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EVALUATION OF THE HIGHER EDUCATION IMPACT ON THE ECONOMIC GROWTH OF RUSSIAN REGIONS: AN INSTITUTIONAL APPROACH

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Abstract

Management of regional economic systems is a key factor in the national economic growth in general. Some researchers noted a close relationship of higher education and regional economy, but a unified methodological approach to assessment of the impact of education on regional economic growth has not been produced. The issues are associated not only with the ambiguous wording of the term "region" as a territorial or spatial unit, but also with the complexity of the formalized description of the education system through objective indicators of its development. The paper proposes a model based on the institutional approach to assessment of the impact of regional educational systems on the economic growth of territories. Results of research empower estimation of effectiveness of the regional Russian universities and identification of the gaps between the regional educational systems and the needs of regional economies. Key findings can be used in further theoretical and applied research, and in regional policy both in Russia and in other transition economies.

Keywords: knowledge generation, regional educational system, economic growth, institutional approach, human capital development, knowledge transfer, workforce production.

1 INTRODUCTION

Higher education contributes to the economy of the region in different ways: providing employment, increasing consumer expenditures and revenue from outside the region at the expense of students and visitors of the University [1] - [5]. However, the most important role of the university as a subject of regional economic system is the generation of knowledge, which is the most important resource in the knowledge economy [6], [7]. A popular model of university contribution was proposed by H. Etzkowitz [8] - [10]; this model known as the "triple helix" is a partnership university - business -government. Then, new components were added to the model: civil society and public institutions [11], natural environment and ecological institutions [12]. S. Hill has developed a model of university engagement to the regional socio-economic system [13], based on several dimensions:

- *Education*: lifelong learning, skills development, Continuing Professional Development (CPD).
- *Research*: fundamental, applied, community.
- *Knowledge exchange*: commercial and social enterprises, knowledge sharing, business links.
- *Public relations*: media, special workshops, public lectures, research presentations.
- *Community-based research*: volunteering students and staff, action research, cultural and social partnerships.
- *Flexible learning*: foundation degrees, part-time education, cooperative programs.

However, a unified methodological approach to the analysis of the impact of regional higher education systems on the economic growth has not been developed yet. The diversity of terminology and the indicators analysed makes it difficult to study taking research away from the key problem - identification of the institutional mechanism of the higher education impact on regional socio-economic systems. The aim of our work is development of a unified theoretical and methodological platform grounding on the institutional approach to the analysis of economic phenomena with subsequent analysis of the key institutions. The results are important for the future theoretical and applied research, as well as for decision-making in the field of regional economic and educational policies.

2 THEORETICAL BACKGROUND

2.1 Generation of knowledge, intellectual capital, and intangible assets

In the context of the post-industrial economy, processes of knowledge generation, the formation of intellectual capital, and implementation of intelligent manufacturing are particularly important. The concept of knowledge generation is rooted in the works by Schumpeter [14], who methodologically separated invention from innovation. The cycle of scientific and technological activities includes three stages: invention (creation of new knowledge) - innovation (implementation of new knowledge) - imitation (copying of innovations by other market players). Basic research precedes applied studies affecting economic growth with a large time lag. The aim of oriented basic research is the creation of the broad scientific basis for specific research and technological areas [15]. Therefore, it seems doubtful to offer integration of science and innovation policies; in our opinion, any innovation is based on scientific inventions [16], the science is primary in relation to the development of innovative strategies. The role of basic research in modernization of the country was emphasized, in particular, by S.Y. Glazyev [17].

Researchers distinguish analytical knowledge (scientific base) and synthetic knowledge (engineering base) [18]. Analytical knowledge often takes explicit or codified form (articles, reports, patents); synthetic knowledge exist implicitly, it results in new products and processes [19]. Codified knowledge is produced in a standardized compact form [20] and can be delivered over long distances [21]; tacit knowledge is sensitive to localization - it is usually transmitted in person. This classification of knowledge traces back to the works by M. Polanyi, who wrote of the impossibility to separate the produced knowledge from the personality of researcher [22]. In this case, two kinds of knowledge (explicit and tacit) dynamically interact with each other, that is the basis of the spiralling process of expansion of existing knowledge. Nonaka and Takeuchi in the mid-90s created a model of relationship between explicit and tacit knowledge in the process of knowledge generation in the workplace known as SECI [23]. SECI acronym denotes four-phase cycle of knowledge creation:

- *Socialization*: tacit knowledge spread between people through mentoring institutions, interviews, corporate culture, experience sharing, etc. Key skills: empathizing.
- *Externalization*: people begin to develop metaphors and analogies to explain the rational sense of implicitly informed behaviour. Tacit knowledge becomes more explicit in the process of concept development. In other words, this process can be described as a codification of tacit knowledge. Key skills: articulating.
- *Combination*: explicit ideas are combined with other ideas in search for dependencies and elimination of redundancies, the culmination of the process is providing a full description of the processes and procedures to perform the tasks. Key skills: connecting.
- *Internalization*: explicit ideas are expanded in the course of consumption by human beings. The knowledge is again in the area of socialization, the helix of knowledge cultivation enters the next level. Key skills: embodying.

