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Human Resources development and research capacity and their impact on economic growth*[1]

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Abstract

The goal of this research is to provide an analysis of the development of the Republic of Croatia and 110 selected countries in terms of human resource development index components and the components of the Technological Achievement Index. Developmental lags of the Republic of Croatia were determined by the bird's eye view method in terms of the observed developmental indicators, and suggestions were provided for their development. The impact of the analysed indicators and their components on the economic growth of the Republic of Croatia and the selected countries was established by regression analysis. The paper provides possible developmental guidelines for certain components. The results of the research proved that the Human Resources Development Index is insufficient in the analysis of economic development, as well as the existence of the expected correlation between trained human resources, which enable technological progress, and economic growth of a country. Taking into consideration the correlation between the growth of the Human Resources Development Index, Research Capacity Index, Technology and Innovation Index, and the Ability to Absorb Knowledge and Technology Index and economic growth, which was determined by the application of a model, Croatia has to make additional investments in the growth of human capital and labour productivity in order to reduce developmental lags.

Key words: *human resources, research capacity, economic growth, Republic of Croatia*

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1. Introduction

Land, labour, capital, and later organisation, had been considered basic developmental resources until the emergence of the third scientific-technological revolution. In knowledge-based economies, knowledge and human resources have become the key factors of development. Development of science leads to full automatisation of physical labour, growing cybernatisation of intellectual tasks and management processes, and to the rise of human domination over energy, space and time. New scientific disciplines have emerged, investments in scientific research have become more extensive, and the time span between scientific discovery and its application has been decreasing.

Nowadays, we can witness growing investments into research, development of research and educational capacity, accumulation of scientific and financial resources through (transnational) megaprojects, and connecting science and economy in order to accelerate the commercialisation of research results. The consequence of these changes is increased effectiveness of economies, stimulation of as interdisciplinary and multidisciplinary approach to research, promotion of creativity and innovativeness and growth of export rates of products which contain a great share of knowledge and information. In the world trade structure at the end of the twentieth century, knowledge-based high technologies were on the rise. The amount of medium-and-high technology products almost doubled in this period, so that in 1996 it comprised almost 55% of total world barter. At the same time, in the world trade structure, there was a decrease in the share of resource-based products and other primary products by 21 percentage points, a decrease in the low-technology-based products by three percentage points, and an increase in the share of products based on medium-and high-technology by 10, i.e. 11 percentage points. This trend has been accelerating in the last decade. (http://www.hrvatska21.hr/znanost%2030_6_2003.pdf 1.3.2009.) According to the United Nations indicators, export of medical and pharmaceutical products rose the most (by 13.1%) in the world trade structure from 1992 to 2003, as well as of organic and non-organic compounds (11.1%), precise medical and optical instruments (10.0%), and telecommunication equipment (9.0%) and microprocessors (8.0%). At the same time, there was a great decrease in products based on primary resources such as wool, wood and stone. (UNCTAD Handbook of Statistics, 2005:150-154)

The current know-how quickly becomes outdated, and application of new knowledge demands permanent education of human resources. Human resources have to be constantly trained in order to be able to develop, apply and use new technologies.

The article supports the hypothesis that trained human resources provide for fuel technological progress, and that development, application and expansion of new technological achievements have a direct impact on economic growth of a country.

2. Theoretical-methodological starting points

On the national level, human resources can be defined as the total psycho-physical energy at the disposal of a society, which can be used by the society to achieve its developmental goals. At pre-working age, the society has a decisive influence on the formation and development of human resources, primarily through education and health care, but also through other activities, such as social care for children, sports and cultural activities.

The value of human resources cannot be measured directly; their development level is measured indirectly. Literature offers various criteria for the assessment of human resources development in a particular area. It is considered that the greatest breakthrough was achieved by Harbison and Myers in their book "Education, Workforce and Economic Growth" (Harbison, F., Myers, Ch., 1964), in which they elaborated on quantitative indicators for indirect measuring of human resources development, after they had concluded that economists disregarded research of the human factor and its significance and contribution to economic development. This was caused by their inability to determine the input-output relationship which is indisputable in physical capital, because this capital is directly measurable in terms of value. By means of seven partial indicators, Harbison and Myers calculated the complex Human Resources Development Index[4].

The OUN recently calculated the Human Development Index (HDI), which, in terms of its content, represents Human Resources Development Index.[5] Namely, the OUN defines the human development concept in a wider sense, as the development of the people, for the people and by the people (Human Development Report, 1993).

However, in regard to the contribution of human resources to economic growth and development on macro level, in all the papers published so far, it has been measured by the influence of the population's education level on economic growth. In other words, the subject of calculation is the correlation between the achieved education level and the achieved GDP per capita. For example, this is visible in Harper-Anderson's works ("Measuring Connection between Workforce Development and Economic Development", Harper-Anderson, 2008), Hayton JC ("Competing in

[4] For calculating complex Human Resources Development Index, Harbison and Myers used the following indicators: 1. the number of teachers in primary and secondary education per 10,000 inhabitants; 2. the number of engineers and scientists per 10,000 inhabitants; 3. the number of doctors and dentists per 10,000 inhabitants; 4. inclusion of children from five to 14 years of age in primary education; 5. the average enrolment rates in primary and secondary education; 6. percentage inclusion of the population between five and 14 years of age in secondary education; 7. percentage inclusion of the population between 20 and 24 years of age in college education.

[5] The index was constructed at the beginning of the 1990s by Amartya Sen (Nobel Prize winner), Mahub ul Hak, Gustav Ranis (Yale University), Meghan Desai (London School of Economics) and has been used since by the OUN. It is published in the annual Human Development Report.

the New Economy: The Effect of Intellectual Capital in High-Technology New Ventures"; Hayton JC, 2005), Jayasuirya ("Measuring and Explaining the Impact of Productive Efficiency on Economic Development; Jayasuirya, 2005).

The efforts to explain the difference between inputs and outputs, which has been marked as a residual in the production function, have become very significant in contemporary economics of the second half of the twentieth century. More and more economists have assigned the residual to knowledge and education (E. Denison, S. Kuznets, M.Reder, M.S. Višnev, B. Higgins, M. Adiseshiah, S. Lebergot). The notion that economic growth is influenced by both quantitative and qualitative factors has become very significant. In the classification of the source of growth, E. Denison claims that output is not only influenced by the quantity of work invested as input, because output can be increased by investing in education and professional training, health care and professional mobility of the employees (Denison, E., 1972). Thus, investments are made in human capital. At the same time, Denison claims that output also depends on the allocation of resources; thereby, on allocation of human resources as well, i.e. on adequate employee assignment to certain work places. In other words, in professional terms, Denison claims that the effects gained by human capital depend on the efficiency of human resources management.

In the second half of the 20th century, numerous economists clearly pointed out the significance of education and education level on national economic growth, as well as on prosperity of an individual. Harbison and Myers established a pattern which is manifested as the need for multiple growth in terms of human resources development, in order to reach doubled domestic income per capita. In terms of the four degrees of economic development (the first degree being the lowest, and the fourth degree the highest), the difference in domestic income per capita between the first and the second degree countries at the beginning of the 1960s was doubled, and, at the same time, countries of the second degree of development had seven times more developed human resources. The fourth group, i.e. the most developed countries, had up to 13 times higher domestic income per capita than the first group, and as much as 38 times more developed human resources. (Harbison, F., Myers, Ch., 1964).

At the beginning of the 1970s, L. V. Stepanov (Stepanov, L.V., 1972) pointed out that American society, in accordance with the rules of global economic development, creates the situation in which educated people, especially those with quality education, rule over the less-educated.

