Technological progress and its contribution to economic development

Ewa, Lechman

Faculty of Management and Economics, Gdansk University of Technology

2009

Technological progress and its contribution to economic development

Ewa Lechman[1]

Published in monograph: Growth and innovation - selected issues, 2009

Key words: *ICTs, technology, economic development*

JEL codes: *011, 033*

1.1 Introduction

Economic development is a complex area determined by lots of different and often interdependent factors. It is broadly defined as a process of improving people`s life. In recent years it has become crucial to identify the potential role that information and communication technologies can play in it. Now, many countries – especially these less developed – are undergoing a revolution in information and communication technologies (ICTs), and it has been widely recognized that these technologies have great implications for current and future social and economic situation[2] of many economies. Although there is much evidence that ICTs have influenced positively the performance of national economies, we still lack any quantitative proof that ICTs really contribute to the development level. But identifying which areas of life (social, economic, political) can benefit most from proper application and use of ICTs, remains a fundamental issue for planning national development policies. So the question arises: is there any relationship between ICTs development and economic development? And if there is one, is this relationship positive or negative, and what is its strength? In the section the author will try to answers the given questions.

1.2 Information and Communication Technologies – definition, measurement and their role in development

Information and communication technologies (ICTs), broadly defined, are tools used by most of governments to achieve some economic and social targets. They are tools that facilitate – by electronic means – the creation, storage, management and dissemination of information and knowledge[3]. ICTs can be understood as industry but also as a tool, or set of tools, and only if they are regarded as tools they can potentially become an enabler of social and economic development. But why are these ICTs assigned such importance in the development context? Mostly it is because of their unique characteristics, opportunities they offer and benefits they create. They are relatively cheap tools that can be implemented and used practically everywhere. ICTs have great impact on individual user`s welfare, change the way business is run, transform societies, enable knowledge sharing and free from the so called 'tyranny of physical distance'. ICTs infrastructure create economies of scale[4] and by stimulating building social and economic networks they spillover benefits. They enable overcoming distance, promote social inclusion, foster information and knowledge sharing, offer new services, health care information and learning opportunities. They also enhance job creating and local entrepreneurship. 'ICTs reduce transactions costs, change the structure of markets and of public services and institutions, entrap human resources, and

[1] Ph.D., eda@zie.pg.gda.pl, Gdansk University of Technology, Faculty of Management and Economics

[2] Report of the meeting of the high-level panel of experts on Information and communication Technology (New York, 17-20 April 2000), United Nations, May 2000.

[3] R.Gester and S.Zimmermann (2003), *Information and communication Technologies for poverty reduction: discussion paper*, Swiss Agency of Cooperation & Development. http://www.ifpri.org/pubs/jhu/ICTTelecom.asp, accessed on 4 March 2009.

[4] Torero, M. and J. Von Braun (2006), *ICTs for the poor*, International Food Policy Research Institute, www.ifpri.org, accessed on 7 March 2008.

immediately increase potential values of human capital[5]'. Much evidence from all around the world has shown that enormous benefits can be derived from ICTs, if they facilitate mainstreaming of information and knowledge. Full and effective use of ICTs requires transparent environment, including policy and legal frameworks, and what is even the most important – ICTs should be available at an affordable cost so that everyone could use them with little limitations.

ICTs if deployed and used properly, can solve many problems that many economies are struggling with. Now, almost everyone would agree that technology has always been, and still is a great and powerful tool for human development.

Trying to measure technological achievements of nations one should realize that usually they are much more extensive and complex than any index – even the most sophisticated – could capture. But having in mind a necessity of being able to monitor countries progress in implementing and using ICTs, but also making international rankings to compare their achievements, there is an essential need for such index. Until now there have been introduced three methods to measure ICTs development in a country. United Nations Development Programme and International Telecommunication Union (ITU) have elaborated three indices which try to measure overall achievements of countries and nations in implementing ICTs, but also nation's ability to benefit from multiple opportunities that ICTs offer. These three mentioned indices are:

- Technology Achievement Index (TAI) – introduced by UNDP,
- Digital Access Index (DAI) – introduced by ITU,
- Digital Opportunity Index (DOI) – introduced by ITU.

