

FORECASTING THE COST OF EDUCATION IN HIGHER EDUCATIONAL INSTITUTIONS OF THE REGION

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Abstract

The successful functioning of higher education institutions is impossible in isolation from the cost-and-bridge criteria, since it is the value that is the most important characteristic of economic relations in the conditions of which there are higher educational institutions in the modern realities. A significant reduction in the volume of funding for HEIs and the neutralization of tax privileges for higher education establishments direct universities to independently ensure an appropriate level of profitability of activities, which automatically turns educational services into the main source of income for institutions of higher education. A specific feature of educational services for undergraduate programs in public educational organizations as a subject of economic relations is the different plans of target consumer audiences. Pressure on state educational institutions from the market and power structures leads to the fact that institutions of higher education cease to be special social institutions, they are increasingly subject to the same rules of the game that exist for market production and commercial enterprises.

Market relations in the sphere of Russian higher education contribute to exacerbating competition between higher education institutions, which makes it necessary for universities to achieve the optimal cost-benefit ratio, which is impossible without the availability of an effective tool for the formation of the value of the main product of the productive activity of higher education institutions-educational services.

The cost of contractual training is considered as an assessment-exchange relationship between the subjects of the market of contractual training on the equivalence of resources spent on the production of educational services, the cost of contract training in higher education, which causes the introduction of the linguistic variable "the level of compliance of costs of the main agents of the education sector with their expectations."

Keywords: algorithm, cost of contract training, higher school, bachelor's program

1 INTRODUCTION

The market of contract training in the course of its functioning is based on the operation of the basic economic laws of the classical market - the law of value and the law of supply and demand.

In economic theory, nothing produced so many mistakes and disagreements as exactly the inaccuracy and uncertainty of meaning, which is put into the word value.

During the XVII-XIX centuries, the basic concepts of economists on the issue of the value of goods were formed.

Smith reduced the cost of labor spent on the production of goods to the labor (wages), the amount of wages, profit and land rent. Ricardo and McCulloch defined it as the cost of production, Say - the utility of the thing, Lodel - by supply and demand.

Marx and Engels, considering their polemics, concluded that value is the real form of the expenditure of social abstract labor and expresses the ratio of the costs of production to utility.

A long dispute in economic science is conducted both on the value of the commodity, and of course, at its price.

Smith took as a measure of value sometimes the working time necessary for the production of goods, and sometimes the cost of labor, Ricardo - the working time for the production of goods in relatively worse conditions of production. Sismondi reduced the value of the commodity to the relation between the need of the entire society and the amount of labor that is sufficient to satisfy this need.

In the works of Samuelson, Clark and others, the formation of a price is considered taking into account the effect of marginal costs, as additional costs associated with the production of an additional unit of goods.

An analysis of all these views allows us to distinguish between the categories of value and value. Note that the value of the goods is a special case of manifestation of economic value in certain historically specific conditions.

Thus, the value of any product is determined on the one hand, the costs of its producer, on the other - the value for the consumer, in other words, the consumer value.

However, speaking about the cost of the educational service, it is necessary to take into account both the peculiarities of the product itself - the educational service, and the peculiarities of the exchange process itself.

If we are talking about the sale of material objects, then only producer and seller's costs are taken into account, the buyer (consumer) in exchange for his money receives exclusively benefits (benefits).

As for the exchange process, the object of which is the educational service, here are the following specific moments:

- Firstly, the costs are borne by both service providers (universities) and consumers (students and organizations) and the customer (state), which makes it necessary to take into account the costs of all agents of the educational sphere as an economic field when determining the cost of educational services;
- Secondly, the paramount role in determining the value of contract training is played not by its value to consumers, but by its value to the customer-state.
- Third, despite the level of value of contractual training of a particular university for the state, the cost of its services cannot be lower than its cost price.

