PECULIAR FEATURES OF FORMING A REGIONAL INNOVATION SYSTEM IN THE CHUVASH REPUBLIC BY THE EXAMPLE OF THE ELECTRO-TECHNICAL CLUSTER

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Abstract: Formation of a regional innovation system in the Chuvash Republic today is one of the most important objectives of the economic development. However, the process encounters great difficulties. The proposed study is an attempt of authors to reveal the contributing and hindering factors for this process by the example of the most efficient in terms of innovations sector of the Republic. To fulfill it there was created for the first time a summarizing historical sketch of establishing an electro-technical cluster in the Chuvash Republic. The research has an inter-disciplinary nature, that is why to prepare it there was used a complex of scientific methods: a concept of the national innovative systems, as well as institutional, normative, historical, sociocultural and system approaches. Specific research results was revealing historical preconditions and primary stages of formation of the regional innovation system in the Chuvash Republic, determining specific features of this process in the Republic, revealing the most essential difficulties preventing the development, and conditions contributing to the achievement of an efficient result. The obtained conclusions have practical value for arranging the institutional part of the regional innovation system directly depending on the activity of the republican authorities.

Keywords: Chuvash Republic, economic development, electro-technical cluster, innovation system.

1. INTRODUCTION

The *relevance* of the research subject-matter is confirmed by the events of the first quarter of the XXI century that demonstrated an obvious falsehood of the economic policy conducted by the former leadership of our country in the 1990th. It had an evident resource nature and was chiefly directed at supplying energy resources and products of primary processing to the international market. In the meantime we know some fulfilled examples of more successful paths of economic development. Modern influence of the PRC industry on the global economy on the whole for instance shows that it is creation and accelerated introduction of innovations into production which is the most promising method of the long-term economic modernization today. Back in 2008 the Concept of long-term socioeconomic development of the Russian Federation till 2020 was adopted in the country. It specified that

the primary objective of the state is to ensure a long-term sustainable rising of well-being of the Russian people, and national and economic security. Resolving this objective today is in many respects determined by the usefulness level of resources of intellectual potential of the national innovation system (NIS). Building a scientific and innovative developed society in the Chuvash Republic allows creating such an economic system in which the information and knowledge become not just a primary resource. On the basis thereof the possibilities of reducing negative impact of the economic process on the human environment appear, and a new system of stable social guarantees based on the socially important qualities of citizens is formed.

In practice a key element in the regional innovation system is science and innovation complexes formed on the basis of higher educational institutions. A modern state of the educational sphere preconditions the need for the innovative transformation of the educational complex on the federal and regional levels, and on the level of educational institutions, including the whole system of the elementary, secondary and higher professional education and advanced training. The condition of the innovation infrastructure of the region that should ensure cooperation of the university complexes and regional enterprises within the frameworks of the innovation cycle also has an essential value for the efficient functioning of the regional innovation system. In this respect a certain experience has been accumulated during 1990-2018 in the Chuvash Republic that requires classification and comprehension. Under modern conditions of the anti-sanctions economic policy of import phase-out the theme of our research gained particular relevance. In this regard the implementation of the science and innovation potential has undoubtedly encountered a number of difficulties. However, performing this activity acquired even more important prospects and great demand.

The *goal* of our paper is conducting an interdisciplinary research that enables basing on the historical data on the development of electro-technical sector in the Chuvash Republic to reveal the factors contributing to formation of a regional innovation system, as well as to determine the most essential difficulties preventing this process. In accordance with it the authors identified the following *objectives:* reconstruct the history of formation of the electro-technical cluster in the Chuvash Republic which has not been a subject of a special historical study so far; determine the main stages of creating a regional innovation system in the Republic; identify positive and negative aspects in formation of the specified system in the Chuvash Republic.

2. LITERATURE REVIEW

When conducting the research the authors initially oriented towards its interdisciplinary nature. The reason for such supposition was the developments of predecessors. The concept of national innovation systems on the basis of which we will further consider the regional innovation system of the Chuvash Republic has been developed relatively recently. Different authors in several countries stated it in the 1980th practically simultaneously. The Professor of the Uppsala University (Sweden), B. Lundvall, a British economist and member of the Science Policy Research Unit at the University of Sussex, C. Freeman, as well as the Professor of the Columbia University in USA, R. Nelson are considered to be the acknowledged authority founders of this direction. In 1988 this team of scholars published a joint monograph "Technical Change and Economic Theory," that has become pivotal for further development of this direction in science.[1]

[1] Technical Change and Economic Theory. Pinter, 1988. Available at: http://www.freemanchris.org/publications (accessed: 05.07.2019).

However, considerable discrepancies were immediately revealed in a number of viewpoints of the "fathers" of the concept of national innovation system. In particular, B. Lundvall stated his ideas pertaining to the territory of one country, at the same time considering the indicators of similar systems on the basis of the data on the states of the Northern Europe. In his turn, C. Freeman regarded the institutional side as the most important in securing a successful innovation activity. [2] In his opinion, the national innovation system is first of all a network of institutional structures. At that the content of a specific model of the innovation system is conditioned by the features of historic development of one or another country.[3]

P. Patel and K. Pavitt introduced a number of clarifications in the concept of a national innovation system. Particularly, they refer a system of incentives and innovations of the national institutes to the key factors of the system formation. To prove their approach they conducted a comparative analysis of experience of different countries in this sphere.[4] The discourse on the research theme was considerably enriched by the Canadian scholar, Benoit Godin. He investigated the history of formation of the "innovation" notion, and studied different models of innovation systems and constituent parts thereof, to which Mr. Godin refers besides the industrial sphere itself, the state represented by governmental structures and science with education in form of university centers.[5]

