

## FACTOR ANALYSIS OF ACTIVITY OF HIGHER EDUCATIONAL ESTABLISHMENTS OF VOLYN AREA OF UKRAINE

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### **Abstract:**

*In this article the author conducted a factor analysis of statistical indicators of activity of higher educational establishments of Volyn area of Ukraine. Two main factors of influence on these objects are certain. For automation of calculations a programmatic package StatSoft Statistica is used.*

**Key words:** factor analysis, statistical indexes, higher educational establishments, Volyn area.

**JEL classification:** C81, I23

### **INTRODUCTION**

In obedience to Law of Ukraine «About higher education» realization of public policy in industry of higher education comes true by providing of the balanced structure and volumes of preparation of specialists with higher education, that comes true in higher educational establishments (HEE) of state and communal patterns of ownership, for money of corresponding budgets, physical and legal persons, taking into account the necessities of person, and also interests of the state and territorial communities [1]. Therefore research of statistical indicators of activity of higher educational establishments in the separate regions of country, in particular in Volyn area, will be interesting.

For research a factor analysis will use, namely its partial case – a method of main components. Popularity of this method consists in, that after its help it is possible to educe the hidden hypothetical sizes (factors) on the basis of plenty of experimental data. A factor analysis is used by such sciences, as psychology, biology, sociology, meteorology, medicine, geography, and also economy. In the field of education after his help determined rating of regions after the regional index of market of educational services development, conducted segmentation of consumers of educational services [2–3].

The aim of writing of this article is realization of factor analysis of statistical indicators of activity of HEE of Volyn area of Ukraine. For it realization it is needed to untie such tasks:

- 1) to build a table with primary data;
- 2) to define the optimal amount of the hidden factors, that influence on them;
- 3) to give interpretation to the got factors.

### **EXPOSITION OF BASIC MATERIAL**

The factor analysis of activity of HEE of Volyn area of Ukraine will conduct on the basis of such 10 indexes:

- index 1 – amount of HEE I–II levels of accreditation, units;
- index 2 – amount of HEE III–IV levels of accreditation, units;
- index 3 – amount of students in HEE I–II levels of accreditation, thousand persons;
- index 4 – amount of students in HEE III–IV levels of accreditation, thousand persons;
- index 5 – amount of the accepted students to HEE I–II levels of accreditation for a year, thousand persons;
- index 6 – amount of the accepted students to HEE III–IV levels of accreditation for a year, thousand persons;

index 7 – amount of the produced specialists of HEE I–II levels of accreditation for a year, thousand persons;

index 8 – amount of the produced specialists of HEE III–IV levels of accreditation for a year, thousand persons;

index 9 – amount of graduate students on the end of year, persons;

index 10 – amount of doctoral students on the end of year, persons.

Primary data for all indexes represented in a table 1.

**Table nr. 1. Activity of higher educational establishments of Volyn area of Ukraine**

School year	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6	Index 7	Index 8	Index 9	Index 10
1995/96	15	2	10,4	11,5	3,0	2,6	3,5	2,0	248	2
1996/97	15	3	10,1	13,2	3,0	3,6	3,3	1,9	298	7
1997/98	13	3	10,0	14,8	3,0	4,0	3,1	2,1	365	14
1998/99	13	3	9,9	16,8	3,1	4,4	3,1	2,2	335	16
1999/00	14	3	10,0	17,3	3,3	3,9	3,1	2,9	313	14
2000/01	15	3	10,7	18,1	3,9	4,0	3,2	3,9	311	16
2001/02	15	3	11,6	18,9	4,3	4,2	3,1	4,8	301	12
2002/03	15	3	12,3	19,1	4,4	4,2	3,3	5,6	298	8
2003/04	14	4	12,1	21,0	4,1	4,9	3,4	6,8	244	5
2004/05	15	4	11,9	20,5	4,0	5,1	3,5	3,5	247	5
2005/06	14	4	11,0	23,8	3,6	6,6	3,2	3,8	251	9
2006/07	13	4	9,5	26,0	3,1	6,5	3,0	3,9	262	10
2007/08	13	4	9,4	27,6	3,1	5,8	3,1	3,9	297	15
2008/09	12	4	8,6	27,4	2,7	4,7	2,4	4,6	363	19
2009/10	11	4	7,7	27,0	2,2	4,7	2,0	5,7	408	22
2010/11	11	4	7,9	25,7	2,5	5,1	2,2	6,5	450	23
2011/12	11	4	8,1	23,6	2,5	4,2	2,2	6,3	462	23

