

Development Potential Assessment of Chuvash Republic Electrical Engineering Industry

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Abstract—The relevance of the research is due to the fact that there is a lack of scientific knowledge in determining the development potential of the Chuvash Republic electrical engineering industry, which will help to form a clearer view of the performance of electrical engineering industry enterprises as participants in regional innovation processes. The purpose of this article is to assess the development potential of the regional electrical engineering industry. The leading approach to the research is an integrated one, and the method is a statistical and economic one, which allows to give a comprehensive description of the electrical engineering industry development in modern conditions. As a result of the analysis, we can state that we have assessed and substantiated the development potential of the region’s electrical engineering industry: the advanced enterprises of Chuvash Republic electrical engineering cluster created a reserve expressed in the use of modern technological processes and international quality management standards in industries, however, a certain portion of opportunities is in the form of maximizing the implementation of human capital abilities, shaping the economy knowledge, is still not finding proper application, waiting for arrangements allowing it to realize the development potential of the industry.

Keywords: *electrical engineering industry, potential assessment, regional development, cluster, government regulation, knowledge economy*

I. INTRODUCTION

In a market economy, various ways of attracting resources. The relevance of the research was predetermined by the fact that the enterprises of the electrotechnical engineering cluster, having a solid research base and highly qualified staff, are inferior in economic indicators to the world leaders in this

industry. Currently, the electrical engineering industry of the region [1] can be characterized as innovative [2], however, there are factors that restrain its development potential. Despite the long-term implementation of measures aimed at strengthening the position in the global market, as well as other work carried out by joint efforts of the state and firms in order to increase the level of competitiveness [3] of domestic companies in the field of electrical engineering, regional cluster enterprises [4; 5] cannot accelerate the development of the industry and reach the level of performance of organizations such as Siemens, Alstom and General Electric. The development potential assessment of the industry is one of the first steps necessary to determine its development status.

Based on the foregoing, the purpose of the research is to assess and justify the development potential of the region’s electrical engineering industry in the modern economy.

In the framework of the research, it we solved following tasks: identifying problems in the development of the region’s electrical engineering industry in modern market conditions; analysis of internal and external environment in the industry market; analysis of market-forming factors of the high-tech equipment market; description of difficulties in entering into the market of regional manufacturers of electrical engineering products; substantiation of the need for changes aimed at improving the processes of electrical engineering cluster enterprises development management.

II. METHODS

The methodological basis of the research is an integrated approach. In the research process, the following methods were

used: analysis of statistics data, content analysis, analysis of regulatory documents, analysis of the functioning of the electrical engineering cluster, analysis of the results of the electrical engineering cluster, expert assessment method, PEST analysis, SWOT analysis [6].

Using the PEST analysis method, it was found that the economic growth of the electrical engineering cluster enterprises has a proportional relation with the levels of intensification and extensification of production. Nevertheless, a reduction in the payback period of products can be achieved through innovative methods of managing the production process, marketing policies and encouraging from managers to company employees to make and realize create ideas.

The method of SWOT analysis, adapted to the topic, made it possible to determine that the electrical engineering industry is in a stage of growth and adaptation to conditions in the world market of electrical engineering products. Industry enterprises are building up its potential and competitiveness in various areas of activity. Using this method, the possibilities that have developed in the domestic and industry environment and their potential application in the market environment were clarified. Also, threats to the market for the production and sale of electrical engineering products were identified.

III. RESULTS

Based on the analysis, it was found that the Chuvash Republic electrical engineering industry is at a growth stage, which is accompanied by structural innovative changes – mainly the formation of a market segment for high-tech electrical engineering products and the creation of human capital, integrated into the development processes of the electrical engineering industry and increase its competitiveness. With the right development strategy, the enterprises of the region’s electrical engineering cluster will be able to realize its accumulated potential and pass the technological gap behind world leaders in electrical engineering products, as well as take a strong position in the ranking of successful companies, which is characterized by indicators such as industrial production index, organization turnover, volume of shipped goods, balanced financial result, etc.

225 organizations are registered in the Chuvash Republic electrical engineering industry, of which almost all of it is privately owned, which is 9.6% of the number of manufacturing enterprises and 1% of the number of organizations of all types of economic activity.

Among them can be distinguished such as "EKRA" RPE LLC, "VNIIR" JSC, "ChEAZ" JSC, "Relematika" LLC, "Dinamika" NPP, "Bresler" RPE LLC, "ELARA" RPE, "KASKAD" RPA JSC, "Elektropribor", "Hevel", "Technotron" RPE LLC. In addition to these companies, following organizations contribute to the development of competitive advantages [7; 8] in the field of electrical engineering: NPO Association “Innovative Territorial Electrical Engineering Cluster of the Chuvash Republic”, Regional Engineering Center of the Chuvash Republic; Center for certification, standardization and testing of the Chuvash Republic; Academy of Electrical Engineering Sciences of the

Chuvash Republic; NPO "Venture Investment Fund of the Chuvash Republic"; PJSC "Development Corporation of the Chuvash Republic".

