# Theoretical Foundations for Analyzing Problems of Macroregional Innovative Development and Ways to Solve Them

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Abstract: The paper presents the results of research into the economic foundations of the creation and development of scientifically-educational centers (SEC) in the global crisis. The prerequisites for the emergence and the role of SEC according to the diffuse model (bell curve) of innovation by E. Rogers are analyzed. It is established that SEC participants and project teams can be a kind of trendsetters (early adopters) between innovators and the rest of the community. The possibility of using the method of determining the technology readiness (maturity) level (TRL) in the development of high-tech knowledge-intensive products is shown, while the drivers and limiters of TRL in Russia, the SEC's area of responsibility according to the TRL levels and the specifics of the implementation of innovative projects in general are revealed. Using the example of the world-class interregional SEC "Baikal" as an example, the principal tasks of SEC functioning for the purpose of perspective transformation of natural and economic potential of the macroregion (Irkutsk region and the Republic of Buryatia) are formulated: motivation of participants, engineering and knowledge ranking, design, assembly and development of competencies in the field of integrated processing of wood and wood waste.

## 1 INTRODUCTION

It is known that the development and successful activity of any organization or country are largely determined by the strategy adopted in them - a set of methods and means of solving prospective long-term tasks.

The modern global economy, built on a longstanding trend of constantly increasing demand, is not at its best. The vast majority of enterprises are forced to focus not on accumulating and developing their assets, but on finding opportunities to do business in the conditions of falling markets, changing sales channels and production chains.

The cost of making inefficient decisions is also increasing. The main losses of organizations are not from market conditions and external economic factors, but from the mistakes of managers who do not know how to properly allocate available resources and try to "fit" the activities of the enterprise to the framework known only from the position of the standard academic education received earlier.

Managers who develop development strategies do not have the necessary competencies and do not understand how the infrastructure of the global production and consumption system is changing, so they often substitute strategic decisions with situational ones that have only a short-term effect or do not play a role at all, based on the principle of "decision for decision's sake".

The education and training level of classical specialists is not modified for the specifics and needs of the crisis economy. For the development of business strategy it is important to understand how it fits into the global model of demand, how the market will be transformed in the current conditions. After all, the market, according to the liberal model of social policy adopted in developed countries, is the most effective economic mechanism. At present, not only new goods and services are important, but also a competent program of balanced functioning of enterprises and regions (macroregions) (Antipina and etc., 2020), as well as advanced tools for the development of performers' competencies.

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## 2 RESEARCH METHODOLOGY

System analysis to find out the causes of existing difficulties, setting goals, solving problems of macroregional innovation development by using the potential of SEC. Method of determining the level of readiness (maturity) of technologies to formulate and "repackage" the true objectives of SEC functioning.

## 3 PROBLEMS AND GOALS OF INNOVATIVE DEVELOPMENT OF REGIONS (MACROREGIONS)

As noted above, the world economy is based on demand, which, in turn, today does not correspond to the level of income of the population.

Monetary and credit emission are the alphabetical ways to solve the crisis, but the effectiveness of these instruments has long been lost. Thus, monetary emission only increases inflation, while credit emission and increase in the bank multiplier contribute to the problem of underpayments.

Today there are affordable loans for small and medium-sized businesses, but the demand for them is still low, because the real capitalization of assets does not coincide with the expectations of their owners. In other words, the assets of enterprises are depreciating, but debts are not.

For example, real estate properties that do not generate income may become unprofitable because there will always be expenses (Bogatyreva and etc., 2022; Zakharov and etc., 2021). It is necessary to pay utilities and taxes in any case, even if no one lives in the hotel or apartment. This results in a paradoxical situation when the cost of credit is decreasing, while debts are constantly growing, because the accumulated debt can only be serviced at a 0% interest rate in a falling market.

If there is no demand for basic product groups, the demand for related services decreases. And along with commodity markets, labor markets are also falling. Employers determine for themselves how much they are ready to pay based on their current capabilities, and are not at all aimed at meeting the real needs of employees. Moreover, "narrow" specialists who possess a limited set of competencies for solving specific tasks are in a special risk group.

In the current situation, the correct goal-setting and diversification of enterprises' assets, i.e. the search for alternative capital, are necessary, since the process of reproduction of traditional capital may be postponed indefinitely or not start at all.

A comprehensive analysis of the problems of the world economy allows us to formulate the following objectives facing the modern management system:

- development of environmentally neutral technological processes of the future ("green" technologies);
- increasing the share of knowledge-intensive products to meet the qualitatively new demands of consumers;
- scientific organization of work and development of production culture, allowing to significantly increase the productivity of enterprises without significant costs;
- more efficient realization of natural and economic potential, through the creation of regional and macroregional associations and clusters (Bovkun and etc., 2020).

It is easy to see that the first two goals require innovation and significant investment. Innovation and investment are known to be closely linked to the size of markets. The larger the market, the more likely it is that investments will pay off. If the market shrinks, then all the sophisticated innovations and knowledge-intensive technologies become of little use.

