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ON THE QUALITY ENHANCEMENT CONDITIONS OF EDUCATIONAL PROCESSES IN UNIVERSITIES

Abstract. *The subject of the research is the quality of educational processes in universities in the modern world. The hypothesis of the study suggests that creation of favourable educational process conditions contributes to the quality improvement of the studied issue. The following methods were used: expert analysis method, associative rules construction method. Calculations used statistical data from the site of the Round University Ranking which characterize the world ranking of universities for four key missions: teaching, research, international diversity and financial sustainability. The results of the study suggest a model of value creation for universities on the basis of the concept of TQM. It is shown that the introduction of the value-creation model in the educational activities of universities contributes the quality improvement of educational processes in them for several years.*

Keywords: *quality of education, data mining, total quality management, value creation, educational processes, determinant*

1. Introduction

In modern economic conditions the need for highly qualified personnel, which has formed professional and communication competencies, increases (P. Wells, P. Gerbic, et al., 2009, A.R. Masalimova, V.G. Ivanov, 2016, P. Siivonen, K. Komulainen, at al., 2016, A. Basak, K. Khanna, 2017, G. Romanova, S. Romanov, 2015).

A special role in the training of highly qualified specialists in various fields is played by universities which unite in their structure educational, research and innovation elements (G. Secundo, P. Del Vecchio at al., 2017, Á. Fidalgo-Blanco, M.L. Sein-Echaluce, F. García-Peñalvo,

2015).

The interaction of these elements creates a synergistic effect which determines trends of formation and development of world standards of education, contributes to the organization of international cooperation of universities and updates the need to address issues of improving the assessment quality of educational processes in them (M.M. Kennedy, 2016, P. Ramsden, 1991, I. Svetlik.,A. Braček Lalić, 2016, F.M. Hill, 1995, G. Srikanthan, , J. Dalrymple, 2003).

The conducted research has noted that the assessment of the quality of educational processes will be effective only if it is built on identifying the main determinants of the implementation of these processes.

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M. Tsinidou, V. Gerogiannis, P. Fitsilis show in their studies that when identifying determinants and ranking them, it is first necessary to take into account reflection from students' educational activities (M. Tsinidou, V. Gerogiannis, P. Fitsilis, 2010). Chua C. stresses the need to take into account the marketing component in the implementation of educational processes while assessing their quality (C. Chua, 2004). Harvey L. and Berit A. find a very important thing exploring the impact of funding on the implementation of educational processes (L. Harvey, A. Berit, 2003).

Consequently, as a determinant in solving the problem of quality assessing of educational processes and managing them conditions and patterns of their implementation can be used.

Moreover, the activity of modern universities is carried out under conditions of high uncertainty and a change in economic and educational trends, variety of identified determinants of the implementation of educational processes in them. While forming effective tools for assessing and managing the quality of these processes it is necessary to apply data mining methods which allow distinguishing patterns in low structured data.

All above mentioned has determined the purpose of the study.

The purpose of the study is to identify conditions under which the implementation of educational processes corresponds to a given level of quality.

2. Research methodology

Based on the completed bibliographic research (G. Secundo, P. Del Vecchio, at al. 2017, Á. Fidalgo-Blanco, M.L. Sein-Echaluce, et al., 2015, M.M. Kennedy, 2016, P. Ramsden, 1991, F. Abdullah, 2006, M.V. Sunder, 2016) it was determined that the key

management determinants of the of educational processes in universities are interrelations between the educational processes, research and innovation activities, international cooperation and financing of universities.

To analyze that fact, we used statistical data of the rating agency RUR which is the official representative of the British international university ranking of Times Higher Education (<http://roundranking.com>).

As it was mentioned above, the structure of the statistical data includes four indicators characterizing education, research, international activities, international diversity and funding in universities. These indicators are determined by experts on the basis of additive convolution of sub criteria forming the structure of the above indicators. The study was based on the assessment of 521 universities in 2015 and 2017.

In the study, in order to take into account the mentality and national characteristics, universities were divided according to their location – by continents.

The study has been conducted in technical universities.

The values of each indicator based on the calculation of quartiles are divided into three levels: high, medium, low. Values lying in the range from the values of the third quartile (75th percentile) to the maximum, the mean values in the range from the first quartile (25th percentile) to the third quartile (75th percentile), to the low level - from the minimum to the first quartile (25th percentile). A nominal scale was used for recoding calculated indices. Recoding of initial indicators was carried out separately for 2015 and 2017.

