

Building a Financial Model for Developing a Flagship Technical Higher Education Institution

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Abstract— This paper covers both the problem of funding flagship technical universities and that of choosing a better financing model in the current context. Financial support of a higher professional education institution is highly important for the state. Therefore, studying the methods for capital raising to invest the country's higher education institutions (HEI) seems to be the task of highest priority. It is also important that any specific HEI realizes which funding sources are the most preferable for it, how efficiently the sources are utilized, and in what way its personal activity should be developed in the coming future. To select the best model for funding a newly emerged regional flagship HEI is particularly essential. The model of regional flagship technical HEI development should provide variants and mechanisms for developing regional systems in the following context: - limited federal and regional resources; - low demand for innovation; - problems with human resources, - differently vectored interests of the subjects involved in the process. This paper studies and determines the optimal model of financing a regional flagship technical university via mathematical methods by viewing the case of Volgograd State Technical University.

Keywords— *flagship technical higher education institution (HEI), funding sources, development model, budgetary funding, non-budgetary funding*

I. INTRODUCTION

The program of the Ministry of Education and Science of the Russian Federation, which promotes the establishment of flagship HEIs, is aimed at creating strong regional universities that, on the basis of encompassing scientific data, human and financial resources, will ensure the transformation of the personnel training system, attract high-achieving students, create research laboratories, and cooperate with large industrial enterprises of the region.

The program of the Ministry of Education and Science of the Russian Federation is designed to develop and to promote the application of a series of measures in each university, to provide analytical support and advisory assistance to management teams, and, in addition to the present public funding, to aid every joint institution with annual subsidies in the amount of 200 billion RUR for three years. [1]

Thus, under the current economic situation, the funding of the higher education system will be increased rather than be cut. The funds which are released as a result of the alliance of HEIs will be used for the salaries of their tutors, and some extra funds will be invested in the program of the development

of the flagship HEI. The financial basis of the activity of the regional flagship university are discussed in the manuscripts [2, 3]

II. PROGRAM OF DEVELOPMENT OF REGIONAL FLAGSHIP HIGHER EDUCATION INSTITUTIONS

A draft program for the development of a flagship HEI should cover the following aspects: [4]

- Target model of a flagship university (i.e., its mission, strategic goals and key tasks related to HEI establishment and development, key indicators of its efficient performance);

- Key directions of reforming (modernization of education activities, modernization of scientific research and innovation, development of human resources, modernization of the HEI administration system, modernization of HEI material and technical facilities and its socio-cultural infrastructure);

- Financial support for the implementation of the flagship HEI development program;

- Supplement with a list of the actions to support the flagman HEI development program.

The implementation of such a program should be aimed at achieving the prescribed values of its development targets. In this connection, by 2020 a flagship HEI should train approximately 10,000 full-time students in at least 20 specialties and majors. Graduates and post-graduate students should make up 20% of its trainees. By the same time, the HEI budget should be at least 2 billion RUR from all sources, and the amount of research and development finance per academic researcher must exceed 150,000 RUR, while 100 tutors should have at least 15 manuscripts cited in Web of Science and 20 papers cited in Scopus. [5]

Investigate the peculiarities of the performance of regional flagship HEIs. In Russia, for now, there are the following regional flagship technical HEIs:

- Don State Technical University;
- Ufa State Petroleum Technical University;
- Samara State Technical University;
- Volgograd State Technical University;
- Voronezh State Technical University;
- Omsk State Technical University;

- Nizhny Novgorod State Technical University n.a. R.E. Alekseev;
 - Novosibirsk State Technical University;
 - Belgorod State Technological University n.a. V.G. Shukhov;
 - Magnitogorsk State Technical University n.a. G.I. Nosov;
 - Saratov State Technical University n.a. Y. A. Gagarin.
- [6]

Serving as both centers for innovation and systemically important elements of the regional infrastructure, regional flagship technical HEIs should improve in the following areas:

- In establishing as centres for innovation development and in creating an innovative environment for every HEI that is a part of regional economy and infrastructure;
- In creating better conditions for the cooperation of those flagship universities and enterprises which execute multipurpose projects in high-tech manufacturing. This may imply the establishment of scientific and educational centres, new engineering centres, and scientific laboratories, as well as the introduction of new majors. [7]

Due to a diversity of its multi-purpose functions, a flagship HEI is the most important element of the regional socio-economic system. [8] A cooperation between a HEI and its external and internal environments is illustrated in Fig.1.

