Yulia V. Makhomet[1]

FACTOR ANALYSIS OF INTELLECTUAL POTENTIAL OF A REGION

The article provides an insight on the nature of the notions "intellectual potential of the region", "structure of intellectual potential of the region", "analysis of intellectual potential of the region". A factor analysis of the intellectual potential of Ukraine's regions based on the resource and outcomes approaches is carried out. The correlation models for identification of the dependence between the amount of gross regional product per capita and partial indicators of intellectual potential of Ukraine's regions have been developed.

Keywords: *intellectual potential of the region; structure of intellectual potential of the region; analysis of intellectual potential of the region; a factor analysis of intellectual potential of the region.*

Юлія В. Махомет

ФАКТОРНИЙ АНАЛІЗ ІНТЕЛЕКТУАЛЬНОГО ПОТЕНЦІАЛУ РЕГІОНУ

У статті розкрито сутність понять «інтелектуальний потенціал регіону», «структура інтелектуального потенціалу регіону», «аналіз інтелектуального потенціалу регіону». Проведено факторний аналіз інтелектуального потенціалу регіонів України на основі ресурсного та результатного підходів. Розроблено кореляційні моделі для виявлення залежності між обсягом валового регіонального продукту на душу населення та частковими показниками інтелектуального потенціалу регіонів України.

Ключові слова: *інтелектуальний потенціал регіону, структура інтелектуального потенціалу регіону, аналіз інтелектуального потенціалу регіону, факторний аналіз інтелектуального потенціалу регіону.*

Форм. 1. Табл. 4. Літ. 16.

Юлия В. Махомет

ФАКТОРНЫЙ АНАЛИЗ ИНТЕЛЕКТУАЛЬНОГО ПОТЕНЦИАЛА РЕГИОНА

В статье раскрыта сущность понятий «интеллектуальный потенциал региона», «структура интеллектуального потенциала региона», «анализ интеллектуального потенциала региона». Проведен факторный анализ интеллектуального потенциала регионов Украины на основе ресурсного и результативного подходов. Разработаны корреляционные модели для выявления зависимости между объемом валового регионального продукта на душу населения и частичными показателями интеллектуального потенциала регионов Украины.

Ключевые слова: *интеллектуальный потенциал региона, структура интеллектуального потенциала региона, анализ интеллектуального потенциала региона, факторный анализ интеллектуального потенциала региона.*

Problem setting. Under the conditions of intellectualization and informatization of economy the driving force of successful socioeconomic reforms in different countries is the development of intellectual potential of these countries. Intellectual potential becomes a strategic resource that determines the competitiveness of contemporary economic systems.

The variety of territorial combinations of intellectual resources, spatial heterogeneity of intellectual potential as well as differences in the structure, specialization and the level of development of productive forces of individual territories enhances

[1] Lutsk National Technical University, Ukraine.

the need to investigate the intellectual potential in the regional context. One of the important objectives of this study is carrying out a factor analysis that in future will help to determine further directions of its development.

Latest research and publications analysis. In national and foreign literature there are many fundamental works studying various aspects of intellectual activities and intellectual potential. Issues related to intellectual potential are studied in the works of O. Butnik-Siverskiy and A. Krasovska (2004), N. Havkalova and N. Markova (2006), V. Heets (2003), O. Hrishnova (2006), S. Illyashenko (2008), B. Leontev (2002), I. Moyseenko and M. Demchyshyn (2008), N. Ushenko (2008) and others. A significant number of scientists, including I. Vahovych (2002), Z. Herasymchuk and L. Kovalska (2003), M. Dolishniy (2003), etc. are engaged in the study of socioeconomic development of regions. They investigate the nature, evaluate the social and economic development of regions and their economic potential etc.

Unresolved issues. It spite of the obvious value and significance of the mentioned scientific researches, there are virtually no studies on the intellectual potential of regions, the influence of intellectual potential on socioeconomic development of a region, methodological approaches to its assessment, there is no standard developed methodology of its assessment, factor analysis of intellectual potential has not been conducted, the factors that affect and determine its level remain scarcely explored. Thus, the lack of scientific and practical studies of certain problems and the growing importance of intellectual potential in social and economic development of regions creates the necessity to conduct a factor analysis of intellectual potential of a region.

The research objective is to conduct a factor analysis of the intellectual potential of the regions of Ukraine and to develop correlation models to identify the relationship between the volume of gross regional product per capita and partial indicators of the intellectual potential of Ukraine's regions.

Key research findings. Before going directly to the factor analysis of intellectual potential of the region, it is necessary to determine its economic contents and structure.

