SCIENTIFIC AND TECHNICAL POTENTIAL: UKRAINE AND THE WORLD

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Abstract
The main scientific goal of paper is researching of theoretical and practical problems of scientific and technical potential of Ukraine and other countries in the aspect of globalization. The paper reveals analysis of approaches of evaluation of scientific and technical potential on different levels, comparing Romania, Hungary and Ukraine by the selected indicators which recognized of knowledge economy and define on scientific and technical potential, structural changes in economy that influenced on changes in scientific and technical development of Ukraine, technological and personnel components. Authors assert that domestic industry of high technologies can be all-sufficient for terms at least maintenance of existent scientific and technical potential and productions capacities and their update.

Key words: *scientific and technical potential, variables of knowledge-economy system, structural changes, high tech industries, science intensiveness*

Introduction

The economy stagnation of Ukraine during 90th, markets reforms of the numerous governments directed on the decision of mainly tactical tasks resulted in disparity and unclaimedness of scientific and technical potential. The potential was reached in the inheritance from Soviet Union and was formed during half of century and lost its disparity and unclaimedness in the condition of national economy. Uninvolved of scientific and technical potential of country during long period, which can be compared to atrophy of muscles of sportsman, resulted in his disparity to the requirements of global economy.

Strengthening of global competition next to the loss of considerable world markets share by domestic enterprises creates the considerable obstacles on the way of the use by them present possibilities of development, potentials. The touch upon the issue of efficiency improvement of production acquire in this situation of the special value, achievement of high economic indicators at the rational use of resources, improvement of investment attractiveness and increase of competitiveness. For the decision of these tasks the estimation of scientific and technical potential is needed as basic strategic force which provides competitiveness, with the purpose of subsequent effective his use.

It is possible confidently to assert about a presence in Ukraine of considerable scientific and technical potential, however about his realization during the last 15 years - heavy.

Problem of neighbours of countries for socialistic camp and former Soviet republics certain in relation to achieving alike or were alike. By the difference of Ukraine from Byelorussia and Russia in relation to realization of scientific and technical potentials there is the speed-up-evolutional way of development of Byelorussia due to the successful economic policy of country leadership in relation to the maintenance and increase of potential and revolutional for Russia due to the change of the world state of affairs on energy resources and due to super-profits got from sale of energy resources. Romania and Hungary unlike Ukraine did not have not internal markets which would require forming in the countries of powerful scientific and technical spheres, and not neighbor-countries, which would be interested at

development of their potentials. In a period 1950-1990th the satisfactory rates of development of their economies were achieved due to the use of scientific and technical achievements of Soviet Union. Last two decades countries form scientific and technical potentials in the collaboration with the countries of Western Europe. However much competition in a scientific and technical sphere with the countries of South-east Asia is complicated for them as well as for Ukraine.

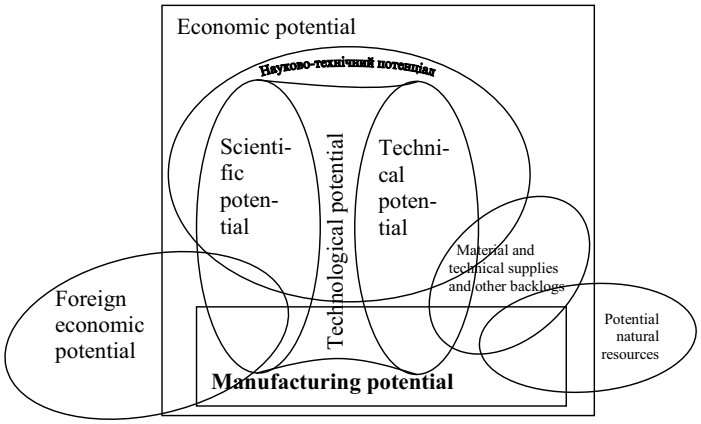
Research results

Approaches of determination of scientific and technical potential

Determine scientific and technical potential as the generalized description of level of development of science, engineering business, technique in a country, and also possibilities and resources which has in the order society for the decision of scientific and technical tasks [1, 2, 3].

In scientific literature exists universally recognizing of scientific and technical potential as inalienable and decision factor of economic development, his connection is marked with economic, social and other potentials of country. We present intercommunication of potentials and place of scientific and technical potential as interlacing of different potentials with the own degree of interinfluence (fig. 1 [4, 5] it is adapted by authors).

Fig. 1. Aggregate of potentials and place of scientific and technical potential



There are a few conceptions of scientific and technical potential. Scientific and technical potential, which wider than other, is especially marked in first from them, co-operates with other potentials of society. The use of the noted potential considerably influences on scientific and technical transformation of production, instrumental in growth of economy of country.

