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Human Capital and Growth of E-postal Services: A cross-country Analysis in Developing Countries

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ABSTRACT. Postal e-services and human capital as a part of intellectual capital are currently two much discussed concepts in the context of developing countries. This paper uses Human Capital Index (HCI) and Postal E-services index (PES index) in order to analyze the level of development of developing countries and to point to the inaccuracy of the developed/developing classification of the World Bank. The paper has two objectives: to discover whether there is a statistical dependence between human capital and postal e-services in developing countries as it is in developed countries, and to create a new sub-group of “more developed” developing countries where this dependence confirms. Results of this paper document that there is a great diversity among developing countries and that additional sub-groups may be defined within the rather broad classification of the World Bank, which is based on the GNI per capita indicator only. Human capital is being under scrutiny in numerous contexts but not yet in the context of postal e-services. Our paper presents a new method of analyzing the level of development and widens the range of aspects that must be taken into consideration when implementing measures to promote development.

Introduction. Human capital, or rather the collection of resources known as human capital, has gained increasing importance over the last few years [9], [8]. Currently, it can be described as one of the major social constructs, especially when taking into account the wide range of studies which consider human capital one of the keystones of development of a company and of a society as a whole [15], [18], [67]. The factors which define human capital in individual studies are viewed as worthy of respect in the application of specific measures in order to ensure sustainable development in a given field [31], [68]. On the other hand, there are also studies, which show that there is no dependence of tracked indicators in an area. These studies are also important because they demonstrate that there is a need to investigate the problem further and in different contexts. Such areas where indicators may be uncorrelated are for example developing states: a closer examination may reveal some extreme values of selected parameters related to their development [21], [36], [59].

Issues of developing countries are among topics, which are of considerable interest to both world organizations and industrialized countries. World organizations make efforts to promote activities that would guarantee at least the basic level of living standards, such as basic material support, healthcare services, education, etc. [44], [61]. States with developed economy perceive developing countries as untapped economic potential, as prospective market outlets for their production and as

potential strategic partners. This “conflict of interest” is one of the forces, which drive globalization at the present time [46], [60].

Each sector of the world economy has undergone development in the last few decades. Among other things, its efficiency has increased and the quality of production and additional services has improved. These development trends are, among other things, the result of development of technical equipment and technological processes, or rather the result of gradual change of place where supply and demand collide [28], [29]. These innovations led to a new way of doing business – the use of e-communications, which include e-postal services, e-commerce, e-government, etc. [30], [33], [40].

Research on the above-mentioned trends is both current and relevant, especially because human capital, postal e-services and the issues of developing countries determine the current direction of development of a society. They are also essential in determining global economic development [27], [32].

The objectives of the article are to prove the effect of human capital development on the development of postal e-services in developing countries and to search for further explanation when defining possible differences between states.

1. Background and related literature. Human capital as a part of intellectual capital is a term well established in the scientific community. Edvinsson & Malone [23] defined the components of intellectual capital and stated that human capital, which consists of knowledge, skills and competences, is one of them. Its definition is interesting especially in the relation to property: according to the authors, human capital is always property of an individual and cannot be property of a company or society. At present many authors use human capital as a tool for evaluation of various integration or development trends. Barro [2] states that the GDP growth rate is a convenient indicator of the impact of human capital. Verbic, Majcev, & Cok [65] stress the importance of human capital as the main endogenous growth element. The method using human capital as a tool for prediction of development trends is applicable across scientific disciplines. It is relevant for evaluation or prediction of development of a company or of a national economy as a whole [10], [11], [34]. Human capital is fundamental for economic growth [17], [20], [52]. Various methods are used to examine human capital more closely [6], [35], [58]. These methods always reflect specific indicators based on which it is possible to prove their interdependence or predict development [64]. Research on the definition of human capital has resulted in the establishment of composite indices (in this case, the human capital index, HCI), which are relevant for evaluation of integration tendencies. In its study from 2010 focused on e-government development, the United Nations assigns a weight of 33 % to the HCI indicator within the calculation of the composite e-government development index (EGDI). The HCI has been defined as a composite of two indicators: adult literacy rate and the combined primary, secondary, and tertiary gross enrolment ratio.

The results of research on human capital can be regarded as relevant in the prediction if the analyzed data reflect current discussion topics in either nation or transnational level [48], [57]. The availability of postal services, their range and quality are among the basic prerequisites for development of a society in each state [1], [39], [56]. A trend towards computerization is evident in postal market, just like in other sectors of national economy, leading to the emergence of e-government, e-commerce, and e-postal services. Universal Postal Union [63] claims in its study that this is a consequence of digital economy development, because in the light of general computerization, postal operators feel the need to innovate and to develop electronic versions of their services. The pace, scope and degree of transition to digital postal services, however, differs among continents, countries, and individual markets. Among the reasons for this diversification is the lack of accurate and reliable information about the scope of services provided and particularly about their added value - the impact on development of a given area. Liu [42] in his work analyzes transactional communications (Postal and Telecommunications, and associations) in post-Mao mainland China on five levels: national, regional, provincial, community, and individual. Results of his research confirm that the development of transactional communications from 1980 onwards has resulted in gradual dissolution of the

artificial nationalism created by the Communist Party propaganda, thus leading to a considerable diversification of the society. On the other hand, the classic mass communications still nurture substantive nationalism in mainland China.