Under "intelligence" we mean a set of mental and cognitive abilities of a person on which his/her ability to absorb information and create new knowledge is formed. "Potential" means the possibilities of a subject to use resources effectively to achieve goals. Under the term "region" we mean the administrative territorial unit of a country, which is characterized by integrity, unity, interrelation of components and differs by its economic and geographical location, historical, cultural and ethnic characteristics, complex of natural, human resources, logistical, financial, innovative and other resources, specialization and structure of the economy. Thus, having defined the nature of the components of this concept ("intelligence", "potential" and "region"), let's formulate the definition of the term "intellectual potential of the region". Under the intellectual potential of the region we mean potential possibilities of a region to create, store and use effectively intellectual resources to ensure a high level of its socioeconomic development. An important characteristic of intellectual potential of a region is its structure. Common understanding of the structure of intellectual potential of a region has not formed been yet. Under the structure of intellectual potential of a region we mean a set of components (subsystems), links and relationships between them to ensure its functioning as a whole. Within the intellectual

potential of a region we should distinguish the following basic components: human potential, educational potential, scientific potential, innovation potential and information and communication potential. The basis for these potentials is formed by human, educational, scientific, technical, and information and communication resources. Therefore, the research on the components of intellectual potential of a region is closely related to the profound investigation of the components of intellectual resources of a region.

Developing a mechanism for increasing the intellectual potential of a region must be preceded by the analysis and assessment of the level of intellectual potential. Before the evaluation of intellectual potential of a region we must first conduct its factor analysis.

Under the analysis of intellectual potential of a region we understand the complex, interrelated research of its components, determination of the fundamentals for relationships and trends of its development in order to make effective management decisions. To investigate the effects of intellectual potential on socioeconomic development of a region we will conduct a factor analysis of the impact of intellectual potential and its components upon the gross regional product per capita.

Based on the set of primary statistical data in 2010, presented by the State Statistics Committee of Ukraine in annual statistics (State Statistics Service of Ukraine, 2012), we will conduct a factor analysis of the intellectual potential of Ukraine's regions according to the resource and outcomes approaches.

Preliminary analysis of the input data allows us make a conclusion about the presence of the linear relationship between the selected economic indicators:

$$y = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + a_5x_5 + \ldots + a_nx_n. \quad (1)$$

To identify the relationship between the volume of gross regional product per capita (y) and partial indicators of intellectual potential in 27 territorial administrative units we have built the correlation models by the following factors:

- according to the outcomes approach: available income of population per capita (x_1), the volume of services sales in the field of education per capita (x_2), the volume of scientific and technical works performed by organizations (companies) staff per capita (x_3), the volume of sales of innovative products that are new to the market per capita (x_4), the volume of services sales in the direction of activity in the field of information and communication and mail activities per capita (x_5).

- according to the resource approach: the number of population (x_1); the rate of natural increase (decrease) of population (per 1000 inhabitants) (x_2), the level of the economically active population (x_3), the level of employed population (x_4), unemployment rate (x_5), the coefficient of migration increase/decrease of population (per 1000 of people) (x_6), the load per one vacancy (x_7), average month salaries accrued to staff employees (x_8), the level of availability of educational pre-school institutions (x_9); the level of availability of secondary educational institutions (x_{10}), the number of students in secondary schools per 10000 inhabitants (x_{11}), the quantity of vocational educational institutions (x_{12}), the number of students of vocational educational institutions per 10000 inhabitants (x_{13}), the quantity of higher educational institutions (I–IV accreditation levels) (x_{14}), the number of students in higher

educational institutions of I–IV accreditation levels per 10000 inhabitants (x_{15}), the proportion of people with higher education employed (x_{16}), the proportion of people with incomplete and basic higher education employed (x_{17}), the level of personnel training (x_{18}), the level of developing the personnel skills (x_{19}), the number of organizations that carry out scientific and technical works per 1000 inhabitants (x_{20}), the proportion of specialists who carry out scientific and technical works (x_{21}), the proportion of highly qualified specialists (doctors, PhDs) employed in the economy of Ukraine (x_{22}), the proportion of expenditures on fundamental researches (x_{23}), the proportion of applied researches (x_{24}), the proportion of expenditures on scientific and technical works (x_{25}), the proportion of expenditures on scientific and technical services (x_{26}), the level of support for innovatively active enterprises (x_{27}), the level of innovation expenditures (x_{28}), the level of support with innovative products that are new to the market (x_{29}), the level of support for innovation products that are new to the enterprise only (x_{30}), the proportion of companies that have implemented innovative products in the total number of innovatively active enterprises in the industry (x_{31}), the level of development of new products (x_{32}), the level of implementation of advanced technological processes (x_{33}), providing the public with radiosets for audio cable broadcasting (x_{34}), the average daily amount of local broadcasting of public TV (x_{35}), the average daily amount of local broadcasting of public radio (x_{36}), the level of provision with newspapers and magazines (x_{37}); the level of provision with mass (public) libraries (x_{38}), the book fund of mass (public) libraries (x_{39}), the level of income from mail and communication services per person (x_{40}).