It is called by an author on basis [4]

Analysis of table 1 shows that for last 17 years in Volyn area of Ukraine amount of HEE I–II and III–IV levels of accreditation (indexes 1, 2) almost did not change. At the same time the amount of students in HEE I–II levels of accreditation (index 3), accepted students to HEE I–II levels of accreditation (index 5), produced specialists of HEE I–II levels of accreditation (index 7) are diminished. After all other indexes (4, 6, 8, 9, 10) were set tendencies to the increase.

Later it is needed to build a correlation matrix on the basis of primary standardized data and find it own values. In a table 2 own values of correlation matrix (their sum equals the sum of units on the diagonal of matrix, id est 10), and also percents of their general dispersion, got by means of programmatic package of StatSoft Statistica, are brought.

**Table nr. 2. Own values of correlation matrix**

№	Own values	% of general dispersion	Combined own values	Combined % of general dispersion
1	6,065154	60,65154	6,06515	60,6515
2	2,365062	23,65062	8,43022	84,3022
3	0,936197	9,36197	9,36641	93,6641
4	0,295323	2,95323	9,66174	96,6174
5	0,145574	1,45574	9,80731	98,0731
6	0,090895	0,90895	9,89820	98,9820
7	0,045516	0,45516	9,94372	99,4372
8	0,032885	0,32885	9,97660	99,7660
9	0,020090	0,20090	9,99669	99,9669
10	0,003306	0,03306	10,00000	100,0000

For determining the optimal amount of the hidden factors that influence on select by us indexes, will apply three methods. In obedience to the first – to the criterion of Kaiser – abandon factors the own values of that exceed unit. Analysing the table 2, see that only two factors greater

unit, id est by the criterion of Kaiser it is needed to leave two factors, as only two own values that explain about 84,30 of combined general dispersion exceed unit.

In obedience to the second method abandon so much factors, how many explain the beforehand fixed part of the combined general dispersion (for example, 80 %). In our case it also two factors.

In obedience to the third method – criterion of scree (offered by Kattal), that is base on analysis of the special chart, on that dependence of size of own value of factor from his number is represented, – the optimal amount of factors can be defined after the point of the second bend. Id est on this chart it is needed to find such place on a chart, where reduction of own values from left to right is maximally slowed. On fig. 1 brought scree plot, on that a point of the second bend is opposite the third own value. Thus, by this method it is needed to leave three factors.

As two from three methods specify on two factors, will take this amount for optimal. The value of the factor loading at these factors is driven to the table 3. In it a grey color is distinguish the factor loading the value of that after the module exceeds 0,65.

