manufacturers in the domestic and foreign markets. The tasks of the system of mandatory and voluntary certification in nanoindustry include the actual classification of products as nanotechnology ones, confirmation of its quality and safety, formation of the positive attitude towards the nanoindustry products and building trust with its manufacturers. For manufacturers, the use of regulatory technical instruments of standardization and certification is becoming a prerequisite for the commercialization of the innovative nanoindustry products and their market launch.

However, a study of the dynamics of the certification process in nanoindustry of the Russian Federation shows that the level of interest of nanotechnology products producers in voluntary certification procedures remains insufficient. This applies to both the procedure of mandatory and voluntary certification (Fig. 2), although the dynamics in this field of activity in the period 2015–2017 was steadily positive [6].

The creation of a comfortable environment to undergo this procedure by the Russian nanoindustry companies becomes a significant factor in the growth of interest to go through the certifying the produced goods and services. The Autonomous Non-commercial Organization ANO "Nanocertifica", which has launched in December 2010 the eponymous system of voluntary certification of nanoindustry products (website <http://nanocertifica.ru>) registered in Rosstandard, has a positive experience in this field.

Certificates of the "Nanocertifica" system confirm the compliance of the functional properties and actual advantages of nanotechnology products as compared with analogues, compliance of the management systems of the enterprises that

manufacture, service or use nanoindustry products with the requirements of ISO 9001.

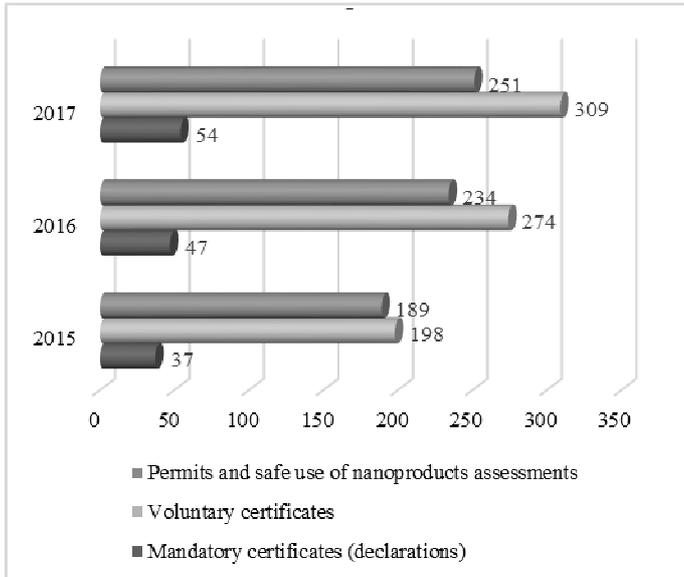


Fig. 2. Dynamics of the certification processes in Russian nanoindustry, 2015-2017

According to the results of the certification procedures at the end of 2018, 334 samples of nanoindustry products were included in the Register of the products certified in the “Nanocertifica” system, and 13 companies – in the Register of the enterprises that have received certificates for management systems in the “Nanocertifica” system [11].

Based on the procedures of this certification system at the beginning of 2018, 80 Russian companies and 138 types of products were entitled to use the Mark “Russian nanotechnology products” (for comparison, in 2014, when this mark has been established, their number was 24 and 37, respectively). The Mark mentioned above guarantees Russian origin, innovative character, high quality and safety of products, as well as consumers’ protection from the unconscientious manufacturers, low quality and forged goods.

Obtaining a certificate of a new specialized certification body “Nanocertifica – Innovations”, created in March 2019, will facilitate the introduction of the products of the innovative nanoindustry enterprises to the market and their participation in the public procurement procedures.

However, to enhance the efficiency of Russian certification systems and increase their attractiveness for manufacturers, it is necessary to ensure reduction of the time and cost of the processes of the innovative products certification, their testing and safety assessment; provide certification of specialists; significantly speed up the development of the new products’ measurement methods.