In constructing of the selected models let's calculate the pair correlation coefficients according to the outcomes and resource approaches. Pair correlation coefficients are used to measure the strength of linear relationship of different pairs of variables of a given set. It is taken into account that each pair of attributes is influenced by the connections of all other attributes between themselves and the attributes of this pair.

The indicators of closeness of connection between the attributes included in the equation according to the effective approach are presented in Table 1.

Table 1. **The matrix of pair correlation coefficients (according to the outcomes approach)**

	Y	X_1	X_2	X_3	X_4	X_5
Y	1	0.97166761	0.871349073	0.87361497	0.40096233	0.862766
X_1		1	0.856380342	0.89040138	0.39810931	0.8849682
X_2			1	0.86827816	0.25630415	0.9385291
X_3				1	0.347793	0.88574
X_4					1	0.2654421
X_5						1

Developed by the author.

These pair correlation coefficients indicate a relationship between the selected factors.

Table 1 demonstrates that the gross regional product per capita is in direct strong relationship with the level of available income of population per capita (x_1), the volume of services sales in the field of education per capita (x_2), the volume of scientif-

ic and technical works performed by own forces of organizations (companies) per capita (x_3), the volume of services sales in the direction of activity in the field of information and communication and mail activities per capita (x_5). Insignificant relationship the outcome variable shows with the volume of sales of innovative products that are new to the market per capita (x_4).

The indicators of closeness of the connection between the variables included in the equation according to the resource approach are presented in Table 2.

From Table 2 it is clear that the gross regional product per capita is in direct strong relationship with the level of average month salaries accrued to staff employees (x_8), the level of availability of higher education of institutions (I–IV accreditation levels) (x_{14}), the number of students in higher educational institutions of I–IV accreditation levels per 10000 inhabitants (x_{15}), the number of organizations that carry out scientific and technical works per 1000 people (x_{20}), the proportion of specialists who carry out scientific and technical works (x_{21}), the proportion of highly qualified specialists (doctors, PhDs) employed in the economy of Ukraine (x_{22}), the average daily amount of local broadcasting of public TV (x_{35}),the average daily amount of local broadcasting of public radio (x_{36}), the level of providing with newspapers and magazines (x_{37}), the level of income from mail and communication services for 1 inhabitant (x_{40}).

As a result of processing these data we obtain the following correlation dependences of the level of gross regional product per capita from the included into the regression equation factors.

Definitions and criteria for the correlation and regression analyses according to the outcome approach are presented in Table 3.

The coefficients show how much the average rate of the GRP per capita change due to the change of the factors per unit for the fixed values of other factors that were included in the model.

There has been such interpretations: an increase of available income of population per capita per 1 UAH will cause the growth of GRP per capita in 2.3 UAH, the volume of services sales in the field of education per capita – in 60.9 UAH. However, the growth of volume of scientific and technical works performed by organizations (companies) staff per capita and the volume of services sales in the field of information and communication and mail activities per person at 1 UAH will cause a reduction of GRP per capita by 0.0001 UAH and 1.8 UAH accordingly.

An important indicator of the model is the elasticity coefficient.

Based on the calculated elasticity coefficient we can make the following conclusions:

1) for the factor x_1: $E_1 = 1.934$. The increase of available income rate per capita at 1% leads to the increase of GRP rate per capita at 1.934%.

2) for the factor x_2: $E_2 = 0.192$. The increase of services sales in the field of education per capita by 1% leads to the increase of GRP rate per capita at 0.192%.

3) for the factor x_3: $E_3 = -0.001$. The increase of the volume of scientific and technical works performed by organizations (companies) staff per capita at 1% leads to the decrease of GRP rate per capita at 0.001%.

Table 2. **Matrix of pairwise correlation coefficients (according to the resource approach)**