2 OPINIONS AND DISCUSSION

The process of managing the cost of contract training for a particular institution can be implemented in several stages. At the first stage, it is necessary to determine the lower threshold level of the cost of contract training. This can be done by determining the cost of educational services.

It should be noted that at present there is no instruction on planning, accounting and calculation of the cost of educational services by higher educational institutions, which universities can rely on when calculating the cost price. Some existing methods for calculating the cost of educational services, summarized by the sector of the normative base of resource provision of higher education.

Method allows you to determine the cost of training one student a certain form of training. The disadvantage

of the methodology is the impossibility of calculating the cost of production in the context of undergraduate programs, and the fact that costs are distributed among forms of training in proportion to the number of trainees, such a distribution base, in our view, is economically unjustified and significantly reduces the accuracy of calculations.

The methodology for calculating the cost of educational services on the basis of standard cost allocation bases is presented in Table 1.

Table 1. Calculation based on standard cost allocation bases

The calculating object and the calculation unit	Calculation object - form of training, specialty The unit of calculation is one student of a certain form and specialty.
Cost Allocation Database	Base 1 - the average number of students; Base 2 - the number of safe days; Base 3 - training load.
Calculation of base of calculation of expenses	Base 1. According to the number of students for the 1st day of each month of the corresponding calendar year, the average chronological values are calculated. Base 2. It is defined as the sum of the components calculated separately by faculties, courses, types of training. Base 3. It is defined as the sum of the components, calculated separately by the departments and objects of calculation.
The cost price of providing educational services to one student	$Cr = (31+32+33) / N$ 31 – General economic costs (salaries of administrative and management personnel, heating, cars, capital costs, etc.), distributed between types of undergraduate programs and forms of training in proportion to the base 1, 32 – Expenses for current repair of buildings and inventory, rent of premises, purchase of furniture and equipment, salary of maintenance personnel, etc., distributed between types of bachelor programs and forms of training in proportion to the base 2, 33 – The costs for the salaries of the faculty, the teaching staff, the office expenses of the departments, the costs of acquiring equipment, capital expenditures, except for the capital expenditures for buildings and facilities distributed between types of undergraduate programs and forms of training in proportion to the base 3.

The presented methodology makes it possible to determine the costs of training for one specialist in a certain specialty and form of training, but the accuracy of calculations is low due to the fact that all costs are to be distributed proportionally to the selected bases and no direct costs are allocated directly to the cost of educational services. A significant drawback of the methodology is that the procedure for generating information on costs in the necessary areas has not been developed, which makes its use time-consuming and expensive.

Table 2. Calculation based on staff standards

The calculating object and the calculation unit	Calculation object - the form of training The unit of calculation is one student of a certain form and specialty
Cost Allocation Database	Base 1 - staff standards; Base 2 - reduced number of students
Calculation of base of calculation of expenses	Base 1. Average values of the number of students in a category, per teacher; Base 2. The number of students of different categories, with the help of conversion factors, is reduced to one category.
The cost price of providing educational services to one student	- the cost of wages related to the training of students of a certain form of education in proportion to the number, - the remaining costs, distributed between forms of training in proportion to the base 2, - number of students full year, - number of students 4 months per year - Number of students 7 months in a calendar year (graduates)

Disadvantages of the above procedure:

- The cost price is calculated only in terms of forms of training;
- scientifically unjustified staff standards are used, which are usually applied at the level of ministries;
- all costs, with the exception of wages, are distributed in proportion to the number of students of a certain form of training.

This distribution base, according to the author of the dissertation research, is economically unjustified.

The methodology for calculating the cost of educational services using the specific labor intensity of the specialty curriculum is presented in Table 3.

