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INNOVATION SYSTEM FAILURES IN RUSSIAN RESOURCE-ABUNDANT REGIONS

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Abstract

Since the “resource curse” phenomena was first mentioned in literature, it has received a significant empirical confirmation both on national and regional scales. However there are several exceptions of the economies that obtained advantages from resource wealth. Among the reasons of inability to turn a resource curse to blessing scholars identified weak institutes, the neglect of education, and poor manufacturing crowded out by high-yielding extracting sector. These effects generate a system of innovation failure that is slowing down economic growth. This paper aims to obtain further empirical evidence of the resource curse hypothesis from Russian regions. Secondly, we examine innovative system failures that slow down the pace of economic development. Our econometric calculations provided another proof of resource curse. We discovered a negative relationship between economic growth and resource wealth of Russian regions. Then we analyzed the case of Krasnoyarsk Krai, a Russian resource-abundant region. We used the survey response by executive directors of small and medium enterprises to identify innovative system failures. The most significant systemic failures in resource-rich region were corruption, hindered interactions between actors and institutions, a high level of taxation and natural monopolies’ prices. Our study contributes to adjusting policy development to the specific conditions of resource-dependent counties.

Keywords: Innovative system, regional development, resource curse, system failures.

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1. Introduction

A curious effect of a negative relationship between economic growth and natural resource endowment has been empirically evidenced on a national level (Auty, 1993, Sachs & Warner, 2001). However, the existence of resource-rich countries that avoided a "natural resources curse" leaves some place for further discussions (Gylfason, 2007). Regional aspects of the resource curse are also ambiguous. Some scholars describe a positive local impact of the extractive industries on employment and incomes (Fleming, Measham, & Paredes, 2015). Other researchers indicate a slowdown in economic growth in the regions with a dominant commodity sector (Papyrakis & Gerlah, 2007; James & Aadland, 2011). That is why extra empirical evidence of the resource curse is needed, especially on a local level, since regional scales provide some advantages. First, one can compare resource-rich and resource-poor counties within the same institutional conditions. Also, the influence of the extracting industries becomes more visible on micro- and regional scales. So, the first aim of our study is to examine the resource curse hypothesis using the data from the regions of Russian Federation, a major resource-rich country.

Another research question is how to overcome the resource curse. The negative influence of natural resource endowment on the economic growth includes several perspectives: (i) manufacturing industry is crowded out with high-yield extracting sectors that tend to impede learning by doing (Gylfason, 2007; Van der Ploeg, 2011); (ii) prevailing natural capital suppresses human capital (Gylfason, 2007); (iii) the weakness of political and market institutes leads to corruption and inefficiency of natural rent distribution (Mehlum, Moene, & Torvik, 2006; Van der Ploeg, 2011). These three perspectives constitute the elements on an innovative system which is a core driver of long-term economic growth. The second aim of our study is to analyze innovative system failures in resource-rich regions and provide the foundation for growth-intensive policy design.

The theory of innovation system is a helpful framework for regional strategy development (Magro & Wilson, 2013). National, regional, sectoral innovation systems are considered as a set of actors, networks and institutions that interact to achieve the technological development of the economy (Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008). According to this approach, innovation is an interactive, non-linear process in which actors (firms), interact with a conglomeration of other organizations (universities, customers, government bodies, financiers) and institutions, including regulations and culture (Edquist, 1997). The success of innovation is determined by the interaction and feedback (Klein Woolthuis, Lankhuizen, & Gilsing, 2005). The innovation systems theory is based on the Triple helix model defined "as a set of: (i) components (the institutional spheres of university, industry and government, with a wide array of actors); (ii) relationships between components (collaboration and conflict moderation, collaborative leadership, substitution and networking); and (iii) functions described as processes taking place in the "Knowledge, Innovation and Consensus Spaces" (Ranga & Etzkowitz, 2013). This model is systemic and explains the role of institutions and actors' networks in the creation and dissemination of knowledge and technology. It forms a conceptual framework for studying the dynamics of post-industrial society, preparing innovation development strategies and policies.