The second conception leans against experience of entire countries of world, which testifies, what only in mutual accordance, projected and operating: technological processes, apparatus-machine facilities, the elements of organizationally-administrative forms of conduct and providing of productions can provide integrity of this technological system, create terms for including of the combined labour potential in the complement of productive forces, to form terms for the effective use of social factors of production, complete opening of creative potential of personnel, that uses facilities of labour are marked [6, p. 19].

Analysis of approaches in relation to determination of scientific and technical potential in robots domestic and oversea authors resulted at table 1.

Table 1. Classification of definitions of „scientific and technical potential"

Author	Definition content	Source
U.M. Kanygin	aggregate of factors (intellectual and material), which determine a level, terms of creation and scales of distribution of the new technological systems in public production, which includes science, education and technical potential of production	Каныгин Ю.М. Научно-технический потенциал: проблемы накопления и использования. – Новосибирск: Наука, Сибирское отделение, 1974. - 254 с.
P.A. Kulvets	aggregate of economic resources (accumulated funds) which has in the order society for scientific and technical activity, that respond to request economic laws and intended for creation new and the improved products, intensive development of production and providing on this basis of change of character of labour, increase of efficiency of public production	Кульвец П.А. Научно-технический потенциал : Сущность, оценка, эффективность использ. : учеб. пособие / П. А. Кульвец. - Вильнюс: МВССО ЛитССР, 1980. - 55 с.
G.M. Dobrov	combined ability of scitech separate country or group of countries, to work out problems of scientific and technical development. This ability is provided by the presence of the properly organized resources (skilled, material and technical, informatively-technical, methodical) in their natural or economic measuring	Научно-технический потенциал: структура, динамика, эффективность / [Добров Г.М., Тонкаль В.Е., Савельев А.А. и др.] ; отв. ред. В.Е. Тонкаль, Г.М. Добров. – К.: Наук. Думка, 1987. – с. 346
V.U. Budavei	organic unity of scientific and technical potentials... In scientific and technical potential results are included only those types of scientific activity, which are direct-coupled with creation of new technique, development of new scientific and technical projects and programs	Будавей Ю.В. Долгосрочные народнохозяйственные программы. – М. : Мисль, 1980. – 207 с.
L.S. Blyakhman	result of R&Ds which concernes by an amount and quality of scientific and technical information geared-up for production application in this country, to industry or on an enterprise, and possibilities of its effective use. Potential is measured by a project and the planned effect of the completed R&D, foremost, openings, inventions and rationalizations suggestions	Бляхман Л. С. Экономика, организация управления и планирование научно-технического прогресса [текст] / Л.С. Бляхман. − М. : Высш. школа, 1991. - 288 с. - ISBN 5-06-000592-5
V.I. Gromeka	unity and co-operation scientific, educational, administrative and the modernized part of technical potential	Громека В.И. США: научно-технический потенциал. – М.: Мысль, 1977. – 245 с. (*Nauchno-tekhnicheskii potentsial (U.S.A.: Scientific and Technical Potential)*
OECD	scientific and technical potential includes resources, which enter science, types of scientific activity and scientific service, scientific products	The Measurement of Scientific and Technical Activities. "Frascati Manual". – Paris: OECD, 1981. – P. 186.
UNESCO	aggregate of present resources, which has in the order country for the scientific openings, inventions and technical innovations, and also for the decision of national and international problems which are pulled out before science and its constituents	Manual of surveying national scientific and technological potential, collection and processing of data. Management of the R&D systems // Sci. policy stud. and doc. and system. – Paris: UNESCO, 1970. - №15. – P. 210

Outcoming from the results of research from we consider that scientific and technical potential of E this the system, that includes to the shot, material, financial and informative resources, which has in the order science sphere and technicians which are realized effectively in certain socio-economic and organizational terms.

The most substantial descriptions of scientific and technical potential are here erected to following G scientific and technical potential: 1) as scientific and technical resources are accumulated; 2) as factor by which accumulated scientific and technical resources influence on socio-economic development; 3) as description of the productivity of the accumulated scientific and technical resources.

Researchers distribute scientific and technical potential on the following constituents [7]: material and technical, skilled, informative, organizationally-administrative.

Select the following even estimations of scientific and technical potential: global (estimation of the state of scitech society on the whole), macrolevel (determination of scientific and technical potential of country), meso level (potential of region or region) and microlevel (scientific and technical potential of association, enterprise).

Estimating scientific and technical potential of region other researchers select following his elements [8]: inventions, commodities signs, industrial prototypes, now-how; innovations which can be offered to the use; innovative programs and projects.

Other researchers [9] for the estimation of scientific and technical potential of region recommend to use the following indexes: volume of innovative products after the degree of newness; specific gravity of innovative products in a general production volume %; amount of patents, certificates; amount of underbacks, projects which are developed (in particular by educational establishments) and parameters: inventions, commodities signs, industrial prototypes, now-how; innovations which can be offered to the use; innovative programs and projects, underbacks; management by intellectual property.