The model was developed for the analysis of knowledge generation at the micro level; however, in our opinion, it can be successfully used in the theoretical constructions of meso and macrolevels. Dividing knowledge into explicit and tacit forms has been used in a number of studies on the so-called "learning" economy [20], [21], [24]. Learning economy is an economic system in which the ability to learn is crucial for the success of individuals, businesses, regional and national economies. Learning is understood not simply as access to information, but as the acquisition of specific knowledge and skills as well [24]. Learning as a process is present both in high-tech and traditional industries. The development of competences in low-tech industries can be more important for economic growth than in a small number of high-tech enterprises [25]. The learning economy is one of the branches of the concept of knowledge-based economy; however, in economics and economic policy, the term "knowledge economy" is more rooted [26].

The knowledge economy is an economic system, where the knowledge is the key factor (or resource) of production and economic growth [27]. The term "knowledge economy" was introduced in 1962 by Fritz Machlup. He used it in his work "The production and distribution of knowledge in the United States" in relation to one of the economic sectors [28]. According to Machlup's classification, the

knowledge is divided into practical, intelligent, pastime[1], spiritual and unwanted. From the economic point of view, scientific knowledge possesses the best value. Knowledge economy immediately found wide application in the corporate sector. P. Drucker marked the exceptional role of knowledge in the creation of added value [29]. Towards the end of the 20th century, knowledge was seen as a key factor of economic growth. P. Romer proposed a theoretical model of economic growth, in which the key exogenous factor is the level of technology and investment in R & D [30]. L. Thurow in his work "Building Wealth" provides a set of practical recommendations for achieving a high level of social welfare through the knowledge economy [31].

Traditionally, researchers allocate three stages of knowledge generation: production, distribution, and consumption [32], [33]. We proposed to extend the model by knowledge distribution; thus, knowledge generation cycle consists of four steps: (1) production; (2) exchange; (3) distribution; (4) consumption [27]. It is important to draw a line between the exchange and distribution. In case of exchange, we have business relationships between two or more economic agents. Distribution means the free circulation and use of new knowledge by an unlimited range of economic agents. Distribution of knowledge can create externalities that promote regional economic development. Knowledge-spillovers in this case is the exogenous factor towards a particular company or industry [34] - [36].

The potential for economic development of the regional economy is determined not only and not so much by the dynamics of growth in the real sector of the economy as by indicators of intangible assets, i.e. human capital development and innovative infrastructure at the regional level. The concept of intellectual capital used to be an exclusively corporate strategy. A. Brooking defined intellectual capital as a complex of intangible assets that empower creation of sustainable competitive advantages [37]. With regard to the meso and macro levels, we found that the key factor of economic growth is knowledge, so our definition of the intellectual capital of the region (country) will be as follows:

Intellectual capital of the region (city, country) is a combination of assets, factors and conditions that determine production (codification), exchange, distribution, and consumption of knowledge in the process of social production in this territory[2].

Nonaka and Takeuchi classified knowledge as an asset in view of SECI model into four groups [23]:

- *Routine Knowledge Assets*: tacit knowledge of procedures, routinized, and embedded in the corporate culture, action, and everyday practice.
- *Systemic Knowledge Assets*: explicit, codified, and systematic knowledge stored in documents, databases, manuals, specifications, and patents.
- *Conceptual Knowledge Assets*: explicit knowledge in symbolic form, including product concepts, brand capital, design, styles, symbols, and language.
- *Experiential Knowledge Assets*: tacit knowledge, arising in the collective experience including skills and judgments of people, prosocial feelings, such as trust and care, as well as motivational resources that drive engagement, passion, and tension.

Scientific knowledge falls into 2nd and 3rd groups.

2.2 The model of institutional configuration

We used the model of institutional configuration to combine these concepts; we understand it as a "model of interaction of institutions and their stakeholders in a particular economic space" [38]. This concept considers the institutionalization in the interaction unity of subjects, i.e., categorical and attitudinal social groups, and factors - institutions. This approach helps to overcome the gap of the traditional institutionalism artificially created in the subject-object relationship. Institutions are understood by us in the definition by D. North, i.e. as a set of formal rules, informal constraints and enforcement mechanism [39]. From a functional point of view, any institution has its inputs, outputs, and the control parameter; in other words, we can represent the institution as a simple relationship y = f (x). In turn, institutions can be classified into 4 types by type of the subject-object interaction [38]: normative - rules, regulations, customs, standards, conventions, contracts, etc. [39]; functional - status functions and routines [40], [41]; structural - organizational forms and transaction models [42]; mental - collective notions, beliefs, stereotypes, values, cognitive structures, etc. [43]. Institutions are

[1] Pastime knowledge is the knowledge satisfying non-intellectual curiosity or the desire for light entertainment and emotional stimulation.