An essential role of interrelation of industrial and scientific structures with the state authorities is also noted by G. Etzkowiz and L. Leydesdorff. In the long run it is universities in their opinion that represent the main tool for introduction of innovation ideas.[6] Their German colleagues, Sebastian Kobarg, Jutta Stumpf-Wollersheim and Isabelle Welpe having studied the interaction of universities and industry by the example of Germany paid special attention to the impact of innovations on the innovative collaboration as represented by the specified partners.[7] An example of the study of the developing innovation system is a paper written by A. Braun and P. Graf.[8] A number of scholars have become the authors of new developments relating to certain aspects of the innovations problem. In particular, the Belgium scholar Wim Vanhaverbeke together with his American colleague Henry Chesbrough identified a modern problem of the so-called open innovations that become relevant under conditions of high-technology investigations that require a comprehensive multi-sectoral participation of industrial and scientific companies of different areas of expertise.[9]

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[2] Freeman C., Louçã F. As Time Goes By: From the Industrial Revolutions to the Information Revolution. Oxford: Oxford University Press, 2002.

[3] Freeman C. The National System of Innovation in historical perspective //Cambridge Journal of Economics. 1995. № 19. P.8.

[4] Patel P., Pavitt K. National Innovation Systems: Why They Are Important, And How They Might Be Measured And Compared // Economics of Innovation and New Technology. 1994. No. 1, P. 77-95.

[5] Godin B. The Linear Model of Innovation: The Historical Construction of an Analytical Framework // Science, Technology, & Human Values. 2006. Volume 31. № 6. P. 639-667; Godin B. National innovation system: The system approach in historical perspective // Science, technology & human values. - Cambridge, 2009. - Vol. 34, n. 4. P. 476-501.

[6] Etzkowitz H., Leydesdorff L. The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations // Research Policy. 2000. Volume 29. № 2, P. 109-123.

[7] Kobarg S., Stumpf-Wollersheim J., Welpe I. More is not always better: Effects of collaboration breadth and depth on radical and incremental innovation performance at the project level // Research Policy. 2019. Volume 48, Issue 1. P. 1-10.

[8] Graf P., Braun A. A policy perspective on open innovation—the Mexican case // *International Journal of Entrepreneurship and Innovation Management. 2013. Volume 17. №* 4/5/6. P. 296-313.

[9] Vanhaverbeke W., Van de Vrande V., Chesbrough H. Understanding the advantages of open innovation practices in corporate venturing in terms of real options // *Creativity and Innovation Management. 2008. Vol.17. №* 4. P. 251-258.

The direction of service innovations is studied by P. den Hertog who revealed certain forms of such innovation activity.[10] His British colleague Ian Miles notes in this respect the emergence of relatively new phenomena - "servicization" of industry and industrialization of the services sector.[11] Alongside with the national innovation systems some scholars started paying greater attention to such a phenomenon in their activity as modern globalization including the impact of innovations on the international market of goods and services.[12] The appearance of a large number of studies covering various directions of activity of the national innovation systems caused a need for summarizing papers of historiographic nature. In 2004 the outstanding specialists in this sphere of knowledge H. Hanusch and M. Balzat published such a summarizing paper.[13] Thus, as N. Sharif stated in one of his papers, in general the conceptual approach to studying the national innovation systems has been formed by now.[14] The problematics of the conducted research drew attention to the papers devoted to studying the value for the development of innovation systems of certain clusters.[15] Quite a lot of such papers were written by Russian specialists as well. However, the majority of them in our opinion does not have the interdisciplinary nature so required in this case, but studies the set problem from the perspective of economic theory only.

3. MATERIALS AND METHODS

The interdisciplinary nature of our research made it necessary for the authors to use besides the classical concept of national innovation systems, five main approaches - institutional, normative, historical, sociocultural and system. Not a single approach from the specified ones can be prevailing with respect to the other. Each of them presumes the achievement of its primary objective. The institutional side of the innovation activity in the opinion of the concept founders is a crucial condition of its efficiency. In their opinion, the national innovation system is first of all a network of institutional structures. It acts both in the state and private sectors of economy making constant diffusion of modern technologies. In the so-called new industrial countries where an economic upturn was observed in the 1980-90th, the state authorities made special efforts to form favorable investment climate, ensure successful results of scientific research, and satisfy the production needs of exactly those branches of industry that manufacture technically complex products. Such products

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[10] Hertog P. Knowledge-intensive business services as co-producers of innovation// *International Journal of Innovation Management. 2000. №.4*(4).P. 491-528.

[11] Miles I. Patterns of innovation in service industries // *IBM Systems Journal. 2008. Vol. 47№* 1. P. 115-128.

[12] Carlsson B. Internationalization of innovation systems: a survey of the literature // *Research Policy. 2006. Vol. 35. P.* 56–67; Omachonu V., Einspruch N. Innovation: implications for goods and services. // *International Journal of Innovation and Technology Management,* 2014. Vol. *7.№*2. P. 109-127.

[13] Balzat M., Hanusch H. Recent Trends in the Research on National Innovation Systems // Journal of Evolutionary Economics. 2004. № 14(2). P.197-210.

[14] ***Sharif N.*** Understanding the "National Innovation System" Conceptual Approach as a Social and Governmental Technology // TECNOSCIENZA. 2016. Vol 6. No. 1, P. 33-60.