For the processing statistical data the association rules method is used which allows identifying the relationship between the factors. The basic concept of association rules is a transaction, a set of events which occur together (R. Agrawal, R. Srikant, 1994, I. Kavakiotis, O. Tsave, 2017).

Transactions are the rules consisting of two components: conditions and consequences. The identified association rules can be trivial or contain hidden information explaining the patterns of functioning of the objects or processes under study.

Therefore, the revealed rules should be additionally interpreted taking into account peculiarities of the functioning of an object or process. The number of selected rules is limited by the minimum and maximum support, the minimum and maximum confidence established by expert on the basis of the results of input or intermediate studies (R. Agrawal, R. Srikant, 1994).

Calculations were performed in the programs Statistics 6, MS Excel 2007, Mat lab 2009.

3. The study results

At the first stage of the study criteria for the quality of educational processes in

universities were determined.

Based on the analysis of the methodology for the formation of rating indicators, two indicators were chosen to characterize the quality of these processes characterizing educational and international activity in universities recoded on a nominal scale.

The quality of educational processes at the university level can be low, medium and high; at the level of the continent - low, below average, medium, above average, high.

The rules for quality assessing of educational processes on the basis of the specified criteria are formed using expert analysis. 17 scientists in the field of management of educational processes in universities from Russia, Kazakhstan, Montenegro and Canada acted as experts.

Table 1 shows the rules for assessing the educational processes quality at the university and continent level.

Table 1. Rules for assessing the quality of educational processes at the university, country, continent level

Rules for assessing the quality of educational processes at the university level		
The value of the indicator characterizing education at the university, the level	The value of the indicator characterizing the international activities at the university, the level	The quality of educational process
Low	Low	Low
Medium	Low	Medium
High	Low	Medium
Low	Medium	Low
Medium	Medium	Medium
High	Medium	High
Low	High	Low
Medium	High	Medium
High	High	High
Quality assessment rules of educational process at the continental level		
Universities with a low quality of educational process of more than 55%		Low
Universities with an average quality of educational process in the range of 45–55%, and the number of universities with a low quality of educational process greater than the number of universities with a high quality of educational processes		Below the average
Universities with an average quality of educational processes of more than 55%		The average
Universities with an average quality of educational process in the range of 45–55%, and the number of universities having their high quality of educational process greater than the number of universities having a low quality of educational processes		Above the average
Universities with high quality of educational processes of more than 55%		High

The recorded indicators of the RUR rating which determine research and development activities and financing are related to the indicators of the conditions for the implementation of the studied processes.

Table 2 shows the results of the analysis of the quality of educational processes in universities of continents in 2015 and 2017. In 2015, 2017 a high level of the quality of educational processes across the continents has not been identified (Table 2). Educational processes implemented in universities of Europe and North America achieved the highest quality in 2015, while the quality of educational processes in

Europe in 2017 decreased and became average. North America in 2017 retained a leading position in the quality of university education. In Oceania in 2015 the quality of educational processes was average, but by 2017 the quality of these processes had been reduced till below average. In Latin America and Asia the quality of educational processes at universities in 2015 was assessed as below average, while in 2017 the quality of educational processes in Latin America declined, and in Asia it remained at the same level. In Africa, as shown by the study, the quality of educational processes in universities was low.

Table 2. Analysis of the quality of educational process at universities by continents in 2015 and 2017

Name of the Continent	The quality of the educational process in universities							
	2015				2017			
	Number of universities ranged by the quality of educational processes,%			Total by continent	Number of universities ranged by the quality of educational processes,%			Total by continent
	Low	Medium	High		Low	Medium	High	
Europe	20	50	30	Above the average	18	56	26	Average
Africa	69	31	0	Low	69	31	0	Low
Latin America	50	50	0	Below the average	50	21	29	Low
Asia	32	55	13	Below the average	34	47	19	Below the average
North America	12	59	29	Above the average	13	58	29	Above the average
Oceania	28	66	6	Average	38	55	7	Below the average

In order to solve the problem of improving the quality of educational processes, associative rules have been built identifying the relationship between educational processes and conditions for their implementation.