Solving these complex tasks of regulatory and legal support of nanoindustry can be ensured by creation of an extensive regional network of regulatory and technical infrastructure. The elements of this network can provide

services in all of the above-mentioned areas and include centers of regulatory and technical support for innovation; representative offices of the standardization center in the field of innovation; territorial departments, as well as testing laboratories and centers of the “Nanocertifica” system.

The formation of such a network has already begun, but the coverage of the economic space of the Russian regions with its elements remains insignificant. With the FIEP contribution, only 5 regional centers of regulatory and technical support for innovations have been created: in Rostov, Sverdlovsk and Novosibirsk regions, Krasnoyarsk and Primorsky Krai – in 5 from 85 subjects of the Russian Federation. Two centers of this number were opened in 2017 on the basis of the large state universities (Far Eastern Federal University and Novosibirsk State Technical University [6, pp. 77-78]). The representative offices of the standardization center in the innovation sphere are located in 14 Russian regions; the territorial offices of the “Nanocertifica” system ensure the certification of nanoindustry products in 15 regions of the Russian Federation. Moreover, 28 testing laboratories (centers) whose competence is recognized by the “Nanocertifica” system carry out tests and measurements for the purpose of certification of nanoindustry products in 10 subjects of the Russian Federation.

The feasibility of creating a network infrastructure of regulatory and technical support for nanoindustry development has been already confirmed by the results of activity of its functioning elements for 2017. The need to develop more than 30 national standards was identified, certification applications for 35 types of nanoindustry products were developed to carry out successfully their certification procedure, and 56 tests were organized.

In addition, regional centers have ample opportunities for attracting local resources to conduct tests at all stages of preparing new products for production and marketing, which will become a significant factor in reducing the costs of certification and product safety assessment.

Promoting the products of Russian nanoindustry enterprises on the foreign markets actualizes participation in the work of international and regional standardization organizations with the aim of harmonizing and advancing the development of national standards, taking into account global technological trends. In the European direction, it is the cooperation with the Technical Committee on Nanotechnologies (CEN/TC 352); in the Eurasian one – the activities of the interstate technical committee on standardization ITC 441 “Nanotechnology” for the regulatory and technical support of priority areas in nanoindustry.

Among the problems hampering the development of this strategically important activity in the context of stimulating demand for domestic nanotechnology products on the foreign market: passive and sometimes opportunistic foreign counterparts behaving under the economic and technological sanctions, complex procedures of the intergovernmental coordination and longer periods of achieving results.

However, in 2017, the ITC 441 “Nanotechnologies” developed and submitted for approval 5 interstate standards for the innovative nanoindustry products that ensure the reduction of technical barriers to the circulation of new products in the post-Soviet space [6, p. 77-78]. The Committee approved a work plan for Russia and Belarus on standardization, certification and metrological provision of innovative products. It also managed to develop and agree on the proposals on the development of 7 interstate standards (harmonized with the international ones) for nanoindustry with the concerned organizations from Belarus and Kazakhstan.

B. Problems of applying standardization as a method of nanoindustry legal regulation in Russia and its improvement

Despite the fact that the subject and method of regulation are necessary, inalienable beginnings of legal regulation in any sphere of public life, the legal regulation of nanotechnology in the Russian Federation has not yet determined properly with its subject. To an even greater extent, this refers to the methods of legal regulation of nanoindustry, which already presuppose a strategic orientation of law-making, an understanding of its tasks and, accordingly, a conscious choice of ways to solve them.

An analysis of the current situation in the field of legal regulation of nanotechnology shows, first of all, that its leading means is still a method that can be conventionally called program-target method. This means that specific rights and obligations, prohibitions and legal responsibility in the sphere of relations under consideration are practically absent, and the existing legal acts are limited mainly to the formulation of prospective development plans, general incentive measures, etc., and if the general principles in it exist, they are barely have strict legal force. All this gives it the features of the so-called “soft law”, one of the defining features of which is the lack of creating legally binding obligations [12, c. 69].