[15] Porter M. Cluster and Competition New Agendas for Companies, Governments, and Institutions // Harvard Business Review. 1998. Vol. 76. P. 77-90; Enright M. Regional clusters: what we know and what we should know //Bröcker J., Dohse D., Soltwedel R. Innovation Clusters and Interregional Competition. 2003, Berlin, Heidelberg, New York: Springer. P. 99-129; Ceglie G., Clara M., Dini, M. Cluster and network development projects in developing countries: lessons learned through the UNIDO experience // Organisation for Economic Co-operation and Development: Boosting Innovation: The Cluster Approach. 1999. Paris: Organisation for Economic Co-operation and Development. P. 269-289; Dohse D. Taking regions seriously: recent innovations in German technology policy // Bröcker J., Dohse D., Soltwedel R. Innovation Clusters and Interregional Competition/ 2003. Berlin, Heidelberg, New York: Springer. P.372-394.

were initially oriented towards the external market. At the same time great attention was paid to quantitative and qualitative growth of the population with higher technical education. Proceeding from these stipulations the authors used the **institutional approach**, that allowed considering the activity of structures specially meant for innovations development in the region being considered.

The current managerial activity of such structures requires establishing standards in the system of management. Proceeding from it the authors applied the **normative approach** contributing to the formation of the required standards in the innovation activity. The development of these standards is regulated in the Chuvash Republic by specially developed legal framework, the primary stages of formation of which are considered in the present research. Using the **historical approach** was conditioned by the content of the classical concept of the national innovation systems noting the importance of experience of historical development of one or another country or region. At that such historic experience is commonly considered by means of analyzing specific examples. In our case such specific example was the electro-technical branch of industry in the Chuvash Republic, the innovation activity in which is in many respects flawless and is traditionally distinguished by high level.

The historic approach enables to consider the development line of a certain direction, note main key stages, identify preconditions for the formation of a regional innovation system and difficulties hindering the process and emerging at certain stages. It is these aspects of the problem that eventually create the historic identity, and in case of the national system - even a civilizational one. A recently emerged term “mining civilization” applied in relation to industrial regions of the Urals can serve as such an example.[16] At that using a historic approach created a certain novelty for researches of such subject-matter in domestic science. Whereas in the foreign science the content of the concept of national innovation systems was influenced by the papers of C. Freeman who considered specific examples from the history of different states, in domestic science the problem was studied in the economic terms only. At the same time the approach of C. Freeman seems absolutely correct to us, since without studying the historic path of development of specific industrial branch, the modern situation of its innovation prospects will not be clear.

Besides, the regional innovation system represents a disperse phenomenon appearing on the basis of already existing one and at the same time forming a new sociocultural space. Hence the necessity to apply the **sociocultural approach** by the authors emerged. Modern sociocultural space formed by the immediate participants of the innovation process in production, research and academic centers is a peculiar epiphenomenon pertaining to the innovation activity itself. However, in contrast to epiphenomena of common type, it in its turn has an influence on both, the content of innovations, public attitude and state policy concerning innovation systems. Therefore, the sociocultural space itself turns from epiphenomena to one of the factors of efficiency of the innovation activity. Thus, for instance one of the hindrances for implementation thereof in the Chuvash Republic and in Russia in general is a weak public understanding of the value of this problem, and the lack of the social goal-setting of the process of the innovation system.

In its turn the study of the sociocultural space of certain phenomenon is fulfilled by means of studying the activity of specific scholars, inventors, teachers, and organizers of science and production. Besides the importance of such people in the sphere of science, production, and professional activity, many of them possessed strong personal qualities adding emotional coloring to them. It is this category of scholars and organizers of scientific and production activity that formed the “innovation” environment, and created professional corporation by setting the peculiar “rules of the game.” These unwritten standard-rules

[16] Ivanov A. *Gornozavodskaya tsivilizatsiya* [Mining civilization]. Moscow, “AST” Publ., 2018.

could be denied by some part of insiders, evolve in the process of innovation development of the branch, and merely be replaced by new ones due to social upheaval. However, it means neither their total absence, nor any succession line, especially in those innovation systems where there were significant scientific schools and traditions. Dispersive nature of the specified approaches and the notion of regional innovation system itself preconditioned the use of the **system approach** by the authors that allowed considering the phenomenon as an integral complex of interconnected elements. Only using such approach makes it possible to achieve the correct final conclusions to the maximum extent, since forming the innovation system even at a regional level and within one industrial branch is a result of summed efforts and factors, a number of which was investigated by the authors.

4. RESULTS

The electro-technical branch is traditionally distinguished by especially high innovation activity in the Chuvash Republic. The origin of its development is deemed to be the evacuation of workshops of the Kharkov Electromechanical Plant and Leningrad plant "Elektrik" in December of 1941 to Cheboksary under conditions of the World War II and the German occupation of part of the USSR territory. Thus, genetically the electro-technical branch of the Chuvash Republic goes back to flagships of this direction that emerged at the turn of the XIX-XX centuries. The thing is that the electromechanical plant in Kharkov came into being as a result of another evacuation – during the World War I. In July of 1915, the equipment of the Russian-Baltic Electro-Technical Plant established in 1888 in Riga was brought here. The Riga Plant was owned by the legendary Russian Electrical Association "Union," established with participation of the Belgium partners.[17] The Belgium companies during that time were constant participants of the energy projects in Russia.[18] In 1915, German forces moved to Riga, therefore the tsar's government took a decision on urgent evacuation of the plant to Kharkov that experienced a real industrial boom that time. After the events of October of 2017, the Kharkov plant that started its activity in 1916 as part of the joint-stock Russian association "Vseobshchaya Kompaniya Elektrichestva" was called "Elektrosila No. 1" (since 1925 – the Kharkov Electromechanical Plant). It is the workshops of this plant that were eventually transferred to Cheboksary. It should be noted that the Kharkov Electromechanical Plant was a real giant. Its evacuated workshops could not be arranged in one city. That is why a whole chain of subsidiary undertakings emerged in the Volga region, Siberia and Urals emerged. As a result, 19 new plants emerged on its basis, one of which gave birth to the electro-technical branch in the Chuvash Republic.