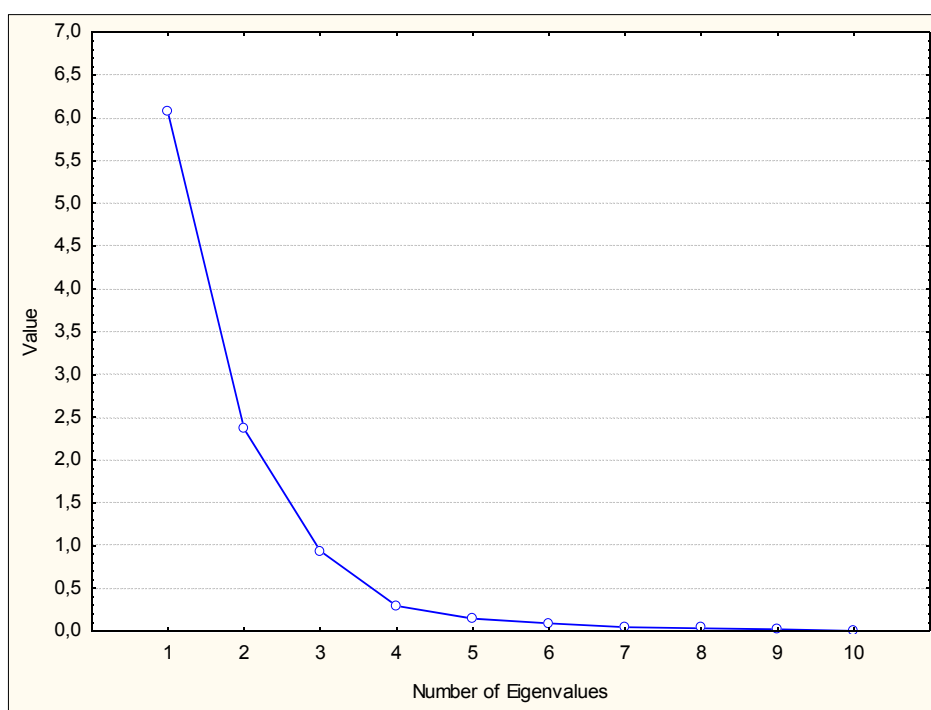


Figure nr. 1. Scree plot

Table nr. 3. The factor loading at factors

Nº	Index	$a_{1j}$	$a_{2j}$
1	amount of HEE I–II levels of accreditation, units	-0,883139	0,399090
2	amount of HEE III–IV levels of accreditation, units	0,232480	0,924794
3	amount of students in HEE I–II levels of accreditation, thousand persons	-0,947011	0,102852
4	amount of students in HEE III–IV levels of accreditation, thousand persons	0,362238	0,896052
5	amount of the accepted students to HEE I–II levels of accreditation for a year, thousand persons	-0,882515	0,047791
6	amount of the accepted students to HEE III–IV levels of accreditation for a year, thousand persons	-0,112104	0,883415
7	amount of the produced specialists of HEE I–II levels of	-0,912223	-

	accreditation for a year, thousand persons		0,336838
8	amount of the produced specialists of HEE III–IV levels of accreditation for a year, thousand persons	0,238203	0,676907
9	amount of graduate students on the end of year, persons	0,930169	0,045392
10	amount of doctoral students on the end of year, persons	0,882238	0,244754
General dispersion		5,185878	3,244338
Part of general dispersion		0,518588	0,324434

The mathematical models of dependences of indicators of activity of HEE of Volyn area of Ukraine from two hidden factors (got after an ortogonal rotation after the method of varimax) will represent as such linear combinations:

amount of HEE I–II levels of accreditation:  $z_1 = -0,883139F_1 - 0,399090F_2$ ;

amount of HEE III–IV levels of accreditation:  $z_2 = 0,232480F_1 + 0,924794F_2$ ;

amount of students in HEE I–II levels of accreditation:  $z_3 = -0,947011F_1 - 0,102852F_2$ ;

amount of students in HEE III–IV levels of accreditation:  $z_4 = 0,362238F_1 + 0,896052F_2$ ;

amount of the accepted students to HEE I–II levels of accreditation:  $z_5 = -0,882515F_1 + 0,047791F_2$ ;

amount of the accepted students to HEE III–IV levels of accreditation:  $z_6 = -0,112104F_1 + 0,883415F_2$ ;

amount of the produced specialists of HEE I–II levels of accreditation:  $z_7 = -0,912223F_1 - 0,336838F_2$ ;

amount of the produced specialists of HEE III–IV levels of accreditation:  $z_8 = 0,238203F_1 + 0,676907F_2$ ;

amount of graduate students:  $z_9 = 0,930169F_1 + 0,045392F_2$ ;

amount of doctoral students:  $z_{10} = 0,882238F_1 + 0,244754F_2$ .