Innovation system analysis gives insights for considering the problems of low innovative performance (Bergek et al., 2008). There are three conceptual assumptions explaining the development of innovation systems: (i) interactions, cooperation and interactive learning play a central role in the

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effectiveness of innovation; (ii) institutions are crucial to economic behavior and performance (Smith, 2000); (iii) the trajectory of innovation system development depends on social evolutionary processes (Klein Woolthuis et al., 2005). Thus, problems of the innovation systems development are caused not only by the market failures, but also by the systemic failures, i.e. failures within the innovation system (Bledaa & del Río, 2013). However, a unified approach to the classification of systemic failures including main barriers, obstacles and defects has not yet been formed in the literature (Carlsson & Jacobsson, 1997).

We classified the innovation system failures by the spheres of their occurrence into infrastructural, institutional, networks, and capabilities failures (Klein Woolthuis et al., 2005). These failures were identified and described at different times by different authors (table 01).

Table 01. Systemic failure typology

Failure group	The causes of failures
Infrastructural failures (Smith, 2000; Edquist, 1997)	Physical infrastructures needed for innovative activities and technology transfer are missing. They include: (i) *communications and energy* (high-speed ICT infrastructure, broadband, telephone, energy supply, etc.); (ii) *science-technology infrastructure* (availability of scientific and applied knowledge and skills, testing facilities, possibilities for knowledge transfer, patents, training, education, etc.)
Institutional failures (Smith, 2000; Johnson & Gregersen, 1995)	Imperfect institutions. They include: (i) *hard institutional failures* related to formal institutions (problems in the framework of regulation and legal system); (ii) *soft institutional failures* related to informal institutions (problems with political and business culture and social norms)
Networks failures (Carlsson & Jacobsson, 1997)	Imperfect interactions between the components of the "Triple helix". Includes: (i) *strong network failures* (actors` groups too closed to each other may miss outside development); (ii) *weak network failures* (lack of cooperation between actors resulting in insufficient use of interactive learning and synergies, low social capital and lack of generalized trust)
Capabilities failures (Smith, 2000; Edquist, 1997)	Lack of competences, intentions, capabilities, resources that allow firms to be able to make the leap from an old to a new technology or paradigm. They include: (i) *transition failures* (firms are unable to adapt to new technologies); (ii) *lock-in / path dependency failures* (the complete system is unable to adopt new technological paradigms); (iii) *capabilities failures per se* (inability for small firms to acquire rapidly and effectively new technologies)

However, there is a significant literature gap in empirical identification of innovation system failures in resource-abundant regions. We intend to fill in this gap in the main part of the paper, using a survey related to Krasnoyarsk Krai. First, we examine the resource curse hypothesis of the regional data of economic growth.

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2. Problem Statement

We tested the resource curse hypothesis using the statistical data from 80 Russian regions. Comparing the growth of GRP per capita from 2005 to 2017 and the share of the extracting sector in GRP, we found the inverse relationship of economic growth and resource availability (Figure 01).

