

Approaches to the Far Eastern Paradigm of the Russian Electronic Industry

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Abstract–The electronic industry of Russia was seriously damaged during economic and political reforms in the country. The main production is focused on defense potential of the country at state-controlled enterprises. The growth of this industry is ensured by the state orders. The share of small and medium business of consumer products makes 11%. Due to the world-class scientific potential, the Russian electronic industry is able to take the leading positions in certain sectors of the world market of defense industry. Therefore, the global competition in the world markets of electronics starts from a new sheet of paper and the change of leaders is possible against the leadership in basic research. The paper discusses the possibility of electronic industry being an alternative to the state corporate in terms of the institutional aspect available in the European part of the Far Eastern pole. The purpose of such clusters is to integrate electronic industry into business structures of the Northeast and Southeast Asian countries functioning in both Russian and foreign markets using technological and economic advantages, including the state support. The first stage of the Far Eastern pole of development of the Russian electronic industry shall be the creation of a cluster of printed circuit board production. The paper shows opportunities and advantages of the above concept within the international Tumangan special economic zone.

Keywords–*electronic industry, Russia, Far East region, production cluster, production of printed circuit boards, small business, international special economic zone, Tumangan project*

I. INTRODUCTION

Electronics is one of the strategic industries defining the level of technological development of any country. Successful development of this industry requires high-quality chemical materials, modern machines and equipment to produce some components and units, highly-qualified scientific-technical, engineering and working staff, creative managers and many other resources. Electronic industry is the most dynamically developing field, which production and technological reforms happen within the shortest period (3-4 years). In view of extraordinary complexity and variety of products, neither country these days is completely self-sufficient within this

industry, including the production of machines and equipment for electronic components and printed circuit boards.

Until recently the development of electronic industry in Russia was defined by the requirements of defense, safety and such knowledge-intensive productions as nuclear power, communication systems, space vehicles. Prior to market transformations the Soviet Union was self-sufficient in electronic and radio engineering industry, and its lagging behind had no qualitative character. Until 1985, the USSR was lagging behind the USA in production of microelectronics by 1.5-2 years, however there was almost no gap in new-product development [1].

The majority of enterprises of the Russian electronic industry is located in the European part of the country. The former USSR countries, such as the Republic of Belarus and Ukraine, have well developed electronic industry.

The “distribution area” of electronic and radio engineering in modern is perhaps ends with Krasnoyarsk Krai. Meanwhile, prior to market transformations this zone also included Irkutsk Region, where alongside with operational plants (“Vostok” Production Association, “Radian” Condenser Plant, Relay Plant) the radio plant in Chermkhovo was built and documentation for the construction of the measuring radio equipment plant in Irkutsk was prepared.

II. METHODOLOGY

The analysis of strategic and conceptual publications almost does not reveal the problem of changing the location of electronic industry. Meanwhile, there are serious reasons to consider the paradigm shift towards the development of the Far Eastern pole of electronic industry in Russia.

To date the Russian electronic industry is falling behind other countries. Many electronic components, including processors, are purchased abroad.

Russia holds 3% of the global consumption of electronic products. At the same time the Russian electronic industry

makes only 0.4% of the world production. Large state enterprises dominate in Russia, the share of small and medium enterprises of consumer electronics makes 11%.

The share of domestic computer equipment in domestic market makes less than one percent [2].

III. RESULTS AND DISCUSSION

In our opinion, this state indicates the need for system reconstruction of the industry, even “from scratch” in many respects, including the creation of new centers thus using available significant scientific achievements.

At present there is a transition to the qualitative and new development level of electronics and radio engineering, including the creation of quantum computers, use of mobile communication of the fifth generation (5G) [3–5] and the related additional “challenges”, which can only be satisfied using new physical principles. Thus, the fight for leadership in the world electronic industry in many respects begins “from scratch”. Considering the available leadership of Russia in basic research, it seems that its chances in a new race are quite high.

The imposed sanctions, including sanctions against electronic components, as well as against equipment for their production, have long-term and geopolitical nature.

To reduce customs (cost and bureaucratic) duties and to avoid sanctions there is a need to place the production of some electronic products in special economic zones. The following can be examples of such kind: IT Park Kaliningrad free economic zone specializing in electronic industry and production of software products; Tomsk special economic zone of technical and innovative type (quantum electronics, high-current electronics) also making software products; partly – Skolkovo Innovation Center.

It shall be noted that the development of electronic industry in China, which became the leader in this sphere, is closely connected with the creation of special economic zones. The international experience of creation of transboundary special economic zones (SEZ) [6] is of special interest for the solution of this trivial task.