In research we will use the estimation of scientific and technical potential on local and macrolevels. For localization we elect the region of East Europe, namely countries which border one to other are acceptable to comparison on their macroeconomic indexes. The requirements are marked to the choice of countries we enter for realization of conclusions in relation to the prospects of their collaboration in a scientific and technical sphere. Romania, Hungary, Ukraine, is such countries.

From beginning − purchased the middle of 90th and got wide distribution in world economic science approach of economy of knowledge, which we equate with scientific and technical progress and intellectual development.

Knowledge economy and its components

The economy development idea on the basis of scientific and technical progress is not new. In particular, a well-known scientist, the academician V. Vernadskiy proposed a noosphere theory at the beginning of XX century. The main place in his theory was taken to human scientific genius as to productive force of the economy growing.

The knowledge-based economy is based on intellectual and human capital, generating and industrial use of knowledges [10]. The term interpretation of knowledge-based economy we can find during the analysis of the world economy evolution stages. The basic of them are: economy of commodity (quality of commodity comes forward the main competitiveness criterion), relations (defines by projects quality), corporate management (by management quality), services (by quality in services), knowledge economy (by quality of intellectual level of worker, personnel, company and country).

A transformation of commodity (and afterwards, service) economy in the knowledge-based economy became possible due to the coincidence in time of the following factors: 1) an

appearance of data processing digital facilities − information technologies; 2) the expansion of spheres of human influence on an external environment; 3) the information computing features are meshed in a network for a rapid information exchange is an information and communication technologies creation.

Methodology of estimation of economy of knowledges, that developed and is used by the experts of the World bank [11], is contained indexes after which can be carried out and conducted certain estimation and comparison of scientific and technical potentials of different countries.

Methodology of determination of degree of development of economy of knowledges of the World bank contains more than 80 structural and quantitative variables after the following groups: economic stimuli and institutional modes, education, innovations and of information and communication technologies [11]. Indexes by which operates methodology is marked allow to carry out the complete estimation of efficiency of economy.

We suggest conducting the comparative analysis of scientific and technical potentials of countries (Ukraine, Romania, Hungary) with application of the following indexes: overall performance of the economy: Human Development Index, Average Annual Gross Domestic Product (GDP) Growth, 1993-97 and 2001-2005 (%),Gross Domestic Product (GDP) Per Capita, 2005 (international current PPP $), Unemployment Rate (% of total labor force), Employment in Industry (% of total employment); economic regime: Trade as % of GDP, Exports of Goods and Services as % of GDP; innovation system: FDI Outflows as % of GDP, FDI Inflows as % of GDP, Royalty and License Fees Payments (US$ mil.), Royalty and License Fees Payments (US$/pop.), Science and Engineering Enrolment Ratio (%), Science Enrolment Ratio (%), Researchers in R&D, Researchers in R&D / Mil. People, Total Expenditure for R&D as % of GDP, Manuf. Trade as % of GDP, Technical Journal Articles, Technical Journal Articles / Mil. People, Availability of Venture Capital (1-7), High-Tech Exports as % of Manuf. Exports; education: Adult Literacy Rate (% age 15 and above), Public Spending on Education as % of GDP, Prof. and Tech. Workers as % of Labor Force; information and communication technology: Total Telephones per 1,000 People, Main Telephone Lines per 1000 People, Mobile Phones per 1,000 People, Computers per 1,000 People, International Internet Bandwidth (bits per person), Internet Users per 1,000 People, ICT Expenditure as % of GDP.

Comparative analysis of scientific and technical potentials: macrolevel

At table 2 presented indexes which determine scientific and technical potential of countries by a complete or partial measure are chosen, which are part of aggregate of indexes for determination of level of economy of knowledge on the methodology developed by the World bank [11].

The knowledge economy estimation methodology uses variables that are measured in different units and on different scales. To calculate aggregate knowledge economy indexes, as well as to simplify graphic representation of countries' comparative performance, we bring all the indicators to the same standard of measurement through the process known as normalization.

The normalization procedure used in the methodology of World Bank is as follows:

1. The actual data (u) is collected from World Bank datasets and international literature for all the variables and countries. Ranks are allocated to countries based on the absolute values (actual data) that describe each and every one of 83 variables (rank u). Countries with the same performance are allocated the same rank. Therefore, the rank equals 1 for a country that performs the best among the countries in our sample on a particular variable (that is, it has the highest score), the rank equals to 2 for a country that performs second best, and so on.
2. The number of countries with worse rank (Nw) is calculated for each country.