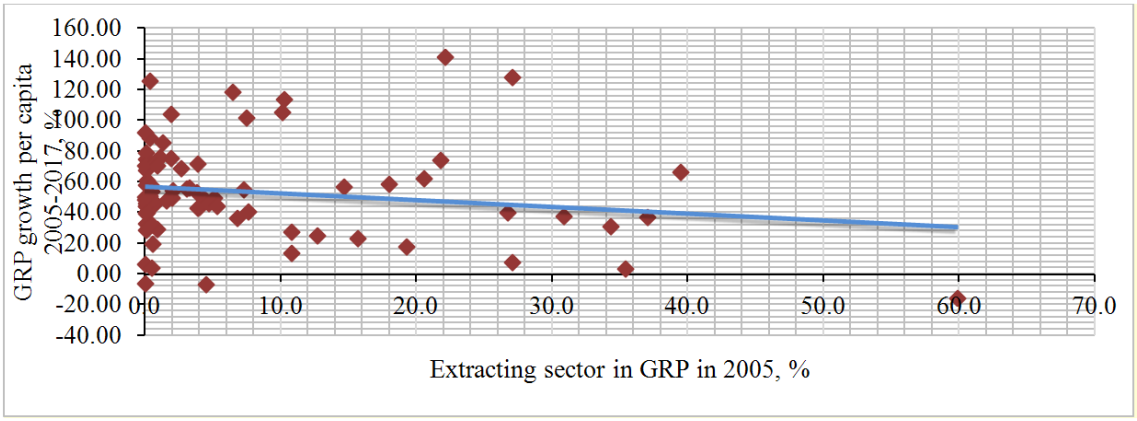

Figure 01. Growth and resource abundance of Russian regions

The negative slope of the trend line increases if we exclude the regions with a low share of the commodity sector in GRP. Figure 02 presents resource-rich Russian regions only. They are the regions where the share of extracting industries in GRP exceeded the national average level in 2005. The resource curse effect for such regions becomes more visible.

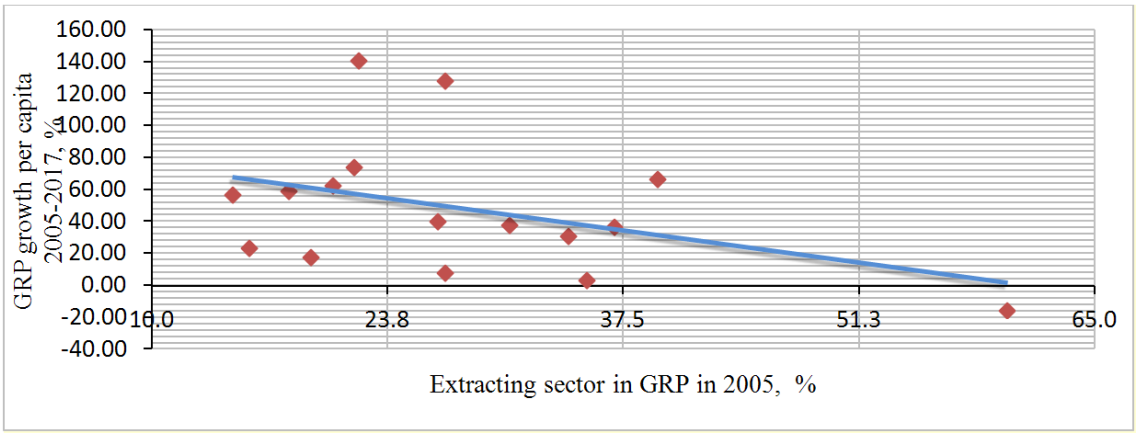

Figure 02. Growth in resource-abundant Russian regions

However, it is not the existence of natural resources as such that seems to slow the pace of economic growth, but rather the weak governmental policy to reinforce innovative system as the main source of sustainable development. Possible perspectives of the policy to avert the negative effects of natural resource riches are described in literature (Auty, 1993; Gylfason, 2007). These are mostly macroeconomic activities that could be conducted on national level. Innovative system development requires a more specific regional policy based on the proper analysis of the system failures on micro- and local scales.

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3. Research Questions

The study raises two research questions. Can the resource cursed regions have an effective innovation system? What are the specific barriers to innovative performance in resource-rich regions?

4. Purpose of the Study

This study contributes to adjusting the regional policy design to avoid the natural resource curse. Our aim is to analyze the innovative system failures of the resource-rich Russian region to find specific perspectives of growth-intensification policy for resource-abundant counties.