At the beginning of the 21st century, it has become evident that the population's education has a strong impact on developmental inequalities between individual countries, as well as on poverty and income inequalities within individual countries. This was also emphasised in Blitzer's works "Measuring Knowledge Stocks" (Blitzer, 2005), Drucker Joshua "Assessing the Regional Economic Development of

Universities" (Drucker, J, 2007) and the edition by the World Bank "How Universities Promote Economic Growth" (Shahid, Y. ed., 2007). The richest countries in the world have the most educated population, and the poorest the most uneducated. Undeveloped countries make efforts to eradicate illiteracy, and the most developed countries have between a quarter and a third of a highly-educated population, with a tendency for the number of highly-educated people to increase in the next ten years to over 40%. For example, in 2006, the illiteracy rate in the most undeveloped African countries (Niger, Chad, Mali, Burkina Faso) amounted to 75 to 79%, while the most developed high-income countries almost eradicated illiteracy (World Development Indicators, 2007, Human Development Report 2007/2008). In these countries, 70 to 92% of the population of the relevant age group was included in tertiary education (http://go.worldbank.org/JVXVANWYY0, 29.2.2008.) Central and Eastern European countries (Estonia, Hungary, Lithuania, Slovenia, Poland, the Czech Republic) had an illiteracy rate of 0.2% to 0.7 %, in the same year, and about 60% of the population of the relevant age group was included in tertiary education. The Republic of Croatia had a 1.9% illiterate population (Human Development Report 2007/2008), and in 2006, only 38.7% of the population of the relevant age group was included in tertiary education. (http://go.worldbank.org/JVXVANWYY0, 29.2.2008.).

Table 1: Number of countries classified according to the Human Resources development index in 1988 and 2006

1988

	A	B	C	D	*Total*	*%*
H		3	18	23	*44*	*35.8*
M	6	41	3	1	*51*	*41.5*
L	22	6			*28*	*22.7*
Total	*28*	*50*	*21*	*24*	*123*	*100.0*
%	*22.7*	*40.6*	*17.1*	*19.6*	*100.0*	

2006

	A	B	C	D	*Total*	*%*
H			14	54	*68*	*40.0*
M	3	35	35	3	*76*	*44.7*
L	15	10	1		*26*	*15.3*
Total	*18*	*45*	*50*	*57*	*170*	*100.0*
%	*10.6*	*26.5*	*29.4*	*53.5*	*100.0*	

Notes: H – high HDI, M – medium HDI, L – low HDI; A – undeveloped countries, B - low middle-income countries, C – high middle-income countries, D – highly developed countries

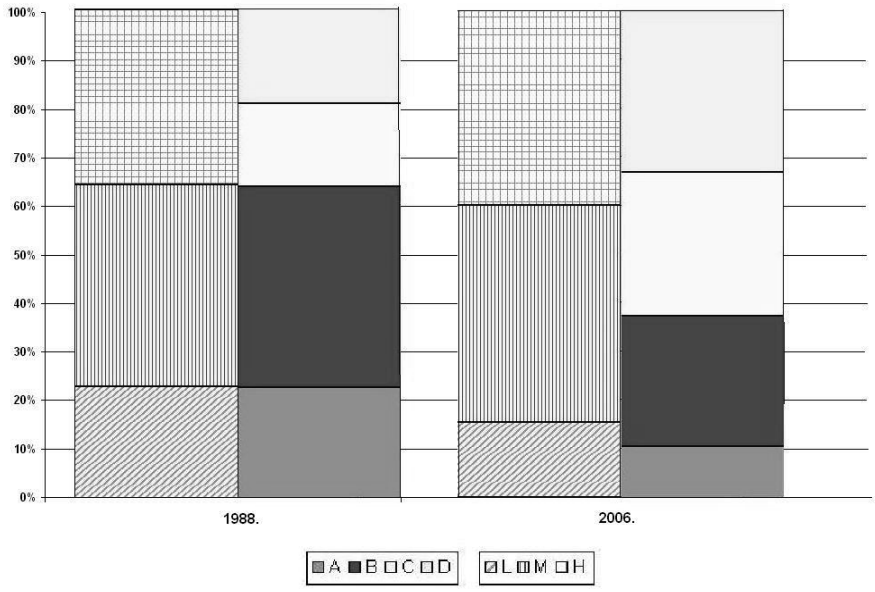
Source: Authors' calculation according to Human Development Indicators 1990, 2007/2008 (11.7.2009)

The table shows the undeveloped countries (A – GDP/pc<975 USD), low middle-income countries (B – 976-3,855 USD GDP/pc), high middle-income countries (C – 3,856-11,905 USD GDP/pc) and highly developed countries (D – GDP/pc>11,906 USD) classified according to the criterion of high (H – 0.80-1), medium (M – 0.50-0.80), and low (L – 0.0-0.50) Human Resources Development Index. The comparison indicates that over a period of 18 years, the number of countries with a high Human Resources Development Index increased by 4.2 percentage points, and the number of countries with a medium Human Resources Development Index by 3.2 percentage points. In the observed period of time, the number of countries with a low Human Resources Development Index fell by 7.4 percentage points.

Until 1998, the Republic of Croatia was a medium Human Resources Development Index country (HDI=0.795), and was ranked 49th according to human resources development. Since 1999, the Republic of Croatia has been a country of high Human Resources Development Index (HDI1999=0.803; HDI=2000=0.809; HDI2001=0.818; HDI2002=0.830; HDI2003=0.841; HDI2004=0.846; HDI2005=0.850). In 2006, the Republic of Croatia was in 45th place in the world according to the Human Resources Development Index. (HDI2006=0.862).

The table data lead to the conclusion that, according to the criterion of income per capita, the countries which have been classified into the groups of countries with medium or low income per capita can also have a high Human Resources Development Index. Albania is often mentioned as an example – a low middle-income country with a high level of human resources development, which was ranked 69th in the world, according to the Human Resources Development Index (HDI2006=0.807) (Human Development Indicators, 11.7.2009). Countries with equal incomes per capita can be on different levels of human resources development (for example, Egypt and Jordan). The following chart shows the imbalance between human resources development and income level per capita in the selected countries.

Figure 1: Countries classified according to the Human Resources development index in 1988 and 2006



Note: H – high HDI, M – medium HDI, L – low HDI; A – undeveloped countries, B- low middle--income countries, C – high middle-income countries, D – highly developed countries

Source: Authors' calculation according to figures from Table 1

Based on analysis of the table and the chart, it is evident that human resources development can be accelerated by a well-defined economic policy, increased availability of education, and by activities undertaken by local communities in order to increase the inclusion of the population in the educational process. However, in order to reach a higher level of economic development, it is necessary to achieve significant shifts in human resources development, as well as their utilisation. (Harbison, F., Myers, Ch., 1964.)[6]

Table figures support the thesis that the number of low HDI countries was decreasing, but the same figures also show that the poorest countries lag behind the most in terms of human resources development, while the greatest growth was not achieved by the richest countries, but by the high-and-low-middle income countries (with the exception of Rwanda and Bangladesh). However, this growth is insufficient to compensate for the difference in terms of developmental lagging measured by GDP per capita. Namely, in the medium-income group countries, the growth of the Human

[6] Cf. p. 266.: Four degrees of economic development

Resources Development Index primarily results from the growth of the Expected Life Span Index (the growth of 4.7% in the period between 1998 and 2006). Countries of low Human Resources Development Index achieved their average increase by 3.6% in the period between 1998 and 2005, which is the result of the improvement of educational structure of the population in these countries. At the same time, the high-income countries increased their income per capita by 6.3% in the observed period, which increases the developmental disproportions between the richest and the poorest countries. The income of the poorest countries increases twice as slow. The following table shows the average annual change rate of Human Resources Development Index for some of the selected countries in the period between 1988 and 2006.