[2] We treat territory as a unit of both geographical and economic space here.

exogenous to the subject, but endogenous to the system in general. Thus, the institutional configuration is space-specific, in other words, specific to particular countries and regions.

3 METHODOLOGY

We chose the universities participating in the Russian Academic Excellence Project 5-100 as the basis of research. The project involves 21 Russian universities located in the Russian Federation from Kaliningrad to Vladivostok. We excluded from the analysis the universities in the metropolitan area (the federal cities of Moscow and St. Petersburg), as the capitals have special administrative functions and use additional benefits by exploiting the resources of practically the entire country. Thus, we analysed 12 universities in 11 regions (table 1).

Table 1. *Regional universities analysed.*

Region	University
Primorsky region	Far Eastern Federal University
Krasnoyarsk region	Siberian Federal University
Tomsk region	National Research Tomsk Polytechnic University
Tomsk region	National Research Tomsk State University
Novosibirsk region	Novosibirsk National Research State University
Tyumen region	Tyumen State University
Sverdlovsk region	Ural Federal University
Chelyabinsk region	South Ural State University (National Research University)
Samara region	Samara National Research University
Republic of Tatarstan	Kazan Federal University
Nizhny Novgorod region	Nizhny Novgorod National Research State University
Kaliningrad region	Baltic Federal University

Five higher education institutions (HEI) from the list are federal universities, six - national research university. These types of higher education institutions are defined legally [44]. Federal University is a higher education institution that implements innovative programs of higher and postgraduate education, integrated into the global community, conducting fundamental and applied research in a wide range of sciences and arts, integrates science bringing the result of his intellectual activities to practical usage. The status of "national research" can be claimed by a university that is equally effective in educational activities and research, conducts fundamental and applied research in a wide range of sciences and arts as well as a federal university. "National research" status is assigned for up to 10 years, "federal" - indefinitely. The rest of the differences between these two types of universities are not obvious.

Based on the study of relevant literature and interviews with experts, we have chosen the institution of vocational training and the institution of knowledge transfer as an object of the analysis. Both institutions refer to the processes of internalization of knowledge. Vocational training institution was assessed using a measure of demand for graduates grounding on the ranking by the rating agency Expert. The ranking is an integrated system of indicators in the areas of "co-operation with employers" and "quality of graduates' career". The indicators are calculated on the basis of the survey of universities, employers, and graduates. Ranking consists of 100 universities, we compared it with the ranking of Russian regions in terms of socio-economic development (85 regions). Regions are ranked on the basis of integrated assessment: performance of the economy, economic efficiency indicators, indicators of public and social sphere. If the position of the university in the first ranking is much lower than in the second one, it can be regarded as a dysfunction.

Institution of knowledge transfer was assessed using indicators of income from research and development activities (R & D), the registration of intellectual property objects, issue of licenses for their use, as well as collaborative publications of academia and business (table 2). R & D indicators

empowered estimation of the university's ability to attract funding for its studies; patent activity indicators reveal competences in the field of intellectual property creation, whereas the issue of licenses shows industrial demand for it. Collaborative publications are an indirect indicator of proximity of the university to the business community. We also considered the share of R & D in the university income.

Table 2. *Indicators of knowledge transfer institution.*

Indicator	Unit of measurement
The amount of R & D per employee	kRUB
The share of R & D funds in the HEI's income	percentage
The amount of R & D from non-governmental sources per employee	kRUB
The number of registered intelligent property objects	items
The number of licenses issued	items
The share of collaborative publications of academia and business in total scholarly output of the university	percentage

4 RESULTS AND DISCUSSION

Table 3 shows a comparative analysis of the level of demand for graduates.

Table 3. *Comparative analysis of the level of demand for graduates of regional universities.*

University	Level of demand for graduates, rank*	Ranking of Russian regions in terms of socio-economic development for 2015**
Far Eastern Federal University	67	27
Siberian Federal University	8	14
National Research Tomsk Polytechnic University	21	29
National Research Tomsk State University	20	29
Novosibirsk National Research State University	14	30
Tyumen State University	86	8
Ural Federal University	4	9
South Ural State University (National Research University)	88	17
Samara National Research University	15	13
Kazan Federal University	31	5
Nizhny Novgorod National Research State University	63	15
Baltic Federal University	122[3]	49

*Source: RAEX (Rating agency Expert). URL: http://raexpert.ru/rankings/vuz/vuz_2016/.