Together with states under totalitarian regimes and states with unstable political situation, developing countries can be classified as “extreme states” in comparison with industrialized countries [5]. Economic potential of developing countries is the subject of increasing number of studies, which also study human capital and confirm that human capital (potential) has major impact on further development of a given state [12], [25], [45]. Dunning [19], Lucas [43], Zhang & Markusen [68] classify human capital as one of the key determinants in development of foreign direct investment (FDI) in developing countries. Renström & Spataro [51] confirm the relationship between economic and population growth in an endogenous growth model driven by human capital accumulation and support their claim with evidence from selected developing countries based on the classification of the World Bank. Cooray, Mallick, & Dutta [14] in their study point to the differentiation of impact of human capital (among other things) on the development of market in South Asia. They examine the issue from gender perspective: primary education has a positive effect on secondary education among men, while among women, no such effect has been found, and i.e. primary education has no major impact on secondary education among women. Authors highlight the need to ensure stability of nationwide education system as a necessary prerequisite for stimulation of overall economic growth in a given group developing countries. Further studies confirm these findings. In the last few years, researches have increasingly focused on gender in the relation to the development of human potential, in particular in developing countries where this phenomenon belongs among the major challenges posed to overall growth of the society [7], [24], [49] and [54].

1.1 Conflict of interest. A certain conflict of interest may be perceived in the relation to human capital and postal e-services in the context of developing countries. It is mainly because of the different approaches to developing countries adopted by industrialized countries and world organizations.

The World Bank (2015) divides states into four basic categories according to the GNI per capita; the first two categories are Low-income economies and Lower-middle income economies, together labeled developing countries.

To ensure such a form of intervention that would guarantee stability and consequently jump-started the development of a sector of national economy in developing countries, it is necessary to provide a suitable classification of developing countries, i.e. of such states, which show dependence on certain variables, which are important in the relation to determination of relative economic stability. Thus it is necessary to respect not only the classification of developing countries according to the World Bank, but also results of partial studies, which examine stability of developing countries by the means of proving interdependence of chosen indicators that reflect current phenomena of globalized society [4], [13], [55], [37]. E-postal services is undoubtedly one of them [62].

2. Methodology. In order to define a group of developing countries, which show significant dependence in the relation to the current level of human capital development, it is necessary to define variables, which will be used to prove the dependence. This research is a global evaluation of current development tendencies in developing countries. All the input data are therefore supported by research of world leading institutions, which deal with these topics systematically.

2.1 Measurement of human capital index. To define human capital as a possible tool for prediction of development of e-postal services in developing countries, it is possible to employ the study of World Economic Forum [66], which provides a comprehensive look at the measurement of human potential. The basis for quantification of human capital are the following propositions:

- Human capital is understood as an economic value, which represents an employee’s set of knowledge, skills and competences.

- Human capital reflects not only the current state of a given country, but also its past as it includes indicators which result from policy decisions that will shape the future workforce.
- The Index aims to take into account the individual life course.
- The composite index also takes into account indicators defining productivity of older population.

These propositions are analyzed in four basic thematic pillars:

- The Education pillar presents indicators relating to quantitative and qualitative aspects of education across primary, secondary and tertiary levels. It also contains information on the present state of labor market and its future potential.
- The Health and Wellness pillar presents indicators relating to physical and mental well-being of a population from childhood to adulthood.
- The Workforce and Employment pillar presents indicators that quantify the experience, talent, knowledge and skills of the working-age population of a given country.
- The Enabling Environment pillar is designed to capture the impacts of legal framework, infrastructure and other factors, on the value of human potential.

The Human Capital Index (HCI) consists of several input indicators, which together express the composite index. Individual indicators are assigned such a weight that each group of indicators (i.e. Education, Health and Wellness, Workforce and Employment, Enabling Environment) has a weight of 25 %, and all together make 100 %. The following tables list the individual indicators defining the four basic pillars of human capital.

Table 1. Education

Sub-pillar	Indicator	Weight	Source
Access	Primary enrolment rate	2.08	UNESCO, Institute for Statistics, provided database extraction, 2013 (latest available data 2003-2012)
	Secondary enrolment rate	2.08	
	Tertiary enrolment rate	2.08	
	Education gender gap	2.08	World Economic Forum, <i>Global Gender Gap Report</i> , 2012
Quality	Internet access in schools	2.08	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
	Quality of the education system	2.08	
	Quality of primary schools	2.08	
	Quality of math and science education	2.08	
	Quality of management schools	2.08	
Attainment	Primary education attainment	2.08	UNESCO Institute for Statistics, <i>Education Statistics</i> , 2011 or latest year available
	Secondary education attainment	2.08	
	Tertiary education attainment	2.08	
Total Pillar Weight:		25.00	

Source: World Economic Forum (2013)

