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## Conceptual Framework of Human Capital Systemic Assessment at Macro Level

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### Abstract

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In line with the constant environmental changes in the political, economic and technological areas is changing the social structure of society. In conjunction is changing a content of intellectual potential as well is increasing rapidly a scale of intellectual activity. The assessment of human capital at macro level should be carried out in an integrated approach, identifying the factors affecting the formation of human capital value. This paper presents a systemic point of view of the human capital assessment at macro level forming a conceptual framework which is based on the creation of a comparative database of the human capital structure among the countries, on the estimation of the human capital value, distinguishing four constituents and on the evaluation of human capital utilization effectiveness in the value creation process. Findings reveal that an estimation of the human capital value unclosethe an access to the calculation of the net human capital value, meanwhile, comparison of the human capital value index and its utilization effectiveness are more related with the application of the estimated human capital value.

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### 1. Introduction

Progress of the modern economics is based on the rapid creation and deployment of new knowledge, applying informational technologies and developed human capital. The main and important role here goes to an individual, his special abilities, knowledge, and skills. The development of acquired human skills throughout the world, and accumulation of useful knowledge is the foundation for future economic productivity and people wellbeing (Schultz, 1998). The development of human

capital in the individual, organizational or macro level always has a special, non-liquid value that provides the system with the potential to grow and with the new status of being.

The rudiments of the HC conception may be found since the seventeenth century, in the works of classical economists - W. Petty, A. Smith, D. Ricardo J. B. Say, K. Marx, seeking to find a place for HC in the overall value creation process. On this basis, this concept was developed in neo-classical, Keynesian, social market and other economic theories, emphasizing the different components of HC and their role for economic activities. However, as a single entity and a separate theory of human capital has been developed in the works of Weisbrod (1961), Becker (1962), Schultz (1964) and etc. If at first sight, the concept of human capital appears to be a simple one, so in its empirical use, the concept of human capital is fairly complex. Researchers have used a large spectrum of variables - all signifying human capital: formal education, training, employment experience, start-up experience, owner experience, parent's background, skills, knowledge and others. Following Becker (1962) human capital is defined as skills and knowledge that individuals acquire through investments in schooling, on-the-job training, and other types of experience.

Today's society is an innovative society and resting on a high level of new technologies that are being developed and managed by highly skilled people. At the same time it must be recognized that human capital formation and its efficient utilization requires developing certain conditions. Therefore, it is very important to understand the multidimensional character of HC assessing the factors affecting the formation of HC value, aligning goals - the results with the investments, and thus to achieve the maximum of system performance.

The systemic approach for HC evaluation is determined by a broad and diverse concept of HC, an abundance of HC definitions found in the scientific literature (Psacharopoulos, 2006; Bontis & Fitz-Enz, 2002; Piazza-Georgi, 2002; Roos, Pike & Fernstrom, 2006; Baron, & Armstrong, 2007) emphasizing knowledge and skills, qualifications and competence, education, job training, innate abilities, health, motivation, investments in education, informal learning, innovation, operating experience.

Though valuable works have been performed analyzing HC at macro level (Nafukho, Hairston & Brooks, 2004; Boedker, Mouritsen & Guthrie, 2008; Erosa, Koreshkova & Restuccia, 2010; Kagochi & Jolly, 2010, Doong, Fung & Wu, 2011; Tudorescu & Zaharia, 2011; Suvorov et al., 2014) it is missing a systemic point of view to HC assessment at macro level, evaluating separate factors affecting the formation of HC value.

This paper will begin by defining the research focus and problematics, further followed with an identification and discussion of methodological principals of HC evaluation at macro level proposing a conceptual framework of human capital systemic assessment at macro level. This is followed with an empirical verification of the model proposed analyzing its separate stages.

## **2. Problem statement**

In the context of HC evaluation, the term „systemic“ means a versatile character of assessment. In other words, systemic evaluation of HC involves gathering of both value and non-value data of HC activity spheres, analysis and selection of assessment methods.