Of course, at the early stages of the formation of a conceptual framework of legal regulation, in seeking and designing the contours of a new legal institution or a potential branch of legislation, the use of the program-target method is completely justified and even irreplaceable. On the other hand, if the application of this method becomes protracted, and the corresponding type of legal documents (concepts, strategies, programs, etc.) for a long time is not replaced by the legislative or sub-legal acts with their own normative content, this is a crisis symptom, because it indicates the lack of ideological potential for the continuation of legal regulation.

At the same time, in parallel with the program-target method, another method of legal regulation of nanoindustry – standardization is being developed. Thus, on behalf of the Government Commission on High Technologies and Innovations (Protocol No. 4 of May 19, 2009, Section II), the Program of Standardization in nanoindustry (hereinafter referred to as the Program) has been developed and approved by the Government of the Russian Federation Office (letter No. П8-1371 of April 26, 2010). It identifies measures for carrying out work on standardization, as well as priority areas,

subject areas, objects and aspects of standardization in the field of nanotechnology, nanoindustry products, including nanocomposite materials and products produced with their application, deadlines, and key performers. The Program also provides for the application of existing and currently developed international standards in the field of nanotechnology.

The standardization method has already become customary for legal regulation, especially in the high-tech and innovative sectors of the economy. Standardization as a method of legal regulation includes the following necessary elements: an idea of the permissible, acceptable, desirable state of objects or processes that determine the subject of legal regulation; quantitative approach to measuring the basic characteristics of these processes and objects; setting threshold values of appropriate quantitative parameters; reference or blanket method for securing specific rights and obligations associated with these quantitative characteristics

Correspondingly to paragraph 5 of Article 1 of the Federal Law of June 29, 2015 No. 162-FL (as amended on April 5, 2016 No. 104-FL, and on July 3, 2016 No. 296-FL) “On Standardization in the Russian Federation”, a standard is a document developed by a participant or participants in standardization work, approved by the federal executive body on the results of the examination, and which establishes for the universal application general features of the object of standardization, as well as the rules and general principles in relation to such object [13].

The use of the standardization method has become so universally accepted phenomenon that the question of its relevance or inappropriateness in relation to a particular area of legal regulation is hardly ever seriously raised. In particular, the problem of the effectiveness of the standardization method in the field of the legal regulation of nanotechnologies is hardly discussed in the scientific legal literature.

In the light of the relatively small previous experience in this field, we will try to identify the most vulnerable points of the effective application of standardization as a method of legal regulation of nanotechnologies. First of all, standardization assumes that the properties of both the objects and processes themselves, as well as their individual components, are reasonably well-studied and that there is a relatively rich experience in their evaluation based on their technical and consumer features. However, it is nanotechnology (that has long been commonplace not only at the doctrinal level, but also has been formally documented) captures the characteristic that many of their essential peculiarities have not yet been fully studied, or, in any case, the relevant knowledge is only hypothetical.

There is a clear contradiction: on the one hand, standardization requires reliable, repeatedly verified knowledge of the subject; on the other hand, this kind of knowledge regarding nanotechnology is only a task for the future research, but not a *fait accompli*.

In the current nanotechnology program documents, improving the competitiveness is the most often declared primary objective. For example, clause 4.1. of the Concept of

the normative and technical activities of the FIEP (standardization, technical regulation, safety provision and certification in nanoindustry) [14] stipulates that the purpose of the regulatory and technical activities of the FIEP is creating the basic normative and technical tools oriented towards the nanoindustry subjects (standardization, technical regulation, safety assessment, certification, optimization of the permitting procedure undergoing), aimed at establishing conditions for the sustainable market entry and circulation of the qualitative and safe (competitive) nanotechnology products. This goal is rather qualitative than quantitative.

