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KNOWLEDGE AND HUMAN CAPITAL AS THE EFFECTS OF TERTIARY EDUCATION AND FACTOR OF ECONOMIC GROWTH

Introduction

The aim of the article is to present the significance of science and the knowledge that is gained during tertiary education and constitutes a crucial component of human capital which is a recognized factor of economic growth. The article presents the role of science and knowledge in the structure of neoliberal economics; it describes the processes of knowledge acquisition and implementation and defines human capital as the result of education.

1. Science and knowledge in neoliberal and institutional economics

Contemporary economics attaches great attention to the cause-effect phenomena that influence processes determining economic growth. The research is mainly focused on the attempts to develop models that describe the factors that constitute the basis for economic growth[1]. One could even venture to say that at present much effort is made to present the differences between the wealth of particular countries and to explain the reasons for such state of affairs.

The theory of economic growth makes an attempt to describe and explain the reasons why countries are getting richer by introducing science and knowledge to the model of economic growth. As a result, the concepts of **science** and **knowledge** became the object of interest of neoliberal and institutional economics. Moreover, it is worth reviewing the definitions and systematizing these two notions with regard to the economic growths of particular economies while differentiating between knowledge and science.

When reviewing the works and theoretical considerations on the concept of knowledge as the category of basic research, one should turn to the philosophical thought of ancient Greece. With respect to the completeness, the classical definition of knowledge was formulated by Plato

[1] D. Romer, *Makroekonomia dla zaawansowanych*, Wydawnictwo Naukowe PWN, Warszawa 2000, p. 23.

and presented in his *Paramenides Teajtet*[2]. Knowledge was defined as a correct belief. The notion of knowledge presented in this way has a dual character: epistemological and methodological. What is more, knowledge according to the Greek philosophers cannot exist without the concept of **science**. In the epistemological approach knowledge can be treated as a set of beliefs that were, first of all, proved in a correct way and, secondly, are true. In the methodological approach, knowledge is a "set of critically developed systems of beliefs" [3]. The system may include scientific theories (beliefs) that are systematized in relation to one another with the assumption that they can be either mutually contradictory or compatible. Consequently, the beliefs that form a system of beliefs in a particular field may be complementary or they may exclude one another. The evidence for the latter is the set of systematized beliefs in economics. Here, it is easy to identify numerous alternative theories or contradictory scenarios or models that explain the same phenomena (e.g. the economic growth) in different, frequently discrepant way. Currently, the economists differ as regards the choice of the best model to describe economies and they cannot reach agreement in quantitative interpretations. This is a classic case when the definitions of knowledge as beliefs affect the argument on the ways how economies function[4].

In order to analyze the economy-based approach to knowledge, one should refer to the work of Friedrich Hayek who was the first in modern times to make an attempt of systematizing the notion of **knowledge.** He defined knowledge as "all human adaptations to environment in which past experience has been incorporated"[5]. It is worth noting that such approach to knowledge emphasizes the role of human being, which is close to economic approach. Moreover, Hayek appreciates the essence of the knowledge gained by a human individual and identifies it also with the skills and information acquired. This fact is crucial as regards the significance of knowledge in the modern theories of economic growth where it is information and skills (gained throughout the whole life) that are the components of human capital which in many models is considered to be the economic growth multiplier[6]. However, quite recently because only in the second half of the 20th century, the fact was noticed that civilizational changes, including the economic ones, depend substantially on knowledge which at present is

[2] Platon, *Paramenides Teajtet*, Wydawnictwo Antyk, Kęty 2002.
[3] R. Wójcicki, *Wykłady z logiki z elementami teorii wiedzy,* Scholar, Warszawa 2003, p. 235.
[4] J. E. Stiglitz, *Ekonomia sektora publicznego,* Wydawnictwo Naukowe PWN, Warszawa 2004, p. 25.
[5] F. Hayek, *Competition as a Discovery Procedure,* "The Quarterly Journal of Austrian Economic" 2002, Vol. 5, No 3.
[6] It should be mentioned that the issue of knowledge was discussed earlier from the point of view of economics by A. Smith and D. Ricardo, cf. R. Bartkowiak, *Historia myśli ekonomicznej,* PWE, Warszawa 2008, p. 36.

referred to as the carrier of social and economic change[7]. It is safe to state that knowledge in contemporary economy is becoming an element of capital perceived as a set of basic factors that are necessary in running an economy. This is true on the condition that knowledge should not only be an integral part of a social individual but – as an element of human capital - it should contribute to economic growth (the feature of knowledge-based economy). One could go further and state that economic activity (running an economy) as one of the fundamental objects of the study of economics should not be inspired solely by material resources and manual labour. Present-day economy requires the incorporation of knowledge into economic activities; in this context knowledge is of particular significance to the perception of the notion of capital.