Technology Achievement Index is a measure which tries to show how well a country is creating and diffusing technology, and building human skill base[6]. TAI focuses on four dimensions which are thought to be crucial for getting benefits that ICTs offer. It is calculated on the base of indicators of four dimensions: creation of technology (patents granted *per capita*, receipts of royalty and license fees from abroad *per capita*), diffusion of recent innovation (internet hosts *per capita*, high- and medium-technology exports as a share of all exports), diffusion of old innovations (logarithm of telephones *per capita*, logarithm of electricity consumption *per capita*), human skills (mean number of years of schooling, gross enrolment ratio at tertiary level in science, mathematics and engineering). TAI value ranges from 0 to 1, where 1 is the best possible score. Up till now estimates of TAI have been prepared for 72 countries[7]. In order to reflect to the great disparities between countries, nations for which TAI has been calculated, are divided into 4 groups: leaders (for TAI above 0,5), potential leaders (for TAI from 0,35 to 0,49), dynamic adapters (for TAI from 0,34 to 0,20) and marginalized (for TAI below 0,20).

In 2003 ITU has launched Digital Access Index, which tries to measure an overall ability of nations to access and use new ICTs[8]. DAI is estimated by using data from 5 different fields: infrastructure[9] (fixed telephone subscribers *per* 100 inhabitants, mobile cellular phone subscribers *per* 100 inhabitants), affordability (Internet access price as percentage of Gross National Income *per capita*), knowledge (adult literacy, combined primary, secondary and tertiary school enrolment level), quality (international Internet bandwidth (bits) *per capita*, broadband subscribers *per* 100 inhabitants) and usage (Internet users *per* 100 inhabitants). DAI value ranges from 0 to 1, where 1 is the best score. DAI calculations cover 178 countries[10], which are divided into 4 categories (according to the DAI value): high access (for DAI above 0,70), upper access (for DAI from 0,50 to 0,69), medium access (for DAI from 0,30 to 0,49) and low access (for DAI below 0,29).

---

[5] Spence, R. (2005), *ICTs, Internet, Development and poverty reduction*, www.developmentgateway.org, accessed on 15 Feb 2007.

[6] *Making New Technologies Work For Human Development*; UNDP, Human Development Report 2000, www.un.org, accessed on 18 July 2008.

[7] Only for that number of countries there have been sufficient, valuable data necessary to calculate TAI value. Full list of countries is available in Human Development Report 2001.

[8] http://www.itu.int/ITU-D/ict/dai/, accessed on 5 May 2007.

[9] http://www.itu.int/newsarchive/press_releases/2003/30.html, accessed on 5 May 2007.

[10] Full list of countries is available at: http://www.itu.int/newsarchive/press_releases/2003/30.html, accessed on 5 May 2007.

In February 2005 ITU and the Korea Agency for Digital Opportunity and Promotion (KADO) announced a new index to measure ICTs. DOI is a composite index that allows the tracking and comparison of countries in ICTs infrastructure capabilities, access path and device, affordability and coverage, and quality[11]. DOI methodology utilizes 11 core indicators categorized in 3 groups: opportunity (percentage of population covered by mobile cellular telephony, mobile cellular tariffs as a percentage of *per capita* income, Internet access tariffs as a percentage of *per capita* income), infrastructure (proportion of households with a fixed line telephone, mobile cellular subscribers *per* 100 inhabitants, proportion of households with Internet access at home, (mobile) Internet subscribers *per* 100 inhabitants, proportion of households with computers) and utilization (Internet users *per* 100 inhabitants, ratio of (fixed) broadband Internet subscribers to total Internet subscribers, ratio of (mobile) broadband Internet subscribers to mobile Internet subscribers). DOI value ranges from 0 to 1, where 1 is the best score.
Table 1.1 (below) presents comparison of all three indexes for chosen economies.

Table 1.1 Comparison of three indices values for chosen countries.

Country	TAI[12]	DAI[13]	DOI[14]
Sweden	0,703	0,85	0,65
United States	0,733	0,78	0,60
Israel	0,514	0,70	0,60
Spain	0,481	0,67	0,55
Hungary	0,464	0,63	0,47
Poland	0,407	0,59	0,45
Mexico	0,389	0,50	0,35
China	0,299	0,43f	0,31
Peru	0,271	0,44	0,17
India	0,201	0,32	0,14