5. Research Methods

5.1. The empirical data was collected by the method of the survey (phone interviews) of 142 firms-respondents of Krasnoyarsk Krai, which is a typical Russian resource-rich region. The survey was conducted in 2017-2018, the questionnaire included, among other things, the questions for identification of interviewees preference in technology transfer channels. 41% of our respondents were in the field of construction, 19% – in trade, 15% – in energy power industry, 19 % in manufacturing (chemical industry, metallurgy, production of construction materials, machinery engineering, food processing, wood processing). Over 90% of interviewees belonged to the sector of small and medium enterprises. Most questions were formulated to find out the respondens' attitude and were estimated on the Likert scale (where answer "1" means "strongly disagree", answer "7" means "strongly agree"). To measure a grade of respondents` attitude to the importance of a systemic failure we made the reverse coding of scale, where "1" means the weakest barrier, "7" is the strongest.

5.2. The character of variables determined the limitations on their processing: variables estimated in Likert scale are non-metric, they have a different gap (distance) between a neighboring value from the point of view of different respondents. Thus, we cannot applicate the algebraic operations, such as addition or averaging, to these data. Therefore, we obtained normalized components` estimates for the groups of failures. For this purpose, the response data of each interviewees was summarized according to the block of questions that identify the component of failure, and then, using the one-parameter Rasch model, they were converted into comparable metric values – logits. This made it possible to compare separate groups of failures with each other, despite the differences in the number of questions and, in some cases, the scales of their ranking.

6. Findings

6.1. We evaluated **the infrastructural failures** identifying a single block of barriers, those in the sphere of education. The reason was a time limit for phone interview. Figure 03 shows the variation in the respondents' assessments of the significance and severity of infrastructural failures.

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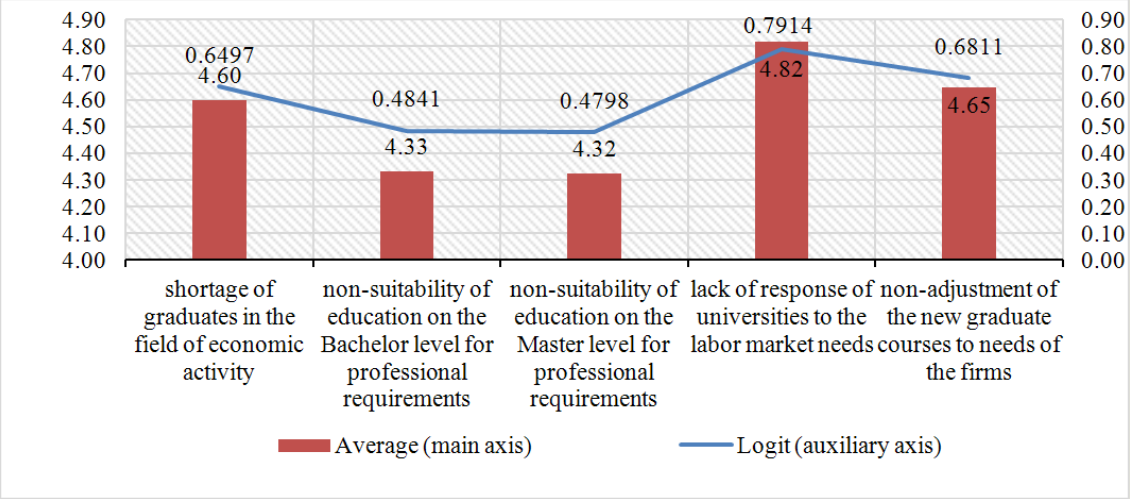

Figure 03. Assessment of infrastructural failures

Considering the sample size and the extreme values on the survey scale, in our case the logit value of +0.29 corresponds to the neutral ratio of all respondents to the barrier. When the logit value is -1.8, all respondents rate the barrier as insignificant, when it rises to + 6.9 the barrier is considered the most significant and insurmountable. We also compare the results with the average respondents' assessment of the significance of the failure. In this case, we assume that their subjective assessments of significance coincide.