A regional flagship HEI should pay a particular attention to efficient interaction with both customers and consumers of educational services, with federal, regional, and municipal authorities, and with the regional community. [9, 10]

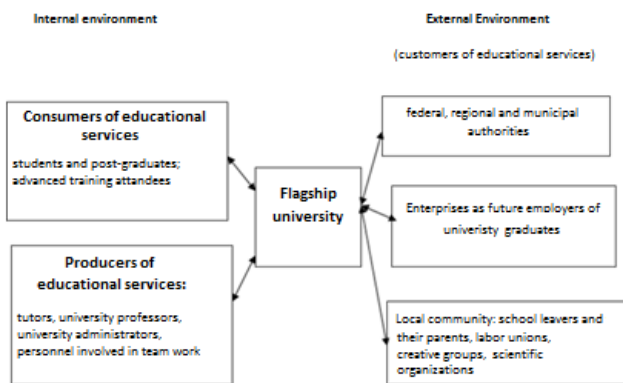


Figure 1. Interaction between a flagship HEI and regional external and internal environments (compiled by the authors)

The tasks of a regional HEI can be formulated in accordance with the particular nature of the region's development: [7]

1) Training of highly qualified specialists showing both technological (engineering) culture and social mobility, being capable of both modernizing the economy (including solving the problems of the green economy) and promoting technological development of the region;

2) Harmonization of the structure of educational and scientific activities and innovation (in order to achieve synergy);

3) Research of various industrial trends, which influence education, with due regard to regional characteristics;

4) Investigation of the potential partner environment for the purpose of creating a cluster model for the development of the region;

5) Utilization of innovative educational technologies in an active manner;

6) Creation of some special mechanisms for a timely and adequate response of the system of professional training (modernization of educational courses, educational technologies, etc.) to the ever changing demands of the regional labor market and regional manufacturing;

7) Advanced training and reskilling of employees on the basis of the human resources and technical potential a HEI possesses to ensure the order of regional enterprises to train engineers and technical specialists;

8) Creation of the innovative environment of a HEI in order to provide both the possibility of forecasting and building a career to its graduates and that of active participation in scientific, innovative, and research technical projects to its students.

III. SELECTING BETTER SOURCES FOR FINANCING THE DEVELOPMENT OF A REGIONAL FLAGSHIP TECHNICAL HIGHER EDUCATIONAL INSTITUTION

In 2016, Volgograd State Technical University (VoISU) changed its status of a regional flagship technical university; this enabled to use its case with the aim of studying all aspects of flagship HEI funding.

Public funding is the main source of income for the regional flagship university; just like for the majority of state educational institutions. [11, 12, 13] The amount of allocations from the federal (major part) and municipal (minor part) budgets has recently been raised. This source of funding is the most reliable and stable, and, in case of unforeseen circumstances, it can ensure the adequate performance of the university.

As can be seen in Fig. 2, in the present time, of all the variety of sources of funding involved in the financial support of the activity of the flagship HEI, the income from paid educational services, federal subsidies and that from scientific and innovative services constitute the major part of it.

Extrabudgetary funding is almost half of the total budget of the regional flagship university, and this area is constantly developing. Here, the main sources of funds are income from paid educational services (including from training on a contract basis, preparatory courses and second higher education), research and innovation services (conferences and grants), and commercial services (income from economic activities). [11, 12, 13] This group of sources is not so reliable; therefore, it should be developed first of all in all available directions for providing the reserve.

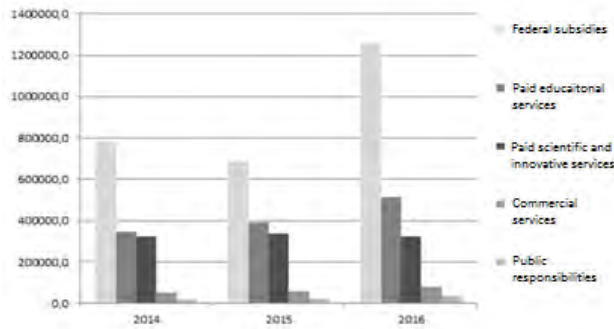


Figure 2. Changes in the amounts of funding from different sources in 2014-2016, the case of VolSU (compiled by the authors from [14, 15, 16, 17])

To select the most promising source of financing, it is necessary to analyze such indicators as the contribution of the source to the current budget of the university and its dynamics, the stability of the source, the long-term prospects for its use, possible limitations, etc. To do this, mathematical tools should be utilized. The possibility of its application for the analysis of the activity of the university is considered in detail in [18]

According to the data presented in Table 1, the sources that make the largest contribution to the total funding of the university at the present time were selected for evaluation. Also, on the basis of the data given hereinabove, selection criteria were determined, each alternative financing option was evaluated for each criterion. The results of the formalization of the decision problem [19] are presented in Table 1.