3. The following formula is used in order to normalize the scores for every country on every variable according to their ranking and in relation to the total number of countries in the sample (Nc) with available data :

$$\text{Normalized}(u) = 10 \cdot (\text{Nw/Nc}) \quad (1)$$

4. The above formula allocates a normalized score from 0 to 10 for each country.

Table 2. Indexes, which influence on scientific and technical potential of countries for Romania, Hungary, Ukraine

Variable, year	Romania		Hungary		Ukraine	
	actual	normalized	actual	normalized	actual	normalized
1	2	3	4	5	6	7
Economic Performance						
Annual GDP Growth (%), avg 2001-2005	5,7	7,77	4,2	4,96	7,7	8,99
GDP per Capita (in/nal current $ PPP), 2005	9059,9	5,9	17886,7	7,39	6848,4	4,78
Human Develop-ment Index, 2004	0,8	6,16	0,87	7,61	0,77	5,07
Unemployment Rate (% of labor force), 2004	8	5,5	6,1	6,75	8,6	4,5
Employment in Industry (%), 2005	30,3	8,68	32,4	9,12	24,2	6,58
Employment in Services (%), 2005	37,5	1,84	62,6	5,96	56,4	4,74
Economic Regime						
Trade as % of GDP, 2005	76,5	4,46	134,9	8,42	106,1	7,27
Exports of Goods and Services as % of GDP, 2005	33	3,77	66,4	8,41	53,5	7,39
Innovation System						
FDI Outflows as % of GDP, 2000-05	0	0,72	1,1	7,2	0,1	4,08
FDI Inflows as % of GDP, 2000-05	4,4	6,84	5,2	7,67	3,4	5,26
Royalty and License Fees Payments (US$ mil,), 2005	173,1	6,42	1068,5	7,92	421	7,17
Royalty and License Fees Payments (US$/pop,), 2005	8	6	105,8	8,83	8,9	6,08
Science and Engine-ering Enrolment Ratio (%), 2005	25	6,9	17,8	2,18	26,5	7,47
Science Enrolment Ratio (%), 2005	4,7	0,91	5,5	1,82	4,2	0,8
Researchers in R&D, 2004	21257	6,77	14904	5,94	85211	8,54

Ending of the table 2

1	2	3	4	5	6	7
Researchers in R&D / Mil, People, 2004	976	4,9	1472	5,94	1749,1	6,56
Total Expenditure for R&D as % of GDP, 2004	0,4	3,72	0,88	6,38	1,16	7,02
Manuf. Trade as % of GDP, 2005	53,5	7,23	94,2	9,23	53,6	7,38
Technical Journal Articles, 2003	988	6,91	2503	7,55	2089	7,41
Technical Journal Articles / Mil. People, 2003	45,5	5,9	247,8	7,77	43,7	5,83
Availability of Venture Capital (1-7), 2006	3	3,61	3,8	6,81	3,2	4,71
High-Tech Exports as % of Manuf. Exports, 2005	3,4	3,72	24,5	8,53	3,7	3,88
Education (by the UNCD data [12])						
Adult Literacy Rate (% age 15 and above), 2004	97,3	6,47	99,36	7,55	99,4	7,63
Public Spending on Education as % of GDP, 2005	3,6	2,66	5,9	7,42	6,4	8,15
Prof. and Tech. Workers as % of Labor Force, 2004	17,44	3,7	27,65	7,65	25,34	6,67
Information and communication technologies (by the ITU data [13])						
Total Telephones per 1,000 People, 2005	820,3	6	1256,7	7,5	621,6	5,21
Main Telephone Lines per 1000 People, 2005	203	5,47	332,7	7,55	255,9	6,19
Mobile Phones per 1,000 People, 2005	617,3	6,43	924	8,07	365,7	4,57
Computers per 1,000 People, 2005	113	5,83	146	6,52	38,4	3,18
International Internet Bandwidth (bits per person), 2005	622,94	7,06	991,37	7,5	17,16	3,38
Internet Users per 1,000 People, 2005	207,5	6,43	297,4	7,21	96,9	4,57
ICT Expenditure as % of GDP, 2005	3,6	1,73	5,84	4,67	8	8,13

Determining at the analysis of any object, especially scientific and technical potential of country, application of approach of analysis of dynamics comes forward. At table 3 the change of base indexes which determine efficiency of economy of knowledge on methodology of the World bank is presented, which influence on development and realization of scientific and technical potential for Romania, Hungary and Ukraine.

Table 3. Basic variables which defined knowledge economy performance

Variable	Romania		Hungary		Ukraine	
	most recent *	1995	most recent *	1995	most recent *	1995
Annual GDP Growth (%), * avg 2001-2005	5,7	2,1	4,2	1,9	7,7	-12,5
Human Development Index, *2004	0,8	0,77	0,87	0,81	0,77	0,74
Tariff & Nontariff Barriers, *2007	74	94	76,6	56	72,2	50
Regulatory Quality, *2005	0,17	-0,59	1,11	0,45	-0,26	-0,63
Rule of Law, *2005	-0,29	-0,34	0,7	0,62	-0,6	-0,73
Royalty Payments and Receipts (US$/pop.) *2005	10,2	0,5	188,4	9,9	9,4	n/a
Technical Journal Articles / Mil, People, *2003	45,5	28,55	247,8	177,28	43,7	55,46
Patents Granted by USPTO / Mil. People, *avg 2001-05	0,34	0,1	5,54	4,44	0,43	0,16
Adult Literacy Rate (% age 15 and above), *2004	97,3	97,6	99,36	99,2	99,4	99,5
Gross Secondary Enrollment Rate, *2005	85,1	77,9	96,5	97,8	88,7	92,61
Gross Tertiary Enrollment Rate, *2005	40,2	18	59,6	23,6	69	41,7
Total Telephones per 1,000 People, *2005	820,3	131,3	1256,7	234,5	621,6	161,6
Computers per 1,000 People, *2005	113	13,2	146	38,7	38,4	8,3
Internet Users per 1,000 People, *2005	207,5	0,7	297,4	6,8	96,9	0,4