The enterprises of the electrical engineering cluster employ 15.303 people (99.4% compared to the first half of 2018), which is one fifth of the number of manufacturing enterprises employees.

For the first half of 2019, the turnover of organizations in the electrical engineering industry amounted to 21.590.4 million rubles (94% compared to the first half of 2018) – this is 7.1% of the turnover of organizations of all types of economic activity of the Chuvash Republic, and the index of production of electrical engineering products decreased by one eighth compared to the corresponding period of 2018.

The volume of shipped goods of its own production, work and services performed on its own by organizations of the electrical engineering industry amounted to 17832.7 million rubles (96.2% compared to the first half of 2018) –this is almost one seventh of the volume of shipped goods, work and services of organizations of all types of economic activities of the Chuvash Republic.

The data on the balanced financial result in the Chuvash Republic electrical engineering industry in January-May 2019 are given in TABLE I. The rate of change in the balanced financial result of the reporting period compared to the corresponding period of the previous year is calculated for a comparable circle of organizations; taking into account the adjustment of the data of the corresponding period of the previous year, based on changes in accounting policies, legislative acts in accordance with the accounting methodology.

TABLE I. BALANCED FINANCIAL RESULTS IN JANUARY-MAY 2019

Type of economic activity	Balance of profit (+) and loss (-)		Amount of profit, million rubles	The share of profitable organizations in the total number of organizations, %	Amount of loss, million rubles	The share of unprofitable organizations in the total number of organizations, %
	million rubles	% by January-May 2018				
Total	40788.1	in 8.4	42042.2	69.1	1254.0	30.9
including:						
manufacturing industries	23839.8	in 5.6	24564.0	68.6	724.1	31.4
of them:						
manufacture of computers, electronic and optical products	266.1	91.0	–	83.3	–	16.7
manufacture of electrical equipment	364.7	20.4	788.7	60.9	424.0	39.1

Indices of goods producers prices in the Chuvash Republic electrical engineering industry are shown in TABLE II.

TABLE II. ELECTRICAL ENGINEERING PRODUCER PRICE INDICES IN 2014-2019

Type of economic activity	2014	2015	2016	2017	2018	First half of 2019
Production of industrial goods, % to the previous year	106.5	113.5	107.6	103.6	104.7	100.2
Manufacturing, % to the previous year	107.1	114.2	107.7	103.5	104.6	105.8
Production of computers, electronic and optical products, % to the previous year	99.2	110.9	105.7	104.0	101.3	105.6
Production of electrical equipment, % to the previous year	104.8	114.3	111.0	101.3	101.6	101.5

To determine the influence of the external environment on the development of the industry, a PEST analysis was carried out (TABLE III).

The conducted PEST analysis indicates that the electrical engineering industry of Chuvash Republic is influenced by external factors that are reflected in the work of enterprises of the entire cluster, especially in its production indicators. It was revealed that using technological innovative solutions [9] it is possible to improve the quality of products and shorten the payback period. And also that a risk-based approach contributes to the intensification of production.

TABLE III. PEST ANALYSIS OF CHUVASH REPUBLIC ELECTRICAL ENGINEERING INDUSTRY

Political	Economic
The lack of significant results in the process of interaction of economic agents involved in the development of the electrical engineering industry.	The complexity of pricing policies at the company level, as well as the volatility of the price level.
Preferential tax conditions for the accelerated development of the industry.	Long payback period.
Difficulty in choosing an effective industry development strategy.	Lack of experience with staff in solving some problems.
Social	Technological
Difficulty in regulating legislative measures to restrict civilians in the context of technological change.	Risk-oriented thinking – the implementation of risk management and control measures.
Inadequacy of main social mass to technological changes.	Technical and technological modernization of production.
A hard-to-see perspective of the emerging digital world.	Difficulty in regulating legislative measures to struggle the violation of intellectual property rights.

The SWOT analysis shows that the region has accumulated significant potential for the development of the high-tech electrical engineering products market, but it still cannot be properly implemented (TABLE IV).

TABLE IV. SWOT ANALYSIS OF CHUVASH REPUBLIC ELECTRICAL ENGINEERING INDUSTRY

Strengths	Weaknesses
Good engineering base.	Not enough initiative of economic agents for high results in the industry.
Developed logistics system.	Low level of salaries.
Close cooperation of universities and training centers with enterprises of the electrical engineering cluster.	Gradual, and sometimes latent, implementation of product quality management standards.
Opportunities	Threats
Improving the conditions in quaternary sector of the economy.	The emergence of new players in the market.
Improving the system of educational standards.	Threat from suppliers.
Increase of the share of exported products.	The emergence of substitute goods.
The gradual transition of the state economy to the knowledge economy.	Instability of the price level.
State support for industry enterprises.	The imposing new sanctions.

