

# Analysis of the Human Resource Quality Under the Terms of Innovative Economy

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**Abstract**—The problem of creating an innovative economy in Russia is urgent but it can not be solved without complex and unbiased quantifiable assessment of human potential adaptation to innovations and the efficiency of its use. The author suggests a number of indicators that may be applied for analysis of the efficiency of the innovative system of a country or region due to their relevance, relative nature, and availability from the statistics open for public. The author also defines certain ways of adaptation these indicators for the needs of human resource description and assessment of their adequacy to the requirements of innovative economy.

**Keywords**—*innovative economy; human potential; labour relations; indicators; efficiency*

## I. INTRODUCTION

One of the key problems hindering the transition of Russian society to an innovative economy is insufficient labour productivity, which results from a number of reasons, a significant share of which can be combined under the terms of poor quality and low efficiency of human potential use and weak competitiveness of employees. The urgency of this problem increases with the growth of global competition and the need for radical innovative changes in Russian business.

The important aspect for improvement of the innovative qualities of the human potential is its adequate assessment [1]. Meanwhile, the complete and comprehensible set of indicators available from national statistics and relevant for assessment of the innovative powers of the human resources and their competitiveness under the innovation and knowledge economy has not yet been formulated.

## II. ASSESSMENT OF THE COMPETITIVENESS OF REGIONAL HUMAN POTENTIAL

There exists a number of definition competitiveness in general of competitiveness of labour resources, or employees, or individuals. One way or another, they are united by the idea that competitiveness should mean such a set of characteristics of the subject, which in some or another area provides him with superiority over other entities claiming the same benefits or resources. Such competitiveness manifests itself under the terms of competition, rivalry, whereas it exists even in the absence of such conditions. If people as the carriers of the

ability to work compete for the best jobs, which provide the means of subsistence and opportunities for self-realization, then the regions, among other things, compete for the best workers, high human potential of the population. It provides opportunities for their further development, as well as for attracting and effectively using other resources, including innovations and already accumulated knowledge.

However, from the point of view of the competitiveness of the region or another territorial formation, the high quality of human potential is a necessary, but not sufficient, condition. The actual development and growth of the attractiveness of the territory for living and doing business are possible with the opportunities for implementation, effective use of human capital.

Naturally, the evaluation of both the level of the human potential development and the effectiveness of its economic use can be carried out only for a whole set of indicators [2, 3]. Traditionally, labour productivity (or GRP per capita in case of a region or territory) is an important part of them, but this indicator can not be the only and absolute one. This is due to the fact that labour productivity reflects the current situation, while the very concept of potential, including human potential, is oriented to the future. Consequently, the analysis should use demographic, qualifying, structural indicators and parameters for the development of social infrastructure and the level of social and labour relations.

For detailed characteristics, it is required to form a whole complex of parameters that take into account various aspects of human potential, including quantitative and qualitative indicators. The quantitative parameters mainly include the demographic parameters: gender and age structure, birth and death ratio, migration of the population, as well as health indices and life expectancy - all that creates opportunities for human development. Qualitative indicators, which directly characterize the level and dynamics of such development, as well as the efficiency of using the potential, including GRP per capita, the educational level, the speed of creation and introduction of new technologies, etc., should be recognized as qualitative. For example, G.A.Khmeleva and V.V.Vakhovskiy [4] suggest using the many of the indicators shown in Table 1. The important requirement concerning the availability of these data is observed.

**TABLE I. INDICATORS OF THE EMPLOYEES' COMPETITIVENESS IN THE REGIONAL ECONOMY**

Group of indicators	Indicators
Quantitative indicators	Total number of employable age population. The share of such population in its total, % Average life expectancy Health index Migration growth of population The share of population age groups of 25–34 and 50–59, %
Qualitative indicators	GRP per capita The share of individuals with higher education among the adult population The share of employees of the occupation in research and development, % of the employed The number of created new technologies The share of innovative products in GRP The educational structure of the unemployed
Conditions for development	Institutional
	Legal regulations of the labour relations Living and working standards, work place safety
	Socio-economic
	Decent labour indicators according to ILO methodology including: - the share of the employed in the age interval of 15–72, %; - unemployment level - the share of the „shadow“ sector of economy and employment - the share of the „working poor“ - accident frequency rate
	Innovation oriented
	The share of jobs requiring for extra intellectual and creative abilities The number of created new technologies per employee and per employee of the innovative organizations The share of employees of educational / consulting/ scientific, innovative organizations, etc.