Table 2. Health and Wellness

Sub-pillar	Indicator	Weight	Source
Survival	Infant mortality	1.79	World Health Organization, Global Health Observatory, <i>World Health Statistics, Mortality and Burden of Disease, Child Mortality</i> , 2011
	Life expectancy	1.79	
	Survival gender gap	1.79	World Economic Forum, <i>Executive Opinion Survey</i> , 2012
Health	Stunting and wasting	1.79	World Health Organization, Global Health Observatory, <i>World Health Statistics, Nutrition, Child malnutrition</i> , latest available data 2003-2011
	Unhealthy life years	1.79	Healthy adjusted life expectancy, World Health Organization data, 2007, taken from the <i>Global Gender Gap Report 2012</i> ; life expectancy, as above
	Deaths under 60 from non-communicable diseases	1.79	World Health Organization, Global Health Observatory, <i>World Health Statistics, Non-communicable diseases</i> , 2008
	Obesity	1.79	World Health Organization, Global Health Observatory, <i>World Health Statistics, Adult risk factors</i> , 2008
	Business impact of non-communicable diseases	1.79	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
	Business impact of communicable diseases	1.79	
Well-being	Stress	1.79	Gallup, <i>Worldview database</i> , latest available data 2009-2013
	Depression	1.79	Gallup, <i>Worldview database</i> , latest available data 2006-2011
Services	Water, sanitation and hygiene	1.79	World Health Organization, Global Health Observatory, <i>World Health Statistics, Environmental Health</i> , latest available data 2005-2011
	Healthcare quality	1.79	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
	Healthcare accessibility	1.79	
Total Pillar Weight:		25.00	

Source: World Economic Forum (2013)

Table 3. Workforce and Employment

Sub-pillar	Indicator	Weight	Source
Participation	Labor force participation, age 15-64	1.56	ILO, <i>Key Indicators of the Labour Market (KILM)</i> , 2010
	Labor force participation, age 65+	1.56	
	Economic participation gender gap	1.56	World Economic Forum, <i>Global Gender Gap Report</i> , 2012
	Unemployment rate	1.56	ILO, <i>ILOstat</i> , latest available data 2003-2010
	Youth unemployment rate	1.56	ILO, <i>Laborstat</i> , latest available data 2003-2010
Talent	Country capacity to attract talent	1.56	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
	Country capacity to retain talent	1.56	
	Ease of finding skilled employees	1.56	
	Pay related to productivity	1.56	
	Capacity for innovation	1.56	
	Index of Economic Complexity	1.56	Hausmann, R., Hidalgo, C., et al. <i>The Atlas of Economic Complexity</i> . Cambridge: Puritan Press, 2011
	Firm level technology journal articles	1.56	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
	Scientific and technical journal articles	1.56	World Bank, <i>World Development Indicators online database</i> , 2009 and United Nations, Department of Economic and Social Affairs, <i>World Population Prospects</i> , 2009
	Median age of the working population	1.56	United Nations, Department of Economic and Social Affairs, Population Division, <i>World Population Prospects DEMOBASE 2010</i>
Training	Staff training	1.56	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
	Training services	1.56	
Total Pillar Weight:		25.00	

Source: World Economic Forum (2013)

Table 4. Enabling Environment

Sub-pillar	Indicator	Weight	Source
Infrastructure	Mobile users	2.78	World Bank, <i>World Development Indicators</i> online database, 2011
	Internet users	2.78	
	Quality of domestic transport	2.78	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
Collaboration	State of cluster development	2.78	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
	Business and university R&D collaboration	2.78	
Legal framework	Doing Business Index	2.78	World Bank and International Finance Corporation, 2012
	Social safety net protection	2.78	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
	Intellectual property protection and property rights	2.78	
Social mobility	Social mobility	2.78	World Economic Forum, <i>Executive Opinion Survey</i> , 2013-2014
Total Pillar Weight:		25.00	

Source: World Economic Forum (2013)

2.1.1 Calculating the composite Index. The composite Human Capital Index consists of several indicators that are measured on different scales, so the Standard Score method was used to standardize the data obtained. The Standard Score method is used in cases when it is desirable to clearly express position of individual figures within the entire dataset or to compare results from multiple measurements on various scales, which have various means and dispersions. The following mathematical formula is used to calculate the standardized score:

$$x' = \mu' + \sigma' \frac{x - \mu}{\sigma}, \quad (1)$$

where x' – is the standardized score;

x – is the original raw data;

σ – is the original standard deviation;

μ – is the original mean;

σ' – is the desired standard deviation of the standardized score;

μ' – is the desired mean value of the standardized score.

One of the methods most commonly used in calculation of the standardized score is z-score. Z-score is a statistical method used to express a score's relationship to the mean in a given group of scores. Z-score is expressed as a standard deviation from the mean. The mean is zero and has a standard deviation of one. Thus, all data points above the mean are expressed as positive scores, while all data points below the mean are expressed as negative scores. The z-score method is based on the assumption of normal distribution. A standard deviation of plus (minus) 1 represents the area 34.13 % above (below) the mean and a standard deviation of plus (minus) 2 represents the area 47.72 % above (below) the mean. The z-score of a data point indicates the number of standard deviations

above or below the mean. This means that a z-score of -2 is exactly two standard deviations (or 47.72 %) below the mean.