Source: own specification based on data from www.un.org and www.itu.int, 2007

1.3 Is economic development related to ICTs diffusion in a country? – empirical evidence

It is difficult to prove that ICTs diffusion and technological progress have positive influence on GDP growth and economic development. It is because of the fact, that ICTs influence on country's economy and society is mostly a qualitative one. ICTs programmes are usually *'built to last'*, which means that positive effects are supposed to be noticed in the future and not today. Technology implementation and usage is closely related to the so called *'technology spillover effect'* – which means that it is hardly possible to assess the quantitative impact of technology on economy's condition; and to the *'network effect'* – the more people use technology the more benefits can be derived from its usage. The only thing that can be assessed precisely is the kind of relationship between technological advancement and economic development of a country.
To accomplish the required analysis, the author evaluates nonlinear regression model to assess the magnitude of relationship between two variables. Additionally correlation coefficients are calculated in three cases: between TAI and HDI[15], DAI and HDI, DOI and HDI. The correlation coefficients (Pearson r) were estimated for all of the countries for which necessary indices were available[16]. There have also been estimated 'statistical significance' (p-value) in each case.

Human Development Index vs. Technology Achievement Index
For purposes of assessing the magnitude of relationship between HDI and TAI, nonlinear regression model and coefficient of correlation are elaborated. The statistical analysis shows to what extend changes in TAI can influence positively or negatively changes in level of economic development.

[11] http://www.itu.int/osg/spu/statistics/DOI/background.phtml, accessed on 5 May 2007.
[12] Data for 2001.
[13] Data for 2003.
[14] Data for 2005.
[15] Human Development Index – commonly used measure for assessing level of economic and social development of a country. Annually calculated by UNDP.
[16] HDI value are available for almost all of the countries.

To complete the analysis data for 72 economies are applied, for which TAI[17] and HDI[18] values are available at the same time. All estimations have been completed by the author.
When relationship between development level and technological advancement (measured as Technological Advancement Index) is considered, the nonlinear regression model has a general form:

$$HDI = 1{,}073 + 0{,}2497 * \ln(TAI)$$

In the given model HDI (level of economic development is considered as dependent variable, and TAI as independent variable.
The value of parameter $\beta = 0{,}2497$ gives an information about the magnitude of changes in HDI value that would be caused by changes in TAI value. The Table 1.2 presents increase in HDI value (in percentage points), caused by increase of TAI by 1 percentage point (at the given level of TAI).

Table 1.2 Marginal increments of HDI induced by growth of TAI at 1 percentage point.

TAI value	ΔHDI/ΔTAI
0,05	4,994
0,1	2,497
0,15	1,664
0,2	1,248
0,25	0,998
0,3	0,832
0,35	0,713
0,4	0,624
0,45	0,554
0,5	0,499
0,55	0,454
0,6	0,416
0,65	0,384
0,7	0,356
0,75	0,332
0,8	0,312
0,85	0,293
0,9	0,277
0,95	0,262
1	0,249

Source: own calculations

The following conclusion can be drawn from the Table 1.3. Let us have, for example, a country where TAI = 0,05. According to the nonlinear regression model we know, that when in a given country TAI = 0,05, and the TAI value increases by 1 percentage point, it will probably cause increase in HDI value of approximately 4,99 percentage points. Literally it means that 1 percentage point change in TAI level implies change in HDI level of approximately 4,99 percentage points, when TAI = 0,05 is a 'starting point'. Going further, it is clear that the higher TAI value, the weaker impact in increase of HDI value it will have when TAI increases of 1 percentage point. The level of TAI = 0,2 is a critical point and by exceeding it, increase in TAI level will cause proportionally smaller increases in HDI level.
Additionally coefficient of correlation has been evaluated. In the given case r = 0,884 which stands for positive and very high statistical relationship between TAI and HDI level. The relationship is statistically significant (p = 0,00), which means that the analysis results can be generalized to the whole population. In this case it would mean that results obtained are also true and significant for all these countries which – for technical reasons – are excluded from the analysis.

Human Development Index vs. Digital Access Index
Like in the first case, for the purpose of assessing the magnitude of relationship between HDI and DAI, nonlinear regression model and coefficient of correlation are elaborated. The

[17] *Data referring to Human Development Report* 2001.
[18] *Data referring to Human Development Report* 2006.

statistical analysis proofs to what extend changes in DAI can influence positively or negatively changes in level of economic development.
To complete the analysis data for 168 economies are applied, for which DAI[19] and HDI[20] values are available at the same time.
When relationship between development level and technological advancement (measured as Digital Access Index) is considered, the following nonlinear regression model is as follows:

$$HDI = 0{,}9913+0{,}2644*\ln(DAI)$$

In the given model HDI (level of economic development is considered as dependent variable and DAI as independent variable.
The value of parameter $\beta = 0{,}2644$ gives an information about the magnitude of changes in HDI value that would be caused by changes in DAI value, at the given level of TAI. The Table 1.3 presents increase in HDI value (in percentage points), caused by increase of DAI by 1 percentage point (at the given level of DAI).