<sup>a</sup> Based on [4] with the author's amendments and alterations

The factor that determines the specifics of further research in the region's innovative competitiveness and its relationship to the characteristics of human potential seems to us to be the diversity of conditions throughout Russia, their significant differences both among its regions and within many regions, especially large and multinational ones. The economic and cultural diversity of territories is revealed both through demographic characteristics, and psychological, as well as historical and cultural characteristics of the population, and the specific conditions for doing business. On the other hand, there are many characteristics that can be used to bring these aspects into one quantitative system, allowing not only to compare the territories, but also to develop a common policy for them. These parameters include, in the first place, those shown in the last line of Table 1, as well as assessing the intellectual and creative potential of the population and the innovative component of economic development.

In our opinion, it is these indicators that are the most important characteristics of human potential in the light of the rise and development of the innovative economy, the knowledge economy.

### III. ASSESSMENT OF THE INNOVATIVE DEVELOPMENT OF REGIONAL ECONOMY

Creation of scientific and technical innovations in the form of highly competitive high-tech knowledge-intensive products

is the most difficult direction from the position of organization of interaction between scientific organizations and the market through the innovation infrastructure. The technologies for developing innovative ideas here are changing depending on the technological structure and the type of innovation cycle.

Evaluation of the regional innovation system is hampered both by the lack of a single point of view concerning the list of constituent elements of it, and by the limited availability of data necessary for its full and comprehensive consideration. Nevertheless, we considered some indicators of innovative development of the Voronezh region on the basis of data available on the website of the Federal State Statistics Service (Table 2). We should point out, that the statistical services of different regions are still collecting and presenting information on innovation activities in different ways, therefore the list of indicators presented for different regions often do not match.

**TABLE II. THE KEY INDICATORS FOR INNOVATIVE ACTIVITY OF A REGION (VORONEZH REGION)**

Indicator	Year				
	2012	2013	2014	2015	2016
Number of organizations carrying out innovative activity	-	66	70	76	94
Innovative goods manufactured and sold in the region, mln RUR	-	4715,5	8500,2	21107,7	4861,7
Number of organizations performing research and development	57	56	53	63	63
Number of the employees involved in research and development	10799	10763	10865	10600	10334
The amount of scientific and research works, mln RUR	20138,8	24787,4	36232,0	32416,0	31849,3
Number of created state-of-the-art industrial technologies	9	59	31	25	26

<sup>b</sup> Based on [5]

An interesting fact, in our opinion, is that in Belgorod region, not only comparable indicators for innovation activity were significantly higher than in Voronezh, but the relevant indicators in statistics are much more detailed.

The data on innovation activity in Lipetsk region are well represented, the data for Kursk region are extremely restricted, although there are no fewer scientific and technological developments here than, for example, in Belgorod region, and there are even more people employed for R&D sector. Data concerning Tambov region are not presented at all, there is no such section in the statistical yearbook.

However, we are not satisfied with the available set of indicators for assessing the efficiency of the innovative development. It is possible to assess the effectiveness of innovation activity with rather wide range of indicators, some of which are difficult to quantify objectively, but the others are quite disposed to such assessment. Besides, any effectiveness assessment should be based on a ratio of results and resources consumed for its achievement. So, we suggest the classification of indicators describing the effectiveness of innovative activity meeting this latter requirement.