The analysis of table 3 testifies to paradoxical scientific and technical and social development in Ukraine. From one side, Ukraine occupied and takes first seat among select countries after the index of formed of population and particle of population with higher education, and from other side by the level of human development Ukraine is the last. This feature testifies to existence of other factors which influence in a greater degree, knife factors of education and literacy of population on social development in a country.

Human Development Index (HDI) calculates as a weighted average of human development measuring indexes (a life interval measured by one index, educational level – by two indexes, GDP per capita – by one index):

$$\mathrm{HDI} = \sum_{j=1}^{j} \alpha_{\mathrm{j}} \cdot \frac{X_j - m_j}{M_j - m_j}, \qquad (2)$$

where M_j, m_j is a maximum and minimum value of human development indexes; X_j: X_1 is a life interval (minimum value - 25 years, maximum - 85 years), X_2 is an educational level of adults (from 0 to 100 %), X_3 is an education density in primary, middle and high school (from 0 to 100 %), X_4 is the special indicator of welfare which calculates as a common logarithm of real GDP per capita (from 100 to 40 000 USD by PPP); α are weighting coefficients of indexes which are assorted thus that three measuring human development indexes had equal weight.

Among 18 competitive edges of Ukraine: quality of infrastructure on the ferrous road (31th place), national debt (17th), quality of primary education (49th), access to higher education (17th), quality of mathematical and essential education (44th), quality of the elucidative system (47th), practical worker of a second job and liberation (16th), attitude of the labour productivity toward of the earnings (26th), participation of women in labour activity (26th), control after international distribution (46th), capacity for the innovations (40th) [14, 15].

Among 92 lacks of economy of Ukraine: inflation (106th place), trades barriers (123th), tax pressure (123th), limitation on the capital (102th) flow, efficiency of antimonopoly policy (98th), quality of highways (116th), quality of aviation infrastructure (116th), professionalism

of leaders of higher link (102th), fluidity of brains (93th), rates of distribution of tuberculosis (86th) and HIV (104th), mean time of life (89th).

Structural changes

The indicator of the state of scientific and technical potential in Ukraine subjected to impact of the structural changes in an economy, which are traced, in particular, in the change of structure of GDP (table 4).

Table 4. Structure of gross domestic product in Ukraine at 1985-2007, % [16, 17]

Economy branches	Years						
	1985	1990	1993	2003 [18]	2004 [18]	2005 [18]	2007 [19, 20]
GDP, total	100	100	100	100	100	100	100
Including:							
Industry	41,4	35,9	43,6	30,4	28,5	28,2	31,0
Agriculture	19,4	24,0	14,2	12,2	11,9	10,9	9,0
Civil Engineering	8,5	7,7	9,8	4,3	4,6	4,7	5,4
Transport and communication	6,3	6,1	8,8	14,7	13,7	13,9	14,6
trade, raw material supply	6,0	5,7	6,3	19,5	23,8	24,7	27,2
others	18,4	20,6	17,3	19,0	18,2	17,6	12,8

Share of industry for period 1985-2005 diminished from 41,4 to 28,2 % (at 2007 the particle of industry was 31 %, that is arrived at mainly by growth of prices index on industrial products and growth of cost of resources), agriculture - 19,4 to 10,9 %, building - from 8,5 to 4,7 %. Specific gravity of transport and connection was multiplied - from 6,3 to 13,9 %, and also, at what salutatory, trade, logistical support and semi's - from 6,0 to 24,7 %.

At the same time in the developed countries there is growth of particle of industry in structures GDP countries (table 5, 6).