The average annual rate of change[7] of the Human Resources Development Index in the period between 1988 and 2006, which amounts to 0.2444%, proves that middle-income countries achieve faster growth of human resources development and that they achieve an average annual index increase of 1%. Croatia had an average an annual index increase of 0.38% in the observed period, and although in 2006 it was ranked 45th in the world in terms of human resources development, numerous neighbouring countries achieved higher growth: Slovenia (higher growth comparised to Croatia with an annual average of 39.7 %), Hungary (36.6 %), Italy (12.5 %), Estonia (11.7 %), the Czech Republic (4.2 %), and Austria (0.7 %). It is important to point out that the most undeveloped countries and Russia experience average annual decrease of the Human Resources Development Index.

In the last 10 to 15 years, there has been a significant shift in understanding of the connection between economic growth and development, human resources development, research, innovations and technology. Unambiguous explanations of technological development or human resource development as the basic moving force of economic growth have been abandoned. Some authors believe that HDI alone is not a sufficient measure for determining economic growth and that analyses should include a whole range of other indicators (Bagolin, I.P., 2008)

[7] The average annual rate of change shows yearly changes in observed phenomenon. Equation for calculation is: average annual change rate=((n-1)root(y_n/y_1)-1)*100 where y_1 is value of HDI in year 1998, y_n value of HDI in 2006 and n number of periods between 1998 and 2006

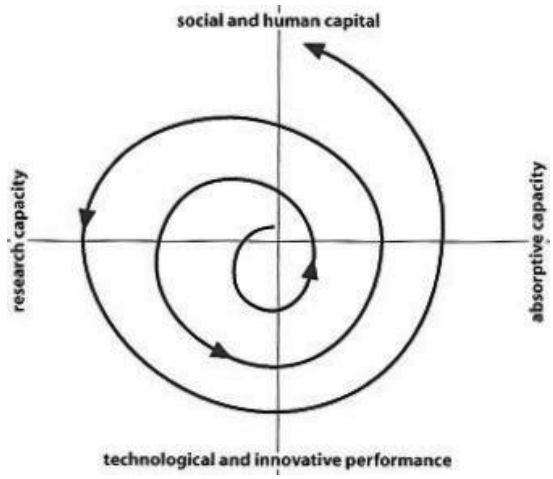
Table 2: HDI rank and the average annual rate of change of human resources development index for the period between 1988 and 2006

Country	HDI rank 2006	Average annual change rate of human resources development index 1988-2006 (%)
Rwanda	165	2.0045
Bangladesh	147	1.9885
China	94	1.5277
Morocco	127	1.5092
Egypt	116	1.5082
India	132	1.4050
Uganda	156	1.3361
Tunisia	95	1.3301
Senegal	153	1.2444
Indonesia	109	1.0252
Bolivia	111	0.9543
Turkey	76	0.8773
Brazil	70	0.8763
Thailand	81	0.8528
Saudi Arabia	55	0.7903
Colombia	80	0.7553
Nigeria	154	0.6617
Chile	40	0.6590
Ireland	5	0.6047
Mexico	51	0.5716
Poland	39	0.5574
Portugal	33	0.5493
Slovenia	26	0.5350
Hungary	38	0.5230
Singapore	28	0.5144
Greece	18	0.5056
Uruguay	47	0.4839
Argentina	46	0.4749
Philippines	102	0.4739
Australia	4	0.4660
Latvia	44	0.4649
Malta	36	0.4642
New Zealand	20	0.4615
Italy	19	0.4307
Estonia	42	0.4276
Cyprus	30	0.4234
Spain	16	0.4063

Country	HDI rank 2006	Average annual change rate of human resources development index 1988-2006 (%)
Czech Republic	35	0.3989
Armenia	83	0.3985
United Kingdom	21	0.3943
Denmark	13	0.3901
Sweden	7	0.3875
Austria	14	0.3830
Croatia	45	0.3827
Congo	130	0.3773
Iceland	1	0.3761
Romania	62	0.3746
Finland	12	0.3669
Germany	23	0.3500
Lithuania	43	0.3389
France	11	0.3370
Belgium	17	0.3322
Norway	2	0.3106
Netherlands	6	0.2993
Japan	8	0.2854
Switzerland	10	0.2711
Kazakhstan	71	0.2615
Canada	3	0.2246
United States	15	0.2142
Belarus	67	0.1990
Russian Federation	73	-0.1066
Moldova	113	-0.1376
Botswana	126	-0.1586
Côte d'Ivoire	166	-0.1679
Namibia	129	-0.1967
Tajikistan	124	-0.2390
South Africa	125	-0.2726
Central African Republic	178	-0.2778
Zambia	163	-0.3990
Swaziland	141	-0.8603

Source: Authors' calculation according to the Human Development Report 2007/2008

Scheme 1: The "ideal" circle of influence on Human Resources, technology, innovations and the ability of their absorption on economic growth and development



Source: Soete, L.: *Notes on UIL-Related Policies of National Governments* in *How Universities Promote Economic Growth*, The World Bank, Washington, 2007

Economic growth and prosperity are based on a combination of optimal functioning of an educational system and development level of research capacity, which determines the development of innovations and technology. Namely, educated employees, i.e. the human capital, become the moving force of the creation of knowledge, which enables greater number of innovations. Innovations lead to technological changes, which significantly accelerate economic growth. According to Drucker, (his thesis was proven on the paradigm of New Zealand), the economy of knowledge and national knowledge-based economy differ from traditional economies by the following: shareable information becomes the basic resource, the value of which grows by its use; location, i.e. position of the economy becomes irrelevant – the market becomes virtual, knowledge and information move where demand is the greatest and obstacles the smallest, prices become a matter of context, and the same product or service can be charged differently every time, human resources become the basic value of the economy of knowledge. Investments made in science, technology and innovations, especially in knowledge management, are very significant.

In a knowledge-based economy, knowledge management becomes a success strategy which is focused on rational, i.e. effective and efficacious, use of knowledge as an important non-material resource in contemporary production and service processes. Efficacious use of knowledge becomes a necessary pre-requisite of economic development. In such conditions, the competitive position of a national economy primarily depends on the quality of its human resources. Their use and investments become the key developmental factors, and education provides for the acquisition

of knowledge, skills, attitudes and values which an individual needs in order to fulfil his/her work and social roles. (http://nvk.multilink.hr/dokumenti/119___Obrazovanje%20za%20rast%20i%20razvoj.pdf).

The following scheme methodologically determines the indicators of human resources development, research capacity, innovations and technology, calculation of the common index of a certain group of indicators, and the cumulative index of all the indicators. Based on indicators presented in the scheme, the authors will calculate the current rank of 110 selected countries.

As previously stated, the HDI, in terms of its content, represents the Human Resources Development Index. *Human Development Index (symbolised by the letter A in the Scheme)* is calculated as a combined index of three indicators. These are: 1. the expected life span; 2. purchasing power of the population; 3. education of the population measured by adult literacy rate and the combined indicator of the share of respective population groups in primary, secondary and tertiary education. These three indicators can adequatly and indirectly show human resources development on a macro level, because the longer expected life span of the population implies better health care, and it results in better psycho-physical abilities, i.e. greater vitality of the people. Purchasing power of the population indirectly shows the level of satisfaction of needs, contentment and motivation level of employees. Also, it indirectly shows labour productivity, although not precisely enough (because GDP per capita, and not per employee, is taken into consideration). Ultimately, the achieved education level indirectly shows the level of mastering knowledge and skills necessary for achieving growth and development.