In regard to particular research, systemic attitude has own restrictions, i.e. it manifests inside particular system under research. According to analogy with organization's assessment (Franco-Santos et al., 2007), an evaluation system is being grouped according to three criteria: features of assessment system; assessment functions; and assessment process.

1. In this study an assessment system is limited by macro level (state, international level) with all requirements of infrastructure related to that level (state statistics level, its international comparability, complexity of conduction of detailed researches and so on).

There is another limitation of assessment system that requires clear formulation of assessment object. Conception of HC is a generalized conception that could be treated in many different ways. It can include citizens, able-bodied population (from 15 to retirement age), workers, and retirement age employees. This study assesses the HC of workers.

2. HC assessment functions allow distinguishing of basic constituents of HC value. Based on scientific literature analysis, HC value depends on many factors. That means the value of HC to individual or economical productivity in terms of usefulness, wellness, education, wage, formation costs and so on.

Therefore, HC has to be assessed by systemic value indicator that would allow calculation of HC value in monetary units. Summarizing of HC assessment theory and practice allow the statement that HC value is usually related to:

- education level, its depreciation and restoration – HC formation value;
- wage that indirectly expresses a consumption value of education;
- environmental influence to increase - decrease of HC value expressed by impact of organizational, social, technical and other factors.

3. Level of particularity of HC assessment process is very different. Usually it is determined by the level of assessment system and research infrastructure. At the lower, human level researches are the most detailed, at macro level contrary, detail decreases (Weisbrod, 1961; Becker, 1962; Schultz, 1964, 1998; Le, Gibson & Oxley, 2003; Kleynhans, 2006, Erosa et al. 2010; Tudorescu & Zaharia, 2010; Lajili, 2015).

Also it should be noted that the biggest scientific and practical achievements were reached at individual and organizational levels, and HC assessment at macro level is given less attention. Large influence to it is done by a formed provision that at macro level a market, including HC, is little influenced directly by the state.

HC assessment should cover not only a direct assessment of HC but also an assessment of environment. That is to say, not only formal HC value has to be assessed but also material, organizational, social environment conditions that determine its efficiency. These factors have big influence on work results, therefore complex system of HC assessment goals has to be created and logical research model has to be formed.

### **3. Research question**

The paper attempts to answer the following research question: what are the key criteria and elements of human capital systemic assessment at macro level?

#### **4. Purpose of the study**

The purpose is to present a conceptual framework of human capital systemic assessment at macro level, identifying and exploring main methodical principles and key elements involved in this process, verifying it empirically and providing appropriate conclusions. Therefore a systemic assessment of HC at macro level in this study is based on the creation of a comparative database of the human capital structure among the countries, on the estimation of the human capital value, distinguishing four constituents, and on the evaluation of human capital use effectiveness in the value creation process.

#### **5. Research methods**

To answer research question identified above, there were different methods used including a comparative analysis and synthesis of scientific literature, method of browsing, multi-factorial analysis of indices, correlation - regression analysis and the methods of economical calculation.

#### **6. Findings**

##### *6.1. Methodical principals of systemic human capital assessment at macro level*

The level of skills, knowledge and competences held at any one time by individuals can be taken to represent the “stock” of human capital. The total stock within a country can influence its prosperity and international competitiveness (OECD, 1998). The distribution of knowledge and skills has an important bearing on social participation and access to employment and income. Assessing the HC value, governments are interested in both the overall human capital stock and ways in which specific skills and competences are distributed within the population. To identify and measure the many different attributes that make up human capital requires a focus directly on what it is that individuals bring to work and economic activity.

If in the theory of human relations there is possible a united description of HC that reflects similar factors, then in assessment of HC we are facing few possible variants. HC formation is not an end process. Its creation requires huge capital investment including financial, material and time expenditures that must pay over longer or shorter period that depends on internal and external environmental conditions.