Table 3. Calculation using the specific labor intensity of the curriculum of the specialty

Calculation object	Calculation object - specialty, form of training, course of study The unit of calculation is one student of a certain specialty, form, level of training.
Cost Allocation Database	Base 1 - the number of hours of pedagogical work, an average of one student, Base 2 - the total average annual number of students.
Calculation of base of calculation of expenses	Base 1 - is determined on the basis of curriculum specialties, the norms of labor costs for the performance of academic work
The cost price of providing educational services to one student	- training costs associated with the training of a specialist in a particular specialty, - The average costs per one hour of the training load is determined by the ratio of the total educational costs of the educational institution to the total training load of all teachers, - costs, respectively, for scholarships and hostels per one student of a certain category, - is determined by the ratio of total costs for scholarships of the category of students being studied and their total number, the total costs are distributed by direct ratio, - calculated as the ratio of total costs for hostels to the total average annual number of students.

Low accuracy of calculations owing to averaging of all expenses, calculation is conducted without taking into account specificity of educational activity.

The main purpose of calculating the cost of educational services is determined by the specific features of the activity of universities in the market of educational services. Information on the cost of bachelor's programs in terms of their types and forms of training is necessary to implement an effective assortment and portfolio policy, to determine the adequacy of the amount of the established tuition fee for each direction, and to make decisions on starting training in new directions.

Therefore, it is necessary to improve the procedure for recording costs and develop a methodology for calculating the cost of educational services in terms of bachelor's programs and forms of training, taking into account the specifics of educational activities of universities.

The specifics of the activities of HEIs and the process of providing educational services to students of a certain specialty and forms of training led to the conclusion that the process of providing educational services is continuous, in-line and consists of successive stages that fall within the framework of one or several training courses that follow one another. Services are provided immediately for students of all undergraduate and graduate programs. Consequently, it is advisable to use similar calculating methods, as in material production, where the product is one-type and its production is flow-wise and consistently. To take into account the costs and calculation of the cost of production products, where serially or massively produce the same or the same product, the production cycle is continuous, apply the process-based cost accounting and costing.

Calculation of the cost of production by the process method takes into account the fact that the entire production cycle is divided into a certain number of technological processes (stages, redistribution), within each of them, direct costs for production are taken into account, which are accumulated in production units and evenly distributed to all units of production . And indirect costs are included in the cost of production by distribution in proportion to the distribution base in the organization.

The basis for calculating with the process method is finished products, and the object of cost accounting is

the process, the technological stage, the redistribution. The list of allocated economically independent processes (stages, redistribution) in a particular production is determined on the basis of the general technological process, based on the possibilities of accounting and calculating.

Paying attention to the specifics of the activity of HEIs, the process of providing educational services and the possibility of accounting for costs for training courses and the total amount of indirect costs, it is necessary to indicate that the method of calculating costs and calculating the cost of providing educational services, offered below, has signs similar to the process method.

The difference between the "classical" and the proposed method is as follows. At the production plant, the process (stage, redistribution), acting as an object of cost accounting, is carried out within the framework of separate structural subdivisions in accordance with the production technology. In higher education institutions, the training of a student of a certain specialty and the form of training in each course (process, stage) is carried out in accordance with the curriculum on the territory of the entire university and enterprises that are the basis of practice, without reference to a particular structural unit. At the same time, a certain course of instruction for students of a particular specialty and form of training is an object of cost accounting.

Consequently, the calculation of the cost of providing educational services to a student of a certain specialty and form of training will be carried out by a method that will be called modified by process. The name of the method is due to the similarity of the cost accounting procedure for the process method: direct costs are accounted for by processes; indirect costs are accounted for by organization as a whole. The difference is in the specifics of the technological process of industrial enterprises and the technological process of rendering educational services by universities.

When calculating the basic educational services of the institution of higher education, the object of calculation will be an educational service provided to a student who studies according to a certain form of education. The object of cost accounting will be training courses (processes), which differ from each other in technology and the organization of the provision of basic educational services, the number of processes being equal to the number of courses for students studying directions and forms of training. A calculating unit will be an educational service provided to one student for a full course of study at a university.