In the case when z-score (z) has the mean 0 and a standard deviation of 1, the formula can be simplified:

$$z = \frac{x - \mu}{\sigma}, \quad (2)$$

where μ – is the mean of the population;

σ – is the standard deviation of the population.

Once all the input data is converted to a z-score, the score of a given country on a given pillar is established by an unweighted average of all available scores in that pillar. Finally, a country's score on the composite Index is determined by an unweighted average of the four pillar scores.

It was discovered, that to be included in the Index, an indicator must have non-missing data for at least 50 percent of the countries. To be included in the Index, each country must have non-missing data for at least 70 percent of all the indicators defined in Tables 1 through 4. This means that a country must have data for at least:

- 8 out of the 12 indicators in the Education pillar,
- 10 out of 14 indicators in the Health and Wellness pillar,
- 11 out of 16 indicators in the Workforce and Employment pillar,
- 6 out of 9 indicators in the Enabling Environment pillar.

Table 5. Composite Human Capital Index (Lower income economies)

	Composite Index	Education	Health and Wellness	Workforce and employment	Enabling environment
Malawi	-0.629	-0.897	-0.723	-0.007	-0.890
Burkina Faso	-1.077	-1.817	-0.943	-0.374	-1.173
Mozambique	-0.966	-1.474	-0.916	-0.337	-1.135
Tanzania	-0.680	-0.870	-0.957	-0.087	-0.805
Cameroon	-0.728	-0.687	-0.850	-0.295	-1.082
Mali	-1.034	-1.747	-0.826	-0.614	-0.949
Lao PDR	-0.297	-0.320	-0.407	-0.097	-0.364
Ghana	-0.363	-0.505	-0.533	-0.099	-0.317
Guinea	-1.272	-1.482	-1.026	-0.911	-1.667
El Salvador	-0.405	-0.612	-0.409	-0.175	-0.425
Philippines	-0.161	0.011	-0.473	0.164	-0.344

Source: World Economic Forum (2013)

Table 6. Composite Human Capital Index (Lower-middle income economies)

	Composite Index	Education	Health and Wellness	Workforce and employment	Enabling environment
Egypt	-0.790	-1.206	-0.521	-0.878	-0.555
Sri Lanka	0.020	0.172	0.323	-0.127	-0.288
Nigeria	-0.878	-1.411	-1.034	-0.328	-0.740
Bhutan	-0.370	-0.498	-0.208	-0.231	-0.545
Guatemala	-0.341	-0.968	-0.196	0.035	-0.234
Pakistan	-0.837	-1.166	-0.920	-0.545	-0.718

Source: World Economic Forum (2013)

The World Bank divides states into several categories according to the GNI per capita. The first two groups of states are labeled developing:

- Low-income economies (\$1,045 or less);
- Lower-middle-income economies (\$1,046 to \$4,125).

Tables 5 and 6 present data expressed by the Composite Human Capital Index, calculated by the means of the above defined method of standardized score. It is evident that the Composite Index does not respect the classification of developing countries according to the World Bank based on GNI per capita: for example, The Philippines has scored -0.161, while Pakistan -0.837.

2.2 Measurement of postal electronic services index (PES index). Information and communication technologies have radically altered both social and business communication and have a major share in the significant decline of the traditional mail correspondence. Although the trend is global, it is possible to perceive a considerable diversity among postal operators and the degree of provision of e-services to their customers. Following the declared state of postal services development, the UPU (2012) has carried out a study, which investigates the importance of use of information and communication technologies as connecting channels in the communication between post offices and their customers.

Although the Internet is the main delivery channel for e-services, other telecommunication channels (such as mobile phones, call centres or televisions) are also involved in the development of e-services and thus considered in the study. The use of information and communication technologies in the internal processes of individual postal operators is not a part of the scope of this study. In this study, postal operators are those national postal operators who are members of the Universal Postal Union. In addition, e-postal services are those services, which are provided by given national postal operators in a given country.

Designing the survey:

Firstly, members of the Electronic Services Group (working group of the UPU) identified 55 postal e-services to be included in the survey. These e-services have been divided into four categories: e-post, e-commerce, e-finance, and e-government. The respondents (national postal operators) were asked to fill in information about availability of a given e-service, its name and the year of its introduction on the market, together with evaluation of its strategic importance on a scale from one to five (with five being the most important). The aim of the survey was to gather information about the number of e-services offered by individual national operators, including information about perceived value of a given service from the perspective of national postal operators themselves. The survey did not examine the perceived value of the service from the perspective of the customers.

Study participants:

The survey was sent by letter to national postal operators in 191 member countries of the Universal Postal Union and followed a prior notice about the planned survey issued by the regional project

coordinators. 49 percent of the questionnaires were returned to the UPU International Bureau by email, post or fax. Thus, the response rate was 49 %.

2.2.1 Calculating the composite Index. To express the composite Index, i.e. the Postal E-services Index, which consists of results from a questionnaire survey evaluating 55 e-services, the Principal Component Analysis (PCA) has been used. It has been used to express one composite indicator based on three individual indices: e-post, e-commerce, and e-finance.