	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Y	1.000	0.542	0.067	0.404	0.573	-0.499	0.536	-0.342	0.943	-0.424	-0.616	-0.498	-0.289	-0.296	0.738	0.842	0.444	-0.462	0.015	0.133	0.791
X1		1.000	-0.123	0.050	0.219	-0.403	0.055	-0.286	0.613	-0.539	-0.534	-0.472	0.032	-0.050	0.257	0.380	0.024	-0.091	0.456	0.475	0.317
X2			1.000	-0.121	0.001	-0.206	0.207	-0.140	0.104	-0.139	0.094	0.674	-0.563	-0.092	0.230	0.258	0.565	-0.224	-0.241	-0.270	0.236
X3				1.000	0.894	-0.092	0.308	-0.327	0.323	0.107	-0.283	-0.301	-0.166	-0.278	0.299	0.303	0.019	-0.241	-0.109	-0.168	0.373
X4					1.000	-0.527	0.580	-0.496	0.539	-0.163	-0.570	-0.428	-0.303	-0.412	0.474	0.452	0.212	-0.453	-0.047	-0.157	0.555
X5						1.000	-0.705	0.469	-0.578	0.571	0.737	0.397	0.351	0.388	-0.476	-0.419	-0.418	0.553	-0.102	0.033	-0.515
X6							1.000	-0.377	0.547	-0.429	-0.588	-0.322	-0.636	-0.610	0.573	0.460	0.535	-0.704	-0.303	-0.362	0.561
X7								1.000	-0.388	0.442	0.430	0.198	0.056	0.182	-0.289	-0.250	-0.172	0.386	-0.249	0.023	-0.317
X8									1.000	-0.551	-0.740	-0.525	-0.232	-0.226	0.672	0.763	0.396	-0.428	0.177	0.188	0.727
X9										1.000	0.689	0.390	0.177	0.145	-0.436	-0.417	-0.415	0.403	-0.145	-0.268	-0.438
X10											1.000	0.711	0.182	0.380	-0.489	-0.446	-0.250	0.389	-0.325	-0.243	-0.550
X11												1.000	-0.228	0.134	-0.365	-0.351	-0.007	0.239	-0.237	-0.240	-0.397
X12													1.000	0.754	-0.439	-0.311	-0.517	0.417	0.419	0.420	-0.418
X13														1.000	-0.398	-0.177	-0.183	0.312	0.146	0.242	-0.349
X14															1.000	0.863	0.721	-0.576	-0.379	-0.143	0.874
X15																1.000	0.751	-0.651	-0.280	-0.069	0.915
X16																	1.000	-0.711	-0.497	-0.273	0.754
X17																		1.000	0.466	0.381	-0.705
X18																			1.000	0.570	-0.319
X19																				1.000	-0.207
X20																					1.000
X21																					
X22																					
X23																					
X24																					
X25																					
X26																					
X27																					
X28																					
X29																					
X30																					
X31																					
X32																					
X33																					
X34																					
X35																					
X36																					
X37																					
X38																					
X39																					
X40																					

