

INTEGRATED ASSESSMENT OF COMPETITIVENESS OF NATIONAL HIGHER EDUCATION SYSTEM

ANTONINA DYAKON

Chernihiv State Institute of Economics and Management
E-mail: antonina.djakona@isma.lv

ABSTRACT

The main indicators of the national higher education system's competitiveness are analysed in the article. In the article is represented the integrated assessment of competitiveness of higher education of Ukraine to determine the basic priorities of implementation of the state policy of development of national higher education system's competitive advantages.

Keywords: national higher education system, higher education institution, integral index, estimation algorithm

1. INTRODUCTION

Statement of the problem. The higher education system is one of the main drivers of innovation development of the national economy and thus the country's competitiveness. In this regard, the need for updated and effective implementation of public policy formation of competitive advantages and development of higher education system in Ukraine based on the study of key performance indicators and parameters of activity of domestic universities over the past decades. Analytical characterization of the competitiveness of the national system of higher education, along with a statistical analysis of the main parameters of the domestic institutions of higher education provides for the implementation of integral evaluation of the influence of groups of indicators. Analysis of the level of competitiveness and the potential formation of competitive advantages of the national higher education system should be based on the principles of unity, consistency, consistency and integrity.

Analysis of recent research and publications. Various aspects of the functioning and development of the higher education system are the subject of research of many scientists, in particular: Kalenyuk I.S., Andruschenko V.P. Nikolaenko S.N., Kuklina O.V., Kholyavko N.I., Tsymbal L. I. and others. Along with this, a permanent research questions require analysis and integrated assessment of the basic parameters and trends of the national higher education system.

Statement of the problem. The aim of the article is to conduct an integrated assessment of the competitiveness of the national system of higher education to support the main directions of its development in the medium and long term.

The main material. Detailed algorithm of the integral evaluation of the competitiveness of the national system of higher education is presented in Table. 1.

TABLE 1 Detailed evaluation of the competitiveness of the algorithm

Phase 1	Feature, content phase 2
Defines the objectives and modalities of the organization - the owner of the information resources	
An information system organization, the necessary basis for the system analysis	
Organization of baseline data collection	
Formation of a group or individual performance criteria, defined as a measure for comparison of quantitative indicators in the study with respect to the operation of funds spent and the results obtained	Criterion must meet the following basic requirements: <ul style="list-style-type: none"> - Have a clear physical meaning; - Be defining and respond to the main purpose of the system, subsystem or component; - Take into account the main factors that determine the level of security of the system; - To be critical to the analysed parameters and sufficiently sensitive to them
Is given by the matrix X, in which - the value of the j-th index of the i-th object	$X = \begin{pmatrix} x_{11} & \dots & x_{1j} & \dots & x_{1n} \\ \dots & \dots & \dots & \dots & \dots \\ x_{i1} & \dots & x_{ij} & \dots & x_{in} \\ \dots & \dots & \dots & \dots & \dots \\ x_{m1} & \dots & x_{im} & \dots & x_{mn} \end{pmatrix}$ <p>The initial data in the form of a matrix allows you to explore or change the values of the</p>

ANALYTICAL MANAGEMENT

	characteristics of different objects, or values of the characteristics that describe the state of an object over time
Is given by the vector K, the elements of which reflect the importance of the j th index	$K = (k_1 \dots k_j \dots k_n)$
Is given by the vector S, whose elements take the values: • - 1, if the j th component-disincentives; • + 1, if the j th component stimulator	Stimulants - it figures corresponding to the maximum value of the best individual criteria. Disincentives - it figures that correspond to the minimum value of the best individual criteria
Standardization specifications (performance), as different characteristics may be of different dimensions. To perform the operation defined	<ul style="list-style-type: none"> - the arithmetic mean of the characteristic $X_j = \frac{1}{m} \sum_{i=1}^m X_{ij}$; - standard deviation of the jth characteristic $\sigma_j = \left[\frac{1}{m} \sum_{i=1}^m (X_{ij} - X_j)^2 \right]^{\frac{1}{2}}$; - standardized value jth object $Z_{ij} = \frac{X_{ij} - X_j}{\sigma_j}$.
Formation of a standardized matrix	$X = \begin{pmatrix} z_{11} & \dots & z_{1j} & \dots & z_{1n} \\ \dots & \dots & \dots & \dots & \dots \\ z_{j1} & \dots & z_{jj} & \dots & z_{jn} \\ \dots & \dots & \dots & \dots & \dots \\ z_{m1} & \dots & z_{jm} & \dots & z_{mn} \end{pmatrix}$
Calculation of etalon-point	etalon-point created by the rule of characteristics - stimulants selected characteristics with maximum values, and of the characteristics - disincentives - with minimal
Ranking objects based on characteristics of the reduction	This stage has an important place in the comprehensive analysis in two cases: 1) when it is necessary to compare the state of several objects based on a uniform system of indicators; 2) The cord is not necessary to compare the results of operation of any object over time
Assessment ranking places	Determined by the distance between the points that characterize the objects under study and the reference point $P_0 : C_{i0} = \left[\sum (Z_{ik} - Z_k)^2 \right]^{\frac{1}{2}}$
The distance between the i-th element and the point can draw preliminary conclusions about the object-place ranking in the quality assessment system	- Formed vector values of the distances $C = (C_{10} C_{20} \dots C_{m0})$
	- Determined by the arithmetic mean of the distances between the i-and the object and the point $P_0 : \bar{C}_0 = \frac{1}{m} \sum_{i=1}^m C_{i0}$;
	- Calculate the standard deviation of the point $P_0 : \sigma_0 = \left[\frac{1}{m} \sum_{i=1}^m (C_{i0} - \bar{C}_0)^2 \right]^{\frac{1}{2}}$
	- Quality Score is calculated functioning of the i-th object $C_0 = \bar{C}_0 + 2\sigma_0$
	You can refine the calculations, defining evaluation $D_i = 1 - \frac{C_{i0}}{C_0}$, which is interpreted as follows: the quality of the object, the higher the index value is closer to unity