The Far Eastern region of Russia, first of all the South of Primorsky Krai and Khabarovsk Krai, can become a pole of development of modern electronic industry, utilizing its proximity to the Asian centers of the world electronic industry. The countries of the Northeast (Japan, the Republic of Korea, China), Southeast (Singapore, Thailand), Southern Asia (India) produce the main part of the world electronic industry. The advantages caused by the specified proximity to the world centers of production and consumption of electronic products are expressed as follows:

1. Possibility of producing modern high-quality materials and accessories within acceptable time limits in the conditions of intercompany and international competition.

2. Modern methods of business management and organization, which are in many respects alternative to those developed on the “continental” part of Russia.

3. Possibility of cooperation, marketing with foreign business partners.

Until recently the industrial development of the Far Eastern region was carried out within the “planting” concept: industrial centers were created in the interests of defense industry of the country and for the use of various natural resources, first of all, sea bioresources, mineral raw materials, forest resources.

The major restriction for economic development of the region is limited human resources; on the other hand, lack of highly-qualified jobs against the background of underdeveloped social infrastructure causes the outflow of working-age population. Meanwhile, the development of Russia’s national economy is characterized by many examples of regional scientific centers and knowledge-intensive industries with the engagement of scientific and engineering staff invited from the European part of the country: Novosibirsk Akademgorodok, closed administrative associations making knowledge-intensive products for defense industry. Strictly speaking, large industrial facilities in the Asian part of Russia were traditionally created due to the inflow of technical staff from the European part of the country.

Now there is a special economic porto-franco zone in Vladivostok specializing in logistic operations, creation of the network of logistic centers [7]. Such SEZ serve a quite good transport prerequisite for other organizational business structures in the production sphere as it happens in Kaliningrad special economic zone. However, the special economic zone of industrial and production type created in 2014 in Vladivostok was liquidated in two years since not a single operating production was created over this period. However, it shall be noted that in 2018 the offshore zone was created on the Russky Island near Vladivostok, which may be favorable for the development of the international business in this region.

In our opinion, the development of hi-tech business, including electronic industry, requires strategically important projects for the country, alongside with their considerable financial and organizational support. In other words, besides traditional business plans, there is a need for strategic study of business development ensuring not only import substitution, but also entry into the foreign markets.

The development strategy of electronic industry in Russia cannot be limited to tasks of saturating the domestic market with personal (localized in the country) products. The current technological lag in the market of electronic products of mass consumption (cell phones, TVs, personal computers) does not make it possible to stop the import of such products, to transfer into a full cycle of their independent competitive production or export during five or even ten years. Therefore, to increase the profitability of domestic electronic industry there is a need for continuous expansion to foreign markets in innovative directions (microwave electronics, electrooptics, power electronics).

In our opinion, the main form of such expansion is joint ventures and cooperation with foreign companies to ensure the supply of required accessories and promote goods to foreign markets. The latter one is critical for innovations. The solution of numerous customs and tax problems, partially credit

settlement problems, can be solved using such tool as special economic zones.

If to consider the creation of the Far Eastern pole of electronic industry as a strategic national project, then its realization shall definitely to rely on multiple state support measures. It shall be noted that in 2004 at the special meeting of the Russian State Duma devoted to the development of electronic industry it was decided to provide state guarantees of hi-tech products focused on both domestic and foreign market jointly with foreign investors [1].

The institutionalism of the proposed project shall be based on small forms of private entrepreneurship, shall be initially paradigm to forms developed in the European part of the country with the domination of large government-sponsored enterprises (their number).

The system defects in the organization of electronic industry in Russia include lack of collaborative connection with multinational companies making the component units [8], insufficient use of franchising. However, the major deficiency is the disregard of cooperation relations, including various outsourcing, with subjects of small and medium business forming vertically integrated structures and production clusters.

For example, one workplace in Samsung Electronics creates from 1 to 3 jobs in small business and four – in other industries [9] since a considerable part of production of components is outsourced to small business.

The production of printed circuit boards shall become the initial stage in the development of the electronic industry pole in Primorye and in the south of Khabarovsk Krai. With regard to Russia this may refer to the creation of the territorial center of competences. From the territorial perspective, this concerns the creation of a regional cluster of printed circuit board producers.

Separating the development strategy of printed circuit boards production, A. Medvedev and P. Semenov note the need for considerably new schemes of industrial production localization by identifying regions with optimal conditions of production and delivery of products to domestic and external markets [10].

