Risk Assessment Methods of HEI

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Abstract. This article sets out to discuss an analysis of different methods of assessing risks in relation to universities. The study focuses on a review of qualitative and quantitative methods of assessing risks, and an analysis has been made of the possibilities of using these methods for the purpose of assessing different types of risks in the higher education system. With respect to a number of methods, computational mathematical models for use in risk assessment have been developed. Based on expert evaluation of socio-economic risks inherent in the university, assessment of risks has been made from the point of view of the likelihood of their materialization and the level of possible losses.

1. Introduction

Transformation of higher education functions in the epoch of digital economy changes the content and types of risks concomitant to the activities carried out by universities [1-3]. Universities belong to the most conservative types of organizations. The history of some of them numbers nearly a thousand years [4]. However, the environment in which universities operate is constantly changing. Category of the risk implies a threat of losing certain values. There are two approaches to understanding the term "risk". On the one hand, risk is likelihood or threat of damage and loss. Nevertheless, losses are not always of quantifiable nature [5]. Those may be losses of emotional equilibrium or social status [6]. For universities, losses may be potential students, revenues from educational and innovation activities, reputation and image, losses resulting from unsuccessful scientific research, loss of the license by the university [7-9].

On the other hand, risk is uncertainty, affecting the goal. Uncertainty is difficult to measure and assess but it is a concomitant condition of the risky situation [10]. In the higher education system, as a sphere of services, one can isolate the uncertainties connected with the quality of education, the results of scientific research, enrollment of students, the policy in the area of education, socio-economic environment, within which a university operates [11-12]. Assessment of risks inherent in a university assumes special importance with a view to determining whether they are acceptable [13].

2. Methods of assessing university specific risks

Within the framework of this article, we intend to consider various methods of assessing university related risks as well as an example of practical implementation of an expert poll.

University specific risk management is a process of finding, assessing, identifying and reducing the level of risks to acceptable level. An important phase in risk management is risk assessment.

The total integrated risk assessment R of a university can be presented as the summation of all the risks. This gives one an opportunity to determine the total level of risks; however, for purposes of risk management, it is the assessment of separate types of risks that is important.

The value of the risk R is defined as the sum of different risks R_i, calculated as the product of assumed losses L_i and the probability of the materialization $p(L_i)$ using the following formulae [14]:

$$R_i = L_i p(L_i) \qquad (1)$$
$$R = \sum R_i \qquad (2)$$

The values L_i may take on high levels with low probability $p(L_i)$ (risk of the university losing its license). And also, the other way around, at low values L_i with high probability $p(L_i)$ (risk of losing students).

At the same time, in a number of cases, it is impossible to determine the quantity of the losses (to quantify the losses) (the university's image, researchers' reputation). In this case, formula (1) is to assume the following form:

$$R_i = p(L_i) \qquad (3)$$

All the methods of assessing risks can be divided into quantitative and qualitative ones (tab. 1.).

Table1. Methods Used When Assessing University Specific Risks.

Type of methods	Variety of methods	Contents
Quantitative methods	Analytical methods	Analytical methods presuppose conduct of precision calculations, allowing determination of different indicators' values, which have a bearing on different types of risks [15]. There exist a few approaches to using these methods when assessing university specific risks: 1. Assessment of university specific cumulative risk through the absolute value of losses. Losses are losses of revenues resulting from educational activities. For example, the absolute value of losses resulting from a reduction in the planned number of first year students, can be calculated per the following formula: $$R_p = (L_p - L_R) \cdot P_{Ed} \ (4)$$ $R_p -$ losses incurred by the university resulting from a reduction in the planned number of first year students; $L_p -$ the number of students in accordance with student enrolment plan; $L_p -$ the number of first year students actually enrolled; $P_{Ed} -$ cost of training one student. 2. Bridge analysis approach is based on analyzing the current or future impact of a risk. Initially, it is crucial to determine the factors instrumental in causing the risks, to be followed up by assessment and calculation of each factor. For example, assessment of HR potential of one university lecturer as a factor influencing the risks of the university ranking positions, can be estimated using the following formula: $$P = 0{,}5 \cdot I_p + 0{,}3 \cdot I_g + 0{,}1 \cdot I_l + 0{,}1 \cdot I_a \ (5)$$