Continuation of *Table 2*

	X21	X22	X23	X24	X25	X26	X27	X28	X29	X30	X31	X32	X33	X34	X35	X36	X37	X38	X39	X40
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Y	0.878	0.828	0.129	-0.323	0.123	0.084	0.005	0.097	0.401	0.162	0.295	0.114	0.228	0.694	0.825	0.852	0.860	-0.669	-0.491	0.853
X1	0.360	0.372	0.009	-0.353	0.214	0.050	-0.145	0.027	0.068	0.096	-0.040	-0.097	0.269	0.062	0.179	0.301	0.327	-0.524	-0.281	0.240
X2	0.235	0.296	0.434	0.294	-0.480	0.192	-0.011	0.179	-0.340	-0.413	0.090	-0.180	-0.131	0.031	0.247	0.286	0.259	-0.154	-0.219	0.263
X3	0.415	0.329	0.301	0.115	-0.048	-0.403	-0.202	-0.489	0.032	-0.003	-0.018	-0.176	0.092	0.428	0.503	0.427	0.410	-0.289	-0.025	0.436
X4	0.589	0.509	0.384	-0.069	0.021	-0.363	-0.214	-0.361	0.041	-0.067	-0.043	-0.229	0.160	0.455	0.567	0.498	0.524	-0.574	-0.323	0.522
X5	-0.510	-0.495	-0.274	0.370	-0.143	0.047	0.094	-0.123	-0.024	0.137	0.073	0.182	-0.180	-0.191	-0.292	-0.281	-0.373	0.726	0.651	-0.321
X6	0.607	0.562	0.373	-0.164	-0.060	-0.005	-0.102	0.018	-0.042	-0.214	0.247	-0.035	0.077	0.530	0.469	0.352	0.459	-0.554	-0.416	0.515
X7	-0.328	-0.305	-0.227	0.154	-0.108	0.260	0.368	0.461	-0.129	0.074	0.146	0.132	-0.058	-0.110	-0.268	-0.252	-0.233	0.482	0.393	-0.175
X8	0.815	0.754	0.081	-0.369	0.193	0.045	-0.071	0.136	0.399	0.139	0.304	0.051	0.171	0.565	0.722	0.787	0.772	-0.785	-0.569	0.756
X9	-0.439	-0.450	-0.048	0.504	-0.228	-0.217	0.135	-0.133	-0.098	-0.088	-0.054	0.031	-0.257	-0.156	-0.139	-0.136	-0.268	0.702	0.400	-0.193
X10	-0.574	-0.490	-0.167	0.472	-0.270	0.067	0.211	0.021	-0.253	-0.109	-0.184	-0.006	-0.258	-0.258	-0.329	-0.351	-0.393	0.930	0.532	-0.342
X11	-0.423	-0.357	0.141	0.570	-0.541	0.215	0.013	0.099	-0.466	-0.316	-0.084	-0.223	-0.354	-0.353	-0.248	-0.210	-0.315	0.527	0.297	-0.247
X12	-0.435	-0.417	-0.538	-0.262	0.449	-0.054	0.028	-0.116	0.507	0.428	-0.316	0.110	-0.027	-0.309	-0.406	-0.264	-0.361	0.245	0.248	-0.462
X13	-0.361	-0.291	-0.423	-0.142	0.290	0.004	0.109	0.061	0.265	0.094	-0.197	0.099	-0.226	-0.303	-0.294	-0.169	-0.234	0.324	0.282	-0.310
X14	0.898	0.905	0.269	-0.153	-0.040	0.046	0.296	0.200	0.120	-0.113	0.185	0.088	0.357	0.732	0.791	0.674	0.878	-0.534	-0.399	0.811
X15	0.950	0.980	0.223	-0.192	0.016	0.026	0.260	0.138	0.310	-0.021	0.244	0.222	0.460	0.779	0.847	0.826	0.922	-0.543	-0.382	0.878
X16	0.734	0.804	0.384	-0.082	-0.143	0.050	0.396	0.275	-0.003	-0.307	0.178	0.175	0.402	0.576	0.523	0.440	0.614	-0.388	-0.327	0.562
X17	-0.646	-0.689	-0.367	0.030	0.098	0.123	-0.220	-0.006	-0.053	0.209	-0.082	-0.092	-0.411	-0.591	-0.473	-0.374	-0.489	0.394	0.272	-0.512
X18	-0.245	-0.315	-0.214	-0.215	0.311	-0.159	-0.512	-0.198	0.229	0.373	0.083	-0.116	-0.098	-0.445	-0.278	-0.049	-0.296	-0.329	-0.308	-0.328
X19	-0.115	-0.141	-0.494	-0.395	0.414	0.196	-0.211	0.197	0.183	0.294	-0.071	0.065	0.135	-0.161	-0.245	-0.068	-0.137	-0.245	-0.075	-0.273
X20	0.960	0.952	0.318	-0.228	0.023	-0.038	0.362	0.109	0.311	-0.074	0.168	0.161	0.532	0.713	0.800	0.734	0.867	-0.620	-0.415	0.826
X21	1.000	0.977	0.281	-0.238	0.048	-0.042	0.223	0.113	0.295	-0.083	0.283	0.225	0.465	0.788	0.865	0.825	0.923	-0.656	-0.484	0.889
X22		1.000	0.319	-0.191	-0.019	0.002	0.268	0.125	0.240	-0.098	0.223	0.188	0.484	0.779	0.840	0.790	0.921	-0.581	-0.422	0.870
X23			1.000	0.476	-0.747	-0.090	-0.081	-0.273	-0.313	-0.091	0.136	-0.176	-0.068	0.233	0.288	0.211	0.232	-0.181	-0.177	0.295
X24				1.000	-0.815	-0.195	-0.054	-0.193	-0.472	-0.102	0.037	-0.269	-0.270	0.009	0.021	-0.019	-0.153	0.462	0.312	-0.016
X25					1.000	-0.245	-0.004	0.026	0.427	0.036	-0.035	0.279	0.257	-0.077	-0.113	-0.097	-0.006	-0.261	-0.192	-0.142
X26						1.000	0.187	0.551	0.088	0.178	-0.125	-0.037	-0.102	-0.087	-0.083	0.029	0.007	0.076	0.149	0.040
X27							1.000	0.605	0.234	-0.131	-0.265	0.239	0.415	0.206	0.080	0.050	0.185	0.203	0.111	0.157
X28								1.000	0.075	-0.124	-0.115	0.185	0.077	0.009	-0.004	0.083	0.111	-0.001	-0.172	0.112
X29									1.000	0.557	-0.004	0.420	0.220	0.273	0.287	0.399	0.273	-0.251	-0.228	0.241
X30										1.000	0.031	-0.126	-0.076	0.112	-0.001	0.080	-0.055	-0.060	-0.090	-0.034
X31											1.000	0.359	-0.079	0.384	0.306	0.293	0.257	-0.188	-0.246	0.348
X32												1.000	0.292	0.289	0.157	0.189	0.168	0.013	-0.152	0.154
X33													1.000	0.358	0.136	0.149	0.257	-0.255	-0.095	0.156
X34														1.000	0.742	0.667	0.744	-0.264	-0.297	0.755
X35															1.000	0.918	0.951	-0.417	-0.368	0.970
X36																1.000	0.888	-0.478	-0.457	0.914
X37																	1.000	-0.492	-0.383	0.954
X38																		1.000	0.596	-0.417
X39																			1.000	-0.361
X40																				1.000

Developed by the author.