Table 1.3 Marginal increments of HDI induced by growth of DAI at 1 percentage point.

DAI value	ΔHDI/ΔDAI
0,05	5,288
0,1	2,644
0,15	1,762
0,2	1,322
0,25	1,057
0,3	0,881
0,35	0,755
0,4	0,661
0,45	0,587
0,5	0,528
0,55	0,480
0,6	0,440
0,65	0,406
0,7	0,377
0,75	0,352
0,8	0,330
0,85	0,311
0,9	0,293
0,95	0,278
1	0,264

Source: own calculations

According to the data obtained and presented in the Table 1.4, if a country enjoys very low level of technological advancement, which means that DAI = 0,05, then if in this specific country the DAI increases by 1 percentage point, it is highly probable that this will cause increase in HDI value of approximately 5,28 percentage points. Literally it means that 1 percentage point change in DAI level implies change in HDI level of approximately 5,28 percentage points, when DAI = 0,05 is a 'starting point'.
Similarly like in the first case, the higher DAI level the weaker impact on HDI value would have increase of DAI. Level of DAI = 0,25 is a critical one, and in all countries where DAI is higher than 0,25, the potential impact of increase in DAI level will be proportionally lower than increase in HDI.
In the second case the correlation coefficient equals 0,9284. It means that there is positive and very high statistical relationship between level of HDI and level of DAI. Also this relationship results to be statistically significant (p = 0,00), which means that obtained in the analysis results can be generalized to all economies excluded from the analysis.

Human Development Index vs. Digital Opportunity Index
For purposes of assessing the magnitude of relationship between HDI and DOI, nonlinear regression model and coefficient of correlation are elaborated. The statistical analysis proofs

[19] Data referring to ITU 2005.
[20] Data like in the first case.

to what extend changes in DOI can influence positively or negatively changes in level of economic development.
To complete the analysis, sample data for 175 economies are applied, for which DOI[21] and HDI[22] values are available at the same time.
When relationship between development level and technological advancement (measured as Digital Opportunity Index) is considered, the following nonlinear regression model has a general form as presented below:

$$HDI = 0{,}9698+0{,}2174*\ln(DOI)$$

In the given model HDI (level of economic development is considered as dependent variable and DOI as independent variable.
The value of parameter $\beta = 0{,}2174$ gives an information about the magnitude of changes in HDI value that would be caused by changes in DOI value, at the given level of DOI. The Table 1.4 presents possible increase of HDI value (in percentage points), caused by increase of DOI by 1 percentage point (at the given level of DOI).

Table 1.4 Marginal increments of HDI induced by growth of DOI at 1 percentage point

DOI value	ΔHDI/ΔDOI
0,05	4,348
0,1	2,174
0,15	1,449
0,2	1,087
0,25	0,869
0,3	0,724
0,35	0,621
0,4	0,543
0,45	0,483
0,5	0,434
0,55	0,395
0,6	0,362
0,65	0,334
0,7	0,310
0,75	0,289
0,8	0,271
0,85	0,255
0,9	0,241
0,95	0,228
1	0,217

Source: own calculations.

Literally it means that 1 percentage point change in DOI level implies change in HDI level of approximately 4,34 percentage points, when level of DOI = 0,05 is a 'starting point'. As in the two previous cases, there is a critical level of the index – DOI = 0,2. It means that, for all these countries where DOI value is higher than 0,2, probable increase in HDI level is proportionally lower than increase in DOI level.
The coefficient of correlation is r = 0,9194, which implies positive and high statistical relationship between two cited variables. As parameter p = 0,00, the relationship results to be statistically significant. It means that these results are also true for all these economies which are not included in the analysis.