Initially only 477 workers of the Kharkov plant moved to Cheboksary, but they were mostly highly professional, since 445 of them had 5-6 categories, that is the highest categories in their professions. Through their efforts, the Plant of Dedicated Equipment was opened in Cheboksary shortly. Wartime did not allow long work breaks; therefore already December 8, 1941 the plant released its first products that were used for subsequent production of aviation and tank equipment, as well as for war ships[19]. In 1942, the composition of the established enterprise was supplemented by some part of equipment evacuated from the Leningrad plant "Elektrik." It required new changes of organizational nature, in particular the administration of the enterprise had to make supplements to the

[17] *Knizhnye znaki v sobranii politekhnicheskoy biblioteki. Kniga I*. [Book marks in collection of polytechnic library. Book I]. Moscow, Polytechnic Museum, 2015. p. 199.
[18] Romanov A.A. Electro-technical industry of Moscow in the last third of XIX – early XX century. *Vestnik universiteta (Gosudarstvennyy universitet upravleniya)* [Bulletin of the University (State University of Management)]. Moscow, GUU, 2013. No. 20, p. 281.
[19] *Gosudarstvennyy istoricheskiy arkhiv Chuvashskoy Respubliki. F. R-1517. Op. 1* [State historic archive of the Chuvash Republic. F. P-1517. Op. 1].

technical documents, since Leningrad items were entered into the product nomenclature of the Cheboksary plant.

Difficulties with mastering new products did not have any impact on the growing rates of the enterprise operation during wartime. Its performance efficiency was supported by the great efforts of the team of engineers and workers. Only during 1942 the Cheboksary Plant of Dedicated Electrical Equipment produced 17 thousand double-current electromagnetic relays for the country. Altogether, there were produced around 123 thous. relays of different type during 1941-1945 in the Chuvash Republic. Already in 1943 the plant started to master new products of relay protection and automatics. In fact, it has become a pivotal point in the development of the whole branch in the Chuvash Republic. It is in 1943 that the foundation for the new production direction was laid that has become traditional for the Cheboksary Electrical Apparatus Plant over the course of time. These developments also meant that the plant being under conditions of wartime already started to master peace-time production.

A.M. Bresler, the Head of the design department of the plant had especially great tribute in creating and mastering new products [20]. Aron Mendelevich Bresler was professional construction electrician and obtained its primary production experience back in the time of new economic policy during his work at private enterprises and Moscow plant "Dinamo." Afterwards over 10 years he worked at the All-Union Electro-Technical Institute, where he turned not merely to engineer, but to inventor capable of creating proper scientific developments. Having such experience in 1933 he became a Head of the design department of the Kharkov Electromechanical Plant, and before the very onset of the Great Patriotic War managed to defend a thesis on the theme "Generator Stator Earth Fault Protection" and became a PhD in Technical Sciences. A.M. Bresler was evacuated to Cheboksary with the first group of employees of the Kharkov Plant and headed the activity on arranging the enterprise operation at a new place. It was he, who dealt with the renewal of the product nomenclature of the established Cheboksary Plant of Dedicated Equipment, whereas in 1944 already on position of the deputy chief constructor for relay protection and automatics he designed the first in the country polyphase relay for protection of the high-voltage electric transmission lines "CRS-121" (complete resistance relay). These designs in renewed modifications are still in demand throughout the country and abroad. These relays were consequently called by the name of their creator – "Bresler relay."

Another distinguished developer was Bresler's colleague in the All-Union Electro-Technical Institute, G.F. Edelshtein. Since 1933 he was an engineer in the design department of the Kharkov Electromechanical Plant, and just like A.M. Bresler was evacuated to Cheboksary. He worked for 36 years in the team of the Cheboksary Electrical Apparatus Plant in the long run and headed the relay laboratory after his senior colleague, and afterwards became the Head of the central laboratory of the plant. During the postwar period, the enterprise continued an active mastering and developing the relay construction, creating more and more of new models. The products of the plant regularly received high grades of the scientific and technical union of the Ministry of Electro-Technical Industry of USSR, and were introduced at other enterprises of the country as a single all-union series. They were used upon construction of subway in Leningrad, and upon execution of custom jobs for metallurgical complexes and hydroelectric plants. Since 1956 the plant started its first supplies of its products abroad: there were developed the relay models in the so-called "tropical execution" for mounting at Bhilai Steel Plant in India.

Thus, in the 50th the innovation electro-technical cluster already actively functioned and developed in the Chuvash Republic. The Cheboksary Electrical Apparatus Plant (CEAP)

[20] Kuznetsov I.D., Petrov G.P. *Istoriya Cheboksarskogo elektroapparatnogo zavoda* [History of the Cheboksary Electrical Apparatus Plant]. Cheboksary, Chuvash Book Publ., 1975. p. 72.

was the only enterprise in the USSR during that time that supplied relays of different purposes for the economic needs of the country. Besides the Cheboksary Electrical Apparatus Plant, in 1958 the Cheboksary Plant of Electronics and Mechanics was opened in the city (its building started two years earlier). It has become the second production element of the electro-technical cluster in the Republic. Just like its "older brother" (CEAP), a new enterprise from the first years of its existence developed in close connection with science. In 1960 a special design department of the electronic aggregates of standardized systems was opened at the plant, and production of different instrumental equipment commenced. For a full-fledged structure of the cluster, only a research institution was lacking. This issue became pressing since the scale of inventions and developments of the enterprise has already considerably outperformed the frameworks of a simple design department.