4) for the factor x_4: E_4 = -0.091. The increase of the volume of services sales in the field of information, communication and mail activities per capita at 1% leads to the decrease of GRP rate per capita at 0.091%.

Table 3. **Parameters and criteria for correlation and regression analyses**

Parameters and criteria	Parameters and criteria for correlation and regression analyses according to the outcomes approach			
	available income of the population per capita	Volume of services sales in the field of education per capita	volume of scientific and technical works performed by own forces of organizations (companies) per capita	volume of services sales in the field of information, communication and mail activities per capita
The equation of multiple linear regression	$y = -21115.742 + 2.312x_1 + 60.940x_2 - 0.0001x_3 - 1.8308x_4$			
Coefficient of elasticity	E_1 = 1.934	E_2 = 0.192	E_2 = -0.001	E_4 = -0.091
Coefficient of determination	0.956			
Multiple correlation coefficient	0.978			
Pair correlation coefficient	yx_1	yx_2	yx_3	yx_4
	0.972	0.871	0.874	0.863

Developed by the author.

The main indicator of the tightness of correlation connection between the outcome index y and all the independent variables $x_j (\overline{j = 1,m})$, as well as the degree of closeness of the selected type of mathematical dependence to the sampled data is the coefficient of multiple correlations and determination.

The selected factors significantly affect the GRP rate, because the multiple correlation coefficient is equal to 0.978, indicating that the relationship between quantitative variables and the outcome indicator is strong. Thus, we have built a regression model that is adequate to the experimental data.

The coefficient of multiple determination is 0.956. Hence, 95.6% of the total dispersion is explained by the dependence of the GRP of the factors included in the model. Only 4,4% of the total dispersion cannot be explained by the dependence obtained by us. Therefore, we can conclude that we have built the model which is statistically significant.

Testing the hypotheses of the constructed model significance is carried out by the application of the Fisher F-test. For this let's posit the null hypothesis $H_0 : a_1 = a_2 = ... = a_n = 0$.

Since $F_{calculated} > F_{tabular}$ (687.8 > 3.01 – at the significance level $P = 0.95$), then the hypothesis H_0 has no correlation between the outcome and the factor variables is rejected and the alternative to the hypothesis H_1 about the existence of the correlation is accepted. This is the first evidence of the adequacy of the constructed model and the existence of a significant correlation between the dependent and independent variables.

To assess the significance of the multiple coefficient of determination, as in the previous example, we use the statistics of the F-test.

Again, the hypothesis H_0, which demonstrates there is no significant effect of either of the explanatory variables included in the model on the dependent variable, as $F_{calculated} > F_{tabular}$ (158.8 > 3.01). Therefore, the acceptance of the hypothesis H_1 means that at least one of the explanatory variables (x_1, x_2, x_3, x_5) included in the model, has a significant impact on the outcome index (y).

Multiple correlation coefficient, as mentioned previously, is a sampling feature, so when checking the quality of the constructed model it is appropriate to assess its significance. This assessment is based on the Student's t-statistics.

As the calculations show $|t_{calculated}| > t_{tabular}$ (21.8 > 2.063), H_0 is rejected and H_1 is accepted. In this case we can conclude about the importance of the multiple correlation coefficient between the dependent and independent variables.

Parametres and criteria for the correlation and regression according to the resource approach are given in Table 4.

Table 4. **Parameters and criteria of correlation and regression**

Parameters and criteria	Parameters and criteria for correlation and regression according to the resource approach									
	average month salaries accrued to staff employees	availability of higher educational institutions (I-IV accreditation levels)	number of students in higher educational institutions of I–IV accreditation levels per 10000 inhabitants	number of organizations that carry out scientific and technical works per 1000 inhabitants	proportion of specialists who perform scientific and technical works	proportion of highly qualified specialists (doctors, PhDs), employed in the economy of Ukraine	average daily amount of local broadcasting of public TV	average daily amount of local broadcasting of public radio	the level of provision with newspapers and magazines	the level of income from mail and communication services per person
The equation of multiple linear regression	$y = -20584.9 + 19.6x_1 - 182914.8x_2 + 10.9x_3 - 60763.3x_4 + 21915.4x_5 - 24537.1x_6 + 40.7x_7 - 61.8x_8 + 0.4x_9 + 1.4x_{10}$									
Coefficient of elasticity	E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}
	1.948	-0.160	0.257	-0.074	0.160	-0.214	0.033	-0.041	0.039	0.059
Coefficient of determination	0.944									
Multiple correlation coefficient	0.971									
Pair correlation coefficient	yx_1	yx_2	yx_3	yx_4	yx_5	yx_6	yx_7	yx_8	yx_9	yx_{10}
	0.943	0.738	0.842	0.791	0.878	0.828	0.826	0.852	0.860	0.853