The Far Eastern region borders with countries having high level of printed circuit boards production. China (including Hong Kong), Taiwan, South Korea and Japan, which make 84% of the world production, are among them. At the same time China makes a half of the world production of printed circuit boards. According to Jack Kei, Chris Nuttall and Hans Stahl, although China will remain the key player in the production of printed circuit boards in the near future, we shall not exclude simultaneous positive development of other regions in their corresponding niches [11].

The cluster on printed circuit boards production in China confirms the fact that about 60 percent of these products are located in southern China with the center in Shenzhen [11].

In our opinion, it is crucial to create a variety of (about ten) competing production units owned by small and medium businesses, which shall considerably differ from the approach in electronic industry of the European part of the country where

the production of printed circuit boards forms part of production cycles in large subsistence companies. In foreign countries (Asia and Europe) the producers of printed circuit boards are isolated into independent businesses of contract manufacturing EMS (Engineering and Manufacturing Services).

Modern printed circuit boards within its hi-tech context are multilayered (up to 30 layers), flexible (complex configuration), making it possible to implement optical, super-high frequency, laser methods of signal processing technologies. In fact, these are ultra-large hybrid microcircuits having different configuration and architecture, which complexity and methods of precise processing can compete with the production of semiconductor integrated circuits.

The market of printed circuit boards production called contract manufacturing is characterized by high competition among its main subjects – small- and medium-sized enterprises. For example, the production of hi-tech prototypes with monthly output of about 2.5 thousand sq.m has 12 employees.

The result of the first stage shall be the domination of cluster enterprises in the Russian market of printed circuit boards and transition to the expansion to foreign markets.

Further development of electronic industry in the region will be based on created production of printed circuit boards, according to the development logic of this industry, in the direction of assembly production, production of various chips, active and passive components, software production.

From our perspective, the concept of evolution of the considered regional complex of electronic industry covers the transition from the production of unique, small-scale Russia-sourced products towards large-scale production through gained experience in production and marketing. At the same time, the paradigm of the fifth technological stage is aimed at job-order production of sophisticated technologies, including consumer electronics.

It seems that in a few (five-ten) years the production of key (processor) chips based on new approaches, including subwave holographic lithography [12, 13], electron beam and x-ray scanning, will allow reducing cost and increasing quality. Such “revolution” will make it possible to shift to the next technological stage in electronic production “made to order”, which strengthens the value of small innovative business of electronic industry.

It is interesting to consider new opportunities for the implementation of the national project within the international special economic zone known as the Tumangan project. The concept of this project initiated by China since the end of the 1980s is not indisputable and needs further review to be implemented in modern conditions [14, 15].

The main advantage of this location of a complex of electronic industry is the opportunity to use not only sea routes, but also land-based ways, first of all motor transport (China) and railway: with China and with the countries of the Korean peninsula (by Transkorean railroad).

Transit and international transport corridors through SEZ Tumangan is for instance possible through the following directions:

- Pusan, Donghae–Ranzhin, Songbon–SEZ Tumangan–Vladivostok–Transsib.
- Pusan, Donghae–Ranzhin, Songbon–SEZ Tumangan–Hunchun.
- SEZ Tumangan–Ranzhin, Songbon–Donghae, Pusan–Northern Sea Route–Europe–Berlin.
- SEZ Tumangan–Ranzhin, Songbon–Donghae, Pusan–Suez Canal–Europe–Berlin [8, 16].

To create the cluster of printed circuit boards in the considered region and the production of electronic products in general there is a need to establish the education center since training in this field disconnect from modern production is abnormally weak. The Russian innovation week in Silicon Valley 2013 in California was particularly referring to this fact [17]. We believe that the proximity of modern production centers and educational institutions in South Korea, China, Japan makes Primorye some kind of a “window to Asia” regarding electronic industry.

IV. CONCLUSION

It is impossible within this study to consider all aspects of project and cluster approaches to the Far Eastern pole of electronic industry in Russia. However, the analysis of both approaches in the economy of modern Russia indicates its main disadvantage – focus on large business and large investment projects regardless of their scientific and technical level and content. Nevertheless, modern high innovative technologies are implemented by small businesses and are developed in the conditions of strong competition in domestic and foreign markets. The second disadvantage is lack of strategic development and validity of projects intended for globalized consequences (a striking example covers projects on the production of semiconductor materials of the Skolkovo Foundation). The third disadvantage has system-wide character and refers to disregard of methodology and practice of indicative and strategic planning in national economic regulation. In fact, lack of balance, contingency of projects, operating and created production dooms such project activity to failure. The last disadvantage is the practice of state budgetary co-financing of such projects and corporate lending of participants, where the loan issue – crediting under future value, i.e. under the products of created businesses – is the most efficient.

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