*a) Internal efficiency:* These are the indicators representing the relations among the parameters within the innovative systems, for instance, organizations, that are interrelated directly or indirectly as the reason and the result. They may include, but not be limited to, the following indices:

- Average number of employees in R&D organizations;
- Number of patents issued for the applicants (in Russia or in the region in question) per a functioning R&D organization;
- Number of created state-of-the-art technologies per a functioning R&D organization;
- Share of the graduates who have got their dissertation defended and their scientific degree obtained among the total of the graduates (doctorial and candidate levels);
- Share of researchers in the staff of R&D organizations.

We believe it is comparatively easy to quantify the internal efficiency of an innovative system, but one may face an obstacle in shape of restricted data, especially when surveying military or double technologies. Besides, different organizations may consider necessary to use different indicators for assessing their own internal innovative effectiveness, which we think good in achieving the optimum purposefulness and quality of the assessment but bad for comparability of the data within sector or region.

*b) Technological efficiency:* These indicators should demonstrate ratios between the expenses at present (or sometimes present results) and the future opportunities created with their help. It is rather difficult to select indicators for assessment of technological efficiency both available from national statistics and relevant for the effects we suggest to quantify here. However, we consider certain indices can be used here, such as:

- Total average financing of scientific research per 1 R&D organization;
- The share of expenses for fundamental/applied research in the GDP /total budget/budgetary support of scientific activities in total.

*c) Economic efficiency:* It is illustrated by the indicators showing the ratios of results and expenses for their achievement easily stated in monetary terms and having direct influence on the economic development and economic appliance of those results. It is comparatively easy to select such indicators and calculate them based on the statistical data available from the open sources. They may include but are not limited to:

- Average financing per 1 created new technology;
- Average financing per 1 patent received or 1 application for patent;
- Financial result improvement of a company due to introduction of a new technology (average or specific for the given case).

*d) Social efficiency:* It is the one effect probably most difficult to detect, let alone quantify. The indicators here should reflect the socially important processes and phenomena, public interests, and humanistic values. We believe such indicators may include:

- Share of the researchers in certain fields among the researchers in total (those fields, we believe, include healthcare, pedagogy, history and art history, even politics and sociology);
- Share of the dissertations defended or researches carried out in those fields among all possible scientific researches and defended dissertations;
- Share of employees participating in R&D activities among all the employed in economy of a territory;
- Share of individuals using new technologies in their routine work;
- Growth of the income obtained through R&D activities directly or indirectly.

Definitely each of those indicators can be compared during a given period of time along with among a number of territories (regions, countries).

However, we strongly recommend that these indices be interpreted only as examples of those indicators, a broad set of which must be monitored and considered when assessing the various aspects of the innovation activity and its efficiency.

#### IV. ASSESSMENT OF THE INNOVATIVE QUALITY OF THE HUMAN POTENTIAL

Human capital is described as a certain level of physical and mental development, knowledge, innovative thinking, required for labour activity under the current conditions provide by the existing economic environment [6]. The last part of this definition is crucial for assessment of the human potential in innovative economy, as it requires new abilities and motivation of the employees in addition to the traditional ones.

##### A. Company level

A.N.Mustafin [7], studying the human resource assessment at the company level, insists that these resources form the basis for a company's innovative activities and suggests to evaluate them in terms of the individual needs and an employee and participant of the business process. For this he divides those needs into economic and social blocks and evaluates them based on the separate sets of indicators. For economic block they include the groups of parameters for description of (i) human resource quantity in economy at the meso- and macro-levels; (ii) cost of the human capital for the region and the given company (including wages); (iii) technological infrastructure providing the employees with the means of goal-achieving; and (iv) level of innovative activity of the individuals and their environment. The social block is represented by the parameters characterizing (i) educational level of the human potential; (ii) the quality of the innovative

environment; and (iii) industrial risks affecting the physical and mental state of the human capital.

However, we believe it necessary to divide the indicators for human potential evaluation at the company level into the groups based on the degree of the use of a feature. The first group includes the indicators of the actual achievements; the second – actual attempts; and the third – relevant abilities (Table 3).