Developed by the author.

The given econometric model enables to make the following conclusions: the increase of the average monthly wages of employees at 1 UAH will cause the growth of the GRP per capita in 19.6 UAH; with the increase of the level of higher educational institutions availability (I–IV accreditation levels) per 1000 inhabitants, the GRP per capita will decrease in 182914.8 UAH; with the increase of the number of

students in higher educational institutions of I–IV accreditation levels per unit per 10000 inhabitants, the GRP per capita will increase in 10.9 UAH; the increase of the number of organizations that carry out scientific and technical works per unit per 1000 inhabitants will cause the decrease of GRP per capita in 60769.3 UAH; with the increase of the proportion of specialists who perform scientific and technical work by 1%, the GRP per capita will increase in 21915.4 UAH; with the increase of the proportion of highly qualified specialists (doctors, PhDs) employed in Ukrainian economy by 1%, the GRP per capita will reduced by 24537.1 UAH; with the increase of average daily amount of local broadcasting of public TV by 1 hour, the GRP per capita will increase in 40.7 UAH; with the increase of average daily amount of local broadcasting of public radio by 1 hour, the gross regional product per capita will decrease by 61.8 UAH; with the increase of the level newspapers and magazines provision by one copy per 100 inhabitants, the GRP per capita will increase by 0.4 UAH; with the increase of the level of income from mail and communication services per 1 person by 1 UAH, the gross regional product per capita will increase by 1.4 UAH.

Based on the calculated coefficients of elasticity we obtain the following conclusions:

1) for the factor x_1: $E_1 = 1.948$. The growth of average month salaries accrued to employees by 1% will lead to the increase of GRP per capita at 1.948%.

2) for the factor x_2: $E_2 = -0.16$. The increase of the level of the availability of higher educational institutions (I–IV accreditation levels) per 1000 inhabitants by 1% will lead to the decrease of GRP per capita at 0.160%.

3) for the factor x_3: $E_3 = 0.257$. The increase of the number of students in higher educational institutions of I–IV accreditation levels per 10000 inhabitants by 1% will lead to the increase of the level of GRP per capita by 0.257%.

4) for the factor x_4: $E_4 = -0.074$. The increase of number of organizations that perform scientific and technical works per 1000 inhabitants by 1% will lead to the decrease of gross regional product per capita by 0.074%.

5) for the factor x_5: $E_{15} = 0.160$. The growth of the proportion of specialists who perform scientific and technical works by 1% will lead to the increase of GRP per capita by 0.160%.

6) for the factor x_6: $E_6 = -0.214$. The increase of the proportion of highly qualified specialists (doctors, PhDs) employed in Ukrainian economy by 1% will lead to the decrease of GRP per capita by 0.214%.

7) for the factor x_7: $E_7 = 0.033$. The increase of average daily amount of local broadcasting of public TV by 1% will increase the level of gross regional product per capita by 0.033%.

8) for factor x_8: $E_8 = -0.041$. The increase of average daily amount of local broadcasting of public radio by 1% will reduce the level of GRP per capita by 0.041%.

9) for the factor x_9: $E_9 = 0.039$. The growth of the level of provision with newspapers and magazines per 100 inhabitants by 1% will increase the level of GRP per capita by 0.039%.

10) for the factor x_{10}: $E_{10} = 0.059$. The growth of income from mail and communication services per capita by 1% will lead to the growth of GRP per capita by 0.059%.

The calculated coefficient of multiple determination indicates that 94.4% of the total dispersion is explained by the dependence of the GRP per capita from the selected factors to the model factors. Only 5.6% of the total dispersion cannot be explained by the given dependence. It means that the constructed model is statistically significant.

In the process of diagnosis a relatively high multiple correlation coefficient is received ($|0{,}971| \geq 0{,}7$). This suggests that the relationship between the dependent and independent variables is close.

Testing the hypotheses about the constructed model significance is carried out by the application of the Fisher F-test. This again let's posits the null hypothesis H_0: $a_1 = a_2 = 0$.