The stock of human capital is heterogeneous: no single type of attribute can adequately represent the many human characteristics that bear on economic activity. It is also important to acknowledge that human capital is in practice more than the sum of its parts, and that the identification and measurement of a finite number of specific skills cannot provide a complete account of human capital stock (OECD, 1998). The ability of individuals and groups to put these skills together and turn them to productive use, which is related to social capital, is crucial to the overall picture, although hard to measure in any quantitative form.

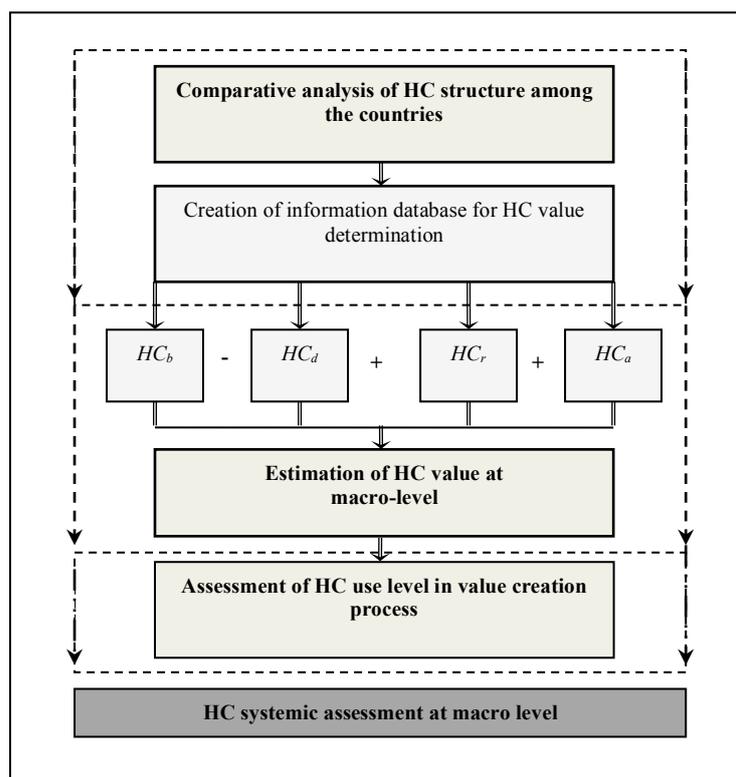
HC assessment goals and used methods determine few variants of HC value calculation, by distinguishing the elements of HC assessment system. In striving to describe all constituents of HC, possibilities of description of their aggregation and interaction, following particular requirements have to be followed:

- knowledge economics requires coordination of different levels of HC and its activity environment;

- the statement, which is confirmed in practice of organizational activity, that HC influences economic growth, increases national competitive advantage (Nehru, Swanson & Dubey, 1995; Porter 1998), more educated individuals are working more efficiently, productively and increasing competitiveness (Schuh & Angeli-Schuh, 1989 et al.) is being transposed to macro level. In the context of the statement presented above, macro level has to be understood as environment where HC is not isolated; therefore assessment of physical and structural capital level is an essential condition. It was proven by researches (Bagdanavičius, 2009), that level of HC use is determined by material and organizational conditions in which it is influencing HC (good conditions are increasing the level, bad conditions - decreasing);

- different approach to HC value conception has to be reflected in methodology of its assessment.

In order to fulfill a systemic assessment of HC at macro level first of all there were identified a HC structure, by calculating a complex index of HC value, then estimated the HC value in monetary terms at macro level according to the wage and the HC formation value, and finally evaluated the level of HC use effectiveness in value creation process. These three versions of HC assessment at macro level combining the identified elements, can be combined to the overall framework of HC systemic assessment at macro-level (see Fig. 1.)



**Fig. 1.** Framework of human capital systemic assessment at macro level

In order to verify a conceptual model presented in the Fig. 1 there was carried out an empirical research. **Empirical research object** is 27 countries of the European Union. These EU countries are differing at economic and social levels but they are unified by united political and economic goals and

mutual assistance in striving for these goals. Countries are often being distinguished to developed, advanced and developing countries (Pereira, 2011). However, within the framework of the problem there could be distinguished a different number of groups (Lieser & Groh, 2010; Kearney, 2009).