What are the peculiarities of innovation projects? In addition to the obvious novelty and high degree of risk, there is also a significant problem of changing the required competencies in the course of the full innovation cycle, since its subject is usually a high-tech product. Consequently, the success of a complex innovation project depends not only on investments, but also on the quality of human capital and the implementation of an anthropocentric design approach.

## 4 SEC POTENTIAL AS A WAY OF INNOVATIVE DEVELOPMENT OF MACROREGIONS

One of the tools for solving the goals set for the modern management system, widely used in recent years, is the creation of SEC.

SEC is an association of leading scientific and educational organizations with the economic sector to provide world-class research and development, obtain new competitive technologies and products and their commercialization, training of personnel to solve major scientific and technological problems in the interests of the development of science and

technology industries on the priorities of national technological development.

The reasons and prerequisites for the creation of the SEC are quite diverse. Thus, the traditional provision of science exclusively at the expense of the state does not give the desired effect. Both funds are insufficient, and the results of research and development are not always oriented to the end user. In other words, in the vast majority of cases, the state finances process rather than result-oriented science, which makes it impossible to maintain the required level of the country's development, including through import substitution. The quality of domestic scientific research, no matter how cynical it sounds, should be measured not by the astronomical number of patents and articles, but by the number of results that reached the real sector of the economy. Consequently, researchers should be primarily focused on the possibility of applying the new knowledge obtained, rather than striving for a permanent increase in scientometric indicators.

It is known that fundamental scientific research generates knowledge, and the search for directions of using this knowledge is carried out with the help of applied scientific research. In the past, these tasks were solved with the help of the sector of applied sectoral institutes. Nowadays, the SECs can take over the search for the use of knowledge, acting in highly competitive markets, and doing so on a continuous rather than occasional basis.

SECs are also indispensable in the constituent entities of the Russian Federation, since the regional leadership cannot physically interact with a multitude of science and business organizations, and is in dire need of one consolidated representative.

Returning to the topic of innovation, it should be noted that innovators, due to the lack of necessary competencies, represent only the beginning and the end of the path, and not the entire intermediate chain. When it is said that finances are needed, it is necessary to understand who can provide them. Potential investors often do not see the prospects or have no idea where and at what stage of the innovation process financing is needed.

Thus, the SEC's practical role is to determine the type and level of assistance to developers and corporations, to "deconstruct" complex knots.

It is advisable to develop knowledge-intensive products and breakthrough technologies using internationally recognized methods and tools, which will enable the SEC to participate more effectively in jointly solving the tasks at hand. One such unified tool is, in particular, the TRL method. TRL provides a consistent and uniform discussion of the technical maturity of different types of technologies, examining program concepts, requirements, and demonstrated technological capabilities of a project (Héder, 2017). TRL levels are measured on a scale of one to nine, where level nine demonstrates the most mature stage of technology (Figure 1).

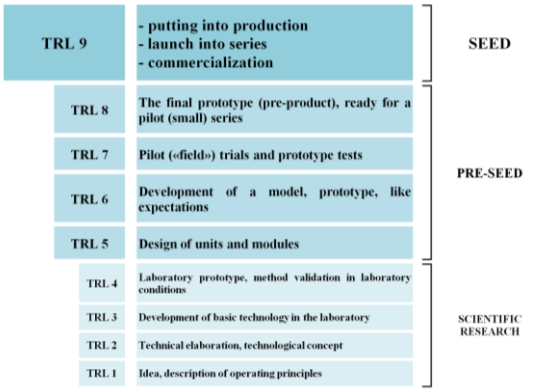


Figure 1: Readiness (maturity) levels of TRL method technologies.

TRL was developed by the National Aeronautics and Space Administration in the 1970s to implement U.S. space programs. Over the years, the method has been modified several times and has become more accessible and versatile. The specificity and complexity of TRL has gradually decreased as its use has expanded beyond its original purpose. The European Association of Research and Technology Organizations recommended in 2010 that TRL be adopted to evaluate innovation projects funded by EU countries (Kasner, 2021). But it was not until 2013 that TRL was formalized by the International Organization for Standardization with the publication of ISO 16290: 2013 (Ribeiro, 2022). It should be noted that some levels of TRL may not be relevant to a single project at all due to the specifics of its implementation.

It is logical to assume that the SEC, by virtue of the purpose of its creation, covers the final two levels of the research and investigation phase and the fully "pre-seed" phase (levels TRL 3 through TRL 8).

SEC also brings together a kind of trendsetters, who play the role of a transmission link or, according to E. Rogers' diffuse model (bell curve) of innovation (Rogers, 2003), early adopters between innovators and the rest of the community (Figure 2). It is the trendsetters who provide the most significant leap and success of knowledge-intensive products in the market as a whole.

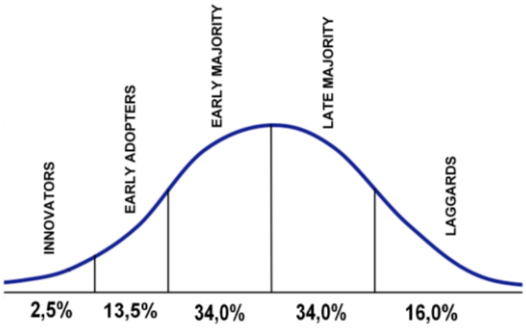


Figure 2: Diffuse model of innovations by E. Rogers.