Since $F_{calculated} > F_{tabular}$ (130.0 > 2.54 – at the significance level $P = 0.95$), then the hypothesis H_0 shows no correlation between the outcome and the factor variable is rejected; the alternative to it hypothesis H_1 on the existence of the link is accepted. This is the first evidence on the adequacy of the constructed model and the existence of a substantial correlation between the dependent and independent variables.

To assess the significance of the multiple coefficient determination, as in the previous case, we use the F-test.

Since $F_{calculated} > F_{tabular}$ (29.7 > 2.54), the acceptance of the hypothesis H_1 means that at least one of the explanatory variables included in the model reveals a significant impact on the outcome index.

To assess the significance of the correlation coefficient we use the Student t-statistics. Thus, our calculations show that $|t_{calculated}| > t_{tabular}$ (16.4 > 2.120), then we reveal the rejection of the hypothesis H_0 and the acceptance of the hypothesis H_1. In this case, we can conclude on the importance of the multiple correlation coefficient between the dependent and independent variables.

The analysis of the intellectual potential of the region by its constituent elements is the basis for its evaluation.

Conclusions. Having constructed the correlation models of the dependence between the volume of GRP per capita and partial indicators of intellectual potential of Ukraine's regions at 27 territorial administrative units according to the resource and outcomes approaches we can conclude that the most effective reserves the increasing for gross regional product level per capita are: according to the outcomes approach – the growing of available income of the population and the volume of services sales in the field of education, according to the resource approach – the increasing of average month salaries of employees, the number of students in higher educational institutions of I–IV accreditation levels per 10000 inhabitants, the proportion of specialists who carry out scientific and technical works, the average daily volume of local broadcasting of public TV, the level of providing with newspapers and magazines, the level of income from mail and communication services.

Prospects for further research. Based on our factor analysis of the intellectual potential of the region further researches should be focused on assessing the intellectual potential of the region and the developing of its extension mechanism.

References:

Бутнік-Сіверський О., Красовська А. Теоретичні засади інтелектуальної інноваційної діяльності на підприємстві // Економіка України.– 2004.– №12. – С. 31–37.

Ваховіч І.М. Оцінка економічного потенціалу регіону // Проблеми раціонального використання соціально-економічного та природно-ресурсного потенціалу регіону: фінансова політика та інвестиції.– Серія: Трансформація, інтеграція та корпоратизація: Збірник наук. праць. – Вип. VIII. – Луцьк, 2002. – С. 45–54.

Гавкалова Н.Л., Маркова Н.С. Формування та використання інтелектуального капіталу: Монографія. – Харків: ХНЕУ, 2006. – 252 с.

Геєць В. Характер перехідних процесів до економіки знань // Економіка України.– 2003.– №4. – С. 4–15.

Герасимчук З.В., Ковальська Л.Л. Виробничий потенціал регіону: методика оцінки та механізм нарощення: Монографія. – Луцьк: ЛДТУ, 2003. – 242 с.

Грішнова О.А. Людський розвиток: Навч. посібник. – К.: КНЕУ, 2006. – 308 с.

Долішній М.І. Про економічну стратегію ефективної зайнятості // Регіональна економіка.– 2003.– №1. – С. 275–276.

Ілляшенко С. Сутність, структура і методичні основи оцінки інтелектуального капіталу підприємства // Економіка України.– 2008.– №11. – С. 16–26.

Леонтьев Б.Б. Цена интеллекта. Интеллектуальный капитал в российском бизнесе. – М.: Акционер, 2002. – 200 с.

Мойсеєнко І.П., Демчишин М.Я. Регресійний аналіз інтелектуального потенціалу // Актуальні проблеми економіки.– 2008.– №10. – С. 142–148.

Праця України у 2011 році: Статистичний збірник. – К.: Державна служба статистики України, 2012. – 343 с.

Регіони України 2011: Статистичний збірник / За ред. О.Г. Осауленка. – К.: Державна служба статистики України, 2011. – Ч. 1. – 358 с.

Регіони України 2011: Статистичний збірник / За ред. О.Г. Осауленка. – К.: Державна служба статистики України, 2011. – Ч. 1. – 783 с.

Статистичний щорічник України за 2010 рік / За ред. О.Г. Осауленка. – К.: Державна служба статистики України, 2011. – 559 с.

Україна у цифрах 2011: Статистичний збірник / За ред. О.Г. Осауленка. – К.: Державна служба статистики України, 2012. – 250 с.

Ушенко Н.В. Напрями відтворення людського капіталу та їх вплив на економічний розвиток країни // Формування ринкових відносин в Україні.– 2008.– №9. – С. 151–157.

Стаття надійшла до редакції 13.03.2013.