An increase in the percentage of highly educated population is a component of a long-term strategy of *research capacity development (B)*. The result of investments in their development is a dynamic co-ordination of the correlation between science and society, and promotion of the efficiency of two-sided communication channel between science and society. This is why the Research Capacity Index is an index combined of three indicators: 1. investments in research and development, 2. investments in tertiary education, and 3. the number of scientific publications.

Positive influence of the above-mentioned indicators has a direct impact on higher efficiency of *technology and innovations (C)*. Namely, more educated human resources produce a greater number of scientific and expert research, the result of which is a greater number of scientific publications, which contribute to an increase in the number of patents, licences and trademarks. A patent is a document which protects the exclusive right of explotation of an invention. An invention which has all the characteristics of patentability undergoes a registration and certification process and obtains patent protection. The patent is, in fact, ownership, and the inventor can allow other persons to use it for a limited period of time and provide them with a licence, or he can fully transfer the ownership to other persons. Thus, the patent

Scheme 2: Contemporary indicators of Human Resources development, research capacity, innovations and technology

Human Development (A)				
INDICATOR	Expected life span	Adult literacy	Inclusion in education	GDP per capita
INDEX	Expected Life Span Index	Education Index		GDP Index
	Human Resources Development Index (HDI)			
Research capacity (B)				
INDICATOR	Investments in research and development	Investments in tertiary education		The number of scientific publications per one million inhabitants
INDEX	Investments in Research and Development Index	Investments in Tertiary Education Index		Number of Scientific Publications Index
	Research Capacity Index			
Technology and Innovation Efficiency Index (C)				
INDICATOR	Number of residents' patents applied in the region	Receipts from licensing in USD		Number of residents' trademarks applied in the region
INDEX	Number of Patents Index	Receipts from Licensing Index		Number of Trademarks Index
	Technology and Innovation Efficiency Index			
The ability to absorb knowledge and technology (D)				
INDICATOR	Labour Force Productivity	GDP per capita		
INDEX	Labour Force Productivity Index	GDP Index		
	Absorption of Knowledge and Technology Index			
C U M U L A T I V E I N D E X (A+B+C+D)/4				

Source: Authors' calculation according to the *Human Development Indicators 2007* and *How Universities Promote Economic Growth,* The World Bank 2007

system is a sort of a trade in which the inventor agrees to disclose the details of his invention to the society, for the benefit of the whole society and for the purpose of technological and economic development and progress, in exchange for exclusive use during a certain period of time. *(Intellectual Property Rights*, 2009; *Patent Act*, *Official Gazette*, 173/03). A trademark is a protected mark or a symbol, used by an individual, a business organisation or some other entity, with the purpose of unique identification of its products or services in order for them to be recognized by the consumers *(Trademark Act*, *Official Gazette* 173/03). The Technology and Innovation Efficiency Index is an index combined of: 1. the number of patents by residents of a certain country applied in the region; 2. receipts from licensing, and 3. the number of residents' trademarks applied in the region.

The ability to absorb knowledge and technology is reflected in successful dispersion of new technologies in an economy. The basic premise of the ability to absorb knowledge and technology is reflected in greater productivity of labour force, which generates greater production, and a greater income level. The Knowledge and Technology Absorption Index is an index combined of two indicators: 1. labour force productivity and 2. GDP per capita.

The following formula and its derivations are used for transformation of all of the above-mentioned indicators into an index that obtains values ranging from zero to one, which enables their comparison and aggregation:

$$x - index = \frac{x - \min(x)}{\max(x) - \min(x)}$$

Where min(x) and max(x) are the lowest and the highest value of the x variable. In the calculation of the Human Development Index for the calculation of the GDP index, the World Bank methodology, for example, uses the quotient of the natural GDP logarithm per capita, reduced by a natural logarithm of the number 100 and the natural logarithm of USD 40,000 as the supposed maximum value of GDP per capita.[8]

The cumulative index (A+B+C+D)/4, which shows the developmental position of the observed country and enables its comparison with other countries, is obtained by an average aggregate of all indices.

What follows is an analysis of the position held by the Republic of Croatia and the 110 selected countries, based on the calculation of all four groups of the above-mentioned indicators. The bird's-eye-view method is also used to analyse the deviation of the Republic of Croatia in the observed categories, as well as regression

[8] $GDP\ index = \frac{\log(GDPpc) - \log(100)}{\log(40.000) - \log(100)}$, cf. OUN methodology for HDI calculation, for example, Human Development Report, 2008

analysis, which is used in an effort to explain the deviation in the development of an individual component of contemporary indicators of human resources development, research capacity, innovations and technology and gross domestic product.

3. Impact of Human Resources development and technological achievements on the economic growth of the republic of Croatia and the selected countries

The table containing calculation of the Human Resources Development Index, Research Capacity, Technology and Innovation Efficiency, and the Ability to Absorb Knowledge and Technology Index for selected countries (in the Appendix of the paper, cf., p. 288), shows index calculations for 110 countries. The countries are ranked according to the value of the cumulative index, from the highest to the lowest.

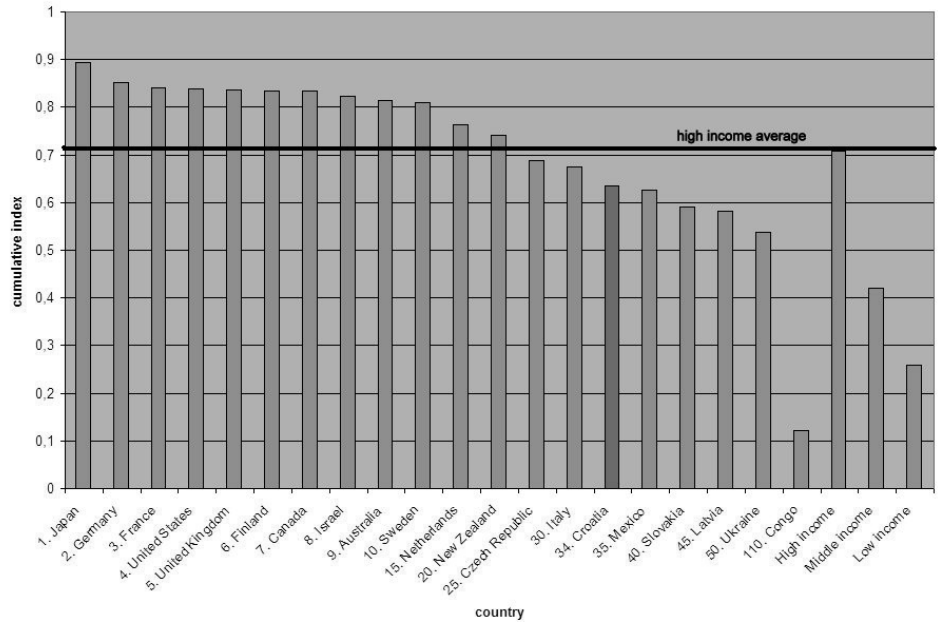
The chart which shows the cumulative index of human resources development, research capacity, technology and innovation efficiency, and the ability to absorb knowledge and technology index for the selected countries in 2006 is provided in the following section of the paper. The chart shows ten countries of the highest rank, every fifth country to the 50th place (including the Republic of Croatia), and the country of the lowest rank.

According to the Cumulative Index, the most developed country is Japan, followed by Germany, France and the Unites States of America. The Republic of Croatia was ranked 34th out of 110 analysed countries, i.e. it is located in the first third of the chart. It is important to note[9] that, according to the Human Resources Development Index by the OUN, the Republic of Croatia was ranked 45th out of 179 countries, i.e. it was ranked in the first quarter of the countries chart. This points to the fact that the cumulative index, as the average of Human Resources Development Index, Research Capacity, Technology and Innovation Efficiency Index, and the Ability to Absorb Knowledge and Technology Index, reflects the current development state of a country more precisely. The inability of a country to keep abreast of development of a country in comparison with the average development level in a certain component can be determined on the basis of a calculation which is derived from data provided in the table in the appendix to this paper.

