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# The Evaluation Of The Innovative Activity Of Modern Russia's Higher Educational Establishments And Ways Of Its Fostering

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## Abstract

The article deals with the innovative capacity of Russia's higher schools and its influence on the socioeconomic development of the region and the country as a whole. It analyzes the activity of five Russian universities and ranks them on the basis of such criteria as innovative institutional structure, number of publications, human and intellectual resources, etc. The analysis revealed the weaknesses and strengths of the universities and served as a ground for recommendations on enhancing the state policy in the sphere of managing the innovative activity of Russia's higher schools.

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*Keywords:* universities, innovative activity, higher schools, innovative rating, modernization of higher professional education system, innovative capacity.

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## 1. Introduction

The present socioeconomic situation in Russia requires transition to innovative ways of development, which implies fostering research and development activities in the field of higher professional education. The transition to the innovative model of economic development is impossible without modernizing the country's higher professional education system. It should be noted that the components of the innovative economy (new scientific knowledge, high technologies and skilled specialists) have attracted special attention of the government institutions that determine the country's economic development. The emphasis on competitiveness, innovation studies and

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effectiveness is a key element of modern state policy, which is stressed in RF President's Messages to the Federal Assembly. The aim of the state policy in the field of scientific and economic development is determined by the necessity to foster the innovative sphere of universities' activities and to cultivate a need to constantly improve the efficiency of research.

## **2. State-of-the-art review**

A great number of papers are devoted to innovative studies. It is connected with the fact that the innovative capacity of the higher school has become a crucial factor of economic development. In higher educational establishments research is conducted in specialized divisions, such as applied research laboratories, research institutes, etc. and by the faculty members. The faculty members may participate in research in different ways (grant projects, part-time work in laboratories, volunteer work, etc.). However, the contribution of the Russian higher school to research and development is not believed to be considerable today. The share of expenditures on the research conducted by 30 % of the country's university research workers and faculty members does not exceed 7% of the total expenses on research and development in Russia. It can be explained by the fact that our higher schools are not involved enough in serious state, regional and cross-disciplinary research programs, which results in multitopicity and concentration on narrow subjects. Besides, the research and trial facilities of the universities need to be strengthened. The term «innovative capacity» can be interpreted as a system capacity to transform the existent order of things into a new one with a view to satisfy the existing or emerging needs. Effective use of innovative capacity makes it possible to actualize a latent potential of a system. Therefore, innovative capacity characterizes a system capability to change, to improve and to progress. The term «innovative potential» of a higher educational establishment implies its system of interrelated and interplaying resources necessary for high performing in the innovative sphere.

## **3. Literature review**

The analysis of higher educational establishments' innovative potential becomes urgent in the context of Russian educational system modernization. It is interesting, therefore, to study advanced domestic and foreign experience in this field. The Bologna Declaration 1999 initiated the creation of the European Higher Education Area (EHEA) that developed the basic directions of and requirements to higher education in order to harmonize the market of educational services in EU countries. This fact is mentioned in many papers on the subject. The Declaration does not urge higher schools to compete for power and leadership explicitly. However, it presents a challenge for them to increase their competitiveness. This fact is stressed, for example, in the works written by Nokkala,(2012). Nowadays, more and more higher schools are entering competition with a view to take a rightful place among the best educational establishments of the world. Choosing this strategy, universities, on the one hand, get new opportunities and earn more money, but, on the other hand, they face cultural and institutional problems. These issues are analyzed by Oleksiyenko,( 2013) Various ranking tools are developed in order to identify the leaders in the field of education. They are carefully analyzed by many authors. The first global rating of universities was published in 2003. It is known today as the Shanghai List. It was followed by Times Higher Education Supplement in 2004. These studies showed that the Top-20 of the best world universities included practically only Asian establishments except for just few British higher schools. The situation provoked a heated discussion in Europe, the ratings being found faulty. The choice of the criteria for such ranking tools is a vital problem, since they determine not only the aims of activity, but also the fundamental components, the basis of future success. Besides, the use of ranking tools resulted in copying the successful models which were regarded as winning formulas. The advantages and disadvantages of this process are discussed by Herbert and Tienari, (2013). Some researchers emphasize that the competition in the educational field is closely connected with the global competitive rating of national economies, thus presenting higher educational establishments as part and parcel of the innovative system. Therefore, the problem of European universities' administrative and financial autonomy is getting more and more pressing. They are moving closer to «the American model». The overregulation of the university life balks the modernizing process and prevents the higher school from acting on the environment.