Source: compiled by the author on the basis of [1; 6-7]

Consolidated integral indicator of the competitiveness of the national system of higher education can usefully be measured by the following formula: $I=0,1A+0,1B+0,15C+0,3D+0,15E+0,2F$,

And where - consolidated integral indicator of the competitiveness of the national system of higher education;

And - an integral component of intellectual and labour to ensure the competitiveness of the national system of higher education;

In - integral indicator logistics competitiveness of the national system of higher education;

C - an integral component of financial support the competitiveness of the national system of higher education;

D - an integrated indicator of the internationalization of higher education;

E - an integral component of knowledge transfer of the national system of higher education;

F - integrated performance indicator of scientific and technological activities.

Weight values of the coefficients for the calculation of the consolidated integral index of competitiveness of the national system of higher education are presented in Table. 2:

ANALYTICAL MANAGEMENT

TABLE 2 Weight values of the coefficients for the determination of the consolidated integral index of competitiveness of the national higher education system

indicators	integral index of intellectual staffing competitiveness of the national system of higher education (10%)	integral component of logistics competitiveness of the national system of higher education (10%)	integral indicator of financial support competitiveness of the national system of higher education (15%)	integral indicator for knowledge transfer of the national system of higher education (30%)	integral indicator of the internationalization of the national system of higher education (15%)	integral indicator of the effectiveness of the national system of higher education (20%)
weight ratio	0,1	0,1	0,15	0,3	0,15	0,2

Source: Calculated by the author

First of all we define the integral index of intellectual - staffing competitiveness of the national higher education system. Components of the projected figure elected the following parameters: number of students, the number of trained professionals, the number of graduate students, the number of doctoral students, the number of scientists, the number of PhDs in the economy, the number of doctors in the economy, the number of specialists engaged in scientific and scientific - technical work, the number of authors of Industrial Designs.

Integral indicator of the effectiveness of the national system of higher education is based on a consideration of the dynamics of the following parameters: the volume of completed fundamental research, applied research performed by volume, the volume of completed development, the volume of completed scientific - technical services, the volume of completed scientific and scientific - technical work on the creation of new products, the volume of performed scientific and scientific - technical works on the development of materials, the volume of completed scientific and scientific - technical work on the creation of methods, theories, and the volume of completed scientific and scientific - technical works on the development of technologies.

The calculation of the above-mentioned partial indicators in order to calculate the integral composite index of competitiveness of the national higher education system requires the construction of each of these matrices observation. Matrix describes the observations to the study of the values of partial features. In the next step narrows the space in order to improve the rationality and exclusion of features does not significantly affect the productive indicator. This requires estimation of the coefficient of variation: $V_j = \frac{S_j}{\bar{x}_j}$, $S_j = \sqrt{\frac{1}{m} \sum_{i=1}^m (x_{ij} - \bar{x}_j)^2}$, $\bar{x}_j = \frac{1}{m} \sum_{i=1}^m x_{ij}$, where x_{ij} - the value of i-th index for the j-th year; \bar{x}_j - the arithmetic average value of i-th index; S_j - the standard deviation of the i-th index; V_j - coefficient of variation of the i-th index [1; 6-7].

Subsequently composed calculation table for calculating the coefficient of variation. For each j-th indicator to check the following inequality: $V_j < e$, where e - limit value [1; 6-7].