		P - indicator of HR potential of one lecturer; I_p — number of publications in international databases SCOPUS and Web of Science; I_g —number of grants and R&D contracts; I_l — number of patents and licenses registered by the lecturer; I_a — number of awards and prizes conferred on the lecturer.
	Statistical methods	Assessment of risks is carried out based on the statistical data for the previous periods. Such methods do not only enable assessment of the resultant risk, but also assessment of the risk at the stage at which the activities begin. This approach is reflected in the Markowitz model and is based on characterizing distribution of socio-economic phenomena using the normal distribution law [16]. Use of the method is possible when assessing the risk of the university's innovation activities, training quality indicators, risks of reduced revenues resulting from educational activities. Similar approach also allows use of the VaR method.
	Decision tree method	One of the most complicated challenges is to analyze scenarios of events development. Such an analysis allows simultaneous effect of several parameters on the end results of the university's activities or a project to be assessed by assessing the likelihood that each separate scenario option for development of events may transpire. The main problem with the use of this method in assessing the risks characteristic of theв of the university is the deficit of data [17].
	Experimental methods	If the impact of the risk is constantly changing and is typified by high dynamism (risks of students inflow and outflow), then the data for using mathematical apparatus for risk assessment are not enough. In a case like this, subjective input data are usually used. Classed as such methods are the expert evaluation methods (rule-of-thumb methods). These methods do not stipulate any strict mathematical requirements that optimality of decisions being made be proven. Experts are used to obtain quantitative assessments of risks which cannot be measured.
Qualitative risks	Descriptive methods	The principal focus in using the qualitative methods is on causes and factors which are conductive to occurrence of the risks, definition and classification of the university specific risks, the mapping of risks and describing the university's system of risks. Establishing the risk chart allows one to determine the position of various risks in relation to the borders of tolerance, laid down by the university itself. Thanks to the descriptive methods, one can see the linkage between different types of risks [18].

The choice of the method depends on availability of input data. If the university has data available to it on the previous period, in this case quantitative methods are used. When there are no data available or the available data are not sufficient, in practice non-quantitative methods are resorted to.

3. Expert evaluation method when assessing university specific risks

In order to investigate the probability of occurrence and the implications of the universities' socio-economic risks, a poll of experts was conducted [19]. The survey incorporated the following stages:

1. Selecting experts depending on self-assessment of their level of competence in the area of risk management in education.

2. Establishing a questionnaire.

3. Assessing the degree of probability for the socio-economic risks to materialize.

4. Assessing the degree of consequences resulting from materialization of socio-economic risks.

5. Analyzing and processing expert assessments.

To ascertain the experts' competence, calculation of summarized index of expert's competence was used. To assess the experts' competence, the following criteria have been determined (tab. 2.).

Table 2. Criteria for Determination of Experts' Competence.

Competence criteria, i_j	Degree of criterion impact
Availability of access to data on innovation and management processes, projects at the university, i_2	0.5
Competencies in the area of management in high education, i_1	0.4
Freedom from personal preferences in relation to the projects being implemented at the university, i_3	0.1

The experts assessed their competence level according to such indicators as "high", "medium", "low", which corresponded to the following numerical values 1; 0,5 and 0. Then, we proceeded to determine the expert's competence index, corresponding to the expert's level of competence based on the arithmetic mean value of the indicators in accordance with the following formula.

$$K_j = 0{,}5i_1 + 0{,}4i_2 + 0{,}1i_3 \qquad (6)$$

where K_j– competence index to the j-th expert,

i_j – value of the respective competence indicator.

The deficiency of this method is the likelihood of overstated self-assessment.

As a result of this phase of study, 6 were selected with the following indices of competenceK_j.

$$K = (0{,}75; 0{,}8; 0{,}95; 0{,}8; 0{,}95; 0{,}75) \qquad (7)$$

To carry out the expert analysis, 6 experts were invited (50% men and 50% women, experts' ages: 50 % - up to 40 years old, the rest – older than 40 of age) from six Russian universities (Northern (Arctic) Federal University, Southern Federal University, Astrakhan State University, Crimean Federal University). Such a number of experts correspond to the degree of analysis authenticity at the level of up to 90%.