A number of authors pay attention to the innovative activity of universities and the transfer of knowledge from universities to the business community. Thus, Janeiro, Proenca, Goncalves & V.D.C., (2013) analyzed the work of 967 enterprises of the Portuguese service industry and found that the raising of the innovative activity was due to their intensive relations with the country's universities. Avralev & Efimova,(2013) discuss the institutional and innovative changes in the system of higher education which reflect the integration of Russia's economy and higher schools into the global and regional economic area. They concentrate their study on the cluster approach which implies the interaction of regional administrative bodies, higher educational establishments and enterprises aiming at increasing universities' competitiveness and turning them into the world scientific and innovative centers.

#### 4. Methodology

The subjects of the innovative activity include university structural divisions, legal persons (administrative bodies, municipal authorities, enterprises with different patterns of ownership, new structural forms of innovative process, etc.) and individuals who take part in the innovative activity of the establishment. The objects of the innovative activity include new organizational methods, new technologies and products, the intellectual property, innovative projects and processes, as well as innovative programs which imply new economic and legal relations among the subjects of the establishment's innovative activity. The structure of the innovative capacity can be regarded as a unity of three components (resourceful, internal and performing ones) which are supposed to interact and interrelate and manifest themselves when used as a whole unity. The resourceful component of the innovative capacity is a « spring-board» for its development. It includes the following basic elements which have different functions: material, technical, information, financial, human and other resources. The education system as a whole and the higher professional education system in particular represent a national economic sector where an increased demand for new knowledge and technologies is formed. Therefore, higher schools today have all opportunities to become regional and country's centers of innovative activity. In the developed countries higher educational establishments are traditional basic institutions for conducting scientific research and development. Our analysis of higher schools' innovative activity consisted of five stages: Stage 1 included a content analysis as a standard procedure used in social sciences for studying texts and products of communicative writing. The sources analyzed in our investigation were official sites of the universities under study. The stage also included developing the criteria for evaluation of the establishments' research potential and innovative activity. Stage 2 was devoted to the identifying of the integral index with the help of the graphic method. This method identifies the integral index as square area of a polygon, the number of corners of which corresponds to the number of characteristics discussed. Let  $x_i$  be particular characteristics discussed,  $i=1, \dots, n$ ;  $a_i$  – normalized values of particular characteristics where reference values are used as a basis for comparison (the reference values are either the largest ones for the establishments under study or found by expert analysis). The normalized values  $a_i$  change in the range [0-1]. 1 corresponds to the high level of innovative activity, while 0 is characteristic of inactive establishments. The final formula that calculates the integral index of innovative activity is [10]:

$$S = \frac{1}{2} \sin \frac{360^\circ}{n-1} \left[ \sum_{i=1}^{n-1} a_i \cdot a_{i+1} + a_i \cdot a_n \right]$$

The graphic presentation of the integral index contributes to better perception of the heterogeneous characteristics that determine the intensity of a higher school's innovative activity and its specific features. Having got similar data about the competitors one may conduct a comparative dimensional analysis. Examining the changes over a certain period one may evaluate the trends of their innovative activity. Any change in the activity of an organization is supposed to be connected with a problem to be solved, as well as with the program of its development to be implemented. All this is impossible without evaluating its present potential.

## 5. Empiric research: basic results

Let's evaluate the innovative capacity of Russia's higher educational establishments. At present, to develop their innovative activity, as well as educational and research spheres is the most important task of modern higher schools. Their cooperation with industrial enterprises is based on the intellectual property which is their basic nonmaterial asset. The intellectual property can be used most productively only when the establishment possesses a highly developed innovative infrastructure. Our investigation analyzes the work of the most developed higher schools of the Tatarstan Republic: Kazan (Volga-region) Federal University (KFU); Kazan Tupolev National Research Technical University (KTNRTU); Kazan National Research Technological University (KNRTU). Since KFU is a federal university it was interesting to compare it with its main competitors – other federal universities of Russia, such as: Ural Eltsin Federal University (UEFU); Siberian Federal University (SFU).

We may present the data obtained in one summary table (Table 1).