From the point of view of contemporary economy and the understanding of the notion of knowledge in economic activities, knowledge - according to the current approach - means "data and information (…) that is stored, analyzed and arranged in minds about objects, facts and phenomena existing in the surrounding of human being as well as images, projects, concepts and models that are developed and exist virtually in human minds"[8]. Such an approach makes it possible to make an attempt at determining a model of knowledge development as the factor that can be used in the implementation of knowledge in a particular activity[9].

However, one should point out to the fact that there is one more issue that requires systematization: it is the difference between the notions of data, information and knowledge. For this purpose the so called model of knowledge hierarchy is applied. Its base is formed by data, which – after processing (statistical processing included) – becomes information. The pieces of information which are mutually connected and used in coherent, critical and analytical way, become knowledge. Knowledge, enriched by experience and intuition becomes wisdom, i.e. the capacity to make correct and rational choices. Fig.1 presents Tobin's knowledge hierarchy[10].

Onto this knowledge hierarchy model can one impose the system of human knowledge development that influences the growth of the economy that is based on knowledge and human capital which are the objects of interest of contemporary economics (institutional economic

[7]More in: B. Poskrobko, *Wiedza i gospodarka oparta na wiedzy* [in:] B. Poskrobko (ed.), *Gospodarka oparta na wiedzy. Materiały do studiowania,* WSE w Białymstoku, Białystok 2011, p. 26.

[8] Ibidem, p. 27.

[9] M. Niklewicz-Pijaczyńska, M. Wachowska, *Wiedzka – Kapitał Ludzki – Innowacje,* Uniwersytet Wrocławski, Wrocław 2012, p. 19.

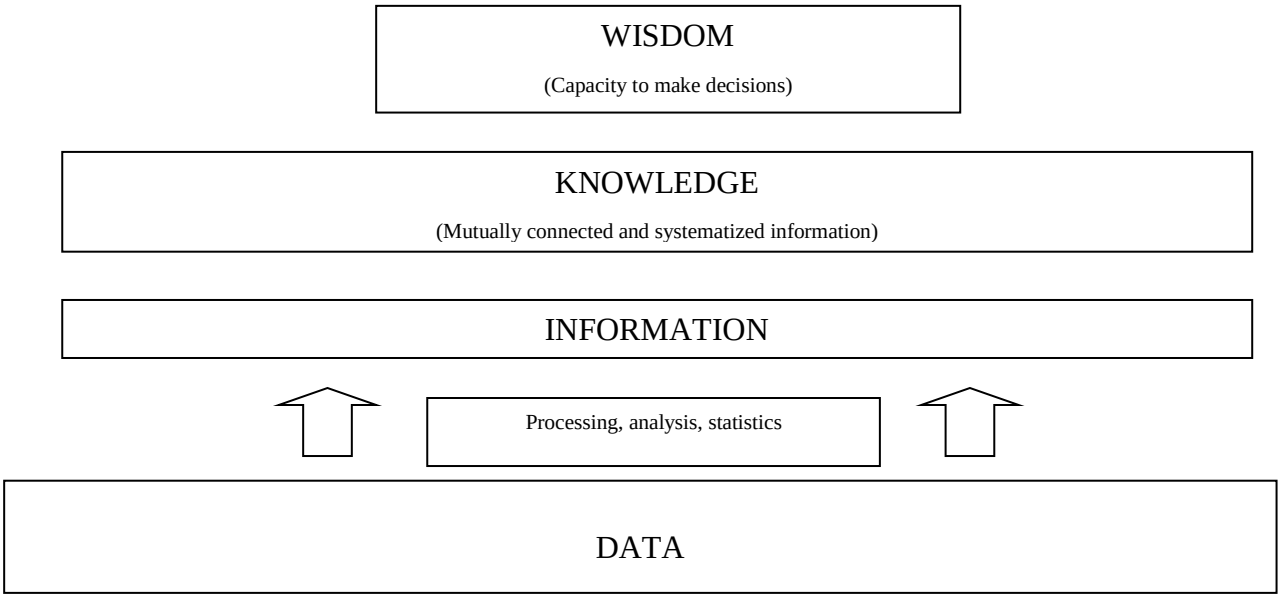
[10] J. Tobin developed a company valuation model in which knowledge and human factor are logically incorporated into the valuation process that is determined by the Q Tobin index (the ratio of the market value to the book value); the human factor in the model is given as the difference between market and book values; J. Tobin, *A general Equilibrum Approach to Monetary Theory,* „Journal of Money, Credit and Banking" 1969, No. 1.

including)[11]. It should be reminded here that from the point of view of institutional economics, the crucial achievement of the institutionalists and neoinstitutionalists was not the rejection of the principles of market economy but the attempt to incorporate human being into economic models, i.e. the humanization- the introduction of knowledge as an essential factor that represents the role of man in the achievement of economic growth.