The total cost of providing educational services to one specialist of a particular specialty and form of training will be determined as the sum of the direct costs of all the processes associated with his training and indirect costs. Incomplete production is not available, and all costs are fully included in the cost of providing educational services to this bachelor in the reporting period (academic year).

When calculating the cost of providing educational services, students will initially be collected direct costs of courses (in terms of bachelor's programs and forms of training), and indirect costs will be reflected by the total amount and then distributed among the directions and forms of education in proportion to the economically justified distribution base-the number of hours of training per year One student of this profile and the form of training. This indicator includes the following components: individual sessions with the student, classroom practical and lecture classes. The proposed base for the distribution of indirect costs corresponds to the specifics of the activity of the university, since it reflects the student's time in a certain direction and form of education in the university: the more time a student is engaged in a university, the more he consumes the services of general university departments, public services, exploits the fixed assets of the university, and vice versa .

Calculation of the cost price will be carried out taking into account that during the academic year the educational process is carried out simultaneously for the training of students of different courses of the same specialty and form of training. Therefore, for the academic year there are costs associated with providing educational services to students of a certain direction and form of training in terms of courses. The total amount of these costs is the cost of providing educational services to specified students of all courses of study.

In order to more accurately calculate the cost of providing educational services in a particular specialty and form of training, the maximum direct costs associated with their training are allocated:

- costs that are attributable to the cost of training of one student;
- costs attributable to the cost of training for a group of students;
- costs attributable to the cost of training of all students in this area and the form of education.

Further, to calculate the cost of providing services to one student for the full period of his / her education at a university, the amount of costs attributable to the cost of training for a group of students will be divided by the

average annual number of students in the group, and the amount of costs attributable to the cost of training for all students of this direction and form Training and the amount of indirect costs - the average annual number of students enrolled in this form of training.

Thus, we will receive the full cost price of providing educational services to a student of this direction and the form of training for the full period of his / her education at the university. The increase in the accuracy of the calculation will be achieved, firstly, by the organization of direct costs accounting in terms of courses, undergraduate and training programs and the distribution of indirect costs between directions in proportion to the economically justified distribution base. Secondly, special attention in calculating the cost of educational services for students in this area and the form of training will be given to the collection of those costs that occupy a significant proportion in the total amount. In particular, these are labor costs, the specific weight of which in the total amount of the university's costs reaches 44%, which is determined by the specifics of the educational process, characterized by the possibility of producing an educational service using first of all labor resources. A significant share in the total amount of costs is taken by the costs of social security for students - 30%. This is due to the fact that universities in accordance with the federal law "On Higher and Post-Graduate Professional Education" are obliged to provide social support to students and pay them scholarships and other social benefits. In connection with the growth of the technical equipment of the educational process, the amount of expenses for the maintenance and operation of fixed assets, software costs, etc., whose specific gravity is 10% of the total cost, is also significant. The remaining costs are 15% of the total costs of the university.

The proposed methodology for calculating the cost of providing educational services in a formalized version:

- the full cost price of rendering educational services to one student;
- the amount of costs for the training of one student in the direction of the course;
- the amount of costs that arise in connection with the training of a group of students in the direction of students on the course;
- the number of students enrolled in the course;
- the amount of costs arising in connection with the training of students of all courses in the direction of this form of training;
- The amount of general university expenses for the maintenance of the university, attributed to the cost of the direction of this form of training;
- the number of students of all courses studying in the direction of this form of education.