In December of 1960, the Chuvash Electro-Technical Research Institute was initially opened at the basis of the Cheboksary Electrical Apparatus Plant. The Institute grew quickly and the limits of only one enterprise became rather small for it very soon. Since 1970 it has become the All-Russian Research Institute of Relay Construction. At that we can easily see here the features of a cluster, not merely a single institution. In 1961, the Volga branch of the Moscow Energy Institute that dealt with training of highly professional power engineers was established in Cheboksary. Thus a complex of university – production – research institute was formed. In 1967 the I.N. Ulianov Chuvash State University was created on the basis of the Volga branch of MEI.[21] It allowed proceeding joint work on the development of the electro-technical branch in the Chuvash Republic at a qualitatively higher level. A number of new developments in this sector during the 1970-80th were made through the joint efforts of the specialists from the Cheboksary Electrical Apparatus Plant, All-Russian Research Institute of Relay Construction and Chuvash State University. In particular, during this period a set of protection relays for the Aswan Hydroelectric Power Station in Egypt was manufactured, supplies of protection relays based on semi-conductors began, and production of large-block complete relay shields, complete transformation substations and other high-voltage equipment started.

The growth of the society needs for quality electric equipment caused further expansion of electro-technical enterprises and growth of the product range. In the 1970th for example the Cheboksary Plant of Electronics and Mechanics produced 147 names of different mechanisms. At that their range looked very broad indeed: from the factory automation control systems widely introduced in USSR during that time to the first gaming machines ("Sharp Shooter" was manufactured from 1975). As a result of the enterprise growth it was transformed into the production association "Prompribor" in 1976.[22] From 1985 the association was called "Elektropribor." By that time microprocessors were already manufactured in it. The Cheboksary Electrical Apparatus Plant also grew both in terms of quality and quantity. In 1986 the High-Voltage Apparatus Plant in Ishlei established on the basis of earlier existing machine-building plant, became a part of the Cheboksary Electrical Apparatus Plant that has already become a production association by that time. In the modern time, the electro-technical cluster of the Chuvash Republic remains an example for other sectors of economy that set a goal to create the innovation model of development. For example, in the electro-technical branch a number of organizational changes took place that

[21] Vyazova O.G., Galosheva O.N., Danilov A.P., Ivanova T.N., Idrisov R.A., Krasnova M.N., Lipatkova I.A., Shirokov O.N., Shirokova M.A., Yaltayev D.A. *Polveka na nive obrazovaniya: k 50-letiyu ChGU imeni I.N. Ulyanova* [Half a century in the field of education: by the 50-year anniversary of I.N. Ulianov ChSU]. Cheboksary, Akademia Publ., 2017. p. 6.

[22] Boyko I.I. *Rabochie Volgo-Vyatskogo regiona: opyt i uroki sotsialno-ekonomicheskogo razvitiya* [Workers of the Volga-Vyatka region: experience and lessons of the socio-economic development (1960-1985)]. Cheboksary, 1997. p. 202.

were meant to ensure further modernization and better compliance with the existing realias of the modern economic model.

In 1992 the All-Russian Research Institute of Relay Construction became an open joint-stock company and remains it up to the present (full name is OAO "All-Russian Relay Research, Design and Technology Institute with Pilot Production"). Thus, the present Institute is a multi-functional enterprise and deals not only with the research activity in the sphere of relay construction, but also with service maintenance of the equipment delivered to it. A beneficial aspect of the Institute reflecting its constant capability for innovations remains the possibility to create special engineering developments oriented towards the customer request. In the 1990th the Cheboksary Electrical Apparatus Plant was re-profiled to production of low-voltage complete devices used in the energy branch and oil and gas sector. Actually the enterprise developed low-voltage complete devices for the machine-building branch ever since the 1970th and it made its contribution to the fact. From 1994 it became a closed joint-stock company. New success on the plant began in the 2000th. The plant started producing new types of electric equipment, including high-voltage devices, digital relay protection devices, and relay devices for the atomic and thermoelectric plants. Thus, for example, the major consumers of Cheboksary products during that time were thermoelectric plants in Iran ("Yusifiya") and India ("Obra"). From 2016 the CKSC CEAP started producing the equipment for the atomic sea ships, in particular, they equipped the ice breakers "Arktika," "Sibir," "Ural" and other offshore industrial facilities.

As for the Cheboksary Plant of Electronics and Mechanics, in 1988 it separated from the production association "Elektropribor." Actually, it was the beginning of formation of a proper business-structure based on the plant. From 1995 the parent company – joint-stock company "Plant of Electronics and Mechanics" started its operation. Over 30 smaller subsidiary enterprises formed around it. At that these enterprises could have different form of property. At the end of the 90th the enterprise became a participant of the international project of the United Nations Economic Commission for Europe – "Energy efficiency – 2000." A pivotal moment was the establishment of the workshop of instrument production "ABS Elektro" at the enterprise in 2007. At the end of the same year, the plant received modern name under which it is known up to the present – OAO "ABS ZEIM Automation." It is part of the holding "Rusel" uniting a wide range of enterprises of the branch in the Volga region and in the Urals, including the plants of Kazan, Ufa, Izhevsk, Perm, and Nizhniy Novgorod. The products of the renewed plant are in good demand on the market of electric equipment and are supplied to not only the post-soviet countries of the so-called Neighboring Countries, but also to the European and Asian countries.

Certain organizational changes took place in the research sphere as well. In 2004, OOO "Bresler Research Center" was established. From the very beginning, it had a multi-industry nature and dealt not only with the research in the field of electric engineering, but also with manufacture of electric equipment and training of specialists in this sphere. In 2012 for example there was opened a proper academic center in it for advanced training of relevant specialists. From 2016 the "Bresler Research Center" was called OOO "Relematika."

Nevertheless, the name of the father of the Chuvash relay construction, A.M. Bresler did not disappear. In the I.N. Ulianov Chuvash State University there is a research and development enterprise "Bresler," established on the basis of the research laboratory of the Chair of theoretical foundations of electro-engineering and relay protection and automation. The employees of this laboratory and chair took part in many developments of relay systems of the Cheboksary Electrical Apparatus Plant and All-Russian Relay Research, Design and Technology Institute (ARRRDTI) back in the 1970-80th. Now they founded their own enterprise having their own capabilities for conducting research and executing production orders. In 2014, the "NPP Bresler" became already a research and production complex possessing the required proper production squares of 3500 sqm.