When assessing the probability of occurrence and the implications of the socio-economic risks characteristic of the universities, the following risks were under consideration: risks of change in the budgetary policy in the area of education, risks of change in ownership at the university, inability to do jobs under business contracts, restructuring of the educational services market, deterioration of tax burden for the universities, change in the requirements relating to university applicants at the government level, fiercer competition among universities, demographic situation, teachers' low level of salaries [20].

When assessing the degree of probability for socio-economic risks to arise, the probability of each risky event setting in was looked into. The risks were evaluated according to the following scale: "improbable", "hardly probable", "probable", "almost probable", "possible". This enabled determination of the place of the risks in the form of a row of natural numbers arranged according to the degree of their probability. That was followed up by the ranking of the assessments obtained. Ranks were determined as follows: the risks were arranged depending on the sums of their ranks obtained as a result of individual assessments of each expert. In the process, the first place was

awarded to the risk whose sum of ranks was maximum. Thus, all the risks were ranked depending on degree of their probability (tab. 3.).

Table 3. Assessment of Degree of Probability for University's Socio-Economic Risks To Arise.

Item No.	Socio-economic risks	"improbable" - 5	"hardly probable" - 4	"probable"- 3	"almost probable" 2	"possible" - 1	Ranking
1	Risks of change in the budgetary policy in the area of education	0	8	6	4	0	18
2	Risk of change in the form of ownership at the university	0	24	0	0	0	24
3	Inability to do jobs under business contracts	0	12	9	0	0	21
4	Restructuring of the educational services market	5	16	3	0	0	24
5	Deterioration of tax burden for universities	0	0	3	8	1	12
6	Change in the requirements relating to university applicants at the government level	0	4	12	2	0	18
7	Fiercer competition among universities	0	0	0	2	5	7
8	Teachers' low level of salaries	0	0	0	6	3	9
9.	Demographic situation	0	0	12	4	0	16

Table 4. Assessment of Consequences Resulting From Materialization of the University's Socio-Economic Risks.

Item No.	Socio-economic risks	"maximum"- 5	"high" - 4	"medium"- 3	"low"- 2	"minimal"- 1	Ranking
1	Risks of change in the budgetary policy in the area of education	15	12	0	0	0	27
2	Risk of change in the form of ownership at the university	0	12	6	2	0	20
3	Inability to do jobs under business contracts	0	16	6	0	0	22
4	Restructuring of the educational services market	5	20	0	0	0	25
5	Deterioration of tax burden for universities	5	16	3	0	0	24
6	Change in the requirements relating to university applicants at the government level	0	0	9	6	0	15
7	Fiercer competition among universities	5	10	9	0	0	24
8	Teachers' low level of salaries	0	0	3	6	0	9
9.	Demographic situation	0	0	3	6	2	11

As can be seen from table 3, the least probability is characteristic of the risk of change in the form of ownership at the university, inability to do jobs under business contracts, restructuring in the market

for educational services. The experts awarded the greatest probability to the risks of fiercer competition among the universities and the risks of the teachers' level of salaries declining.

Assessment of degree of consequences resulting from materialization of the socio-economic risks was made in the same fashion using the following scale: "minimal", "low", "medium", "high", "maximum". All the risks were arranged according to degree of the consequences resulting from their occurrence (tab. 4.).

In the opinion of the experts, the most hazardous consequences for the universities are possible if such risks materialize as the risk of change in the budgetary policy in the area of education, in the event of restructuring of the educational services market, in the event of deterioration of the tax burden for the universities and in the case of stiffer competition among the universities. The least damage may be inflicted by the change in the demographic situation and low level of teachers' salaries (tab. 4.).

4. Conclusion

Assessment of risks is the key to effective risk management of the universities. Research of this activity is of great practical significance for the educational institutions. It is important that a suitable method of risk assessment be chosen. That may give universities a spectrum of tools which would enable them, at the stage of planning their activities, to identify unfavourable factors and to mitigate the unfavourable impact of financial and management risks in decision making.

5. Acknowledgements

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