In addition, the recognition of man as the „carrier" of knowledge made it possible to introduce knowledge as a factor to the models of economic growth; thus, it enabled the description of the so called knowledge capital (accumulation of knowledge) which affects positively the development of human capital[12].

Figure 1 presents in a graphical way the approach to wisdom and knowledge in a hierarchical context.

Figure 1. Wisdom and knowledge in hierarchical approach



Source: Author's research based on M. Bereziński, J. Hołubiec, Dariusz Wagner, *Hierarchiczna struktura poznania – piramida wiedzy* [in:] A. Januszewski (ed.), *Studia i materiały Polskiego Stowarzyszenia Zarządzania Wiedzą,* PSZW, Bydgoszcz 2009, pp. 13-14 and J. Tobin, *A general Equilibrum Approach to Monetary Theory,* „Journal of Money, Credit and Banking" 1969, No. 1.

To sum up – knowledge can be treated as non-material and intangible resource that has a decisive impact on the achievement of economic benefits, both in the micro- and macro-scale.

[11] Theoretical foundations for the economic models that recognize knowledge as one of the key driving forces of economies were developed already in the 19th century; they are visible in the works of T. Velen or J. Schumpeter. The issue was also widely discussed by the classics and neo-classics, including A. Smith, D. Ricardo, and their followers: M. Friedman, R. Mundell or R. Lucas.

[12] R. Lucas Jr., *Wykłady z teorii wzrostu gospodarczego,* C.H. Beck, Warszawa 2010, pp. 14-17.

This is even more visible in the cases of dramatic moves from economic systems based on industry and technology to knowledge-based economies where **knowledge, intellect, entrepreneurship** and **innovativeness** are the main factors that stimulate development[13].

Knowledge is the object of science, while science is the result of development. The interest of contemporary economics, both neoliberal and institutional, is concentrated on the role of knowledge and science in economic growth. The point is in finding the answer to the question *whether* or to *what extent* science and knowledge (carried by humans) contibute to the growing wealth of nations.

The starting point for further considerations is the analysis of the term **science** as opposed to **scientific knowledge**. Scientific knowledge is rational, i.e. it deals precisely with facts and its reasoning is logically correct. Scientific knowledge has a different structure and higher quality than everyday knowledge. It is the result of the work of specialists who apply adequate instruments and methods and it is open to criticism, which results in its precision and reliability. The tools, methods and criticism related to scientific knowledge make it possible to provide a broad definition of **science**.

The notion of science itself is comprehesive and has several meanings. However, when considering the impact of science on economic processs, one should rather focus on the philosophical approach to science (scientific condition). Then, science can be defined as "a system of the objective knowledge on nature, society or man, the relations between them and the rules that govern them. It is a system of socially developed beliefs that have been proved and verified, i.e. beliefs that are true"[14]. As regards cognition, science can be referred to as all the activities that include establishing and sharing results (e.g. of research), the implementation of the results, and the presentation of scientific assertions and laws in line with the scientific research methodology (so that they meet the condition of completeness, reliability and truth). Thus, one can say that science is also a process of knowledge acummulation as well as the process of the revolution of the notion of knowledge, i.e. a cognitive process during which it is possible to negate previously accepted opinions and replace them by new ones that are proven, verified, desribe the reality in a better way and are materialized thanks to scientific processes.

That definition of science is the effect of long lasting evolution of scientific cognition that started already in ancient Greece. It was then that the first attempts to define the concept of

[13] A. Herman, A. Szablewski, *Orientacja na wzrost wartości współczesnego przedsiębiorstwa* [in:] A. Herman, A. Szablewski (ed.), *Zarządzanie wartością firmy,* Poltext, Warszawa 1999, p. 14.

[14] J. Apanowicz, Metodologiczne elementy procesu poznania naukowego w teorii organizacji i zarządzania, Wydawnictwo Diecezji Pelplińskiej, Pelplin 2000, p. 11.

science were made and science was distinguished from the notion of **skills** which at present are considered to be the components of human capital, which is a pro-growth factor and is accounted for in the theoretical models of economic growth[15]. In this context, **science** or **scientific cognition** can be defined as the acquired information that is put into order, analyzed, proven and systemitized into logical sequence. These concepts constituted the basis for further considerations regarding the notion of science – also in the context of the work of Pitagoras and his followers. This group of scholars began to deal with mathematics in a systematized, i.e. scientific way (their work concerned symbolics and the application of maths in ancient Greece).