Using the PCA, it is possible to convert a set of observations of possibly correlated variables into a set of values of uncorrelated variables, which are called principal components. This transformation is defined in the following way: the first component has a high variance, thus it aggregates most of the information contained in the original dataset. This first component is used in this study as the resulting index for the establishment of level of e-services development in the countries, which participated in the UPU survey.

Mathematically, the transformation to the principal component of the PCA is defined by a set of p-dimensional vectors of weights or loadings:

$$w_{(k)} = (w_1, \dots, w_p)_{(k)}, \quad (3)$$

that map each row vector to a new vector of principal component scores

$$t_{(i)} = (t_1, \dots, t_p)_{(i)}, \quad (4)$$

given by

$$t_{k(i)} = x_i \cdot w_{(k)} \quad (5)$$

in such a way that the individual variables of t considered over the data set successively inherit the maximum possible variance from x , with each loading vector w constrained to be a unit vector.

First component:

The first loading vector $w_{(1)}$ thus has to satisfy

$$w_{(1)} = \arg \max_{\|w\|=1} \left\{ \sum_i (t_1)_{(i)}^2 \right\} = \arg \max_{\|w\|=1} \left\{ \sum_i (x_{(i)} \cdot w)^2 \right\} \quad (6)$$

Equivalently, writing this in matrix form gives

$$w_{(1)} = \arg \max_{\|w\|=1} \left\{ \|Xw\|^2 \right\} = \arg \max_{\|w\|=1} \left\{ w^T X^T X w \right\} \quad (7)$$

since $w_{(1)}$ has been defined to be a unit vector, it equivalently also satisfies

$$w_{(1)} = \arg \max \left\{ \frac{w^T X^T X w}{w^T w} \right\} \quad (8)$$

A standard result for a symmetric matrix such as $X^T X$ is that the quotient's maximum possible value is the largest characteristic vector of the matrix, which occurs when w is the corresponding characteristic vector.

With $w_{(1)}$ found, the first component of a data vector $x_{(i)}$ can then be given as a score $t_{1(i)} = x_{(i)} \cdot w_{(1)}$ in the transformed co-ordinates, or as the corresponding vector in the original variables, $\{x_{(i)} \cdot w_{(1)}\} w_{(1)}$.

The full principal components decomposition of X can therefore be given as

$$T = XW, \quad (9)$$

where W – is a p-by-p matrix whose columns are the characteristic vector of $X^T X$.

Table 7. Composite Index of postal e-services (Lower income economies)

	PES index
Malawi	-0.47
Burkina Faso	-0.59
Mozambique	-0.60
Tanzania	-0.79
Cameroon	-1.06
Mali	-1.18
Lao PDR	-1.29
Ghana	-1.29
Guinea	-1.37
El Salvador	-1.44
Philippines	-1.54

Source: United Postal Union (2012)

Table 8. Composite Index of postal e-services (Lower-middle income economies)

	PES index
Egypt	0.23
Sri Lanka	-0.45
Nigeria	-0.70
Bhutan	-0.72
Guatemala	-0.81
Pakistan	-1.22

Source: United Postal Union (2012)

Tables 7 and 8 show results of the above defined Principal Component Analysis for the same group of developing countries that is presented in Tables 5 and 6 (which report their scores on the Composite Human Capital Index). Once again, it is clearly visible that the results are inconsistent with the classification of developing countries according to the World Bank (GNI per capita indicator): Malawi has scored -0.47, while Egypt 0.23.

2.3 Validity of predicted relationship between human capital index and PES index in developing countries. Pearson's correlation coefficient was used to verify the predicted relation, i.e. to confirm the dependence of PES index on the human capital index in Lower-income economies and Lower-middle income economies groups.

$$r = \frac{\sum \left[(x_i - \bar{x}) \cdot (y_i - \bar{y}) \right]}{\sqrt{\sum (x_i - \bar{x})^2 \cdot \sum (y_i - \bar{y})^2}} \quad (10)$$

Probability value (*P* value) with significance level at 5 % was used to establish the final determination of significance of correlation.

It has been rather a challenge to determine the procedure of the testing and a particular methodology, especially because this approach has not been used in this field before. Authors generally assume significance of relationship of PES index and the HCI in countries labeled *developed*, i.e. in countries whose GNI per capita is higher than in states which are under consideration in this study. This trend has been verified by the authors at the beginning of this study (Fig. 1).

The following procedure was derived from the first step of the testing - monitoring the significance of relation between two variables in the group of countries classified as developing by the World Bank. Nevertheless, this classification did not show as suitable, especially when taking into account a number of studies [38], [41], [22], which state that developing countries are very specific in comparison with industrialized countries.

UPU (2012) in its study shows the relationship between PES index and HCI by the means of quadratic regression. They claim that there is a possible explanation for the quadratic functional dependence between the development of postal e-service and human capital development: once human capital reaches a certain level, the speed of e-service adoption is higher, which leads to greater provision of postal e-services. This finding raises the question of the possible role of postal e-services development and its relationship to education in countries where the HCI is low.