**Empirical research goal** is to assess HC in systemic approach in the context of the EU countries.

In order to reach the formulated goal following **tasks of empirical research** are raised:

- 1) To perform comparative analysis of the EU countries by distinguishing and connecting the main groups of indices forming HC value, calculating partial and complex index of HC value and forming informational database;
- 2) To determine a size of HC value in value terms at macro level according to wage and HC formation value by distinguishing four constituents of HC value;
- 3) To assess a level of HC use in the process of value creation.

All the data required for the analysis of EU countries' HC was gathered from European Commission „Eurostat“ information (Eurostat, 2010) and the World Data bank information (World data bank, 2011).

## 6.2. Comparative analysis of HC structure among the countries

Widely applied method to analyze different links and the structure between the researched objects in practice is often used the index method (Human Development Index (Human development report, 2011), the index of Genuine Wealth Assessment (Genuine Wealth Assessment, 2012), Physical Quality of Life Index (Thanawala, 2007) and others). These indices are used on the consideration of quality aspects with other economic perspective. For evaluation of HC at macro level it is not enough to have individual indicators, there should be selected an appropriate set of indicators reflecting the complexity of this concept. There should be evaluated such social, economic and innovation indicators as poverty reduction, education, human training, health protection, neonatal mortality, development of technologies and so on. These are the areas that must complement the conception of HC assessment at macro-level.

Following the procedures of data browsing statistical methods (principal components analysis, factor analysis, correlation analysis, correspondence analysis, etc.) there were distinguished five large first-order index groups: 1. HC social index; 2. HC innovation index; 3. HC income value index; 4. HC cost index; and 5. HC economic value -development index. This allowed to calculate a complex index of HC value for each EU country (for more detail information look - Liepe & Sakalas, 2013).

The EU countries presented in the Fig.2 are divided into four separate groups according to the calculated complex index of HC value. There is calculated an average complex index of HC for each country group, which allows to compare the role of an individual country in the context of others.

An accomplished analysis of the empirical research initial phase allowed to select the data reflecting HC in the EU countries statistical databases, grouping and consolidating the factors according to the structure of HC value index. The obtained results allowed to state that the selected survey sample is sufficient, the correlation among indicators is reliable and may be carried further HC evaluation analysis in the context of the EU countries.

A performed comparative evaluation of the HC structure in the EU countries using the method of indices, suggested that the reliability of applied method of indices and a performed classification of

countries (see Fig. 2) according to their level of HC structure is sufficiently high in the terms of mathematical - statistical criteria and logical analysis.