TABLE III. THE INDICATORS FOR ASSESSMENT OF THE HUMAN INNOVATIVE POTENTIAL AT THE COMPANY LEVEL

Groups of indicators	Examples	
	Absolute	Ratio
indicators of the actual achievements	Innovative projects fulfilled Innovations introduced Innovative products produced, etc.	Share of staff involved in the innovative projects Introduction of innovations per staff member / manager / engineer Share of the bonuses granted for participation in innovative activities, etc.
indicators of the actual attempts	Innovative projects currently in process Applications for patents, etc.	Share of staff involved in the ongoing innovative projects Share of worktime spent for studying new technologies / approaches
indicators of the relevant abilities	Educational level Past experience of participation in innovative projects, etc.	Share of staff possessing certain competencies associated with specific innovative process Share of staff participating in training aimed at innovation stimulation, etc.

<sup>c</sup> Suggested by the author

Such indicators can be used to describe the innovative activity of a company’s staff, but at the same time they may help to correct the existing situation as well as set innovation-oriented and innovation-based system of labour remuneration.

**B. Territory level**

At the regional or national level of the innovative economy traditional industries and economic sectors actively change their essence under the influence of new knowledge: goals, means, technologies, results. Production that turns out to be incapable of changes becomes at best ineffective, and at worst – unsustainable [8]. At the same time, such economy presents different demands on employees in a wide range of professions and spheres of activity, and generally these requirements are related to the use of intellectual potential [9]. The sphere of labour use that does not require simultaneous application of knowledge, skills, intellectual efforts and creativity, diminishes dramatically and might soon become virtually non-existent in the national economy.

Meanwhile, the formation of innovative-oriented and adapting to the ongoing changes in human capital does not occur without the efforts and significant investment of resources. The usual approach to human potential development and assessment becomes deficient. Each stage of transition to innovative-oriented human capital requires its measures and its indicators of success and efficiency of application of such measures (Fig. 1).

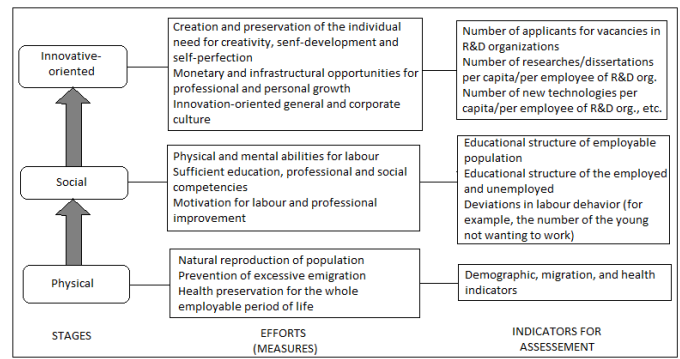


Fig. 1. The stages of formation of innovative-oriented human potential

In the Fig.1 we pay the greatest attention to the indicators of the topmost group matching the innovative-oriented stage of human potential development. Here we can apply some of the indicators for assessment of innovative development of a region (country) listed as internal, economic, and social efficiency indicators above, as long as their concern the use of human resources or the effect caused to R&D organizations’ staff or population in general.

**V. RESULTS**

Innovative part of the process of transition of the national economy of Russia to maximize the production and export of products with high added value, without which socio-economic development, progress, and preservation of competitiveness in the modern world are inconceivable. Introduction of innovations in any economic sector or within any area leads not only to changes in the range of products and technologies used, but also actively influences social and labour relations. On the other hand, the innovation process itself is impossible without changing the traditional approaches to employing labour resources towards the concept of human potential and its development.

The correct and unbiased assessment of the human potential adequacy to the requirements of the innovative economy and the efficiency of its use is crucial for the future growth of innovative and knowledge economy. Meanwhile we found out that the data directly available from the national and regional statistics are insufficient for such assessment. The indicators recommended in some researches for human potential analysis are also deficient and sometimes even irrelevant. We suggest a number of indicators for quantifiable evaluation of the human potential use in innovation development both at the company and regional scale and draft the directions for the further improvement of the system of such indicators.

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