Although the chart shows a significant development lag of the Republic of Croatia in comparison with the most developed countries, Croatia's slow pace of development in key developmental components in 2006 will be determined by additional calculations, and the bird's-eye-view method.

[9] Cf. Table 2.: The average change rate of Human Resources Development Index for the period between 1988 and 2006, p. 271.

Figure 2: The Cumulative Index of Human Resources development, research capacity, technology and innovation efficiency and the ability to absorb knowledge and technology for the selected countries



Source: Authors' calculation

In 2006, the expected life span in the Republic of Croatia was 75.3 years, the literacy rate[10] 98.1%, and GDP per capita USD14,309 PPP. (World Development Report, 2009) The index of 0.8620 grouped the Republic of Croatia among countries with high Human Resources Development Index. However, in the same year, Central and Eastern European countries (Estonia, Hungary, Lithuania, Slovenia, Poland and the Czech Republic) had the illiteracy rate of 0.2% to 0.7 %, and about 60% of the population of the relevant age group was included in tertiary education. These countries achieved from 4.63 (Lithuania) to 74.05 % (Cyprus) higher gross domestic product per capita than the Republic of Croatia. This resulted in a development lag of the Republic of Croatia in terms of human resources development, in comparison with the observed countries which joined the European Union after May 1, 2004. The Republic of Croatia even more lags behind highly developed countries such as Japan, Germany, France, Finland, Sweden, Ireland... Also, the Republic of Croatia

[10] According to the UN definition, a literate person is a person with the ability to understand, interpret, communicate, calculate and use written and printed material in accordance with its meaning. Literacy enables the continuum of learning in order to fulfill individual objectives, knowledge and potential and to participate in the society, http://www.uis.unesco.org/ (12.3.2009.)

significantly lags behind the highly developed countries in terms of research capacity development. Although Croatia invests more in research and development (1.22% of GDP) than neighbouring countries which joined the European Union in the last accession wave (more than Estonia by 18.85%, Latvia 37.7%, Lithuania 53.28%, Hungary 22.13%, Poland 53.28%, and Slovakia 57.38%), investment into research and development is almost two times smaller than those in the highly developed countries. This difference is especially visible in investments made in tertiary education. The highly developed countries invest up to 18 times more than Croatia.

The following table shows the deviation of the Republic of Croatia in the key developmental indicator components in 2006. The table facilitates comparison of Croatia with its neighbouring countries, as well as with the most developed countries.

Table 3: Deviation index of Croatia in key developmental indicator components in comparison with the selected countries in 2006

(Croatia=100)

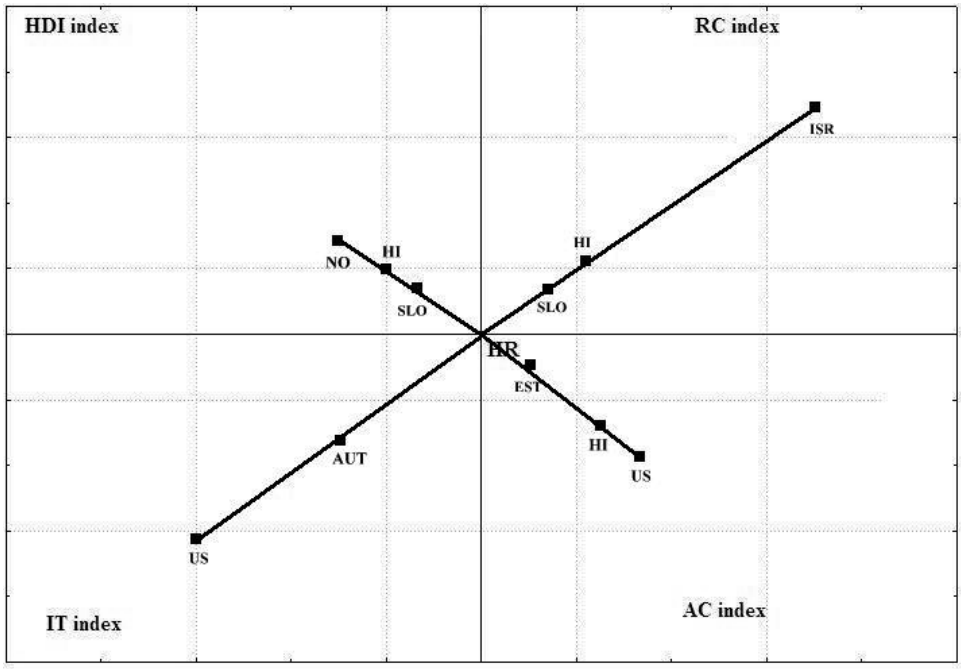
Country	Human Resources Development Index	Research Capacity Index	Technology and Innovation Efficiency Index	Ability to Absorb Knowledge and Technology Index	Cumulative Index
Croatia	100.00	100.00	100.00	100.00	100.00
Japan	110.90	176.94	195.50	121.47	140.71
Germany	109.05	167.42	172.74	119.97	133.98
France	110.79	155.87	168.23	121.50	132.16
United States	110.21	115.53	199.17	128.19	131.93
United Kingdom	109.28	152.62	170.28	122.01	131.56
Finland	110.67	170.63	145.14	122.30	131.11
Canada	112.18	158.20	151.83	124.21	131.08
Israel	107.89	191.08	131.77	115.44	129.51
Australia	111.95	145.91	150.77	123.04	128.21
Sweden	111.14	182.38	109.63	122.94	127.53
Austria	110.32	146.39	128.20	122.76	123.80
Spain	110.09	131.30	143.60	117.04	121.84
Ireland	111.37	116.50	133.51	126.66	120.79
Netherlands	111.14	146.67	104.00	123.34	120.16
Switzerland	110.79	165.07	79.49	123.77	119.34
Belgium	109.98	138.14	112.37	121.99	119.22
Norway	112.30	134.50	95.21	126.79	117.88
Denmark	110.44	150.95	74.76	123.79	115.83
Greece	109.86	113.21	106.59	116.41	111.92
Czech Republic	104.06	118.75	104.60	109.02	108.36
Slovenia	107.08	108.58	97.62	114.61	108.04
Hungary	101.74	105.01	126.59	103.99	107.28

Country	Human Resources Development Index	Research Capacity Index	Technology and Innovation Efficiency Index	Ability to Absorb Knowledge and Technology Index	Cumulative Index
Portugal	104.41	104.04	104.22	110.94	106.31
Italy	109.63	133.39	47.84	118.65	106.16
Poland	101.51	105.88	104.34	101.33	102.74
Estonia	101.04	79.69	77.83	115.02	97.45
Bulgaria	96.75	80.72	114.02	95.59	96.42
Turkey	92.58	108.68	82.93	97.30	95.32
Slovakia	101.16	89.57	57.13	106.05	93.00
Lithuania	100.81	84.61	60.57	103.80	91.87
Latvia	100.12	53.21	87.16	107.12	91.47
Romania	95.71	78.58	102.37	88.10	91.38
Ukraine	91.18	58.50	103.84	82.06	84.58
Serbia	95.24	50.19	56.41	82.11	76.32
Georgia	88.52	39.86	79.93	79.05	75.24
Congo	41.87	8.92	0.22	11.02	19.21
High income	107.89	109.06	99.91	114.86	111.39
Middle income	82.18	36.48	38.15	72.52	66.14
Low income	52.73	22.89	5.28	37.97	40.70