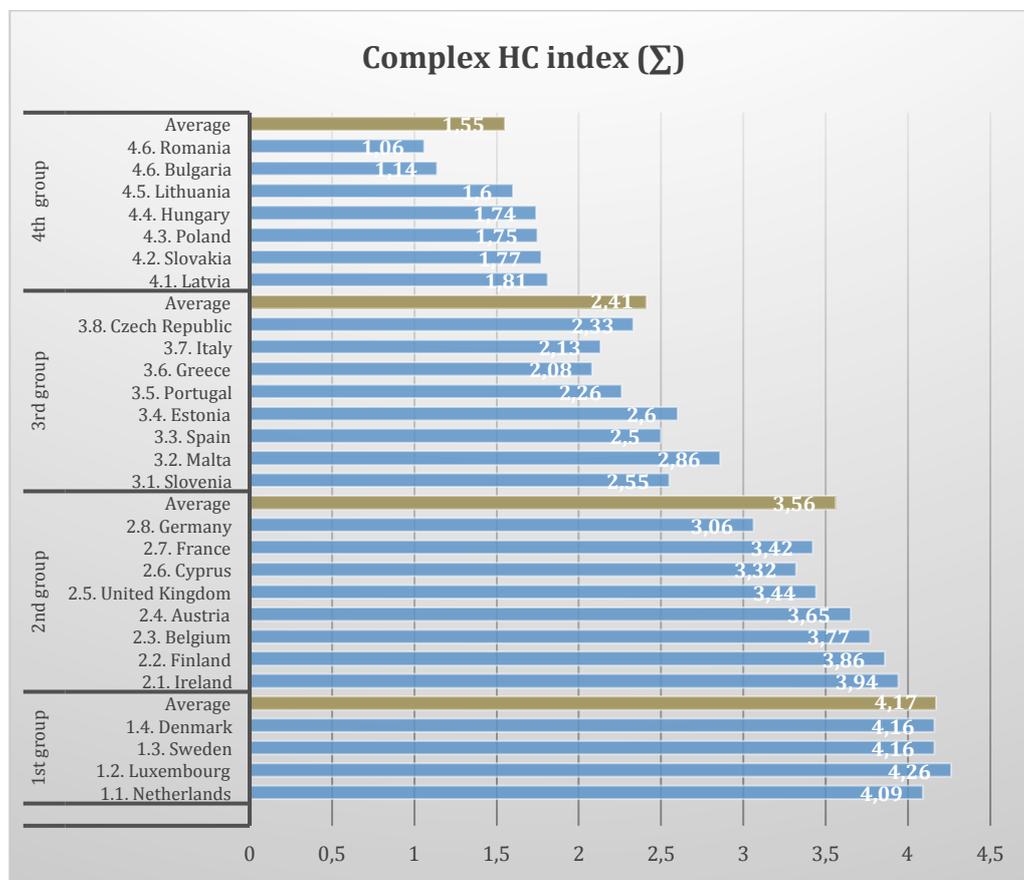


Fig. 2. Complex indices of HC value in groups of countries

The systematic evaluation of HC value among the researched countries allowed to perform a justification of the HC value database calculation, however this systematic evaluation did not allow the calculation of the HC value in Euros, pounds, and so on., therefore it was performed an integrated HC evaluation.

### 6.3. Estimation of the human capital value at macro level

In order to perform an assessment of HC value in monetary terms at macro level, there has been adapted the formula of “Saarbruecken” applied for calculation of HC value in the enterprise level (Scholz, Stein, Bechtel, 2004). There were distinguished the four constituents of HC value at macro-level and calculated an aggregate value of HC (see equation 1):

$$HC_v = HC_b - HC_d + HC_r + HC_a \quad (1)$$

here:  $HC_b$  – basis of HC value;  $HC_d$  – depreciation of HC value;  $HC_r$  – recovery of HC value;  $HC_a$  – alteration of HC value.

HC value base. Calculation of HC value base in this paper is based on the evaluation of the countries' employees number and available wage, including social contributions, as well is evaluated the purchasing power parity, identifying the consumer price index for each country.

Human capital value depreciation. HC value depreciation or loss is calculated evaluating the process of employees' actual knowledge aging. Knowledge depreciation rate is calculated indirectly, using the influencing factors innovation indexes and determining the coefficients of knowledge devaluation.

Human capital value recovery. The quantity of HC value recovery at macro level was determined directly by the selection of two indicators: - general public expenditure on education (all education levels from 0 to 6) as a percentage of GDP; - investment in skills upgrading and retraining, as a percentage of GDP.

Human capital value alteration. Calculating the HC value alteration or change, the motivation and country's organization level was associated with the organizational and innovative level indices (human development index, life-long learning - participation in training index, age group 15-64). The quantitative level of motivation is calculated in the base of motivation index, using the methodology applied for the calculation of the knowledge depreciation (for more detail information look - Liepe & Sakalas, 2013).

An accomplished calculation allowed to identify an aggregate value of HC of the 25 EU countries (lack of statistical data for Greece and Luxembourg), expressed in millions of Euro, adopting that HC value depreciation reduces the aggregate value of HC (see Fig. 3.).