The research of relationship between PES index and the HCI follows the attempts to define new sub-groups of developing countries, which could be described as being developed on the basis of defined variables enough to be able to adopt measures to kick-start further development of e-service market in order to sustain continuous development in relation to HCI. If any extreme values are found, a sub-group of states showing these extreme values will be defined, unless it already exists in the classification by the World Bank.

This research focused on analysis of the trend of quadratic function. In the testing of statistical dependence of tracked variables (PES index and the HCI), the study focused on explanation of the trend of relationship between the two variables in two groups of developing countries according to the World Bank (i.e. Lower income economies and Lower-middle income economies). In the first step, dependencies of defined variables (PES and HCI) were tested in all states of a respective group of developing countries. In the second step, countries under the curve of quadratic function were

excluded, and a new testing of dependence was carried out among the remaining countries (see Fig. 2 and 3). Fig. Results of the testing are presented in the following chapter.

3. Results. In the first round of testing, countries labeled developed by the World Bank (i.e. High-income economies with GNI per capita of \$12,736 or more) were chosen to verify the assumption of dependence between the development of human capital and postal e-services. These countries were: Switzerland, Germany, Australia, Austria, Republic of Korea, Canada, France, Russian Federation, Israel, United States of America, Spain, Portugal, Italy, and Hungary.

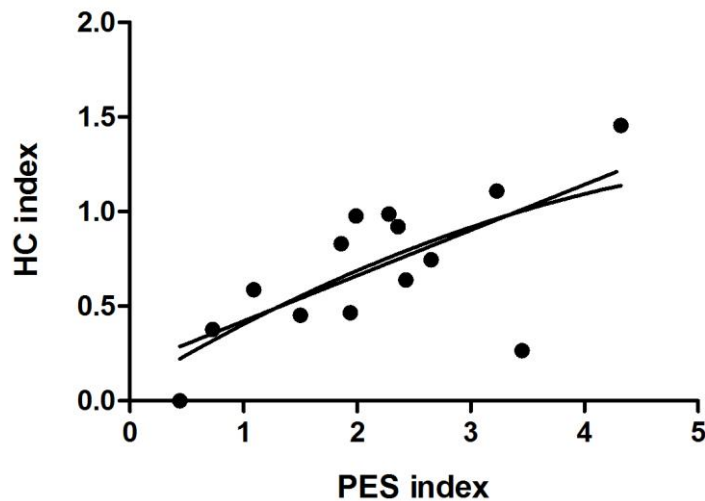


Fig. 1. Dependence of development of HC and e-postal services in developed countries (authors)

In this group of countries, linear function practically copies the quadratic function and the statistical dependence of the indices shows immediately.

Table 9. Outputs from statistical linear regression analysis (High income economies)

r^2	0.4488
F test	9.772
P value	0.0088
Deviation from zero?	Significant

Source: Authors

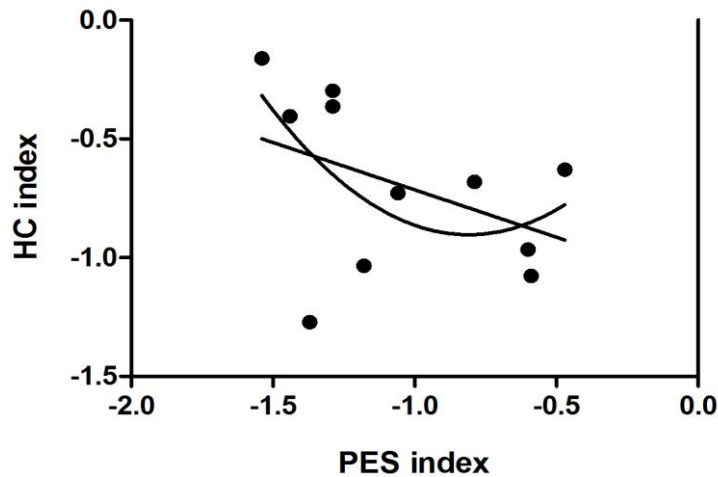


Fig. 2. Dependence of development of HC and e-postal services in Lower-income countries (authors)

It is evident from Fig. 2 that in this group, there are significant differences between the indices: the linear function does not correspond with the trend of the quadratic function (compare with Fig. 1). When considering all the countries in the Lower-income economies group, the dependence has not been confirmed.

Table 10. Outputs from statistical linear regression analysis (Lower-income economies) – first step

r^2	0.1754
F test	1.914
P value	0.1999
Deviation from zero?	Not Significant

Source: Authors

Countries, which were under the curve of the quadratic function (Fig. 2) were excluded from the second step of testing (namely Burkina Faso, Mozambique, Mali, and Guinea). In the remaining states, the dependence has shown to be statistically significant (see Table 11). However, another extreme has been discovered in the remaining states: countries with a higher HCI value show lower values of PES index, which should be vice versa (when compared with the trend in Fig. 1). This result confirms that the development of human capital in relation to the development of postal market as one of the basic parts of national economy, is uneven. Generally, it can be said that in this group of developing countries, the sectors of Education system, Health and Wellness, Workforce and employment and Enabling environment are not directed effectively. Therefore the development of human capital of the population of individual states does not go hand in hand with development of other sectors of the national economy. Nevertheless, the assumption of inequality of relationship between the tracked indicators in all countries in this category has been confirmed. Thus it is possible to define a sub-group of states which show this extreme trend in order to apply measures which would stabilize the current situation and deal with the issues comprehensively.