Source: Authors' calculation

The table shows average deviations in the developmental indicator components of the Republic of Croatia in comparison with the selected countries. Although Croatia has been grouped among countries of higher medium economic development (according to the criteria of the World Bank), and to a group of countries of high human resources development (according to the OUN criterion), in terms of key developmental components, Croatia lags behind the most in the application of research capacity, and in the efficiency and application of technology and innovations. When Croatia is compared with the neighbouring countries, it can be clearly seen that it lags behind Slovenia in terms of human resources development (lag of 7.08 %), as well as the Research Capacity Index (lag of 8.58 %). The Technology and Innovation Efficiency Index shows that Croatia lags behind Austria (28.2 %), and Estonia (15.02 %) in terms of ability to absorb knowledge and technology. In global terms, Croatia lags the most behind Norway in human resources development (12.30 %), Israel in terms of research capacity (91.08 %), and the United States of America in the ability to absorb knowledge and technology (28.19 %), and the efficiency of technology and innovations (99.17 %). Taking into consideration almost a double lag behind the average of highly developed countries in terms of all developmental indicator components, Croatia will have to make greater efforts in order to reach the level of highly developed countries and the European Union Member States.

Figure 3: Deviation of the Republic of Croatia in terms of key developmental indicator components – bird's eye view



Notes: HDI Index – Human Resources Development Index; RC Index – Research Capacity Index; IT Index - Technology and Innovation Efficiency Index; AC Index – Ability to Absorb Knowledge and Technology Index; HR – Croatia; SLO – Slovenia; NO – Norway; ISR – Israel; US – the United States of America; AUT – Austria; EST - Estonia; HI – high income countries.

Source: Authors' calculation

Croatia's slugging economic growth in the key developmental components is shown in the chart by the bird's eye view method. Greater distance from the starting point means a greater developmental lag behind the more developed countries in a certain component. The bird's-eye-view method provides an insight into slugging growth in terms of an individual component, and determination of critical areas to which the bearers of economic policy should pay special attention.

The chart analysis provides several conclusions:

a) Croatia lags behind the most in terms of research capacity and the efficiency of technology and innovations,

b) Slovenia is the most developed country from of all the analysed neighbouring countries (European Union countries), in two out of four developmental components,

c) The neighbouring countries (Slovenia, the Czech Republic, Hungary, Estonia, Poland...) use their technological and innovation capacities insufficiently, and this is why they lag behind the average of the medium-developed countries, and even more behind the average of highly developed countries,

d) The Republic of Croatia, as well as the other observed neighbouring countries, must make a shift from the scientific and educational policy which has primarily been focused on reproduction of knowledge, to a higher degree of scientific and professional research,

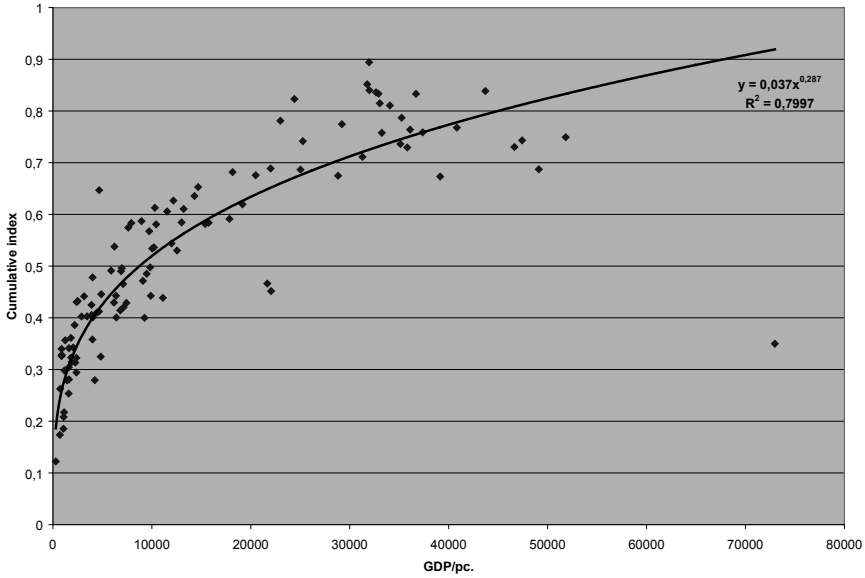
e) The consequence of slow absorption of knowledge and technology is slow economic growth and lagging behind with the Republic of Croatia in all the components of human resources development, research capacity, innovations and technology,

f) The Human Resources Development Index is insufficient in the analysis of economic development and the thesis mentioned in this paper that unambiguous explanations of technological progress of human resources development as the basic moving force of economic growth are no longer sufficient, is correct. Although Croatia is grouped among countries of high human resources development (according to the HD Index), the actual position of Croatia is that of (lower) medium development level.

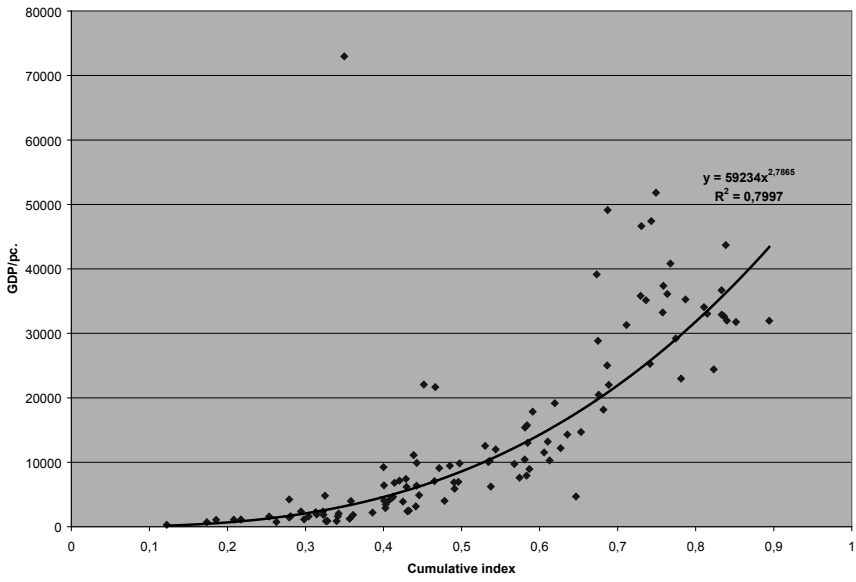
Taking into consideration the above-mentioned conclusions resulting from the bird's-eye-view method, the impact of the Human Resources Development Index, Research Capacity Index, Technology and Innovation Efficiency Index, and the Ability to Absorb Knowledge and Technology Index on the economic growth will be determined by the OLS regression method[11].