Our findings demonstrate that these failures are primary and they cause, among other groups of systemic failures, the most pronounced negative reaction of representatives of the business community. It can be assumed, they produce the weakness of network interactions between the two main groups of the "Triple helix" actors, that is firms and universities. That process leads to the stoppage of channels of knowledge and technology transfer and blocks the dissemination of innovation. It should be noted that firms are experiencing a significant shortage of qualified personnel and assume that universities are extremely weak in their reaction to the modern economy needs in terms of educating as well as in terms of the preparing graduate programs.

At the same time, interviewees are quite satisfied by the quality of education.

6.2. The institutional failures estimation was based on the respondents` assessment of the severity of certain institutional barriers to the development of entrepreneurial and innovative activity. Among hard institutional failures (Figure 04), the tax burden is considered by firms as the most significant one because it leads to severe financial constraints. A remarkable fact is that a relatively minor role is played by the sanctions regime associated with the restrictions on imports and exports: this barrier is significant for large enterprises engaged in international economic activity.

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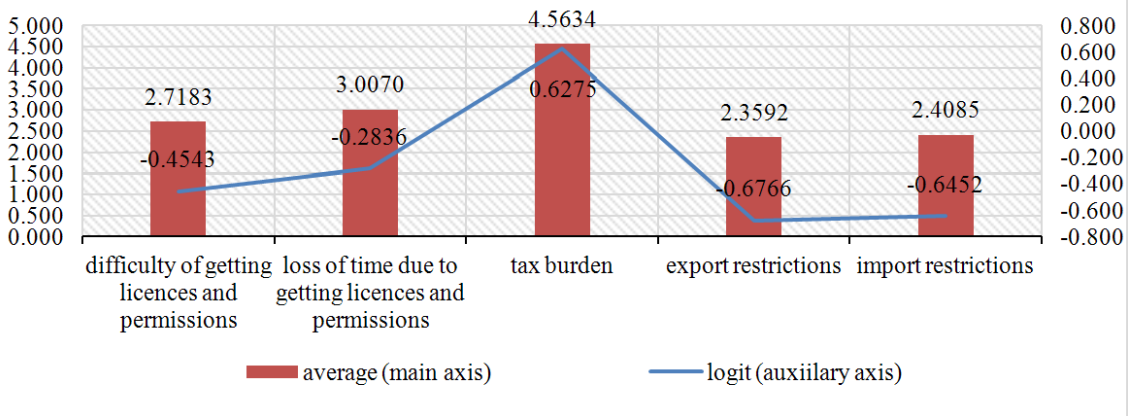

Figure 04. Assessment of hard institutional failures

We found that *soft institutional defects* (Figure 05) were generally more significant for the business community than the hard ones. This shows that entrepreneurs see the root of the problem not in the poor design of the law system or the absence of legislative norms, but in neglecting them, in forming an unwritten system of shadow regulation under the pressure of prevailing social values and norms. The most significant among these failures are high tariffs of natural monopolies because it directly affects the financial situation in business, withdraws a significant portion of entrepreneurial income and deprives a company of funds to finance breakthrough projects. In addition, entrepreneurs assess corruption and "closed" decision-making process of government bodies as significant failures: they distort market signals and interfere with the normal functioning of markets. The barriers associated with insufficient credentials of government officials and poor quality of work of politicians from the security or military services (well known as "silovik" bodies) belong to the same field of restrictions.