As it was already mentioned above the availability of common production, scientific, academic and business-structures is an inherent part of the modern regional innovation system. In this respect, the modern electro-technical branch of the Chuvash Republic can demonstrate several examples. In particular, the electro-technical department of I.N. Ulianov ChSU that always acted in cooperation with the All-Russian Relay Research, Design and Technology Institute (ARRRDTI) has good prospects for intellectual capitalization. The initial purpose of creating this department was to resolve the problem of the lack of staff in the sphere of relay construction. ARRRDTI and ChSU proceed fruitful cooperation with each other. In particular, the Head of the chair of theoretical foundations of electric engineering and relay protection and automation of the University is the Director of ARRRDTI, Professor G.S. Nudelman.[23] However, it should be kept in mind that the innovation development of the branch in its turn raises the customer requirements to the level of staff training and will demand further innovation renewal of the process of specialists' training.

Another successful example in this sphere can be considered the opening of the Science and Technology Park "Chuvashiya" at the same University (Tech Park of ChSU).[24] The innovation center of the Tech Par of ChSU deals with ensuring the interaction of the intellectual potential of universities, research groups, and scholars with the design and research centers of enterprises for fulfilling research developments; creating information Internet-system for the process of commercialization and introduction of development projects and high technologies into the economic turnover. The Tech Park "Chuvashiya" includes a number of companies on the associated basis among which is the above mentioned Limited Liability Company Research and Development Enterprise "Bresler" (NPP "Bresler").

5. DISCUSSION

Modern comprehension of the national innovation systems allows identifying them at a regional level. It is especially relevant for the countries having national-administrative units and inhabited by the representatives of a certain ethnic community. Therefore, in the Russian Federation in a number of cases it is rather justified to identify alongside with the national innovation system, also regional systems having not only common but also distinctive features with the national system. Talking about the structure of the NIS pertaining to the Chuvash Republic, we can identify a group of regional institutes predetermining the development of its innovation system.[25] It mostly includes the authorities creating a practical regulatory basis aimed at encouraging the development of the regional innovation system, as well as the structures dealing with production and commercial implementation of scientific knowledge and technologies within national borders. To the last ones can be referred both small and major companies, as well as universities and research institutes.[26] In modern scientific practice a key element of the regional innovation system in Russia is first of all scientific and innovation complexes being

[23] Vyazova O.G., Galosheva O.N., Danilov A.P., Ivanova T.N., Idrisov R.A., Krasnova M.N., Lipatkova I.A., Shirokov O.N., Shirokova M.A., Yaltayev D.A. *Polveka na nive obrazovaniya: k 50-letiyu ChGU imeni I.N. Ulyanova* [Half a century in the field of education: by the 50-year anniversary of I.N. Ulianov ChSU]. Cheboksary, Chuvash Book Publ., 2017. p. 193.

[24] Vyazova O.G., Galosheva O.N., Danilov A.P., Ivanova T.N., Idrisov R.A., Krasnova M.N., Lipatkova I.A., Shirokov O.N., Shirokova M.A., Yaltayev D.A. *Polveka na nive obrazovaniya: k 50-letiyu ChGU imeni I.N. Ulyanova* [Half a century in the field of education: by the 50-year anniversary of I.N. Ulianov ChSU]. Cheboksary, Chuvash Book Publ., 2017. p. 221.

25 Patel P., Pavitt K. National Innovation Systems: Why They Are Important, And How They Might Be Measured And Compared // Economics of Innovation and New Technology. 1994. No. 1, P. 93.

[26] Godin B. National innovation system: The system approach in historical perspective // Science, technology & human values. - Cambridge, 2009. - Vol. 34, n. 4. P. 483.

opened on the basis of higher educational institutions.[27] An example of such complex in the Chuvash Republic is for instance the I.N. Ulianov Chuvash State University at which the Science and Technology park "Chuvashiya" (Tech Park of ChSU) was opened.[28]

In the Chuvash Republic, the concept of the innovation system was formed within the frameworks of general process flowing with the different intensity throughout the Russian Federation. The initial period of the 1990th passed under very hard conditions of conversion of major industrial enterprises, change of the system of their finance (refusal from state support), re-profile of economic ties, search for new partners and marketing outlets, and re-equipment of the enterprises. The main activity of organizations at the turn of the XX - XXI centuries aimed at survival, rather than at development and introduction of innovation technologies. However, at a rather low indicator of innovation activity, many organizations have high development potential, which is characteristic of the countries being on the initial stage of modernization.[29] It means that innovation processes at enterprises only developed momentum. Poor development of innovation processes was conditioned by insufficient finance, and by the fact that the means were not sufficiently invested in human resources.

Nevertheless, already in 2002-2004 the situation changed. These years can be considered as the beginning of the process of innovation potential development in the Chuvash Republic that was a result of changes in the position of state authorities with respect to this problem at a federal level. In 2002 the National Council of the Chuvash Republic adopted the law "On Science and Scientific and Technical Policy in the Chuvash Republic," in which for the first time there was underlined the value of the scientific sphere as the guarantee of further successful development of the whole socioeconomic system of the Republic. In 2004 the operation of this law was reinforced by the adoption of Decree of the President of the Chuvash Republic, N. Fedorov "On additional measures for innovation development of the Chuvash Republic." In 2005 the Cabinet of Ministers of the republic for the first time devoted its activity directly to the innovation development and adopted a relevant resolution. It was the beginning of forming a systematic approach to the problem. Immediately after new documents developing the already adopted resolutions in practice were adopted.