[11] OLS – the ordinary least square method

Figure 4: Correlation between the cumulative index and GDP/pc in selected countries (a) and GDP/pc and the Cumulative Index (b) (n=110)



(a) CI = 0.037xGDP$^{0.287}$; R^2=0.7997



(b) GDP = 59,234xCI$^{2.7865}$; R^2=0.7997

Source: Authors' calculation

The models show a clear correlation between the growth of Human Resources Development Index, research capacity, efficiency of technology and innovations, and the ability to absorb knowledge and technology on economic growth (model a), but also vice versa (model b). Taking into consideration the coefficient of determination which marks the correlation between two or more variables, which in (a) and (b) models represents 89.42% of all points in the function, a strong correlation can be established between the observed phenomena, based on which conclusions can be drawn. The above-mentioned models provide assessment of the effort that individual countries would have to make in order to achieve an adequate income level. For example, in order to achieve an average income value of highly developed countries, the Republic of Croatia should increase the Human Resources Development Index, Research Capacity Index, Technology and Innovation Efficiency Index, and the Ability to Absorb Knowledge and Technology Index by 5.13% (in this case, the cumulative index would amount to 0.67). In order to reach the average income level of the highly developed OECD[12] countries, the increase should amount to 17.8% (the cumulative index would amount to 0.77). It is evident that both increases demand great effort from the bearers of economic policy, and this is why the authors propose several possible guidelines for development of certain components:

a) *Increase in human capital***:** Considering the fact that demographic trends in Croatia indicate that the population has been getting older, and considering the low birth rates, which will result in the lack of student- and working population in the future, it is necessary to enforce measures of pro-birth demographic policy (increase of maternity benefits and child support); the problem of emigration will be a great challenge to the economic growth of this country in the future, especially the emigration of educated workers, who need to be kept in Croatian work places by provision of additional stimulations.

b) *Stimulation of productivity*: by stimulating greater investments in research and development; financing of vocational education in Croatia which has currently been viewed in a traditional way; by the reform of vocational education; the need for particular practical knowledge and skills should be addressed, such as inter-personal relationships and social competencies; additional investments should be made in college education - such investments in Croatia have currently been too low in comparison with the European average; life-long education should be stimulated - for now, it has mostly been conducted through adult education policy. Good examples should be applied from other European economies; information-communication technology should be applied in education; diverse, innovative learning approaches should be encouraged; direct investments in regional development should be increased.

[12] The average income level of highly developed OECD countries according to the World Bank criteria for 2006 amounts to USD 35331

4. Conclusion

The result of the research supports the thesis that the Human Resources Development Index is insufficient in the analysis of economic growth, that trained human resources provide for technological progress, and that development, application and expansion of new technological achievements have a direct impact on the economic growth of a country. The main contribution of the paper is reflected in analysis of the development of the Republic of Croatia and 110 selected countries in terms of human resource development index components and the components of the Technological Achievement Index.

Although, in global terms, Croatia has been grouped among countries with high Human Resources Development Index (according to the cumulative index of human resources development, research capacity, innovation and technology), Croatia can be classified among countries of (lower) medium development level. When Croatia is compared with neighbouring countries, the following is especially evident: it is lagging behind Slovenia in terms of human resources development and research capacity development; lagging behind Austria in the efficiency of technology and innovations; lagging behind Estonia in its ability to absorb knowledge and technology.

Croatia has to additionally invest in the growth of human capital. It is necessary to encourage productivity by stimulating investments in research and development, by financing and reforming vocational education, by making additional investments in college education and by encouraging life-long learning. This would facilitate compliance with the pre-requisites for faster absorption of knowledge and technology and reduction of developmental lag. It would also provide for an in competitiveness and reach the average level of development of the European Union Member States as well as the most developed countries in the world.

The calculations are based on data acquired from relevant databases for 110 countries in the world. Data for other countries have not been published, which is a typical limitation in the application of such research methodology. Further research should additionally establish the importance of individual economic growth component derived from the analysed model by statistical and mathematical methods. This would pave the way for precise determination of specific measures for stimulation of the efficiency of technology and innovations, the ability to absorb knowledge and technology and human resources development.

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Razvijenost ljudskih potencijala i istraživačkih kapaciteta i njihov utjecaj na ekonomski rast[1]

Nada Karaman Aksentijević[2], *Zoran Ježić*[3]

Sažetak

Cilj ovog rada je uz pomoć komponenti indeksa razvijenosti ljudskih potencijala i komponenti indeksa tehnološkog dostignuća analizirati razvijenost Republike Hrvatske i 110 odabranih zemalja. Metodom ptičje perspektive utvrđena su razvojna zaostajanja Republike Hrvatske u promatranim razvojnim pokazateljima i njihovim komponentama te su dani prijedlozi za njihovo poboljšanje. Također, regresijskom analizom utvrđen je utjecaj analiziranih pokazatelja i njegovih komponenti na ekonomski rast Republike Hrvatske i odabranih zemalja. Navedene su moguće smjernice napretka pojedinih komponenti. Rezultati istraživanja dokazuju da indeks razvijenosti ljudskih potencijala nije dovoljan u analizi gospodarske razvijenosti te da postoji očekivana povezanost između osposobljenih ljudskih potencijala, koji čine tehnološki napredak mogućim, i ekonomskog rasta zemlje. S obzirom na primjenom modela utvrđenu vezu između porasta indeksa razvijenosti ljudskih potencijala, istraživačkih kapaciteta, učinkovitosti tehnologije i inovacija te sposobnosti apsorpcije znanja i tehnologije na gospodarski rast, Hrvatska mora ulagati dodatna sredstva u povećanje ljudskog kapitala i produktivnosti rada da bi smanjila razvojna zaostajanja.

Ključne riječi: *ljudski potencijali, istraživački kapaciteti, ekonomski rast, Republika Hrvatska*

JEL klasifikacija: *O10, O15, O33, I0*

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Appendix

Table: Calculation of Human Resources Development Index, Research Capacity Index, Technology and Innovation Efficiency Index and the Ability to Absorb Knowledge and Technology Index for the Selected Countries

No	Country	Human Resources Development Index	Research Capacity Index	Technology and Innovation Efficiency Index	Ability to Absorb Knowledge and Technology Index	Cumulative Index
1	Japan	0.9560	0.8226	0.8512	0.9476	0.8943
2	Germany	0.9400	0.7783	0.7521	0.9359	0.8516
3	France	0.9550	0.7246	0.7325	0.9478	0.8400
4	United States	0.9500	0.5371	0.8672	1.0000	0.8386
5	United Kingdom	0.9420	0.7095	0.7414	0.9518	0.8362
6	Finland	0.9540	0.7932	0.6319	0.9540	0.8333
7	Canada	0.9670	0.7355	0.6611	0.9689	0.8331
8	Israel	0.9300	0.8883	0.5737	0.9006	0.8232
9	Australia	0.9650	0.6783	0.6565	0.9598	0.8149
10	Sweden	0.9580	0.8479	0.4773	0.9591	0.8106
11	Austria	0.9510	0.6806	0.5582	0.9577	0.7869
12	Korea (Republic of)	0.9280	0.5316	0.7666	0.8986	0.7812
13	Spain	0.9490	0.6104	0.6252	0.9130	0.7744
14	Ireland	0.9600	0.5416	0.5813	0.9881	0.7677
15	Netherlands	0.9580	0.6819	0.4528	0.9622	0.7637
16	Switzerland	0.9550	0.7674	0.3461	0.9655	0.7585
17	Belgium	0.9480	0.6422	0.4893	0.9516	0.7578
18	Norway	0.9680	0.6253	0.4145	0.9891	0.7492
19	Singapore	0.9180	0.4876	0.5906	0.9761	0.7431
20	New Zealand	0.9440	0.5415	0.5732	0.9074	0.7415
21	Denmark	0.9520	0.7018	0.3255	0.9657	0.7362
22	Kuwait*	0.9120	0.3781	0.0000	0.9015	0.7305
23	Iceland**	0.9680	0.0000	0.0000	0.4910	0.7295
24	Greece	0.9470	0.5263	0.4641	0.9081	0.7114
25	Czech Republic	0.8970	0.5521	0.4554	0.8504	0.6887
26	United Arab Emirates*	0.9030	0.1909	0.0000	0.9676	0.6872
27	Slovenia	0.9230	0.5048	0.4250	0.8941	0.6867
28	Hungary	0.8770	0.4882	0.5512	0.8112	0.6819
29	Portugal	0.9000	0.4837	0.4538	0.8655	0.6757
30	Italy	0.9450	0.6201	0.2083	0.9256	0.6747
31	Hong Kong. China (SAR)	0.9420	0.2514	0.5135	0.9861	0.6732