Table 5. GDP's structures of the countries, %

	Agriculture		Industry		Services			
					GDP		Employment	
	1994	2004	1994	2004	1994	2004	1995	2005
Great Britain	1.7	1.0	30.6	24.3	67.7	74.7	70.7	76.5
Germany	1.2	1.1	32.9	29.1	65.9	69.8	60.5	67.6
Italy	3.3	2.5	30.1	27.3	66.6	70.2	59.2	64.6
Norway	3.0	1.5	32.9	39.2	64.1	59.2	71.4	75.8
USA	1.9	1.3	26.4	22.2	71.7	76.7	73.1	78.6
France	3.3	2.5	24.7	21.3	73.1	76.3	69.1	73.5
Sweden	2.7	1.8	28.7	27.7	68.7	70.5	71.0	76.0
Japan	2.1	1.6	33.9	29.0	64.0	69.4	60.8	67.6
Hungary	6.4	3.9	30.0	30.9	63.7	65.2	58.2	62.2
Poland	6.4	2.9	36.2	32.1	57.4	65.0	45.4	53.4
Czech R.	4.9	3.3	38.8	37.9	56.1	58.8	51.1	56.4
Russia	6.2	5.8	42.5	35.2	53.5	59.0	49.7	60.6

Sources: OECD in figures. Statistics of the member countries 2006-2007 Ed. Paris, 2007. – P. 16, 17, 22, 23; Russian statistics yearbook. Moscow, 1997. – P. 115, 312; National assets of Russia in 1997-2004. M., 2006. – P. 74

The share of hi-tech modes in domestic good production is insignificant, while low tech modes are prevailing. While the developed countries invest the considerable sums on hi-tech production, there are opposite tendencies in Ukraine: 1) growth of general production takes place due to industries of 3d and 4th technological modes; 2) production of food industry grows the greatest rates; 3) growth of low tech and raw materials industries overtake which is formed the country export. The developing countries characterized with the following average industry division investments in period of 1990 - 2007 by data of OECD: energy and power - 15 %, hi-tech production - 12 %, raw materials - 19 %, telecommunication - 16 %, financial services - 12 %, consumers goods and services - 9 %, other - 17 %.

Table 6. Dynamics of branch structure of the services, %

Country	Specific particle of large of particular a branch groups at GDP %									
	Trade, feed, hotel business		Transport, connection, ware-house economy		Finances, insurance, real estate, business services		Education, health protection, social service		State services	
	1994	2004	1994	2004	1994	2004	1994	2004	1994	2004
Great Britain	14.0	15.0	7.8	7.2	24.0	30.0	15.1	16.7	6.3	4.9
Germany	12.2	12.4	5.7	5.6	26.0	29.1	14.9	16.4	6.8	6.0
Italy	17.1	15.5	6.5	7.7	21.8	26.6	13.3	13.1	6.4	6.4
Norway	12.1	10.3	10.5	8.8	18.8	20.6	16.5	17.5	6.1	5.0
USA	17.7	15.4	6.7	6.1	27.0	32.4	11.4	15.8	8.0	7.5
France	13.3	13.1	6.7	6.3	27.9	31.4	14.3	17.3	8.4	7.6
Sweden	12.3	12.1	8.1	8.2	21.4	24.4	18.5	21.0	6.4	5.5
Japan	14.0	12.7	6.4	6.8	15.9	18.2	15.0	17.4	4.9	5.5
Hungary	20.1	20.7	6.4	7.7	11.0	16.4	12.3	13.1	7.1	7.1
Poland	14.1	14.5	10.4	15.9	15.9	16.3	10.1	11.1	5.0	6.0
Czech R.	13.3	12.6	8.8	8.1	17.7	20.7	14.5	14.5	7.5	9.4
Russia	18.4	22.0	9.9	8.7	5.8	12.0	7.4	6.2	6.7	10.4

Sources: OECD in figures. Statistics of the member countries 2006-2007 Ed. Paris, 2007. – P. 16, 17, 22, 23; Russian statistics yearbook. Moscow, 1997. – P. 115, 312; National assets of Russia in 1997-2004. M., 2006. – P. 74

Table 7. Share of industries of industry at GDP world countries [21, p. 333]

Industries	Share of industries at GDP, %		
	Ukraine	Developed countries of EU	World on the whole
Machine building	13,1	34,3	29,1
Metallurgy	28,2	6,9	6,9
Chemical industry	5,9	11,6	11,2
Light industry	1,6	6,5	7,8
Food retail industry	16,1	9,1	10,7
Other industries	35,1	31,6	34,3

From positions of world economy of change in the structure of GDP of Ukraine carry appropriate character definitely. It is correlation of sphere of production and sphere of consumption. But falling of specific gravity of industry almost in 1,5 times, building - almost twice, in 4 times growth sphere of consumption during 15 years are extraordinarily sharp changes not only from positions of economy, but also politicians, to psychology of population, science system, education and others like that. The particle of industry of Ukraine after the index of gross valueadded makes in recent years approximately 30-32 %, in that time as at the USA - 26,2 %, to Japan - 25, 4 %, to France - 24,4 % [22].

Under act of high-quality changes in the global technological systems the economic developed countries strengthen the influence on economic and social development of humanity. The of particular a branch structure of world industry which key positions occupy in is progressive: machine building (40 % all products), chemical industry (over 15 %), food retail industry (14 %), light industry (9 %), metallurgy (7 %). Electronic and electrical engineering industry develops by rapid enough rates.