The construction of associative rules was carried out according to recorded indicators

of the RUR rating.

Since the highest quality of educational processes has been found in universities in Europe and North America, association rules are constructed for the indicated continents.

Table 3 shows groups of associative rules for European and North American universities.

Table 3. Groups of associative rules for the implementation of educational processes in universities in the European continent and their characteristics

Cause	Number of universities for which the rule is valid,%	The degree of conditionality of the effect of this cause,%	Effect	The actual quality level of educational services
2015				
An average level of international activities	34.54	63.63	An average level of scientific activity	Above the average
An average level of university funding	35.91	69.62		
An average level of scientific activity	35.91	69.62	An average level of international activities	
	34.55	63.63	An average level of university funding	
2017				
An average teaching level	30.14	57.98	An average level of scientific activity	Average
An average level of university funding	31.05	65.76		
An average level of scientific activity	30.14	57.98	An average teaching level	
	31.05	65.76	An average level of university funding	

As can be seen from the table 3, the quality of educational processes at universities in Europe is determined by the rules relating educational, international and research activities and university funding. All values of the established indicators are at an average level.

The constructed association rules for statistical data for 2015 and 2017 are generally structurally identical.

The interaction vectors between the influencing and resulting indicators are collinear in the constructed association rules and oppositely directed. For example, in 2015 the level of scientific activity in 34% of universities was determined by 63% of their funding level, and in 35% of universities the

attraction level for foreign specialists has reached 70%. And, similarly, the development of scientific activities in 34% of universities determined the amount of funding in to 63%, and in 35% of universities - to 70% - the level of attractiveness for foreign employees and students. At the same time, in 2015 scientific activity, international activity and financing were important indicators for universities. And in 2017, the vector of activities of universities changed somewhat, so the indicator of international activity was replaced by an indicator of the quality of education

Table 4. Groups of constructed associative rules for the implementation of educational processes in universities of the North American continent and their characteristics

Cause	Number of universities for which the rule is valid,%	The degree of conditionality of the effect of this cause,%	Effect	The actual level of quality of educational services
2015				
An average level of international activities	39.60	63.56	An average level of university funding	Above medium
An average level of study	31.68	55.70		
An average level of international activities	43.56	66.94	An average level of study	
An average level of scientific activity	33.66	62/08		
An average level of international activities	41.58	70.00	An average level of scientific activity	
2017				
An average level of international activities	45.60	76.44	An average level of scientific activity	Above medium
An average level of funding for universities and international activities	34.40	67.26		
An average level of scientific activity	37,60	60,38	An average level of study	
An average level of international activities	35.20	62.91		
An average level of international activities	48.80	71.38	An average level of university funding	
An average level of study	42.40	66.13		
An average level of scientific activity	40.80	66.42		
An average level of international and scientific activities	34.40	60.71		

A larger number of association rules are formed for universities of the North American continent than for European universities. The structural identity of the constructed rules for the studied years is not observed.

Collinear, oppositely directed interaction vectors between influencing and resulting indicators are identified. Thus, in 2015 indicators of the level of international activity and level of financing, level of training and level of financing are

interdependent, indicators of international activity and training, and scientific activity and training also have some mutual influence on each other.

At the same time, there are unambiguous (single) connections, for example, the indicator average level of international activity determines the average value of the level of scientific activity, while no inverse relationship has been established. In 2017 the collinear, oppositely directed interaction vectors are larger, and there are no single

connections. Thus, interrelations are established between the level of scientific activity and the level of financing, and the level of international activity and financing; the level of study and levels of scientific activity and international activity. As it is seen, the level of funding is already influenced by four indicators: scientific activity, international participation, training, as well as the joint influence of scientific activity and international activity.

4. Discussion

The results of the calculations showed that among the values implemented in the universities of both continents there is no high quality of education as a result of their activities. Comparing the results obtained, the following feature can be noted: if in Europe the average level of study directly depends on the level of development of scientific activity, in North America the same level of study is also determined by the level of international participation. Similarly, the level of funding at universities in the European continent is determined by the level of scientific activity, whereas in the North American continent it is determined

by the interaction of study quality and the volume of international participation.