A factor structure in two-dimensional space is represented on fig. 2. From it evidently, that the first factor with authority influences on six indexes of activity of HEE of Volyn area (1th, 3th, 5th, 7th, 9th, 10th), thus four from them (1th, 3th, 5th, 7th) are arctic to two other (9th and 10th), that their mutual reverse dynamics certifies. The second factor with authority influences on four indexes (2th, 4th, 6th, 8th) that all one arctic inter se.

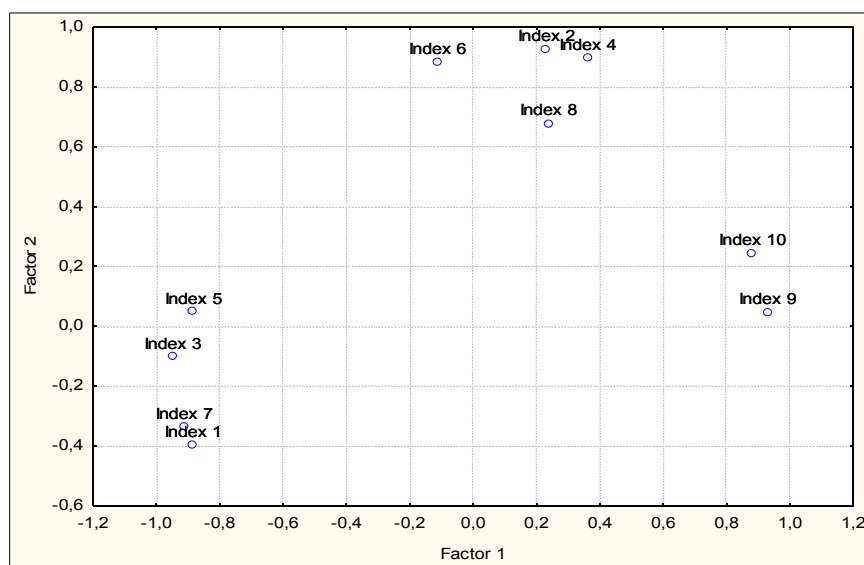


Figure nr. 2. Indexes of activity of HEE of Volyn in a space of the hidden factors

Will explain the got factors thus:

factor 1 – factor of more subzero accreditation and science, as it with authority influences on six indexes (amount of HEE I–II levels of accreditation, amount of students in HEE I–II levels of accreditation, amount of the accepted students to HEE I–II levels of accreditation for a year, amount of the produced specialists of HEE I–II levels of accreditation for a year, amount of graduate students on the end of year, amount of doctoral students on the end of year) factor loading  $a_{1j}$  of that more after the module values 0,65;

factor 2 – factor of higher accreditation, as he with authority influences on four indexes (amount of HEE III–IV levels of accreditation, amount of students in HEE III–IV levels of accreditation, amount of the accepted students to HEE III–IV levels of accreditation for a year, amount of the produced specialists of HEE III–IV levels of accreditation for a year) factor loading  $a_{2j}$  of that more after the module values 0,65.

## CONCLUSIONS

As a result of the conducted analysis it is possible to do such conclusions:

1) for research of indicators of activity of HEE of Volyn area of Ukraine it is expedient to apply a factor analysis, that gives an opportunity to explain plenty of experimental data a few of the hidden factors;

2) as a result of its realization it was got, that on indicators activity of HEE of Volyn area two factors influence: more subzero accreditation and science, higher accreditation;

3) for automation of calculations at this method of research it is expedient to apply the programmatic package StatSoft Statistica, that allows to save time calculations and build pictures with the evident images of results of calculations.

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