Technological component

The presence of advanced technologies provides stable growth of industry and support of level of competitiveness of products in an of long duration prospect. However able modern technologies are to develop country with high scientific and technical potential and developed infrastructure [23, p. 144].

The purchase of the newest technologies requires the considerable capital investments and technicians-and-engineers with the high degree of the labour productivity. In Ukraine the labour productivity for industries of radio electronics and instrument-making at 2006 was in 20 times below than world average the noted industries of industry.

The decline of hi-tech industries of industry during 90th, which were characterized in a world on the whole by most rates of development, resulted in considerable lag of domestic level of technologies from technological development of other countries (table 8).

Table 8. Technology Level rating of the countries in 2004 by UNCTAD [24]

Country	Rating	Estimation	Country	Rating	Estimation	Country	Rating	Estimation
USA	1.	6.24	AEU	25	4.71	Columbia	68	3.6
Taiwan	2.	6.04	Slovenia	26	4.71	Salvador	69	3.6
Finland	3.	5.92	Malaysia	27	4.67	Venezuela	70	3.6
Sweden	4.	5.8	Slovak R.	28	4.67	Peru	71	3.45
Japan	5.	5.68	Hungary	29	4.66	Kenya	72	3.31
Denmark	6.	5.34	France	30	4.65	Indonesia	73	3.31
Switzerland	7.	5.25	Belgium	31	4.59	Morocco	74	3.3
Israel	8.	5.25	Chili	32	4.55	Serbia&Mont.	75	3.3
S. Korea	9.	5.18	Lithuania	33	4.51	Macedonia	76	3.26
Norway	10.	5.17	Hong Kong	34	4.49	Uganda	77	3.22
Germany	12.	5.08	Latvia	35	4.46	Ghana	78	3.21
Canada	13.	5.05	Ireland	36	4.43	Georgia	80	3.18
Island	14.	5.05	Greece	37	4.42	Sri-Lanka	81	3.17
Eesti	15.	5.01	Cyprus	38	4.36	Bosnia&Herz.	82	3.15
Netherlands	16.	4.98	SAR	39	4.33	Ukraine	83	3.15
Australia	17.	4.93	Luxembourg	40	4.28	Tanzania	84	3.12
UK	18.	4.92	Bulgaria	59	3.82	Pakistan	87	3.02
Czech R.	19.	4.88	Philippines	61	3.72	Nigeria	89	2.99
Spain	20.	4.86	China	62	3.72	Vietnam	92	2.92
Malta	21.	4.85	India	63	3.72	Bolivia	95	2.81
Austria	22.	4.85	Egypt	65	3.68	Malawi	97	2.74
Portugal	23.	4.78	Namibia	66	3.66	Algeria	98	2.67
N.Zealand	24.	4.76	Russia	67	3.65	Madagascar	99	2.64

In such industries as radio- and microelectronics of lag is so considerable, that introduction of the imported leading technologies will not provide achievement of world average level of

competitiveness of products through the protracted term of introduction (at least 3 years), shortage of skilled shots, absence of domestic demand on a component electronic base.

Subsequent development of hi-tech industries is possible due to the association of local technological cells in Ukraine, which confess so far in a world conducting, however not finding proper material and technical and production base in Ukraine, in the conditions of undeveloped internal market on high technologies lose the efficiency and more frequent in all become the object of sale. The association of local technical and technological innovations in Ukraine will be instrumental in creation of macrotechnologies. In particular, the countries of G7 own 46 from 50 macrotechnologies, from them - 22 technologies are controlled by the USA, 10 - Germany, 7 - Japan, for 3-5 - Great Britain and France, for to one is on Sweden, Norway, Italy, Switzerland [25, p. 8-9].

Personnel potential and science intensiveness

The investment flow level in science and scientific and technical works in Ukraine do not allow not only creating new knowledge but also saving inherited scientific and technical potential from soviet times. Meantime, the R&D expenditures of high-tech multinational companies amount to 10 % of revenue. Thus, the domestic enterprise competition on the world markets of high technologies is difficult.

In particular, expenditures on R&D by telecommunications companies in the world range from 0,1 to 4 % of revenue. The comparative analysis of some telecommunications companies of world is resulted at table 9 testifies to the considerable differences in financing of R&D to the amount of R&D personnel. Volumes of charges on R&D, which are on one specialist busy in this sphere, is seen ineffective for the monopolist company at industry of information and communication technologies. By investigation of long duration not small rates of investment of R&D per one worker on JSC „Ukrtelekom" there is bringing in of strangers of enterprises structures to development of network of the third generation of cellular in Ukraine through the shortage of specialists able to execute works of such complication in the state of enterprise which counts 127 thousands of people.

Considerable growth rates are observed in domestic industry of information and communication technologies in comparing with other regions and arrived at due to introduction and use of technologies of: Asiatic production (for services with the low requirements of reliability and quality) – services of mobile communication of JSC „Ukrtelecom" on the base of technologies of Huawei; European producers (for services high-reliability and unfaulteness) of cross equipment and fiber equipment of Reichle&De-Massari for the mains of connection of JSC „Ukrtelecom".