No	Country	Human Resources Development Index	Research Capacity Index	Technology and Innovation Efficiency Index	Ability to Absorb Knowledge and Technology Index	Cumulative Index
32	Poland	0.8750	0.4923	0.4543	0.7905	0.6530
33	China	0.7620	0.5758	0.5892	0.6597	0.6467
34	Croatia	0.8620	0.4649	0.4354	0.7801	0.6356
35	Mexico	0.8420	0.4307	0.4747	0.7602	0.6269
36	Estonia	0.8710	0.3705	0.3389	0.8973	0.6194
37	Bulgaria	0.8340	0.3753	0.4965	0.7457	0.6129
38	Russian Federation	0.8060	0.3094	0.5663	0.7602	0.6105
39	Turkey	0.7980	0.5052	0.3611	0.7591	0.6058
40	Slovakia	0.8720	0.4164	0.2487	0.8273	0.5911
41	Brazil	0.8070	0.5055	0.3304	0.7047	0.5869
42	Chile	0.8740	0.4197	0.2340	0.8108	0.5846
43	Lithuania	0.8690	0.3933	0.2637	0.8097	0.5839
44	Macedonia (TFYR)*	0.8080	0.0216	0.2760	0.6444	0.5834
45	Latvia	0.8630	0.2474	0.3795	0.8356	0.5814
46	Romania	0.8250	0.3653	0.4457	0.6873	0.5808
47	Thailand	0.7860	0.3546	0.4346	0.7221	0.5743
48	Belarus	0.8170	0.3788	0.3132	0.7614	0.5676
49	Argentina	0.8600	0.4269	0.1153	0.7725	0.5437
50	Ukraine	0.7860	0.2719	0.4521	0.6402	0.5376
51	Uruguay	0.8590	0.3008	0.2324	0.7519	0.5360
52	Iran	0.7770	0.4146	0.2314	0.7137	0.5342
53	Malaysia	0.8230	0.2045	0.3078	0.7854	0.5302
54	Kazakhstan	0.8070	0.1138	0.3130	0.7565	0.4976
55	Tunisia	0.7620	0.3964	0.1497	0.6755	0.4959
56	Albania*	0.8070	0.0000	0.0478	0.6184	0.4911
57	Cuba	0.8550	0.3186	0.1719	0.6160	0.4904
58	Serbia	0.8210	0.2333	0.2456	0.6405	0.4851
59	Georgia	0.7630	0.1853	0.3480	0.6166	0.4782
60	South Africa	0.6700	0.4379	0.0906	0.6873	0.4715
61	Trinidad and Tobago	0.8330	0.0104	0.1023	0.9194	0.4663
62	Peru	0.7880	0.2199	0.2449	0.6088	0.4654
63	Saudi Arabia	0.8350	0.1506	0.0000	0.8209	0.4516
64	Armenia	0.7770	0.0841	0.2295	0.6918	0.4456
65	Costa Rica	0.8470	0.1868	0.0000	0.7366	0.4426
66	Colombia	0.7870	0.2722	0.0346	0.6759	0.4424
67	Philippines	0.7450	0.2031	0.2765	0.5413	0.4415
68	Venezuela	0.8260	0.1634	0.0000	0.7649	0.4386
69	India	0.6090	0.4335	0.1703	0.5172	0.4325

No	Country	Human Resources Development Index	Research Capacity Index	Technology and Innovation Efficiency Index	Ability to Absorb Knowledge and Technology Index	Cumulative Index
70	Moldova	0.7190	0.1472	0.3260	0.5296	0.4305
71	Azerbaijan	0.7580	0.1974	0.0869	0.6761	0.4296
72	Algeria	0.7480	0.1268	0.2056	0.6349	0.4288
73	Sri Lanka	0.7420	0.1089	0.2470	0.6021	0.4250
74	Ecuador	0.8070	0.0052	0.2022	0.6675	0.4205
75	Bosnia and Herzegovina	0.8020	0.0000	0.1621	0.6925	0.4141
76	Jordan	0.7690	0.2534	0.0000	0.6263	0.4122
77	Angola*	0.4840	0.0000	0.2650	0.4815	0.4102
78	Morocco	0.6460	0.3180	0.0889	0.5687	0.4054
79	Indonesia	0.7260	0.2126	0.0822	0.5905	0.4028
80	Mongolia*	0.7200	0.0276	0.1794	0.2805	0.4025
81	Paraguay	0.7520	0.0069	0.2374	0.6070	0.4008
82	Jamaica	0.7710	0.0522	0.1466	0.6324	0.4005
83	Montenegro*	0.8220	0.0000	0.0000	0.3780	0.4000
84	Uzbekistan	0.7010	0.0852	0.2031	0.5543	0.3859
85	Kyrgyzstan	0.6940	0.0453	0.2200	0.4848	0.3610
86	Bolivia	0.7230	0.1158	0.0317	0.5619	0.3581
87	Ghana*	0.5330	0.1346	0.0000	0.4020	0.3566
88	Cameroon*	0.5140	0.0956	0.0000	0.4181	0.3426
89	Cambodia*	0.5750	0.0043	0.0000	0.4450	0.3414
90	Myanmar*	0.5850	0.0138	0.0000	0.4211	0.3400
91	Uganda	0.4930	0.4974	0.0000	0.3221	0.3281
92	Madagascar*	0.5330	0.0138	0.1387	0.2932	0.3262
93	Turkmenistan	0.7280	0.0000	0.0000	0.5721	0.3250
94	Nigeria*	0.4990	0.0462	0.0000	0.4238	0.3230
95	Viet Nam	0.7180	0.0650	0.0000	0.5066	0.3224
96	Sudan*	0.5260	0.0259	0.0000	0.3910	0.3143
97	Yemen*	0.5670	0.0000	0.1675	0.5184	0.3132
98	Tajikistan	0.6840	0.0086	0.1126	0.4114	0.3042
99	Bangladesh*	0.5240	0.0137	0.0000	0.3569	0.2982
100	Pakistan	0.5620	0.0932	0.2575	0.2640	0.2942
101	Côte d'Ivoire*	0.4310	0.0000	0.0000	0.4118	0.2809
102	Syrian Arab Republic	0.7360	0.0686	0.0000	0.3125	0.2793
103	Kenya	0.5320	0.1651	0.0395	0.3799	0.2791
104	Mozambique*	0.3660	0.0449	0.0000	0.3770	0.2627
105	Senegal*	0.5020	0.0932	0.0000	0.4189	0.2535
106	Tanzania*	0.5030	0.0505	0.0000	0.3159	0.2174

No	Country	Human Resources Development Index	Research Capacity Index	Technology and Innovation Efficiency Index	Ability to Absorb Knowledge and Technology Index	Cumulative Index
107	Burkina Faso	0.3720	0.0155	0.0819	0.3633	0.2082
108	Mali*	0.3910	0.0000	0.0000	0.3511	0.1855
109	Ethiopia*	0.3890	0.0273	0.0000	0.2782	0.1736
110	Congo*	0.3610	0.0415	0.0000	0.0860	0.1221
	High income	0.9300	0.5070	0.4350	0.8960	0.7080
	Middle income	0.7084	0.1696	0.1661	0.5657	0.4204
	Low income	0.4545	0.1064	0.0230	0.2962	0.2587

Note: * Figures of an individual component are zero or tend toward zero (0.001), so the average cumulative index of these countries was calculated with statistically relevant data.

Source: Authors' calculation