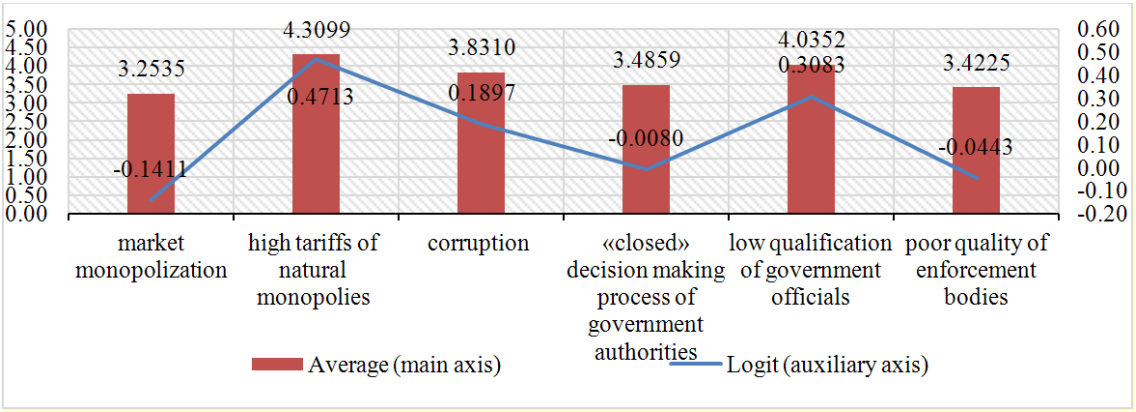

Figure 05. Assessment of soft institutional failures

6.3. We evaluated **the networks failures** using a share of firms that chose strategies of cooperation with other actors of the "Triple helix". At the same time, we considered the interaction between components (universities, firms and government bodies) and also within the entrepreneurial community proper (Figure 06). We selected innovation-active firms among all interviewees and evaluated the share with a strategy of collaboration with other companies in the innovation process. It is remarkable, that more than 70% of innovation-active firms

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implemented the innovation process autonomously: they did not cooperate with other companies, did not form networks and did not disseminate innovations. A peculiarity of networks failures of business community of resource abundant regions is a significant share of firms (34%) interacting only with their suppliers in the innovation process. This indicates the orientation of firms to the purchase of ready-made knowledge and technologies, neglecting their development. This hypothesis is also supported by the fact that less than 13% of companies interact with universities as the generators of knowledge and technology, and none of the surveyed firms work with research institutions. It shows an insurmountable gap between the business sector and the sector oriented towards basic research and demonstrates a lack of the R & D results commercialization. A significant result of our study is that the innovation process in the resource abundant regions is isolated as 30% of the interactions take place within one group of companies. Only 20% of firms are involved in the dissemination of innovation, selling them to customers. The cross-sectoral interactions of firms and their links to the innovation infrastructure are even weaker: only 17% of the companies collaborated with business incubators, 13% asked the government bodies to finance innovation. Only 4% of respondents have some experience of cooperation with university start-ups and spin-offs.

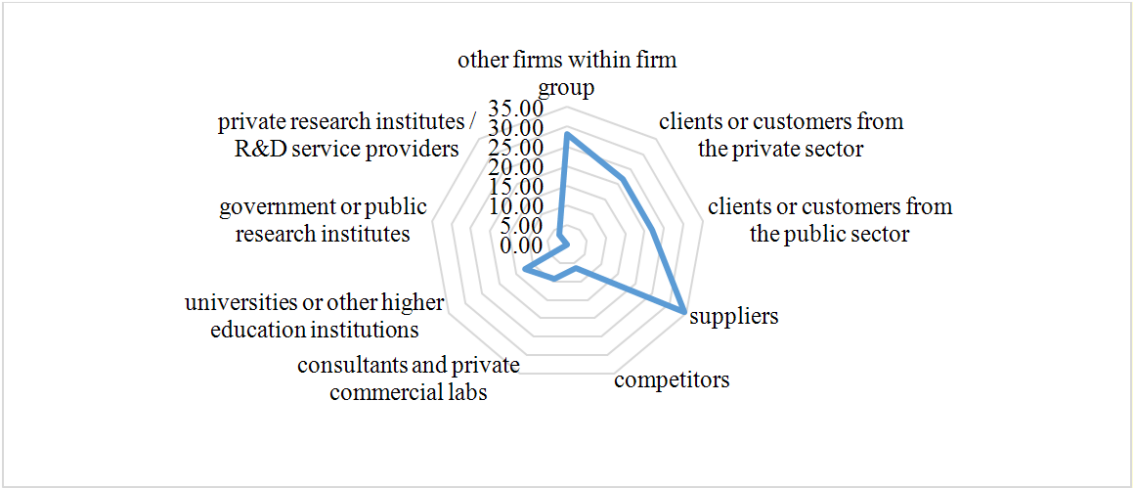

Figure 06. Share of innovation-active firms choosing a strategy of cooperation with other firms in the innovation process, percent