Table 9. Financial performance indicators, expenditures on R&D and quantity of R&D personnel in 2006

Company	Revenue, mln. USD	Expenditures on R&D, mln. USD	R&D personnel	Expenditures on R&D per R&D personnel amount, thsd. USD
France Telecom	60,316	2413	3780 [1]	638,36
British Telecom Group	38,638	390	1695 [1]	230,09
Deutsche Telekom	79,751	1595,0 4	4832 [4]	330,01
Ukrtelecom [2]	1,541	2,1	2124	0,989
Rostelecom [3]	2,318	3,47	1531	2,266

1 London Stock Exchange's Regulatory News Service http://miranda.hemscott.com/

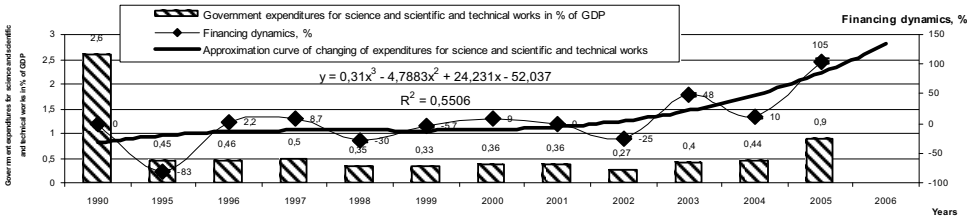
2 Україна телекомунікаційна. Річний звіт ВАТ «Укртелеком» 2006 [Electronic Resource] / Укртелеком, 2007. – Read 24 April 2007.

3 Алло. Годовой отчет ОАО «Ростелеком» 2006 [Electronic Resource] / Ростелеком, 2007. – Read 25 April 2007.

4 Rathe, K. Deutsche Telekom in Transition [Electronic Resource] / TelecomVisions©, 2001. – Read 13 Nov 2007.

The shortage of highly skilled shots in domestic industry is investigation of the low financing of science and scientific and technical works at state level (fig. 2).

Figure 2. Government expenditures for science and scientific and technical works in % of GDP in Ukraine [26]



At development and realization of measures in relation to the revival of scientific and technical development of Ukraine the account of critical standards of science intensiveness comes forward important at the level of the state (choice of partners of countries recognition their level of science intensiveness) and industries (table 10, 11 [27, p. 180]).

Table 10. Indexes of level of scientific and technical development of some countries

Country	Share of the country, %			
Year	1998		2005	
Comparing method	In total	With leader	In total	With leader
Ukraine	1.5	3.6	3.0	7.5
Poland	3.0	7.2	3.0	7.5
Hungary	4.0	9.5	3.5	8.7
Russia	7.5	17.8	9.5	23.7
UK	20.5	48.8	21.0	52.5
France [28]	21.5	51.2	20.0	50.0
Germany	42.0	100.0	40.0	100.0

Table 11. World average science intensiveness of separate branches of industry

Branches of industry	Science intensiveness (R&D expenditures in revenue), %
Energy sources	0.8-1.0
Food and light	1-1.2
Agriculture	1-1.2
Machine building	3.3
Chemical	3.5
Electronics and telecommunication	6.0
Aeronautics, cosmos and aircraft building	5-7
Pharmacy	10.0

Conclusions

1. The estimation of scientific and technical potential must include at itself all complex of infrastructures of hi-tech production. Scientific and technical potential of country depends far of external factors such as GDP per capita, level of formation of population, unemployment rate and others like that.
2. Conception of economy of knowledge is an attempt complex to estimate scientific and technical potential of countries recognition row of external, on the face of it mediated factors.
   In some periods of development or forming of scientific and technical potential the factor of infrastructure can take form determining, that is observed in the countries of South-east Asia, where considerable development of information and communication infrastructure stimulated realization of scientific and technical potential (information and communication maintains) [29, p. 30].
3. The disproportion of development scientific and technical and socio-economic spheres in Ukraine in comparison with the neighbor-countries geographically and partners of countries for the former integration unit − Council for Mutual Economic Aid − Hungary and Romania is traced during the last 12 years. This tendency is explained by local of particular a branch tailings of scientific and technical potential of Soviet Union considerable part of which was reached to Ukraine in the inheritance, and which was successfully lost in many ways.
4. The displacement of economy development character toward domestic (production of domestic equipment from the imported stuffs after the SKD and MKD production charts) and consumer take place in Ukraine.
5. We see, that the relation of results must become the objective estimation of realization of scientific and technical potential (by his efficiency) got from the use of this potential (socio-economic effect) to the cost of constituents of scientific and technical potential (expense on the scientific and technical personnel training during a few generations (50-80 years), expense on development of informative infrastructure, market value of highly skilled specialists which drove out for a border, and others like that).

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