1.4 Interpretation of analysis results

The main target of all conducted analysis's were to verify whether there is ant statistical relationship between technological advancement (measured by three different indexes) and level of socio-economic development (measured by Human Development Index). In order to obtain the required results, nonlinear regression models are elaborated. They are supposed to determine the magnitude of the relationship between two variables. These models are also to quantify to what extend changes of technological advancement potentially influence changes in level of socio-economic development. The analysis of elaborated regression

[21] Data referring to ITU 2006.
[22] Data like in the first case.

models also shows in which countries, broad implementation of new information and communication technologies can have significant impact on living standards.
In all three analyzed cases, the general results are as following:

TAI – HDI
*Regression model: HDI = 1,073 + 0,2497 ln * (TAI)*
Correlation coefficient: r = 0,8840
DAI – HDI
*Regression model: HDI = 0,9913 + 0,2644 ln * (DAI)*
Correlation coefficient: r = 0,9284
DOI – HDI
*Regression model: HDI = 0,9698 + 0,2171 ln * (DOI)*
Correlation coefficient: r = 0,9194

It is seen very clearly that all regression models are very similar, and the β parameters have almost the same values. It means that regardless the measure of technological advancement of a country, the magnitude of relationship between one of the indexes regarding technological advancement and socio-economic development, is almost the same. You can also conclude that changes in level of technological advancement imply very similar changes in development level.
The regression model explaining relationship between HDI and DAI, contains the highest β parameter. It means that factors such as: infrastructure, affordability, knowledge, quality and usage[23] are crucial factors for socio-economic development possibilities of a country. As it has already been mentioned, if one takes as an example a country where DAI = 0,05, and if this country experiences increase of DAI value of 1 percentage point, it is highly probable that it will cause an increase in HDI level of 5,288 percentage points. Currently, the countries for which DAI has the lowest value is Burkina Faso – DAI = 0,08 and Mali – DAI = 0,09. Consequently, if in Burkina Faso the DAI value increases up to 0,09, this will probably imply change in HDI from actual 0,342 up to 0,3750. And the same mechanism should work in Mali, where HDI should increase from 0,338 up to 0,4114.
As β parameters in two other regression models are lower, the potential impact of factors constituting Technology Achievement Index and Digital Opportunity Index is a little bit lower on socio-economic progress, but still results to be significant is less developed countries are considered. In case of analyzing regression model of relationship between TAI and HDI, the β = 0,2497. Considering two least technologically advanced countries, which are Mozambique and Sudan, one can assess the possible impact of growth of TAI. The TAI equals 0,066 and 0,071 respectively. So if in Mozambique TAI increases up to 0,076 it should imply growth of HDI from 0,39 up to 0,4278. In Sudan the change in TAI from 0,071 up to 0,081, would indicate change in HDI from 0,516 up to 0,5511. Finally, if Digital Opportunity Index is taken into account, two least developed countries are Chad and Niger, where DOI equals 0,01 and 0,02 respectively. In Chad, if DOI grows up to 0,02 in consequence HDI should potentially grow from 0,368 up to 0,5851. And in Niger, the same change would be respectively: from 0,02 up to 0,03 and HDI from 0,311 up to 0,4195.
In case of each index, some specific critical values can be distinguished. For TAI it is 0,2, for DAI – 0,25 and for DOI – 0,2. For all countries, where values of TAI, DAI and DOI are below the mentioned levels – if a country implements economic policies that foster technological advancement – growth of HDI value (potentially enabled by technological progress) is proportionally higher than growth of these one of these indexes. It would mean that all actions which are supposed to improve implementation and use of ICTs in national economy and society are highly effective especially in those less developed countries. It also constitutes a right justification for all actions and efforts which are currently undertaken to present ICTs-driven policies in number of developing economies. Results of the statistical analysis are compatible with what is observed in practice. Despite you still lack any quantitative proof that ICTs do have great impact on living standards, evidences from all around the world show that ICTs are effective tools fostering socio-economic development process.
Analyzing international rankings in countries` level of technological advancement, it is possible to delineate these economies where implementation of ICTs would be highly

[23] These 5 mentioned factors, are the 5 dimensions used to calculate Digital Access Index.

desirable, considering possible positive impact they would have on performance of national economy. The lists of these economies are presented in the Table 1.5, Table 1.6 and Table 1.7. There are also presented calculations of potential HDI growth induced by growth of the value of one of the indexes in selected countries.

Table 1.5 Potential – 'new' – level of HDI induced by growth of TAI at 1 percentage point, only the least technologically advanced economies.