Moreover, in 2017 the level of funding for universities in North America is determined by combining the three component characteristics. It should be noted that at the universities of the North American continent the quality of education was among the resulting indicators of their activities both in 2015 and 2017, while in European universities there was a change of priorities.

This can be explained by the establishment of a decline in the quality of education, as a result of which the need to maintain an average and above average quality of education at universities has come to the fore. Analysis of the results allows us to conclude that the average level of education in universities of both continents can be provided by the interaction of elements determining the implementation of educational processes and environmental conditions, and the high level of educational processes is established due to the individual approach to education within a particular university.

Based on the constructed association rules (Tables 3, 4) models of value creation for universities were developed on the basis of the concept of TQM (total quality management) (Figures 1, 2).

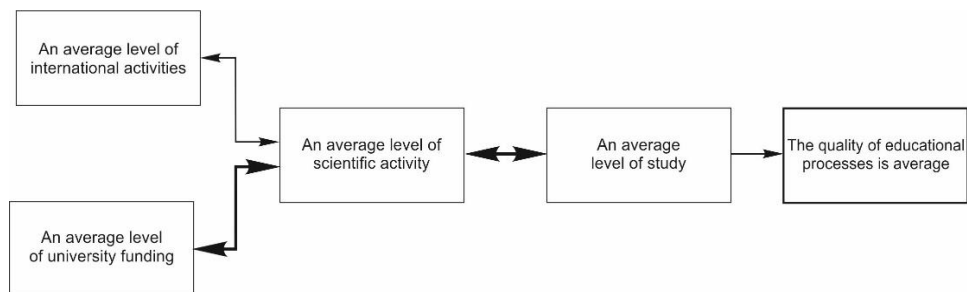


Figure 1. Model of value creation for universities of the European continent based on the concept of TQM

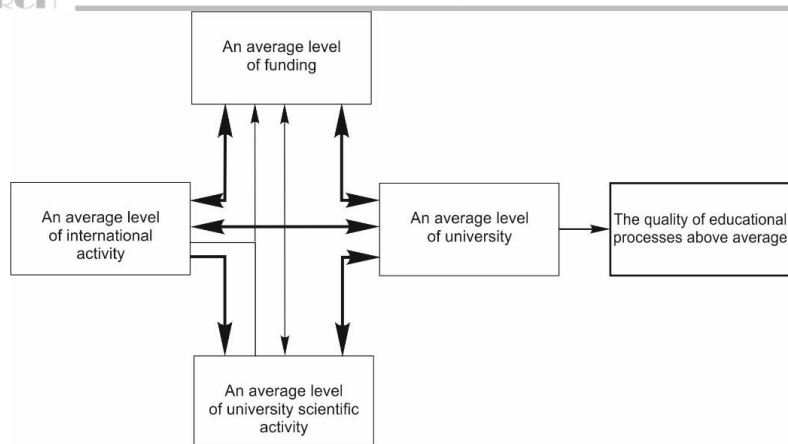


Figure 2. Model of value creation for universities of the North American based on the concept of TQM

In Figures 1, 2 the stability of the bonds between the elements is shown by the thickness of the arrows. Thus, in Figure 1, the relationship between indicators of international activity and scientific activity existed in 2015, but was not revealed in 2017. Similarly, the relationship between the indicators of international activity and scientific activity in the model presented in Figure 2 was revealed only for 2017. The model of value creation for universities in the European continent is characterized by compactness and presence of a small number of connections. As it is investigated, breaking any connection can lead to the loss of this element from the model which reduces its stability.

In the model of value creation in the universities of North America, each element has at least three connections, which ensures stability of the system, even in the event of the breaking or disappearance of any of the connections. The implementation of the concept of this model over several years has allowed maintaining and improving the quality of educational processes in universities in North America. So it can be concluded that creation of favourable conditions is determined by the increase in the number

of links between the elements that form the laws governing the implementation of educational processes.

5. Findings

The average level of education in universities of both continents is ensured by the interaction of the considered elements. A high level of educational processes is determined by the implementation of an individual approach to education within a particular university.

2. The system of support of educational processes is more stable when there are more interconnections between the elements. At the same time, additional studies are needed to clarify the number of these elements and interrelations which allow avoiding the inertia of the development of universities.

3. The implementation of the concept of the TQM model based on the values implemented in the universities of North America allowed maintaining and improving educational processes quality for a number of years.

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