Thus, the application of the standardization method in nanoindustry in correlation with the purpose of regulation causes several problems

Firstly, there are no guarantees that the quantitative parameters that underpin the standardization actually contribute to the competitiveness of the products concerned, since standardization means following some samples, while innovation, on the contrary, implies overcoming existing patterns, finding fundamentally new solutions.

Raising such an objectives before the standardization as “the introduction of advanced technologies, the achievement and maintenance of technological leadership of the Russian Federation in the high-tech (innovative) sectors of the economy” (subparagraph 1 of paragraph 2 of the Federal Law “On Standardization in the Russian Federation”), does not mean that the legislator also reveals the legal mechanism for its decision.

Secondly, there is no exact way that would allow assessing existing and establishing standards in terms of their quantitative indicators’ compliance with the objectives of improving the competitiveness of nanotechnology products, since the regulatory documents do not contain any justification for exactly these, rather than other values defined.

The hidden conflict of quantitative and qualitative aspects is generally typical for standardization as a method of legal regulation in the field of nanotechnology. Transitions from quantitative characteristics, which are attractive primarily because of their easy measurability and controllability, to more complex and elusive qualitative assessments, as a rule, happen in a random way and therefore, are problematic.

For example, in clause 4.4. of the Concept of the normative and technical activities of the FIEP (standardization, technical regulation, safety provision and certification in nanoindustry) it is stated that the number of nanotechnology projects (nanoindustry subjects), for which the minimum required set of the regulatory and technical tools for the products’ sustainable market entry and circulation has been accomplished, was selected as a target indicator that reflects the final results of solving all the tasks assigned.

However, it is evident that there is no direct and obvious connection between the number of nanotechnology projects and their willingness to successfully entering the market; if there is any dependence, it is clearly non-linear in nature and needs special clarification, which cannot be carried out within the framework of regulatory documents.

The object-oriented approach, typical for standardization, when regulation is aimed only at describing the properties of its subject, has as its backside an absence of an exact distribution of rights and duties between the parties of legal relations.

In this respect, the provisions of clause 4.2 of the Concept of regulatory and technical activities of the FIEP are typical from a legal and technical point of view: “Achieving this goal is ensured by solving the following interrelated tasks: developing and updating basic regulatory legal acts in the field of technical regulation in nanoindustry (technical regulations, standards, sets of rules), sanitary rules and norms; development of mechanisms for minimizing the risks of nanoindustry entities related to the possible effect of nanomaterials on the human health and the environment through the assessment (classification) of nanotechnologies and nanoindustry products by the degree of potential danger; the creation of a regulatory technical and organizational infrastructure to assist the nanoindustry entities products’ market entry and circulation ...”

As a result, the set and content of functions for operating with relevant objects is blurred, which, in fact, should constitute the real social basis of legal regulation. “The main element in the method of legal regulation, its determining element is the nature of the general legal position of the entities, their legal status” [15, p. 385].

This aggravates the inherent to the modern Russian legal system gravitation to the generalized descriptive ways of formulating regulatory prescriptions (despite their doctrinal division into the obligatory, prohibiting and enabling ones), and often completely impersonal, without indicating a specific entity of actions.

Thus, in fact, standardization in its existing forms does not provide legal certainty with regard to the production and exchange operations with the nanoindustry objects and, if it has any actual legally significant potential, then only as a normative basis for the legal liability.

Regardless of the legal motives for standardization introduction that are set out in the regulatory documents, standardization objectively is a dissuasive measure that is inherent in the restrictive regulatory and legal regimes. In this sense, it voluntarily or involuntarily conflicts with the officially declared statements, under which the development of nanotechnology in Russia necessitates a strictly stimulating (facilitative) regulatory and legal regime.

IV. CONCLUSION

Standardization and certification of goods and services of nanoindustry of the Russian Federation, as well as the management system at nanoindustry enterprises based on the application of developed national and interstate standards, organization standards, technical conditions should create the necessary conditions for market entry and free market circulation of the competitive nanoindustry products in the Russian and foreign markets.