Table 11. Outputs from statistical linear regression analysis (Lower-income economies) – second step

r^2	0.6180
F test	8.088
P value	0.0361
Deviation from zero?	Significant

Source: Authors

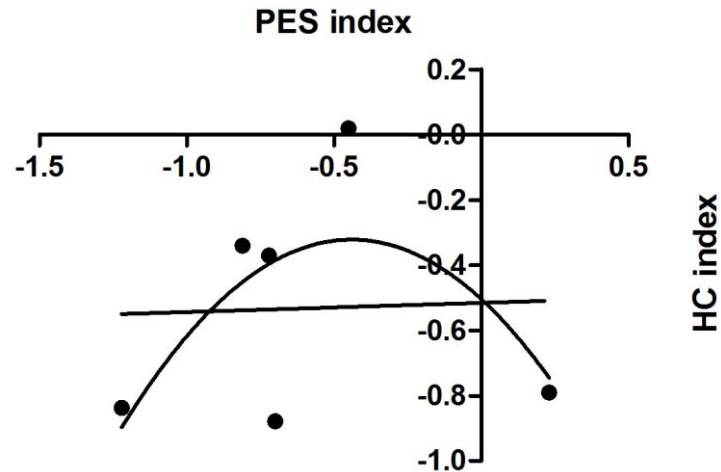


Fig. 3. Dependence of development of HC and postal e-services in Lower-middle income economies (authors)

In the Lower-middle income economies group, it is possible to see a significant difference between the trend of the linear function and that of the quadratic function, and the same applies to the Lower income economies group. In the first testing, when all states from this group were considered, no dependence has been established as statistically significant.

Table 12. Outputs from statistical linear regression analysis (Lower-middle income economies) – first step

r^2	0.001427
F test	0.005714
P value	0.9434
Deviation from zero?	Not Significant

Source: Authors

This group has also been tested two times, the second time with exclusion of the countries which were under the curve of the quadratic function (namely Egypt and Nigeria). The dependence has proven to be statistically significant in the group of remaining states (see Table 13). In this case, no extreme values have been found, in contrast with the Lower-income economies group. The trend of the linear function shows similar direction as in results presented in Fig. 1; in other words, PES index is directly proportional to HCI.

Table 13. Outputs from statistical linear regression analysis (Lower-middle income economies) – second step

r^2	0.9763
F test	82.43
P value	0.0119
Deviation from zero?	Significant

Source: Authors

4. Discussion. Based on the statistical results of this article, it can be confirmed that it is not suitable to classify states according to the GNI per capita indicator only. Generally, it can be stated that classification according to this indicator is even less up-to-date when it comes to decision-making and provision of basic services to inhabitants of developing countries, or when establishing strategic relations with industrialized states, which would mean cooperation on development of a sector of national economy.

Outputs from Fig. 1 confirm that in industrialized countries, there is a clear dependence of PES index on the HCI. Following this finding, these indicators may be identified as possible tools for modeling economic potential of individual states. In the two groups of developing countries, it has been found that the classification of developing countries according to the GNI per capita indicator (issued annually by the World Bank) does not correspond with the trend which has been found in industrialized countries. This is because the countries labeled developing must be examined from various points of view; it is not satisfactory to restrict the examination to the commonly used indicator only. The use of PES index indicator in examination of its relation to the development of human capital is relevant because it is a composite indicator analyzing current development trends in this important field of national economy.

This paper had two objectives:

- To define a sub-group of developing countries which are developed “enough” (because the dependence has shown to be significant), and thus can be labeled as states “more developed”, more economically stable and thus ready to establish new strategic relations with industrialized countries.
- If any extreme values are found, to define a sub-group of states which show these extreme values, unless it already exists in the classification by the World Bank.

Even though there are studies, which deal with human capital in developing countries and with its important role in insurance of maximum stability and finding the right direction for future development of these countries. Dutta & Osei-Yeboah [21], Suliman & Mollick [59] – these papers are the first one to examine human capital in the context of postal e-services.

Guren et al., [27] deal with the relationship of human capital and labor market from the perspective of current challenges of the world trade in developing countries. Goldberg & Pavcnik [26] focus on issues of developing countries and on the impact of globalization on income inequality. Blanton & Blanton [3] deal with the concept of gender as a current phenomenon vital for promotion of stable development of society in both developed and developing countries. They focus specifically on the role of women’s rights in attracting foreign direct investment (FDI) and prove that developing countries show different trends than developed countries, which must be respected when implementing measures.