Table 1 Summary table of statistic indicators for the establishments under study

	KFU	KTNRTU	KNRTU	UEFU	SFU
1. The effectiveness of scientific and innovative activity					
1. Number of research, innovative and promotional departments, including techno-parks, business-incubators, etc.	20	15	6	7	36
2. Availability of the endowment fund	no	no	no	yes	yes
3. Small innovative firms	27	11	23	37	35
4. Results/Products of intellectual activity (Number of intellectual products produced)	69	31	56	196	137
2. The effectiveness of staff training for innovative activity					
1. Number of post-graduate-students	1197	264	421	1767	559
2. Number of PhD students	40	24	42	42	28
3. Number of doctoral theses presented/defended	40	39	20	22	5
4. Number of candidate theses presented	138	136	120	131	43
5. Number of scientific publications	4000	440	1152	6624	3386
3. The intellectual potential of the universities					
1. Number of post-doctoral fellows	2527	665	787	3775	2365
2. The total number of academic staff members	3269	950	1301	4936	3300

According to the data presented above we calculated the largest values for each criterion which served as reference values. The data presented above enabled us to calculate the integral index of the establishments' innovative activity. Let  $x_i$  be particular characteristics discussed,  $i=1, \dots, n$ ;  $a_i$  – normalized values of particular characteristics where reference values are used as a basis for comparison (the reference values are either the largest ones for the establishments under study or found by expert analysis). Using the normalized values we built a radar chart which is similar to a graph in the polar coordinate system and reflects the values distribution relative to the coordinate origin. As a result we obtained the following polygons with the help of the graphic method of presenting the integral index. Then we calculated the square area of each polygon. The larger the area, the more developed the innovative activity.

The reference square area was calculated according to the formula:

$$S = \frac{1}{2} \sin \frac{360^\circ}{n-1} \left[ \sum_{i=1}^{n-1} a_i \cdot a_{i+1} + a_i \cdot a_n \right]$$

$$S \text{ reference value} = 0.5 \sin 360/7 * 8 = 0.5 * 0.78 * 8 = 3.12.$$

The evaluation of the universities' innovative activity (IA) gave the following results: If the square area is equal to 2.1 – 3.12 then the IA is high; If it is equal to 1.1 or less then the IA is low  
 The IA integral index for KFU is presented by diagram 1.

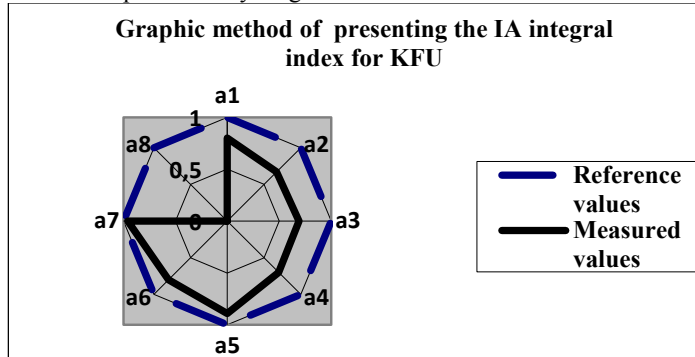


Diagram 1. IA integral index for KFU

The area of the polygon obtained reflects the present level of KFU innovative activity. The final formula for calculating the IA integral index is as follows:

$$S = 0.5 \sin 360/7 [0.8 \cdot 0.67 + 0.67 \cdot 0.69 + 0.69 \cdot 0.7 + 0.7 \cdot 0.89 + 0.89 \cdot 0.8 + 0.8 \cdot 0.96 + 0.96 \cdot 0] = 0.5 \sin 51.42 \cdot [0.536 + 0.4623 + 0.483 + 0.623 + 0.712 + 0.768] = 0.5 \sin 51.42 \cdot 3.6 = 0.5 \cdot 0.78 \cdot 3.6 = 1.4$$

The diagram shows that KFU has a fair number of post-doctoral fellows. It is necessary for the university to increase the amount of research work, to develop innovative structures, as well as to set up small innovative firms. Besides, it is important to attract gifted young people with new ideas and to establish an endowment fund at the university.

The IA integral index for KFU is 1.4 which implies an average level of activity.

The IA integral index for KTNRTU is presented by diagram 2.

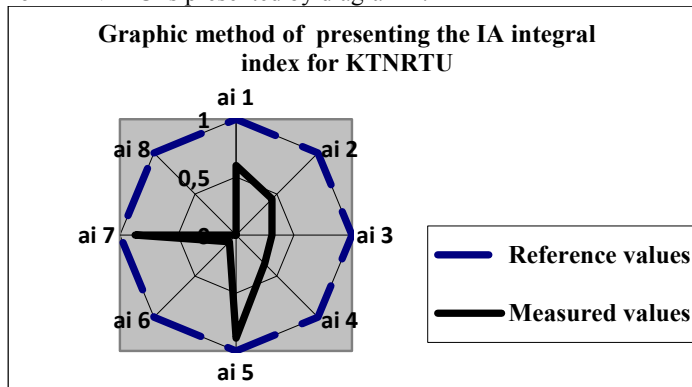


Diagram 2. IA integral index for KTNRTU

The square area of the polygon was found according to the formula :