The creation of an effective system for regulating the market circulation of nanoindustry products in Russia is hampered by the following factors: the lack of a single economic and legal mechanism for regulating the processes associated with standardization and certification of nanoindustry products; insufficient level of interest of manufacturers in the development of standards in the field of nanotechnology and voluntary undergoing the procedure for certification of nanotechnology products; the continuing low level of demand for nanoindustry goods and services on the part of business structures.

The imperfection of the legislative framework for the regulation of nanoindustry in Russia is a direct consequence of the innovativeness of this sphere. If the aim at the regulatory and legal level is truly to foster the development of innovations, it is necessary to adjust the conservative tendencies of the initial legal system and to use more flexible, compromise, preferential and other similar forms of the legal effect.

Standardization, on the contrary, is a manifestation of rigidity in the legal regulation of nanoindustry, based on the conviction that the properties of the corresponding objects are initially already well known and cannot be questioned.

Therefore, the development of the legal regime of nanoindustry in Russia is possible only if the general conceptual approaches to standardization are reviewed and clarified, taking into account the innovativeness of the nanoindustry sphere and the strategic importance of its development for implementing the neoindustrialization policy in the Russian economy, which objectively requires special models of legal regulation.

Acknowledgment

The reported study was funded by the Russian Science Foundation according to the research project № 18-78-10075.

References

- [1] Inshakov O. "Russian nanotechnology industry development: the impact of external political and economic sanctions," *European Research Study Journal*, 2016, vol. XIX, issue 2, pp. 189-204.
- [2] Standardization and certification of nanotechnology products, The Fund for Infrastructure and Educational Programs, 2019. URL: <http://www.rusnano.com/infrastructure/nanocertifica>
- [3] Todua P. "Metrology and standardization in nanotechnology," *Fotonics*, 2010, no. 1(19), pp. 2-9.
- [4] Nanoindustry of Russia: statistical reference book 2011-2017. Moscow: FIEP, Rosstat, HSE University, 2017. 85 p.
- [5] RUSNANO Annual Report 2017. Moscow, 2018. 268 p.
- [6] FIEP Annual Report 2017. Moscow, 2018. 116 p.
- [7] Startbase – System of Supporting and Promoting Innovation. URL: <https://www.startbase.ru/registries/>
- [8] Register of the developed national standards in nanoindustry, The Fund for Infrastructure and Educational Programs, 2019. URL: <https://fiop.site/standartizatsiya-sertifikatsiya/standartizatsiya/>
- [9] Inshakov O.V. "Collaboration as a form of knowledge-based economy organization," *Economy of region*, 2013, no. 3, pp. 38-45.
- [10] Troyan V.I., Pushkin M.A., et al. "Metrology and standards in nanotechnology field," *Measurement techniques*, 2008, no. 9, pp. 45-48.
- [11] Certification and product approval documents, The Fund for Infrastructure and Educational Programs, 2019. URL: <https://fiop.site/standartizatsiya-sertifikatsiya/sertifikatsiya/>
- [12] Zul'fugarzade T.E., Tsirina M.A. "Dispositive and imperative rules of US law in the course of nanoregulation," *Journal of foreign legislation and comparative law*, 2013, no. 1, pp. 68-70.
- [13] Federal Law no. 162-FL, of June 29, 2015 "On standardization in the Russian Federation," *Collection of Legislative Acts of the Russian Federation*, 2015, no. 27, art. 3953.
- [14] The concept of normative and technical activities of the Fund for Infrastructure and Educational Programs (standardization, technical regulation, safety provision and certification in the nanoindustry). Moscow, 2012. 22 p.
- [15] Sorokin V.D. "Method of the legal regulation: theoretical problems" in *Selected works by V.D. Sorokin*. St. Petersburg: R. Aslanov Publ. House "Legislative centre Press," 2005, pp. 307-434.