Country	Present TAI value	Present HDI value	HDI increment (ΔHDI)/100	Potential HDI value induced by TAI growth at 1 percentage point
Mozambique	0,066	0,39	0,037833	0,427833
Sudan	0,071	0,516	0,035169	0,551169
Tanzania	0,08	0,43	0,031213	0,461213
Nepal	0,081	0,527	0,030827	0,557827
Kenya	0,129	0,491	0,019357	0,510357
Ghana	0,139	0,532	0,017964	0,549964
Senegal	0,158	0,46	0,015804	0,475804
Pakistan	0,167	0,539	0,014952	0,553952

Source: own calculations.

Table 1.6 Potential – 'new' – level of HDI induced by growth of DAI at 1 percentage point, only among the least technologically advanced economies.

Country	Present DAI value	Present HDI value	HDI increment (ΔHDI)/100	Potential HDI value induced by DAI growth at 1 percentage point
Burkina Faso	0,08	0,342	0,03305	0,37505
Mali	0,09	0,338	0,029378	0,367378
Burundi	0,1	0,384	0,02644	0,41044
Central Africa	0,1	0,353	0,02644	0,37944
Chad	0,1	0,368	0,02644	0,39444
Ethiopia	0,1	0,371	0,02644	0,39744
Guinea	0,1	0,445	0,02644	0,47144
Guinea-Bissau	0,1	0,349	0,02644	0,37544
Sierra Leone	0,1	0,335	0,02644	0,36144
Angola	0,11	0,439	0,024036	0,463036
Benin	0,12	0,428	0,022033	0,450033
Congo Rep	0,12	0,391	0,022033	0,413033
Mozambique	0,12	0,39	0,022033	0,412033
Bhutan	0,13	0,528	0,020338	0,548338
Comoros	0,13	0,556	0,020338	0,576338
Cote D`Ivoire	0,13	0,421	0,020338	0,441338
Eritrea	0,13	0,454	0,020338	0,474338
Gambia	0,13	0,479	0,020338	0,499338
Sudan	0,13	0,516	0,020338	0,536338
Mauritania	0,14	0,486	0,018886	0,504886
Senegal	0,14	0,46	0,018886	0,478886
Djibuti	0,15	0,494	0,017627	0,511627
Haiti	0,15	0,482	0,017627	0,499627
Lao	0,15	0,553	0,017627	0,570627
Madagascar	0,15	0,796	0,017627	0,813627
Malawi	0,15	0,4	0,017627	0,417627
Nigeria	0,15	0,448	0,017627	0,465627
Rwanda	0,15	0,45	0,017627	0,467627
Tanzania	0,15	0,43	0,017627	0,447627
Camerun	0,16	0,506	0,016525	0,522525
Ghana	0,16	0,532	0,016525	0,548525
Cambodia	0,17	0,583	0,015553	0,598553
Congo	0,17	0,52	0,015553	0,535553
Myanmar	0,17	0,581	0,015553	0,596553
Solomon Islands	0,17	0,592	0,015553	0,607553
Uganda	0,17	0,502	0,015553	0,517553
Zambia	0,17	0,407	0,015553	0,422553
Bangladesh	0,18	0,53	0,014689	0,544689
Togo	0,18	0,495	0,014689	0,509689
Yemen	0,18	0,492	0,014689	0,506689
Kenya	0,19	0,491	0,013916	0,504916

Lesotho	0,19	0,494	0,013916	0,507916
Nepal	0,19	0,527	0,013916	0,540916
Guinea Equatorial	0,2	0,653	0,01322	0,66622
Tajikistan	0,21	0,652	0,01259	0,66459
Azerbaijan	0,24	0,736	0,011017	0,747017
Pakistan	0,24	0,539	0,011017	0,550017
Vanuatu	0,24	0,67	0,011017	0,681017

Source: own calculations.

Table 1.7 Potential – 'new' – level of HDI induced by growth of DOI at 1 percentage point, only among the least technologically advanced economies.