$$S = 0.5 \sin 360/7 [0.6 \cdot 0.44 + 0.44 \cdot 0.31 + 0.31 \cdot 0.35 + 0.35 \cdot 0.89 + 0.89 \cdot 0.08 + 0.08 \cdot 0.87 + 0.87 \cdot 0] = 0.5 \sin 51.42 \cdot [0.264 + 0.136 + 0.109 + 0.312 + 0.071 + 0.07] = 0.5 \sin 51.42 \cdot 0.962 = 0.5 \cdot 0.78 \cdot 0.962 = 0.4$$

The diagram shows that KTNRTU has rich human resources. However, it is necessary to intensify efforts in the field of research, to develop the innovative infrastructure, to set up small innovative firms, as well as to attract gifted young researchers and to increase the amount of publications.

The IA integral index for KNRTU is 0.4 which implies a low level of activity.

Diagram 3 depicts the IA integral index for KNRTU.

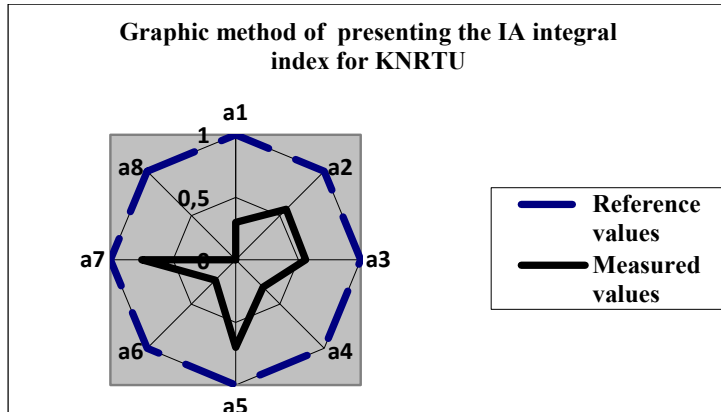


Diagram 3. IA integral index for KNRTU

The square area of the polygon was found according to the formula :

$$S = 0.5\sin360/7 [0.3*0.57 + 0.57*0.56 + 0.56*0.31 + 0.31*0.7 + 0.7*0.23 + +0.23*0.75 + 0.75*0] = 0.5\sin51.42*[0.171 + 0.32 + 0.174 + 0.217 + 0.161 + 0.173] = 0.5\sin51.42*1.216 = 0.5*0.78*1.216 = 0.5$$

The IA integral index for KNRTU is 0.5 which implies a low level of activity.

Therefore, the university authorities should pay attention to the development of research and innovative infrastructure. Besides, it is necessary to set up small innovative firms as well.

Diagram 4 shows the IA integral index for UEFU.

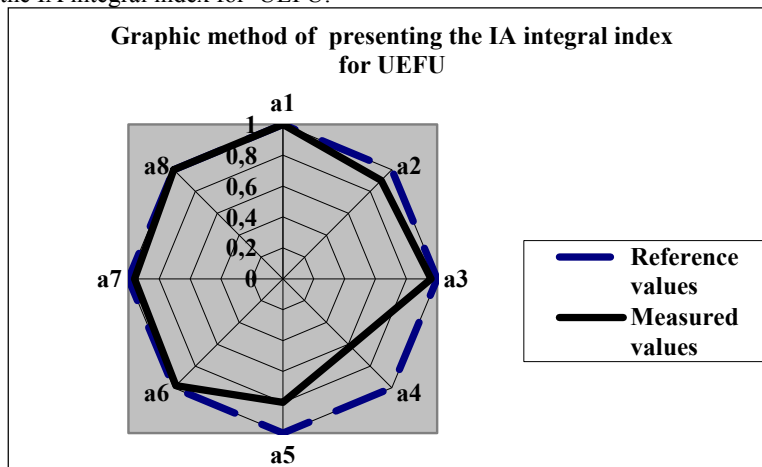


Diagram 4. IA integral index for UEFU

The square area of the polygon was found according to the formula :

$$S = 0.5\sin360/7 [1*0.9 + 0.9*0.96 + 0.96*0.62 + 0.62*0.8 + 0.8*0.98 + +0.98*0.96 + 0.96*1] = 0.5\sin51.42*[0.9 + 0.864 + 0.595 + 0.496 + 0.784 + 0.941 + 0.96] = 0.5\sin51.42*5.54 = 0.5*0.78*5.54 = 2.16$$

The diagram shows that UEFU possesses a well-developed research and innovative infrastructure and is rich in human resources. The university has an endowment fund as well. However, it is necessary to attract talented young people with fresh ideas.