**Source: Rating and information agency Rating. URL: http://vid1.rian.ru/ig/ratings/rating_regions_2016.pdf.

Project 5-100 leader among regional universities is the Ural Federal University, which is ranked the highest (4th) among regional universities. Note that Sverdlovsk region also ranks high among Russian regions in terms of socio-economic indicators being the oldest industrial region of the country. High rates of demand for graduates is largely due to the work of the Centre for Cooperation with employers,

[3] The overall rating includes 100 universities, but in certain areas the university can be ranked lower than 100.

which regularly conducts seminars and exhibitions in cooperation with municipal authorities and leading companies of the region. However, the analysis also revealed a number of problematic universities; first of all, it is the Far Eastern Federal University, Tyumen State University, South Ural State University, Nizhny Novgorod State University, and Baltic Federal University. There is an especially large gap in Tyumen, which is the leading region of the country in the area of oil and gas production. On the one hand, we can explain this situation by the presence of the specialized "oil" university in the region (Tyumen State Oil and Gas University, which ranks the 23th in the demand for graduates), on the other - the situation is still abnormal in terms of strategic development of the university and funding effectiveness.

We also analyzed the level of technology transfer by ranking the performance of universities within the range (12 universities). The results are shown in Table 4.

Table 4. *Comparative analysis of universities in terms of knowledge transfer.**

University	The amount of R & D per employee	The share of R & D funds in the HEI's income	The amount of R & D from non-governmental sources per employee	The number of registered intelligent property objects**	The number of licenses issued	The share of collaborative publications of academia and business in total scholarly output of the university***
Far Eastern Federal University	6	10	3	3	4	11
Siberian Federal University	11	11	12	2	3	11
National Research Tomsk Polytechnic University	-	1	5	-	2	2
National Research Tomsk State University	1	2	1	1	1	7
Novosibirsk National Research State University	4	8	6	10	9	7
Tyumen State University	7	7	4	8	6	10
Ural Federal University	5	5	8	7	9	3
South Ural State University (National Research University)	9	9	9	6	4	4
Samara National Research University	2	4	7	4	9	4
Kazan Federal University	8	6	11	5	6	7
Nizhny Novgorod National Research State University	3	3	2	9	6	1
Baltic Federal University	10	12	10	11	9	6

* Source: reports of universities' self-evaluation.

** Includes patents and certificates of protection registered with Rospatent, the Eurasian Patent Office, and other international patent offices.

*** Source: SciVal by Elsevier B.V., 2011-2016 period.

The leader in the most of indicators is the Tomsk Polytechnic University. In addition to the center of technology transfer, the whole system of units provides commercialization of university research, including a business incubator, design institute, design TPU technology incubator "Pilot production", legal and exhibition centers. Innovative TPU belt includes 80 small innovative enterprises. It should be noted that Tomsk is the only regional center, where 2 universities are involved in the project 5-100. At the same time, Tomsk State University also has fairly good values of performance indicators. This implies the formation of Tomsk innovation ecosystem built around the two higher education institutions. The region has a developed resource industries (oil production). However, unlike many other regions, resource industries income is not spent on the purchase of assets from outside the region, but invested in high-tech industries, such as ICT, biotechnology, robotics.

5 CONCLUSIONS

The contribution of universities to the regional economic growth attracts attention of researchers since the 90s of the last century. This phenomenon was analyzed in terms of employment, the increase in expenditures at the expense of students and visitors of the University, as well as the export of educational services outside the region. Recent studies consider the university as a key actor in the regional economic system. University is the main producer of knowledge in the region, which creates the intellectual capital of the territory being a set of assets, factors and conditions that determine production (codification), exchange, distribution, and consumption of knowledge in the process of social production. The institutional approach helps to avoid the theoretical and methodological uncertainties in research of universities' impact on regional economic growth. In turn, the institutional configuration model eliminates the subject-object gap in institutional research, considering the institutions in the unity with the stakeholders and the environment.

We have applied this concept to analyze the two institutions of explicit knowledge internalization, i.e. the institution of vocational training and the institution of knowledge transfer. The basis of the study were 12 regional universities in 11 regions of the country. The analysis empowered identification of the problematic and leading universities. The study results contribute to evaluation of the regional Russian universities and identification of the gaps between the regional educational systems and political structures. Key findings can be used in further theoretical and applied research, and the formation of regional economic policy both in Russia and in other transition economies. Further research will be focused on the analysis of case studies of Russian regional economic systems based on the institutional configuration model.

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