In 2006 the Cabinet of Ministers of the republic for the first time announced a contest for getting a grant for creating and developing the innovation infrastructure in the municipal formation. The same year a new Resolution of the Chuvash Government was devoted to the development of venture investments in the scientific and technical sphere. Finance of startups waiting for high revenues is directly intended for creative entrepreneurs, and there are a lot of such in the Chuvash Republic. In 2009 the Cabinet of Ministers of the Chuvash Republic adopted a Resolution aimed at the innovation development of industry in the Republic. The following Resolution of the Chuvash Government determined the priority directions that require the direct development of the innovation technologies. A year after the Chuvash Republic started a joint activity in this direction with the OAO "ROSNANO," having developed a plan of mutual actions. The year 2012 was a pivotal one, the formation of the regulatory basis for generation of the national innovation system of the Chuvash Republic was accomplished. In 2012 the State program of the Chuvash Republic "Economic Development and Innovation Economy for 2012-2020 years" was adopted, for elaboration of which

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[27] Etzkowitz H., Leydesdorff L. The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations // Research Policy. 2000. Volume 29. № 2, P. 114.

[28] Vyazova O.G., Galosheva O.N., Danilov A.P., Ivanova T.N., Idrisov R.A., Krasnova M.N., Lipatkova I.A., Shirokov O.N., Shirokova M.A., Yaltayev D.A. *Polveka na nive obrazovaniya: k 50-letiyu ChGU imeni I.N. Ulyanova* [Half a century in the field of education: by the 50-year anniversary of I.N. Ulianov ChSU]. Cheboksary, Chuvash Book Publ., 2017. p. 221.

[29] Graf P., Braun A. A policy perspective on open innovation—the Mexican case // *International Journal of Entrepreneurship and Innovation Management. 2013. Volume 17. №* 4/5/6. P. 298.

a relevant sub-program came into force in 2014. The same year two more important resolutions devoted to the development of the innovation field in the Republic were adopted. The Resolutions are "On the measures of state support for the innovation activity in the Chuvash Republic" and "On the measures for encouraging the demand for the innovation including nano-technological products in the Chuvash Republic."

Certainly by adopting these documents the work on implementation of NIS in the Chuvash Republic does not end and is not limited. However, creation of such incentives is in demand within the frameworks of the institutional stage of formation of the innovation system. [30] Nevertheless, we will not take a risk to assert that even in such traditional cluster for the republic as electro-technical we observe total prosperity in terms of development of the regional innovation system. Though it is the most successful clusters, that could become the main "driving force" on the path of formation of the innovation system in the Republic.[31] We intentionally took the most positive example in this case which is not entirely spread in all sectors of economy in the Chuvash Republic. On the whole, the development of regional, just like national innovation system is a problematic area. There are certain reasons for that.

As it was already mentioned above, the concept of the innovation system in the Chuvash Republic was formed in accordance with the common process that took place throughout the Russian Federation. The 1990th, to which the initial period of forming the modern regional innovation system fell, are generally characterized by great economic difficulties. The early 2000th were more successful, when the authorities of the Republic adopted several key regulatory acts intended to directly help the formation of the innovation system. These years can be considered as the beginning of the process of innovation potential development in the Chuvash Republic that was a result of change in the position of state authorities with respect to this problem at a federal level. Unfortunately the period of hardships is far from the end. We have a whole number of conditions that prevent the achievement of the final success in this direction.

1. The remaining **complexity of the general economic situation** in the country and region. The majority of enterprises still experience objective difficulties with implementation of their own business-plans in the content of which the innovation activity is reflected insufficiently. External sources of finance turned out to be smaller than in the recent past taking into account the drop of prices for energy products and decrease of the government revenues, as well as the decrease in indicators of investment activity. Particularly this fact affects the activity of venture funds.

2. **Anti-sanctions economic policy of import phase-out**, strengthening the demand for successful fulfillment of the scientific-innovation potential began under conditions of an active participation of external partners at the internal market of Russia. The period of changing the situation is quite sensitive and cannot be quick. In this regard, the innovation activity of academic and research institutions cannot but experience certain difficulties as well.

3. **Lack of practical experience in fulfillment of such programs.** The processes of industrialization and cultural revolution externally resembling the formation of the innovation system cannot serve as an example in this case. They flowed under certain historic conditions, therefore it is natural that they qualitatively differed from the modern process of the innovation potential growth and creation of the national innovation system in the Chuvash Republic. The following can be referred to the number of such main distinctions.

[30] Patel P., Pavitt K. National Innovation Systems: Why They Are Important, And How They Might Be Measured And Compared // Economics of Innovation and New Technology. 1994. No. 1, P. 96.

[31] Enright M. Regional clusters: what we know and what we should know //Bröcker J., Dohse D., Soltwedel R. Innovation Clusters and Interregional Competition. 2003, Berlin, Heidelberg, New York: Springer. P. 103.

1. The specified processes were fulfilled not only with a direct active participation of the state, but also under certain ideological pressing. The chief initiator and executive of the specified course was the communist party. This fact strengthened the level of efficiency and executive discipline to some extent. For example there are cases of severe control over the execution of the party decisions known in the most ruling party of the those years. An active party work was accompanied by a large-scale propaganda and agitation, promotion of party decisions among all categories of population, not only among pro-Bolshevist ones (which unfortunately is rarely observed in our time). Besides, the party work presumed elaborating new means of non-economic encouragement (different honorary titles, awards that were often quite symbolic – transferring flags, honorary distinctions etc.). Nowadays they arouse some irony, however, back then under conditions of forming a certain public attitude, they proved to be efficient. At that, such practice did not additionally burden the state budget. The fact itself of becoming a member of the ruling party could be an incentive. However, such practice gave rise to certain negative consequences of such campaigns. To them can be referred for example the features of extreme nature present in all key decisions of the party and government – Council of People's Commissars. It was a result of extreme management measures that proved so successful during the Civil War. In a particular historic and political situation, like the Great Patriotic War, the use of such measures was reasonable and appropriate. However, conducting a broad long-term social reforming and actual civilizational modernization by such methods does not guarantee their final efficiency and irreversibility. At the same time the excessive use of them developed certain attitude to them from society, strengthened team leadership style, and lack of real systematic nature and reasoning of specific actions. Unfortunately these "social diseases" are still not eliminated.