The criterion K1 in this problem is quantitative, the rest are qualitative, where points are obtained by the method of peer review. The higher the score, the higher the level has the appropriate alternative for this criterion. For example, for criterion K2 (reliability and stability of the source), scores are displayed based on the data presented in Fig. 21; the more stable the dynamics, the higher the score.

TABLE 1 Evaluation of the sources of funding due to the decision-making criteria, the case of VolSU (compiled by the authors from [14, 15, 16, 17])

Alternative	Selection Criterion	K1	K2	K3	K4	K5
		Amount of investments, % of the total sum	Reliability, Stability, scores	Usage Variability, scores	Ease of Report, scores	Ability of Extra-investments, scores
A1	Federal subsidies	56.8	7	3	2	0
A2	Public responsibilities	1.6	10	1	3	0
A3	Paid educational services	23.1	9	10	8	1
A4	Paid scientific and innovative services	14.7	6	6	5	1
A5	Commercial services	3.5	9	10	10	1

The decision-making process can be simplified using software tools. In this case, to select the optimal source of funding, one can use the developed program which provides a convenient graphical interface for inputting the original data and viewing the results. The program supports automatic calculation by several methods of decision-making, the most suitable of which for the solution of the task is the method of average ranks [19] and the method of preference functions [20]. An example of the window to input data for calculation is shown in Fig. 3.

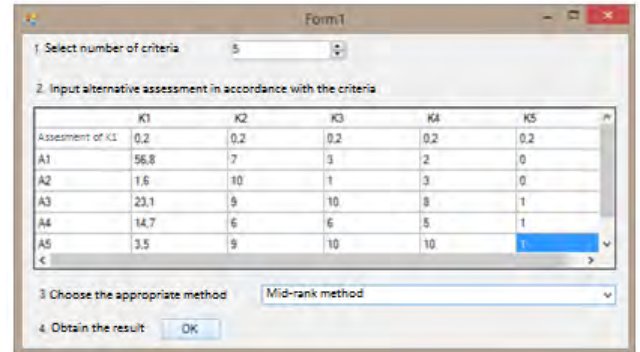


Figure 3. Window for entering the parameters for selecting the best source of funding for Volgograd State Technical University (compiled by the authors from [19, 20])

IV. RESULTS AND DISCUSSION

Find the best solution for the method of mean ranks and the method of membership functions, provided that each criterion has the same level of significance. The results of the calculations are shown in Figures 4a and 4b, respectively.

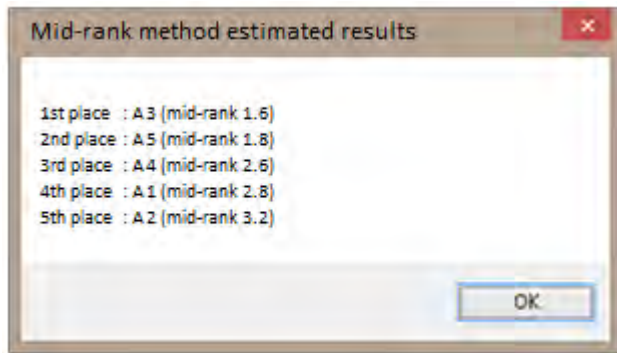
Apparently, both methods gave the same result. According to the rankings received, the best source of funding for the activities of the regional flagship university, given the same importance of all evaluation criteria, is the income from paid educational services. In second place, with a small lag, is the profit from commercial services carried out by the organization.

Such sources as paid scientific and innovative services, federal subsidies and public obligations follow afterwards.