4.1 Limitations of the study. This research used data from primary research of two institutions: the Universal Postal Union and the World Economic Forum. Some limitations of the study may be perceived because of the possible inconsistency of the data. Tables 1 through 4 list the individual indicators which were used to establish the human capital index. It is visible in Tables 1 through 4

that the data used do not always proceed from the same time period. With regards to this, it is important to note that especially in developing countries, it is particularly difficult to gather data about Secondary enrolment rate, Stunting and wasting, etc. on annual basis so that there would be data from all the countries considered and from the same time period. In cases when there was not enough input data available for a given indicator, these indicators were excluded from the quantification of the final composite index.

For quantification of the HCI, the study of the World Economic Forum from 2013 (containing data from 2012) was used. This independent international organization issued further studies on quantification of HCI development in 2015. Authors of the paper have nevertheless decided to use the data from the 2012 study, mainly because the primary research of United Postal Union on calculation of PES index was carried out in January 2012 (containing data from 2011).

Another limitation of the study might be also the range of countries considered. In developing countries (here in this particular context, developing countries are those countries that are generally less industrialized than countries which were subject to the testing in Fig. 1), political stability is a great obstacle in the way of continuous development, as indicated in studies dealing with the issues of human capital. In many cases these are states where the executive branch itself is not transparent and does not gather or share data with third countries. This is a key issue in the attempt to explain long-term development plans of developing countries, because some measures are implemented only partially, or not at all [16], [47], [53].

4.2 Benefits of the study and recommendations for further research. It can be concluded that the important effect of relationship between e-postal services and human capital in developing countries has been confirmed. This relationship has proven to be statistically significant in the defined sub-group of developing countries. Therefore it can be confirmed that the field of postal services, in particular its computerization, can be regarded as relevant in the process of classification of countries as developing. Thus it is necessary to respect this aspect when implementing measures which are directed at developing countries in the attempt to ensure maximum stability and further development of these countries.

Based on the defined methodology for calculation of the PES index and on its results, it has been stated that a possible explanation for the quadratic functional dependence between the development of postal e-services and the level of human capital can be the following: once a country's human capital reaches a certain level, the speed of adoption of postal e-services is higher, which leads to general growth of these services. This trend raises a question of the impact of postal e-services development on education in countries with low level of human capital (UPU, 2012). More research is needed. In relation to the results of this study, two basic areas have been identified where further research would be recommended:

- The explanation of the functional dependence of the trend of quadratic function, which has divided states into sub-groups, where the statistical dependence of human capital and postal e-services has been confirmed.

- An in-depth analysis of education or other indicators of the composite HCI in relation to development of postal market, which, especially in countries from the Lower-income economies group, shows reverse (extreme) trend.

Further studies striving to determine the borderline value of human capital at which the speed of adoption of postal e-services would correspond with development in other countries could use the following input information: the value will definitely not be negative.

There are other facts that justify the need of classification of developing countries based on other parameters than the indicator GNI per capita only. From resulting values of HCI in states which have been excluded from the second round of testing (because they were below the axis of the quadratic function in Fig. 2 and 3), it is evident that the classification on the basis of GNI per capita is not respected: Philippines has scored -0.161 but according to the classification of the World Bank belongs

among Lower income economies, while Pakistan has scored -0.837 and belongs among Lower-middle economies.

The classification of states based on GNI per capita does not correspond with the found extreme trend either: extreme values have been found in the Lower income economies group. Statistically significant dependence of relation of PES index and the HCI has then been found in states which show the following trend: with increasing HCI, the PES index decreases, which should be vice versa.

These findings are relevant and topical, in particular with reference to the works of other authors, who define human capital as a key concept vital for a country's development. The field of postal services is one of the main components of national economy and recommendations for further research stem from the need to broaden knowledge about this sector.

Summary. The issues of developing countries, as documented in this article, surely are among topics of current discussions of both world organizations ensuring basic services in developing countries and of industrialized countries which perceive developing countries as potential outlets for their production. This can be described as the general paradigm for most of research inquiring into the issues of developing countries. In this study, which presents a new way of analyzing developing countries, this paradigm has been defined by means of two indices which reflect the current debates in the globalized world. Firstly, it is human capital used as a tool which has the informative capability about the economic potential of a country. Secondly it is the field of postal services, which is one of the main sectors of national economy of every state (especially the area of postal e-services as one of the current trends of development in postal market). Both human capital and postal e-services are currently being discussed internationally and define the general development trend of the society.

The whole study is based on up-to-date data. Tests of statistical significance of relationship between postal e-services development and HCI have proven this relationship significant, and therefore it must be respected in decision-making especially in developing countries. The study has proven that defined classification of states according to the World Bank does not respect values of the defined indicators. This article brings a new method of analyzing issues of developing states and widens the range of aspects that must be taken into consideration in implementing measures to promote development.

To conclude, it should be noted that there are some limitations of the study. Transparency and effective application of measures to enforce development are not always the main objective of legislative and executive powers in developing countries. However, this fact should not belittle the relevance of results of this study, especially because the data in partial indicators, which have been used to calculate the composite indices, proceed from independent organizations and describe the current status as it is. Nevertheless, to ensure political stability should be the primary aim of all interested parts who have any interest in cooperation with developing countries. The results of this study (and other studies analyzing the human capital in different contexts) can be further taken into account when applying specific measures in the process of targeted economic development in developing countries.

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