TRL, in addition to the obvious advantages, has disadvantages, the main of which is that this method is poorly combined with total control, characteristic not only for Russian enterprises in particular, but also for the state in general (Figure 3).

**DRIVERS**

- ensuring a common understanding of the project level
- effective risk-management
- support for decision-making on project financing
- technology transfer decision support

**LIMITERS**

- technology readiness alone does not necessarily coincide with the degree of maturity of the innovation project as a whole
- other factors influencing on project maturity: engineering, industrial, organizational, market, external risks
- separate TRL levels are not always consistent with the specific development of certain types of products (for example, software) and services
- TRL does not fit well with the administrative management logic adopted in most Russian enterprises

Figure 3: Drivers and limiters of TRL method application.

The SEC's activities should not clearly follow a constructed administrative logic of governance, as the purpose of the SEC is to address the problems of the venture economy (Richardson and etc., 2021; Santoso and etc., 2022), to bring together and ensure the interaction of potential stakeholders of innovative projects.

In view of the above, the principal objectives of the SEC should be considered to be:

- search for the most significant sectoral and regional problems and increase the role of knowledge in their solution;
- structuring the problems of the world economy into a familiar form for scientists;
- knowledge engineering;
- creation of knowledge bases and ranking of knowledge by enterprise and industry problems, management levels and economic effect;
- development of universal rather than highly specialized competencies, as even federal state educational standards do not always offer ready-made competencies capable of "covering" all the problem areas of industrial partners;
- integration of knowledge and competence bases in the SEC's areas of activity;
- assembling and developing competencies;
- motivation and cognitive development of SEC participants, training of project managers and project teams to implement breakthrough technologies.

In 2021, Bratsk State University (BrSU) as a participant of the world-class interregional SEC "Baikal" of the Irkutsk region and the Republic of Buryatia in the following areas of activity started to realize the above tasks:

- integrated wood processing;
- recycling of industrial waste;
- AgroBioPharmTechnologies.

In 2022, BrSU opened the Competence Development Center (CDC), designed to provide analysis of the state and assistance in meeting the future staffing needs of SEC participants and potential external customers of scientific and (or) scientific-technical products, taking into account both current and anticipatory directions of development of socio-economic policy of regions (macroregions).

The scope of CDC activity is participation in the implementation of educational and scientific-technical programs of SEC with the use of network and project forms of training, image building, increasing the intellectual potential of SEC, as well as other educational organizations of higher education, enterprises of the real sector of the economy, state and local authorities.

CDC's main goals are:

- increasing professional and managerial competence of managers of scientific-innovative, scientific-technical projects and laboratories (centers) and the sphere of technological entrepreneurship;

- assisting and advising SEC participants in providing a systematic approach to training motivated leaders and teams to implement complex projects and respond to big challenges;

- generation and ensuring the transfer of new approaches and technologies of training of managerial personnel engaged in research and development.

In 2023, BrSU scientific and pedagogical staff at the CDC implemented additional professional advanced training programs "Integrated wood processing" and "Integrated wood waste processing" and graduated students capable of solving actual problems of the forest industry in Russian regions in the following areas:

- waste and low-quality wood as additional raw materials;

- process wood chips, production of wood chips, requirements for process wood chips;

- additional technological processes of waste utilization, procurement and production of raw materials for the chemical industry;

- ways to quantify additional woody raw material at the harvesting site;

- types of woodworking waste, classification, qualitative and quantitative composition;

- wood-based panel and fiberboard materials;

- wood composite materials and wood polymer-composite materials based on the use of wood processing waste;

- energy utilization of woody biomass.

Currently, thanks to the support of the Fund for Strategic and Innovative Development of the Irkutsk region, which is the project office of the world-class interregional SEC "Baikal", the material and technical equipment of the CDC and the development of new programs for the development of competencies of employees of industrial partners continue.

# 5 CONCLUSIONS

It is impossible to give an answer to two eternal questions - "who is to blame?" and "what to do?". However, it is no longer important who is to blame. When the ways to resolve the global crisis have been exhausted, only the second question remains relevant - "what to do?".

Russian enterprises in the vast majority of cases cannot rank the existing problems and competently allocate resources for their elimination. Business solves private, not global, problems. Such tactics allow survival, but at the same time deprive them of the opportunity to develop.

Enterprises lack specialists who know how to set tasks correctly. When developing a market strategy, managers appeal to problems rather than to knowledge and competencies.

The way out of this situation may be the maximum use of the results of scientific research to increase productivity, develop the quality of products and services in order to gain a competitive advantage.

The paper considers the background to the creation and prospects for the development of SEC, designed to "plug the hole" between science and business and build a chain, during the passage of which knowledge increases its maturity.

The scientific novelty of the research is the formulated true objectives of SEC functioning in order to ensure macroregional innovation development, and these objectives are taken not on a formal basis from the statutory documents, but "repackaged" based on the state of modern economy.

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