Thus, on the basis of the analysis it can be given the following assessment of the development potential of the Chuvash Republic electrical engineering industry.

1. The economy of Chuvash Republic is saturated with innovative changes in production processes. For example, high-tech equipment is used to simplify the production process and shorten the duration of the product cycle.

2. Transformational and transactional costs have a significant impact on the slowdown in the production of electrical engineering products.

3. There is a lag of the enterprises of the regional electrical engineering cluster in many economic indicators from the global leading companies for the production of electrical engineering products of different directions. Developing a strategy to increase the competitiveness of the region's electrical engineering cluster enterprises in the global market.

4. The subtle presence of the state in the formation of the advanced electrical engineering cluster of the region. Regional programs are implemented using funds from extra budgetary sources.

5. Low rates of intensification and extensification of production. An insignificant part of the enterprises of the electrical engineering cluster expands production capacities and realizes the reorganization of production.

6. Only some organizations in the electrical engineering industry of the region carry out crisis management. The insignificant diversification of production creates factors for the development of the crisis state of the company in particular and the industry as a whole.

7. Low interest of economic agents in the accelerated development of the electrical engineering industry. Insufficient initiative of participants in the development of the

industry can be traced in the implementation of the planned level of work, which occasionally and slightly exceeds the previous reporting results.

8. Human capital, which is formed mainly in universities and industries, has a significant impact on the realization of the development potential of the industry. In the region, there is close cooperation between educational institutions and enterprises, which contributes to the formation of highly qualified employees oriented in their work towards achieving high rates.

9. There is an expansion of the circle of countries-importers of products. Maintaining stable relations with other countries as an exporting region of electrical engineering products.

10. The relative stagnation of the venture capital business. Support for a small number of innovative projects. Focus on the development of projects venture financing [10] as a step towards creating a risk-based approach. Risk management in production is one of the factors in the formation of the knowledge economy.

11. All enterprises of the electrical engineering cluster are introducing a quality management system in their production, which helps to improve product quality.

IV. DISCUSSION

The knowledge economy based on such components as high-quality education, reliance on the achievements of science, maximizing the creative potential of employees, venture financing [11; 12], the creation of high-tech products, highly qualified human capital, a knowledge society, is the benchmark that the enterprises of the Chuvash Republic electrical engineering cluster strive to achieve.

The listed development drivers form the scientific and technological appearance of the region [13]. However, in order to achieve the required results in the electrical engineering industry, it is first necessary to identify weaknesses in the system of development, production and sale of products [14], as well as personnel management, marketing, and foreign economic activity of the organization.

Development potential assessment of the industry is the lever by which there is a shift towards productive indicators, since due to the analysis it is a transition to eliminate the shortcomings and strengthen the primary qualities [15].

In the prevailing conditions of the global, regional and sectoral economy, the formation of a successful enterprise-leader in its industry is an extremely difficult task. Achieving high positions in the market of electrical engineering products is hindered by many factors. These include both horizontal and vertical types of competition [16].

Cluster enterprises [17; 18] measures are being taken to intensify production, which contributes to the development of an innovative economy [19]. The direct participation of the state in the development of the industry [20] transforms the face of the industry and helps firms realize its objectives and achieve the desired results. A correctly formulated vision, a

chosen strategy, and assigned tasks contribute to the continuous qualitative development of industry enterprises [21], aimed at advancing the economic indicators of competitors not only in the short, but also in the long term.

Also in the Chuvash Republic there is close cooperation between the enterprises of the electrical engineering cluster and educational institutions [22] (research and educational centers, universities, centers for advanced training) aimed at creating high-quality human capital and continuing education of employees.

V. CONCLUSION

The following assessment of the development potential of the Chuvash Republic electrical engineering industry is given and justified.

1. In the electrical engineering industry of the Chuvash Republic, innovative changes are taking place in production processes that shorten the production cycle and improve its quality.

2. It is traced the influence of transformational and transactional costs on the development, production and sale of electrical engineering products.

3. Domestic manufacturers of electrical engineering products are guided by world leaders in this field.

4. The subtle presence of the state in the formation of the advanced electrical engineering cluster of the region.

5. The low pace of expansion of production capacities of enterprises in the electrical engineering industry.

6. Low diversification of production, suppliers and risks.

7. The low interest of economic agents in the accelerated development of the electrical engineering industry.

8. Close cooperation of regional educational institutions and enterprises contributes to the formation of highly skilled workers.

9. There is an expansion of the circle of countries-importers of products.

10. The relative stagnation of the venture capital business.

11. Gradual implementation by enterprises of a quality management system.

In theoretical terms, the results of this research can help with its use in the compilation and improvement of strategies and programs for the development of the electrical engineering industry in the region. In practical terms, it can be useful for economic agents associated with the electrical engineering industry, for example, when implementing plans and making decisions in strategic planning.

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