If the value of the index is less than the value of V_j $e = 0,01$, then these figures have quasiconstant and excluded from further study, and all indicators, remaining after the elimination of unnecessary and quasi are considered equivalent [1; 6-7]. The analysis showed that in this case none of the indicators is not a quasi-permanent. Features included in the observation matrix, heterogeneous, as describe various properties of objects having different units of measurement. Therefore, to be implemented prior transformation is to standardize signs. This conversion is performed in accordance with the formula: $z_{ij} = \frac{x_{ij} - \bar{x}_j}{S_j}$, where x_{ij} - values of j-th indicator for the i-th period; \bar{x}_j - the arithmetic mean of the j-th index; S_j - the standard deviation of the j-th index [1; 6-7].

Matrix of normalized indicators for each of the integral indices. When forming a point-reference (P0) of indicators stimulant elected the maximum values, and of indicators, disincentives - the minimum

value, i.e.: $P_0(z_{01}, \dots, z_{0k}, \dots, z_{0n})$, where $z_{ok} = \max_i z_{ik}$, $k \in J$; $z_{ok} = \min_i z_{ik}$, $k \notin J$, J - Many indicators of stimulant [1; 6-7].

In the next step we calculate the integrated assessment, which is expressed in the form of the integral index. For this purpose, firstly, to determine the distance (C_{i0}) between the points characterizing the studied elements and the reference point P_0 .

Secondly, using the formulas determine the value of the integral index (I_{ni}): $I_{ni} = 1 - \frac{C_{i0}}{C_0}$,

$$C_0 = \bar{C}_0 + 2S_0, \quad \bar{C}_0 = \frac{1}{m} \sum_{i=1}^m C_{i0}, \quad S_0 = \sqrt{\frac{1}{m} \sum_{i=1}^m (C_{i0} - \bar{C}_0)^2} \quad [1; 6-7]. \quad C_{i0} = \sqrt{\sum_{k=1}^n (z_{ik} - z_{0k})^2}, \quad \text{where } i=1,2,\dots,m, k=1,2,\dots,n$$

Dynamics integral indicators ensure the competitiveness of the national higher education system is displayed in the Table. 3.

TABLE 3 Dynamics integral indicators ensure the competitiveness of the national higher education system

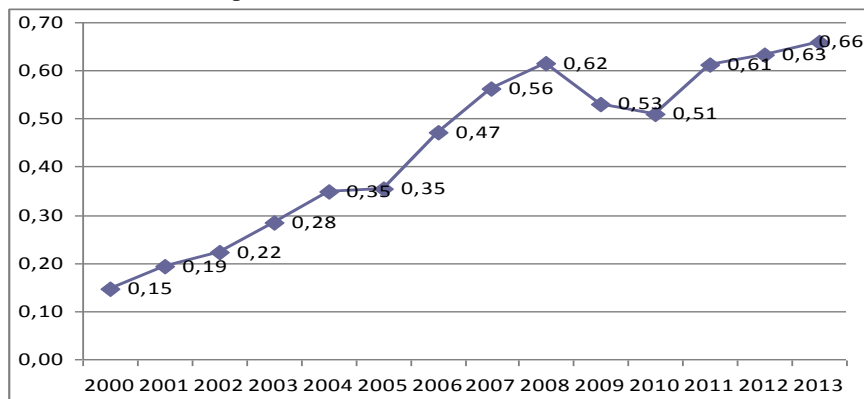
integral indicator	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Integral component intellectually - staffing competitiveness	0,12	0,18	0,17	0,26	0,28	0,38	0,44	0,48	0,55	0,56	0,55	0,52	0,36	0,23
absolute deviation (+/-) Until 2001 p.	-	0,06	0,05	0,14	0,16	0,26	0,32	0,36	0,43	0,44	0,43	0,4	0,24	0,11
The value of the integral index of the material - technical support competitiveness	0,12	0,14	0,2	0,22	0,25	0,14	0,37	0,62	0,5	0,38	0,28	0,51	0,27	0,19
absolute deviation (+/-) until 2001 p.	-	0,02	0,08	0,1	0,13	0,02	0,25	0,5	0,38	0,26	0,16	0,39	0,15	0,07
The value of the integral indicator of the competitiveness of financial security	0,18	0,26	0,32	0,37	0,43	0,45	0,49	0,52	0,6	0,66	0,63	0,81	0,82	0,8
absolute deviation (+/-) until 2001 p.	-	0,08	0,14	0,19	0,25	0,27	0,31	0,34	0,42	0,48	0,45	0,63	0,64	0,62
Value of the integral indicator for knowledge transfer of the national higher education system	0,15	0,17	0,21	0,28	0,36	0,36	0,49	0,62	0,69	0,56	0,61	0,76	0,8	0,87
absolute deviation. (+/-) To 2001 p.	-	0,02	0,06	0,13	0,21	0,21	0,34	0,47	0,54	0,41	0,46	0,61	0,65	0,72
The value of the integral indicator of the internationalization of the national higher education system	0,12	0,1	0,23	0,25	0,25	0,23	0,25	0,28	0,38	0,32	0,16	0,22	0,32	0,34
absolute deviation (+/-) until 2001 p.	-	-0,02	0,11	0,13	0,13	0,11	0,13	0,16	0,26	0,2	0,04	0,1	0,2	0,22
The value of the performance indicator of the national higher education system	0,16	0,27	0,21	0,3	0,44	0,46	0,66	0,73	0,78	0,61	0,62	0,64	0,83	0,87
absolute deviation (+/-) until 2001 p.	-	0,11	0,05	0,14	0,28	0,3	0,5	0,57	0,62	0,45	0,46	0,48	0,67	0,71