6.4. We studied the capabilities failures (Figure 07) analyzing the potential enterprise activity in the creation of new products, knowledge and technologies. Here, the main barrier is the unwillingness of companies to share technologies with any potential partners. This leads to a low ability to use the available knowledge and technology in creating new knowledge and new products. The weakest barrier in this group is awareness of the external environment, market and industry. As a rule, firms monitor significant changes and adjust their strategies in accordance with them.

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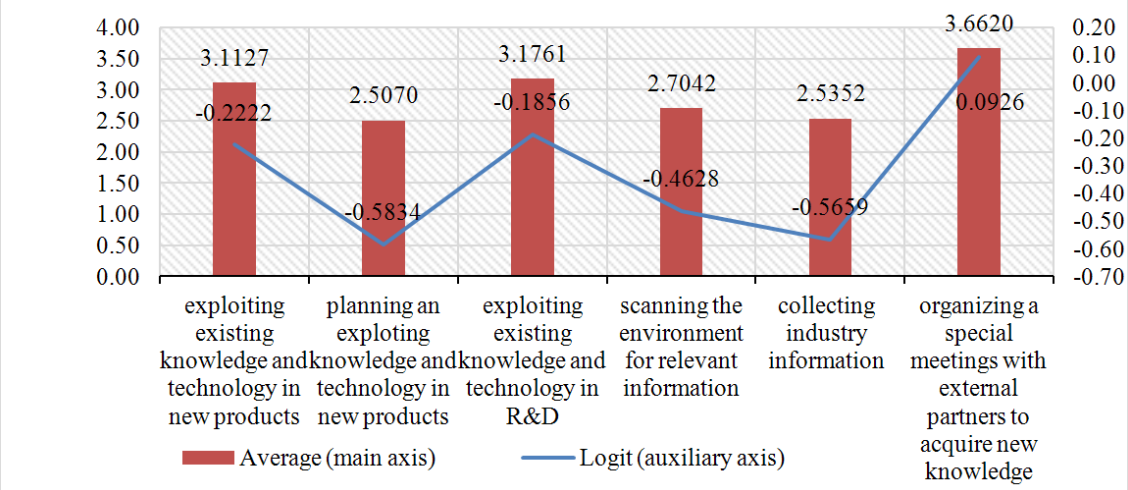

Figure 07. Assessment of capabilities failure

7. Conclusion

This paper confirms the resource curse hypothesis at a regional scale. Russian resource-abundant regions have recently demonstrated that they grow slower than the regions without substantial natural resources. Literature demonstrates that natural resource wealth as such is not a barrier for sustainable economic growth (Gylfason, 2007; Mehlum et al., 2006). The weakness of governmental policy to avoid the negative effects of extracting sector dominance leads to the failures in innovative system, the main driver of economic growth. Our analysis of the innovation system failures for Krasnoyarsk kray, a Russian resource-rich region, showed several significant barriers to innovative activity.

The first barrier to high innovative performance in resource-abundant regions is the problems of higher education. Universities develop their curriculums without taking into account the requirements of local businesses. This leads to a lack of the necessary employees and additional expenditures of companies for personnel training. Another significant barrier is high taxation level and natural monopoly prices that expropriate substantial amounts of entrepreneurial profit. Corruption and a non-transparent fiscal system increase the pressure on non-extractive companies, especially small and medium-size ones.

A failure in the functioning of the Triple Helix in resource-rich regions leads to the lack of interactions between actors of innovative process is a result of technology adoption from abroad. Such a policy allows companies to reduce R&D expenditures but creates a barrier to further development of breakthrough technologies. Weak technology transfers demonstrated by the companies are typical for the competition style in Russian regions and decreases the innovative performance of businesses. Stronger intellectual property protection that requires a legislative reform can solve this problem.