2. The second distinction, resulting from the first one – is poor account of the economic expediency of some projects, constant rush toward quick result at any price, and consequently – not always rational execution of plans. The reasons for that phenomenon have not only a subjective nature (pursuing extreme administration methods described above), but also an objective one (shortage of qualified personnel in general and in the economic area in particular). It made its impact and at the same time was an inherent feature of the whole team-administrative economy in our country. However, focusing on this moment should not be excessive as it is unfortunately observed in historic papers of some authors. The creators of state plans were not ignorant, for preparation thereof there were invited specialists and experts, therefore despite inflated expectations and disputable indicators in some aspects, in general the results of the specified campaigns on industrialization and cultural revolution were noticeable.

3. Another distinctive feature of those years – was an obvious hostile environment of the country. The policy of Bolshevist leadership did not make the heads of other countries well disposed towards it, at least due to ostentatious refusal from the payment of debts of the tsar Russia. An obvious growing of the threat from the fascist Germany, and problematic nature of relations with England and France (USA looked more beneficial in this respect, the industrial and trade companies of which would not mind to take part in the industrialization process on the level of private concessions even against the position of their authorities) set the direct mottoes and objectives of the required forthcoming protection of one's independence before the population. It created an additional powerful social incentive. The modern process of building the national innovation system initially occurred under rather favorable external circumstances and external economic conditions taking into account the level of prices for energy products in the first decade of the 2000th. Unfortunately this situation was scarcely used. Continuation of the process of forming the national innovation system fell on the entirely different international situation. Nevertheless, in all acuteness thereof it should be noted that it was not about any serious prospects of a direct armed

conflict with the countries of Western Europe or USA. Another prospect is more dangerous – consolidated dependence of the national economy on foreign technologies, and loss of opportunities for further successful development and rise of the life of population under conditions of specified dependence. In this respect the policy of import phase-out with all of its problematic character creates opportunities for proper qualitative growth based on domestic know-how, and growth of the level of intellectual capitalization. At that different forms of service innovations capable of forming new competitive clusters and settling economic problems of the region have special commercial appeal.[32]

6. CONCLUSION

Summarizing our research it should be noted that many lead specialists in the field of studying the innovation systems note special role that research centers based at universities can play in the process of the innovation system development. During the Soviet times not every scientific institution dealt with such work, especially academic ones. In the first turn this direction was developed by the so called research and production associations (RPA), or as in our example of electro-technical branch in the Chuvash Republic – ARRRDTI, initially established on the basis of the Electrical Apparatus Plant and consequently closely cooperating with it. The research and production association involved the research institute and pilot plant. The Head of the research institute was the Head of the RPA at the same time. The institute dealt with the scientific research, whereas the technology was de-bugged and pilot batch was manufactured at the pilot plant. Single leadership over science and production ensured clear coordination of works on development, transfer to pilot production and manufacture of products. On the modern stage it is intended to establish the university scientific centers in the first turn, which will also take some time required for their establishment and achievement of positive results.

Efficient results in this respect can be achieved through a number of preconditions. It is first of all the doubtless relevance of the innovation development programs and their being in demand. In accordance with the Concept of a long-term socio-economic development of the Russian Federation for the period till 2020, the primary objective of the state is to ensure a long-term sustainable rise of welfare of the Russian citizens, as well as national and economic security. The solution to this objective is in many respects determined by the level of usefulness of resources of the scientific-innovation potential of the national innovation system (NIS). The work in this direction has become especially relevant under modern conditions of anti-sanctions economic policy of import phase-out.

Secondly, it is synchrony of processes of building a regional innovation system in the Chuvash Republic and national innovation system in the Russian Federation on the whole. It can be easily observed at least by the content of state programs of the Chuvash Republic "Economic Development and Innovation Economy for 2012-2020" and the Russian Federation "Economic Development and Innovation Economy." The first one was adopted even before the second one (in 2011 and 2014 respectively). Both have a goal of formation of NIS at a republican and federal level.

Thirdly, by the present moment the required regulatory basis has already been created both at a regional and federal level. The lead specialists in this sphere of Russia and other countries consider it today a required element in the process of formation of a national innovation system since the last one is formed only in case of direct interest of state authorities in this issue. The state not only creates framework conditions for the system

[32] Hertog P. Knowledge-intensive business services as co-producers of innovation// *International Journal of Innovation Management. 2000. №.4*(4). P. 499; Miles I. Patterns of innovation in service industries // *IBM Systems Journal. 2008. Vol. 47№* 1. P. 121.

operation but in many respects forms the motivational foundation for the activity of the system elements, many resources and NIS institutes, provides an access to them, acts as an accelerator of processes in NIS as a partner reducing innovation risks.

And fourthly, a direct interest of the administration of academic and scientific institutions in successful practical indicators of work in this direction is observed today. The achieved practical results in the sphere of introduction of innovations under conditions of modern reformation of the system of higher education not only can provide the additional external sources of finance, which refers to the number of the required indicators of the general efficiency of the university work, but also represents such an indicator that has a direct impact on the rating of this academic institution. The presence of such indicator allows at the bare minimum to hope for additional budgetary co-finance.

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