If in the higher educational institution there are departments for work with students studying on a paid basis, then this model will take the following form (formula 1.):

$$C/c_i = \sum_{j=1}^m a_{ij} + \sum_{j=1}^m \frac{b_{ij}}{\Gamma_{ij}} + \left(\frac{d_i}{\Gamma_{odi}} + \frac{O_i}{\Gamma_{bi}} \right) + \frac{c_i}{\Gamma_{odi}} \quad (1)$$

Notation	Name of the costing article
$ЗИ_{ij}$	Salary for individual classes with students of the j-th course i-th direction
$ЕИ_{ij}$	Deductions for social needs
$Д_{ij}$	Expenses for providing students with credit books, student cards, diplomas and other
$СТ_{ij}$	The cost of scholarships for j-course students i i-th direction
$П_{ij}$	Costs for students to practice the j-th course in the i-th direction
$Зал_{ij}$	Amount of salary for practical classes for students of the j-th course i-th direction
$Зал_{ij}$	The amount of salary for conducting lecture classes for j-course students in the i-th direction
$Еа_{ij}$	Deductions for social needs
A_i	Depreciation of fixed assets, which are used only in the educational activities of students in the i-th direction
KV_i	Part of the cost of utilities for the content of the auditor fund, which holds classes only with students i-th direction
TP_i	The cost of the current repair of the auditor fund, which is in use only by students in the i-th direction
PM_i	The cost of consumables expended in connection with the operation of fixed assets and / or the auditor fund that are in use only by students in the i-th direction

Зобс _i	Salary for staff serving fixed assets and / or an auditor fund for students in the i-th direction
Еобс _i	Deductions for social needs
ДК _i	Expenses for the functioning of the dean's office to the i-th direction

O_i- Costs for the functioning of the department for work with students studying on a fee basis,

r_{bi}– The number of students in the i-th direction, who are enrolled in the j-th course, who are paid educational services

The following designations are assigned to the costing articles in relation to the model presented:

Table 4. Calculation items and their symbols

In expanded form, in the context of the calculation clauses, the presented model has the following form:

$$C/c_i = \sum_{j=1}^n (З_{Иj} + Е_{Иj} + Д_{ij}) + \sum_{j=1}^n \frac{(C_{Tij} + П_{ij} + Зап_{ij} + Зал_{ij} + Еа_{ij})}{r_{ij}} + \left(\frac{A_i + КУ_i + TP_i + PM_i + Зобс_i + Еобс_i + ДК_i}{\Gamma_{oi}} + \frac{O_i}{\Gamma_{bi}} \right) + \frac{c_i}{\Gamma_{oi}}$$

$$\text{Либо } \sum_{j=1}^m a_{ij} = \sum_{j=1}^m (З_{Иj} + Е_{Иj} + Д_{ij}) \cdot \sum_{j=1}^m \frac{b_{ij}}{r_{ij}} = \sum_{j=1}^m \frac{(C_{Tij} + П_{ij} + Зап_{ij} + Зал_{ij} + Еа_{ij})}{r_{ij}}$$

$$\frac{d_i}{\Gamma_{oi}} = \frac{A_i + КУ_i + TP_i + PM_i + Зобс_i + Еобс_i + ДК_i}{\Gamma_{oi}} + \frac{O_i}{\Gamma_{bi}} \quad (2)$$

This model accumulates the costs of providing educational services to students of a certain direction and form of training for the full period of their studies at the university. The cost price of providing educational services to one student of a certain direction and form of training for one semester is calculated by the following formula:

$$C_i^1 = \frac{C/c_i}{y} \quad (3)$$

C_i¹ – The cost of training one student in the i-th direction and the form of training for one semester;

y – Number of semesters for training specialists in the i-th specialty.

This model will be an instrument through which the university administration will be able to calculate data on the cost of providing educational services in the context of undergraduate and training programs in different economic situations by introducing into the model those initial parameters that may occur in the near future. The second stage determines the upper threshold level of the cost of contract training. To determine the upper threshold level of the cost of contract training, it is necessary first of all to assess the level of the need for the state in specialists of a particular type. We introduce the linguistic variable "The level of the need for states in specialists of a particular type" with the term-set of values "Very Low, Low, Medium, High, Very High". To describe subsets of a term set, we introduce a system of five corresponding functions of trapezoidal form:

$$\mu_1(x) = \begin{cases} 1, & 0 \leq x < 0.15 \\ 10(0.25 - x), & 0.15 \leq x < 0.25 \\ 0, & 0.25 \leq x \leq 1 \end{cases} \quad (4)$$

$$\mu_4(x) = \begin{cases} 1, & 0 \leq x < 0.15 \\ 10(0.25 - x), & 0.15 \leq x < 0.25 \\ 0, & 0.25 \leq x \leq 1 \end{cases}$$

$$\mu_2(x) = \begin{cases} 0, 0 \leq x < 0.15 \\ 10(x - 0.25), 0.15 \leq x < 0.25 \\ 1, 0.25 \leq x < 0.35 \\ 10(0.45 - x), 0.35 \leq x < 0.45 \\ 0, 0.45 \leq x \leq 1 \end{cases}$$

$$\mu_3(x) = \begin{cases} 0, 0 \leq x < 0.35 \\ 10(x - 0.35), 0.35 \leq x < 0.45 \\ 1, 0.45 \leq x < 0.55 \\ 10(0.65 - x), 0.55 \leq x < 0.65 \\ 0, 0.65 \leq x \leq 1 \end{cases}$$

$$\mu_4(x) = \begin{cases} 0, 0 \leq x < 0.55 \\ 10(x - 0.55), 0.55 \leq x < 0.65 \\ 1, 0.65 \leq x < 0.75 \\ 10(0.85 - x), 0.75 \leq x < 0.85 \\ 0, 0.85 \leq x \leq 1 \end{cases}$$

$$\mu_5(x) = \begin{cases} 0, 0 \leq x < 0.75 \\ 10(x - 0.75), 0.75 \leq x < 0.85 \\ 1, 0.85 \leq x \leq 1 \end{cases}$$

Everywhere in the formulas x is a 01-carrier. The constructed membership functions are shown in Figure 1.

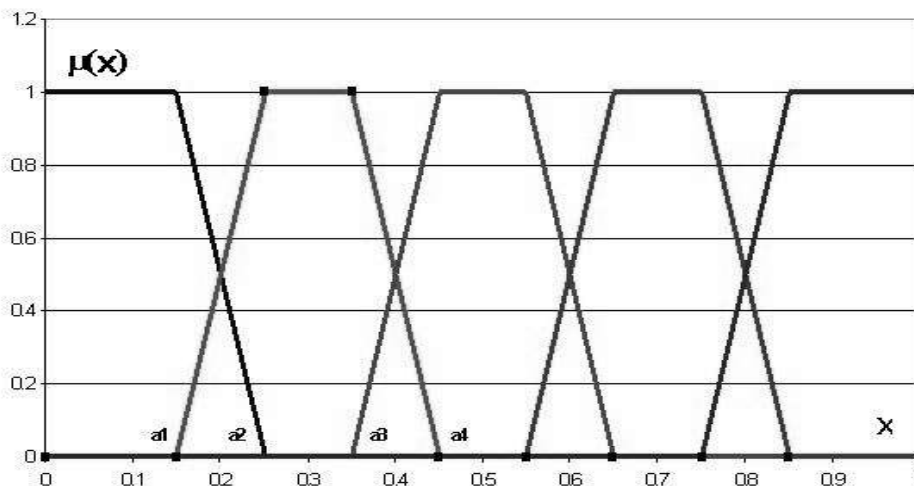


Figure 1. System of trapezoidal functions belonging to 01-carrier

We also introduce a set of so-called nodal points $a_j = (0.1, 0.3, 0.5, 0.7, 0.9)$, which are, on the one hand, the abscissas of the maxima of the corresponding membership functions on the 01 carrier, and, on the other hand, are uniformly spaced from each other by 01-carrier and are symmetric with respect to node 0.5.

Then the introduced linguistic variable "Factor level", defined on the 01-carrier, together with the set of node points hereinafter will be called the standard five-level fuzzy 01-classifier.