Coping with innovative system failures in resource-abundant regions is possible after implementing a well-designed policy based on the proper analysis of the regional features. The policy may include simplification of license procedures, tax reporting and accounting. Secondly, policy makers should pay attention to investment activity support especially in non-extracting sector, and, finally, should create incentives for the interaction of universities and business in employee training and technology development.

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References

Auty, R. M. (1993). *Sustaining Development in Mineral Economies: The Resource Curse Thesis*. London: Routledge.

Bergek, A, Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. *Research Policy, 37,* 407–429. https://dx.doi.org/10.1016/j.respol.2007.12.003.

Bledaa, M., & del Río, P. (2013). The market failure and the systemic failure rationales in technological innovation systems. *Research Policy, 42,* 1039–1052. https://doi.org/10.1016/j.respol.2013.02.008.

Carlsson, B., & Jacobsson, S. (1997). In Search of Useful Public Policies - Key Lessons and Issues for Policy Makers. In B. Carlsson (ed.), *Technological Systems and Industrial Dynamics* (pp. 299-315). Boston: Kluwer Press. https://dx.doi.org/10.1007/978-1-4615-6133-0_11

Edquist, C. (1997). *Systems of Innovation Technologies, Institutions and Organizations*. London and Washington: W.W. Norton

Fleming, D. A., Measham, T. G., & Paredes, D. (2015). Understanding the resource curse (or blessing) across national and regional scales: Theory, empirical challenges and an application. Australian *Journal of Agricultural and Resource Economics, 59* (4), 624-639. https://doi.org/10.1111/1467-8489.12118

Gylfason, T. (2007). The international economics of natural resources and growth. *Minerals and Energy, 22 (1-2),* 7-17. https://doi.org/10.1080/14041040701445882

James, A., & Aadland, D. (2011). The curse of natural resources: An empirical investigation of US counties. Resource and Energy Economics, 33 (2), 440-453. https://doi.org/10.1016/j.reseneeco.2010.05.006

Johnson, B., & Gregersen, B. (1995). System of innovation and economic integration. *Journal of Industry Studies, 2,* 1–18. https://doi.org/10.1080/13662719508538552

Klein Woolthuis, R. J. A., Lankhuizen, M., & Gilsing, V. (2005). A system failure framework for innovation policy design. *Technovation, 25(6),* 609-619. https://dx.doi.org/10.1016/j.technovation.2003.11.002.

Magro, E., & Wilson, J.R. (2013). Complex Innovation Policy Systems: Towards an Evaluation Mix. *Research Policy, 42,* 1647-1656. https://dx.doi.org/10.1016/j.respol.2013.06.005

Mehlum, H., Moene, K., & Torvik, R. (2006). Institutions and the resource curse. T*he economic journal, 116 (508),* 1-20. https://doi.org/10.1111/j.1468-0297.2006.01045.x

Papyrakis, E., & Gerlagh, R. (2007). Resource abundance and economic growth in the United States. *European Economic Review, 51* (4), 1011-1039. https://doi.org/10.1016/j.euroecorev.2006.04.001

Ranga, M., & Etzkowitz, H. (2013). Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society. *Industry and Higher Education, 27,* 237-262. http://dx.doi.org/10.5367/ihe.2013.0165

Sachs, J. D., & Warner, A. M. (2001). *The curse of natural resources. European economic review, 45* (4-6), 827-838. https://doi.org/10.1016/S0014-2921(01)00125-8

Smith, K. (2000). Innovation as a Systemic Phenomenon: Rethinking the Role of Policy. *Enterprise & Innovation Management Studies, 1 (1),* 73-102. https://dx.doi.org/10.1080/146324400363536.

Van der Ploeg, F. (2011). Natural resources: curse or blessing? *Journal of Economic Literature, 49* (2), 366-420. https://dx.doi.org/10.1257/jel.49.2.366