**Fig. 3.** Aggregate HC value by groups of countries (in millions/Euro)

The aggregate values of HC in different countries (see Fig. 3) clearly indicate that the main factor, influencing the level of HC, is the country's size, which is reflected by both population and by GDP. The underlying is a case of Romania, which according to the evaluation of HC structure is in the lowest position (see Table 1 and Fig. 2), while in Figure 3 it looks pretty good in comparison with Lithuania or Latvia. The logically based classification of countries by the estimated aggregate HC value is very close to the clustering of HC system using the indices method (see Fig. 2). The deviations accessed are associated with the different methods of grouping applied and the differences that occur in the analysis of indices and in the analysis of the final results. However, the differences are smaller than the commonalities, which indirectly confirm the applicability of the calculations.

The performed calculation unclosed an opportunity to bring together the country's main factors of productivity (GDP; HC value; Gross fixed capital formation, including intangible assets, that will be treated as fixed assets value; and country's material consumption value, which shows the domestic resource productivity) into a uniform measurement system, which opens new opportunities of their analysis and forecasting, identifying the role of HC in value creation process.

#### 6.4. Assessment of HC use level in value creation process

HC value calculation in monetary units allowed determining its relations with other key national indicators and assess their impact on the GDP. There was performed a multivariate linear regression analysis correlation analysis for all the EU countries participating in the survey, which showed that among the analyzed parameters there is a strong correlation dependence. For regression model validation there was also performed an analysis of standardized *Beta* coefficients and co linearity statistics analysis, which has emerged a multi-co linearity problem.

There was created a regression model, reflecting the dependence of  $Y$  on  $X_1$ ,  $X_2$  and  $X_3$ , which can be expressed in a multivariate linear regression equation (2):

$$Y = 2770,377 + 0,194X_1 - 0,991X_2 + 1,193X_3 \quad (2)$$

here:  $Y$  – GDP value;  $X_1$  – HC value;  $X_2$  – Fixed assets value;  $X_3$  – Material consumption value.

From the equation (2) there can be seen that the value of one of the factors coefficients is negative (-0,991). This can be explained by the fact that the partial correlation coefficient of this indicator (fixed assets value -  $X_2$ ) is negative also (-0,677), but at the same time this reflects the intensity between the GDP and Fixed assets value.

Strong relationships between the independent factors and the GDP in the context of the EU countries are represented in the Fig. 4 highlighting the even distribution of the countries according to indicators linear regression lines. Looking at the countries distribution (see Fig. 4), there emerge such countries as Germany (12) France (11) United Kingdom (9), Greece (19), Spain (15), Netherlands (1) and others with the highest performance indicators which confirms the dependence on the countries' level of development and size. An important role in the evaluation of the significance of the individual constituents makes the scale factor. An exclusion of the particular groups of countries, according to the common indicators shows a significant dependence from the size of the country.