The IA integral index for UEFU is 2.16 which implies a high level of innovative activity.

Diagram 5 shows the IA integral index for SFU.

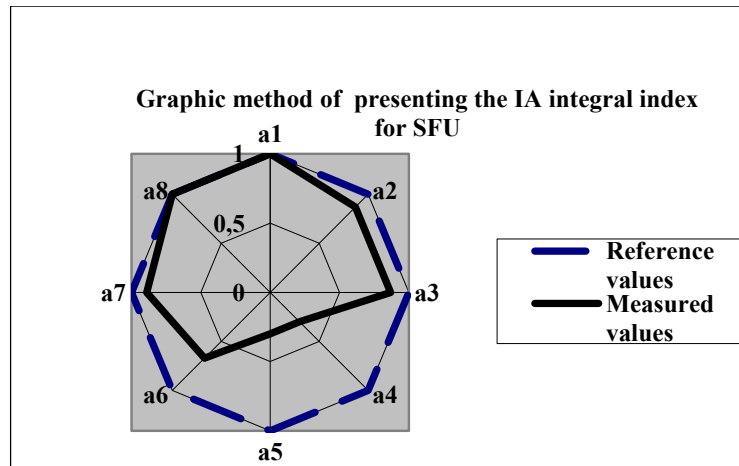


Diagram 5. IA integral index for SFU.

The square area of the polygon was found according to the formula :

$$S = 0.5 \sin 360/7 [0.1 \cdot 0.87 + 0.87 \cdot 0.87 + 0.87 \cdot 0.3 + 0.3 \cdot 0.3 + 0.3 \cdot 0.67 + 0.67 \cdot 0.89 + 0.89 \cdot 1] = 0.5 \sin 51.42 \cdot [0.87 + 0.76 + 0.261 + 0.09 + 0.201 + 0.596 + 0.89] = 0.5 \sin 51.42 \cdot 3.668 = 0.5 \cdot 0.783 \cdot 3.668 = 1.43$$

The diagram shows that SFU possesses a well-developed research and innovative infrastructure, as well as an endowment fund. However, it is necessary to develop human resources and to increase the amount of publications.

Using the data presented above we ranked the universities according to their IA indicators. The first place is due to UEFU; the second place goes to SFU; the third place is given to KFU; the fourth and the fifth places are taken by KNRTU and KTNRTU, respectively.

## 6. Conclusion

The results obtained enabled us to make the following conclusion: Kazan Federal University occupies the third place among Russia's federal universities, while in the Republic of Tatarstan it is № 1.

In addition, our study revealed a number of problems faced by the universities.

1. KFU has the highest IA level among Tatarstan higher schools. Yet it faces a number of challenges.

2. Firstly, there is no endowment fund at the university. The fund is an important component of the innovative infrastructure since it finances innovative projects, scientific research, etc. The university authorities should find benefactors to raise enough money for the fund. Secondly, the majority of students, postgraduates and teaching staff lack knowledge and skills in the field of innovative activity. It is necessary to update the training and advance training programs, as well as to render financial support to the most gifted and productive researchers and most promising projects. Thirdly, it is recommended to create its own system of copyright protection. It is possible to follow the example of Ural Federal University whose copyright protection program implies that the rights to patents, computer programs and other know-hows created by the university workers under terms of their employment contracts are reserved by the university. Yet the copyright to articles, monographs and the like are vested in their authors.

3. The innovative activity of KTNRTU and KNRTU is low according to the data obtained. These universities face the following problems to be solved: they have no endowment funds which are supposed to raise money for research and development; they have rather poor human resources, therefore it is necessary to attract talented young people and to provide material incentives for the employees whose work makes a considerable contribution to the innovative activity of the university; their innovative infrastructure is not developed, therefore it is recommended to establish various research, innovative and promotion divisions, such as techno-parks and business-incubators; they lack scientific publications, so it can be recommended to pay staff members for a fixed number of publications.

4. The innovative activity of UEFU is rather high. The university may be said to be on a strong track. According to the data obtained, however, it should take effective measures to attract more gifted young people as postgraduates.

5. The innovative activity of SFU is at an average level. It has several problems to be solved. It is recommended to develop its human resources, to attract talented young people as postgraduates, as well as to increase the number of publications.

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