The constructed fuzzy classifier is of great importance for the further presentation. Its essence is that if nothing is known about the factor, except that it can take any values within the 01-carrier (the principle of

equal relevance), but we need to draw an analogy between the qualitative and quantitative evaluations of the factor, the proposed classifier does this with maximum reliability . In this case, the sum of all membership functions for any x is equal to one, which indicates the consistency of the classifier.

Also, if there is a set of $i = 1..N$ individual factors with their current values of x_i , and each factor has its own five-level classifier (not necessarily standard, not necessarily defined on the 01-carrier), then you can move from a set of individual factors to a single aggregated factor A_N , whose value is later recognized using a standard classifier. The quantitative value of the aggregated factor is determined by the formula of the double convolution:

$$A_N = \sum_{i=1}^N p_i \sum_{j=1}^5 \alpha_j \mu_{ij}(x_i) \quad (5)$$

α_j – Nodal points of the standard classifier, p_i - weight of the i -th factors in the convolution,

$\mu_{ij}(x_i)$ – Value of the membership function of the j -th qualitative level relative to the current value of the i -th factor. Further, A_N can be recognized on the basis of a standard fuzzy classifier.

From the formula, the purpose of the node points in the fuzzy classifier becomes clear. These points act as weights in the aggregation of a system of factors at the level of their qualitative states. Thus, the node points carry out the reduction of a set of nonstandard classifiers (with their non-symmetrically located nodal points) to a single classifier of the standard type, with simultaneous transition from a set of nonstandard carriers of individual factors to the standard 01-carrier.

It is possible to construct a matrix, where the factors are located along the rows, and on the columns - their qualitative levels. At the intersection of rows and columns are the values of the membership functions of the corresponding qualitative levels.

Table 5. Matrix for calculating the i -th aggregate indicator

Factors	Significance	The membership functions for the levels of the constituent factors:				
		Very	Low	Low Medium	High	Very High
a1	0,30	0,1	0,9	0	0	0
a2	0,35	0	0,6	0,4	0	0
a3	0,10	0	1	0	0	0
a4	0,15	0	0	0	0,5	0,5
a5	0,10	0	1	0	0	0
Nodal points		0,10	0,30	0,50	0,70	0,90

In this case, the matrix is composed for five factors, however, there may be a different number.

Depending on how high the level of demand for the state in the direction of a particular type is, the reference price for educational services of a particular direction of the previous year is chosen as a standard, taking into account the inflation of the current year.

Then, the competitive position of a particular training area (specialty) is analyzed taking into account the prestige of the institution.

To test the effectiveness of the selected cost of contract training, the cost-effectiveness of the cost project is determined.

Thus, the cost of contract training is the content of socio-economic relations of all agents of the educational sphere as an economic field about the value of educational services as a product of contract training.

3 CONCLUSION

The state importance of contractual training of a particular orientation is determined by the priority areas of the overall development strategy of the Russian Federation, the importance of teaching this or that direction at the international level, the level of development of a certain professional sphere at the moment.

The production attractiveness of contractual training of one or another orientation represents the degree of demand for a profile of training from the point of view of enterprises and organizations.

As a single parameter, it is possible to single out the universality of the graduate (for example, accountants and lawyers are necessary for any enterprise, regardless of the field of activity, therefore, the graduates of these directions will always be in demand and in large volumes), the uniqueness of the specialist (here we will talk about industries that need specialists rather narrow profile, for example, energy), the reputation of the university, which produces educational services.

By organizational attractiveness we mean the very organization of the production of educational services as a product of contract training, i.e. We consider the attractiveness of contractual training of one or another orientation in terms of intermediate consumers of educational services - students. As a single indicator here can be identified the possibility of employment, the quality of education, the prestige of higher education, the price of educational services, legal security.

The cost price of educational services is a combination of all the costs of the university for the provision of educational services to students of a certain specialty and forms of training for the full period of their education in the university.

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