Country	Present DOI value	Present HDI value	HDI increment (ΔHDI)/100	Potential HDI value induced by DOI growth at 1 percentage point
Chad	0,01	0,368	0,2171	0,5851
Niger	0,02	0,311	0,10855	0,41955
Eritrea	0,03	0,454	0,072367	0,526367
Guinea – Bissau	0,04	0,349	0,054275	0,403275
Myanmar	0,04	0,581	0,054275	0,635275
Malawi	0,08	0,4	0,027138	0,427138
Rwanda	0,08	0,45	0,027138	0,477138
Burundi	0,09	0,384	0,024122	0,408122
Ethiopia	0,09	0,371	0,024122	0,395122
Mozambique	0,09	0,39	0,024122	0,414122
Sierra Leone	0,09	0,335	0,024122	0,359122
Solomon Islands	0,09	0,592	0,024122	0,616122
Mali	0,1	0,338	0,02171	0,35971
East Timor	0,1	0,512	0,02171	0,53371
Central Africa	0,11	0,353	0,019736	0,372736
Tanzania	0,12	0,43	0,018092	0,448092
Burkina Faso	0,13	0,342	0,0167	0,3587
Camobodia	0,13	0,583	0,0167	0,5997
Kenya	0,13	0,491	0,0167	0,5077
Madagascar	0,13	0,509	0,0167	0,5257
Zambia	0,13	0,407	0,0167	0,4237
Comoros	0,14	0,556	0,015507	0,571507
Lao	0,14	0,553	0,015507	0,568507
Mauritania	0,14	0,486	0,015507	0,501507
Sao Prinicipe	0,14	0,607	0,015507	0,622507
Congo	0,15	0,52	0,014473	0,534473
Haiti	0,15	0,482	0,014473	0,496473
Nigeria	0,15	0,448	0,014473	0,462473
Uganda	0,15	0,502	0,014473	0,516473
Guinea	0,16	0,445	0,013569	0,458569
Benin	0,17	0,428	0,012771	0,440771
Ghana	0,17	0,532	0,012771	0,544771
Togo	0,17	0,495	0,012771	0,507771
Zimbabwe	0,17	0,491	0,012771	0,503771
Papua New Guinea	0,18	0,523	0,012061	0,535061
Cote d`Ivoire	0,19	0,421	0,011426	0,432426
Nepal	0,19	0,527	0,011426	0,538426
Sudan	0,19	0,516	0,011426	0,527426
Vanuatu	0,19	0,67	0,011426	0,681426
Bangladesh	0,2	0,53	0,010855	0,540855

source: own calculations

In all of these countries above-mentioned, ICTs implementation would – possibly – give the greatest outcomes in terms of socio-economic progress. It constitutes a valuable hint for those who plan national development policies. It is worth to realize that nowadays, ICTs exemplify an effective tool of achieving social and economic targets in less developed countries. ICTs as network technologies embody all that enables sustainable development. They emit the so called 'catching up effect' and make possible to leapfrog, which means that ICTs` implementation does not only change structure of national economy and the way business is run, but they also let a country jump over a few stages of traditional (linear) development path.

But it also should be stresses that the real impact of ICTs` implementation primary depends on specific country geographic, politic, economic and social conditions. It is very probable that in different countries, undertaking the same set of actions would lead to different outcomes.

1.5 Conclusions

Recently ICTs are considered to be powerful tools which can improve peoples` life significantly. Many economies from all around the world are making efforts to provide broad – and relatively cheap – access to newest information and communication technologies. These technologies are treated as tool of achievement development goals. As results of conducted analysis show, ICTs constitute these tools that should be especially appreciated in less developed countries, where their impact on development process can be enormous if they are used effectively and their application is demand – driven. Also it should be stressed firmly that there is an essential need for rigorous monitoring and evaluation of ICTs impact on economic and social development progress. The process of evaluation of any development project needs to be focused on the benefits of the new technologies rather than the quantity of technologies available for a given group of people. These is also a strong need for strategic content to ensure that ICTs can be locally appropriated and affect development – in terms of increasing general welfare.

References:

Beardshaw, J. (1992), Economics. A student`s guide, London: Pitman.

Gester, R. and S.Zimmermann (2009) Information and Communication Technologies for poverty reduction: discussion paper, Swiss Agency of Cooperation&Development, http://www.ifpri.org/pubs/jhu/ICTTelecom.asp, accessed on 4 March 2009.

Human Development Report 2006, UNDP 2006.

Making New Technologies work for Human Development, UNDP, Human Development Report 2001, http://www.un.org, accessed on 18 July 2008.

Measuring Digital Opportunity, International Telecommunication Union 2005, http://www.itu.int; accessed on 9 May 2007

Samuelson P. and W. Nordhaus (1995), Economics, International Edition: McGraw-Hill Inc.

Spence, R. (2005), ICTs, Internet, Development and poverty reduction, http://www.developmentgateway.org, accessed on 4 Aug 2007.

Torero M. and J. Von Braun (2006), ICTs for the poor, International Food Policy Research Institute , http://www.ifpri.org, accessed on 7 March 2008.