Source: Calculated by the author

Thus, on the basis of the obtained results it can be stated quite strong intellectual potential - human factors in ensuring the competitiveness of the national system of higher education. Along with this, the problems of aging are updated scientific - teaching staff, the outflow of talented scientists abroad, and low interest young people in science - research activity owing to the relatively low wages. The calculations of the integral index material -Technical ensure the competitiveness of the national higher education system suggest the existence of a number of problems in domestic universities in terms of obsolete and non-operational equipment upgrades needed to provide educational and scientific processes. Particularly urgent is the problem of delayed introduction of modern information - communication technology in universities.

As follows from the results of the simulations performed by the integral indicator of internationalization of higher education, a significant public attention require the intensification factors representation of national universities in the global educational and scientific community. Improving the competitiveness of Ukrainian universities in the educational market is increasing the flow of students (including foreign). Based on a comprehensive generalization of the study is to develop a well-founded

consolidated integral indicator of the competitiveness of the national higher education system, the dynamics of which is reflected in pic. 1.



Picture 1 Dynamics of composite integral index of competitiveness of the national higher education system
Source: constructed by the author.

2. CONCLUSION

Thus, we can conclude that there is a positive trend in the composite performance indicator of the national system of higher education. Along with this, it is necessary to focus attention on the fact that the impact of higher education institutions directly determines the level of their competitiveness. Given the powerful intellectual and human resource capacity of the higher education of Ukraine, in our opinion, the impact of factors can be identified as one of the key factors in strengthening the competitiveness of the national system of higher education at the national level.

Integral assessment of the competitiveness of the national higher education system proves the existence of the Ukrainian universities powerful intellectual and human resource capacity, completion of which determines the effectiveness of the implementation of activities to improve their competitiveness. Problems of development of the system of higher education in Ukraine is concentrated mainly in the parameters of logistical and financial support of teaching methods, research, innovation, international activities of educational institutions. Priority by the management of universities and government regulation of higher education requires activation of factors associated with the transfer of knowledge, efficiency and internationalization of the universities.

REFERENCES

- [1] Антохонова И. В. (2004) *Методы прогнозирования социально-экономических процессов* / И.В. Антохонова. – Улан-Удэ: Ид-во ВСГТУ, 212 с
- [2] Каленюк І. (2002) *Проблеми та механізми фінансового регулювання освіти в сучасних умовах* // Вища освіта. **4-5**, С. 82-90
- [3] Каленюк І.С. (2011) *Інтеграція вищої освіти України в європейський та світовий освітній простір: економічний вимір: монографія* / І.С. Каленюк, О.І. Гонга, М.П. Вербовий, Н.І. Холявко; За заг. ред. д.е.н., проф. Каленюк І.С. – Чернігів: РВК «Десяняська правда» 165 с.
- [4] Каленюк І.С. (2014) *Освітній імператив суспільного розвитку: Наукова монографія* / І.С. Каленюк, О.І. Гонга, Холявко Н.І., Сакун О.С., Демченко О.П., Дьякон А.А., Цимбал Л.І. За заг. ред. д.е.н., проф. І.С.Каленюк. – Чернігів: ЧДДЕУ, 172 с.
- [5] Каленюк І.С. (2012) *Розвиток вищої освіти та економіка знань: монографія*/ І.С. Каленюк, О.В. Куклін. – К.: Знання, 343 с. – (Сучасна наука)
- [6] Носко В. П. (2011) *Економетрика: учебн.* / В.П. Носко. – М.: Издательский дом «Дело», 576 с
- [7] Скітер І. С. (2009) *Аналіз економетричних підходів в моделюванні інноваційних процесів* / І. С. Скітер, Л. С. Ладонько // Держава та регіони. Серія: Економіка та підприємництво. – Запоріжжя : Клас. прив. ун-т, **1**, С. 200–204.