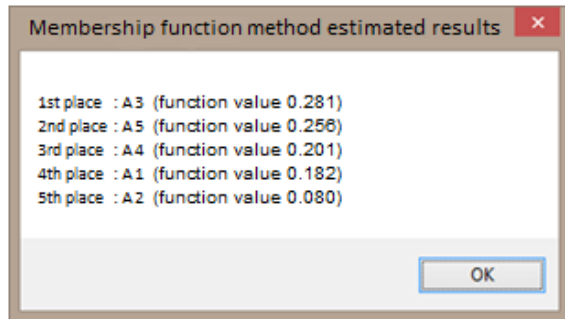
If you increase the importance of such criteria as K2 (reliability and stability of the source) and K3 (variability of the use of funds), reducing the importance of others, the result of the calculation will change. The screen forms of the program for this case are shown in Figures 5a and 5b.

In this case, the order of alternatives has changed a little in accordance with the preference; i.e., federal subsidies have been higher than the revenues from scientific and innovative activity).

The results obtained are not accurate, but they clearly demonstrate the merits and demerits of each of the sources of funds provided. So, the least significant source is public obligations, despite high reliability (it shows stable growth over the past several years, the volume is normatively fixed and depends only on the number of students of preferential categories), has significant restrictions on the application; it can be used only for payment of material assistance and other social benefits.

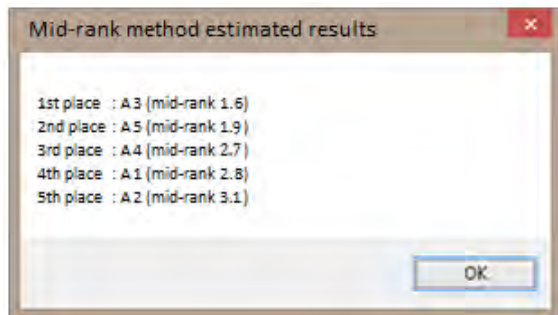


a)

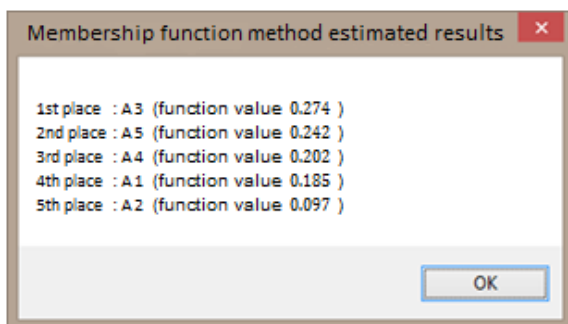


b)

Figure 4. Results of solving the problem of choosing the optimal source of financing for VolgGTU with equal importance of the criteria: a) by the method of average ranks, b) by the method of membership functions (compiled by the authors from [19, 20])



a)



b)

Figure 5 Results of solving the problem of choosing the optimal source of financing for VolgGTU with different importance of the criteria: a) by the method of average ranks, b) by the method of membership functions (compiled by the authors from [19, 20])

Federal subsidies, although they have the most significant share in the capital of the university, show less positive dynamics. Their target character also imposes restrictions on both the items of expenditure of these funds, and on the order of reporting to public authorities

Paid research and innovation services, with all their merits, can not be considered a stable source; i.e., their volume depends on the number and quality of research performed by the university, as well as the level of cooperation with the enterprises of the region. In addition, many cash receipts within this category are also targeted and can be spent only on certain university needs under the contract.

Therefore, the most important and promising sources of funding for the activities of the regional basic university (on the example of the Volgograd State Technical University) were selected paid educational and commercial services provided by the university.

Both of these sources are characterized by relative stability. The university already has an established contingent of students studying on a contract basis and enjoying the results of the economic activities of the organization, and in connection with the change in status to a regional basic university, this contingent will only expand in the coming years.

But the main advantage of these sources is a great deal of freedom of action, which results in such positive aspects of their use as lack of a targeted focus, less strict reporting and the possibility of increasing capital by additional investment of these funds.

V. CONCLUSION

In modern conditions, the development of regional flagship technical universities is possible only with sufficient financing of both current expenditures and strategic development tasks. Competitive HEIs are those universities that take an active position in expanding the sources of funding, vigorously offering new educational services and developing new sources of funding.

It is important to develop the area of paid educational services, especially in supplementary education (second higher education, refresher courses, foreign language courses and others) and training of foreign specialists. These industries both involve people who already have a stable income and allow them to improve their professional level and acquire new competencies, which, undoubtedly, should ultimately have a positive impact on the economy of the region.

The upgrading of the status of a regional flagship technical university with its successful development should entail an increase in its positions in various ratings, which will attract new students and enterprises of the region interested in cooperation.

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