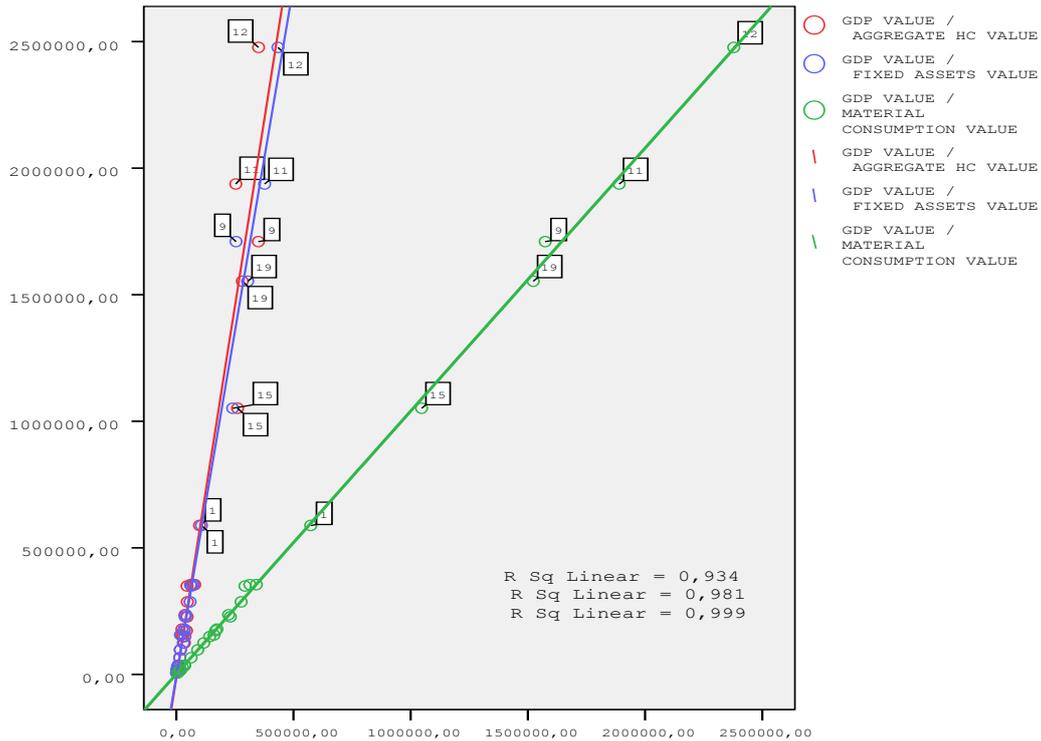


Fig. 4. Distribution of the EU countries by factors and their impact on GDP

Nevertheless exist a strong relationship among independent factors and GDP, it doesn't fully confirm the reliability of the model. There emerge a multi-co-linearity problem, which shows that the prediction of the impact of correlated factors on GDP cannot be assessed well, because the coefficients of regression function are very unstable - a few additional or removal of existing variables can significantly change the predictions (Garson, 2009). Even though there cannot be denied that there are high correlation among the generalizing and its affecting factors, which suggests that all the factors in the production function have a significant impact on gross domestic product, although their significance depends on the individual country's size and its level of development.

## 7. Conclusions

An accomplished analysis of scientific literature and determined methodological principals allowed to form a conceptual framework of HC systemic assessment at macro level which is based on the several stages:

- a stage of comparative analysis of HC structure - creation of comparative database among the countries and verification of its effectiveness, using a factor - indices analysis and clustering methods;
- a stage of HC value estimation - is based on alignment of HC wage value and HC formation – investment value, distinguishing four constituents: 1) real wage amount; 2) knowledge loss in value terms; 3) knowledge loss recovery; 4) HC values increase due to the level of motivation;
- a stage of HC utilization-rate evaluation - an assessment of HC operation effectiveness by the level of HC use in value creation process.

Applying a created model of HC systemic assessment at macro-level there was carried out an empirical research and following results can be summarized:

- a comparative evaluation of HC structure in 27 European Union (EU) countries, using the five groups of indices (social, innovation, income value, cost, and economic development value) allowed the selection of effective indices and the development of comparative information database.
- for the HC value estimation there were distinguished four constituents, including HC value base, HC value loss - depreciation, HC value recovery, and HC value alteration due to motivation. The estimated aggregate HC value in monetary terms for the 25 EU countries (except Greece and Luxembourg, because of the lack of statistical data), considering that the HC depreciation value reduces the aggregate value of HC, revealed that the main factor influencing the level of HC is the country's size, which is reflected both by population and by GDP.
- the performed correlation - regression calculations, an implemented the comparative system analysis of HC value applying the factor indices method among the EU countries clearly show that the rate HC value of separate countries is not the same. In order to properly utilize the highly skilled HC it is required an appropriate material economic development, within is characterized by the value of fixed assets and the materials consumed. In countries such as Lithuania, there exist a surplus of skilled labor, particularly in structural terms - by individual professions, therefore the evaluation of HC, its formation and development of efficient utilization is a particularly important issue that must be considered in future studies.

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