When considering the further evolution od science, one should menhtion the approach of sophists who directed the object of research back to humanism. In their considerations concerning the tasks of science, the sophists concentrated on such crucial, in Plato's opinion, features as the management of a household and state as well as the effectiveness in acting and speaking – which conceptually is close (in the first part) to the issues of contemporary economics. The demands of the sophists were not only restricted to the issue of the definition of science. They also introduced systematized **scientific methods**, e.g. the experiment that was understood as observing and concluding. In this concept, science is restricted to the observation of facts and the relations between them; the prediciton of future events on the basis of facts is also acceptable[16]. Such understanding of **scientific cognition** or *science* is practically still valid. Current controversies concern only the concepts of proceedings in science, the falsifiability of statements (K.Popper) and **science** as a continuous sequence of scientific revolutions (T.S. Kuhn) [17].

The relation of science to knowledge is presented in fig.2. Thus, it can be concluded that both knowledge and science are the objects of interest of economics, including (neo)liberal and institutional economics[18].

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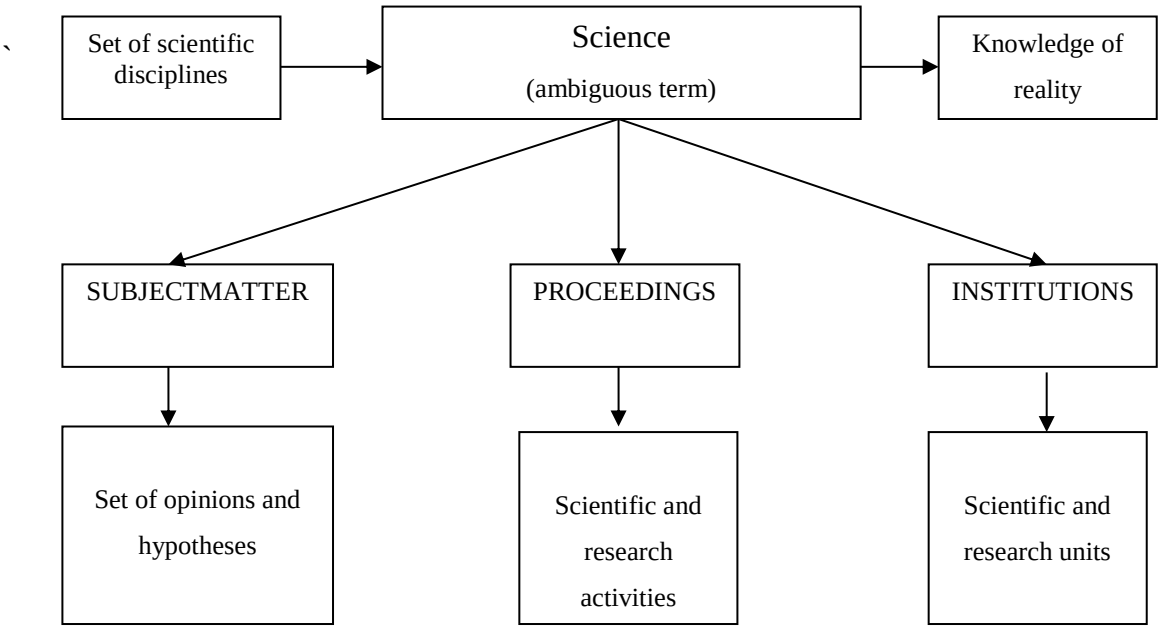
[15] The first to discuss this problem was Tales, a Greek philosopher and mathematician, who created the basis for mathematics and natural sciences; however, his activity cannot be treated as science because - in accordance with the definition of science given above – one cannot refer to single, even if true, statements, opinions or observations as science because true statements do not result in the formation of science. Science is created if they are put into order, formalized, related to other statements and opinions and connected by a logical **process**; cf; W. Tatarkiewicz, *Historia filozofii,* PWN, Warszawa 1981, Vol. III, p. 23.

[16] Ibidem, p. 68.

[17] Cf Warszawa 2002; T.S. Kuhn, *Struktura rewolucji naukowych,* Aletheia, Warszawa 2001.

[18] Currently both science and R&D sector constitute important areas of discussion and argument about the economic growth issues. Institutional economics raises the issue of science in the context of capitalizing the R&D and higher education sectors with capital that comes from the state budget. This is the result of the opinion that science as an element of the basis of economic growth should be substantially subsidized by public means. This concept is not rejected by classics and neoclassics who recognize the need for the existence of the so called public good in economy.

Fig.2. The concept of science



Source: Author's research based on :J. Apanowicz, *Metodologiczne elementy procesu poznania naukowego w teorii organizacji i zarządzania,* Wydawnictwo Diecezji Pelplińskiej, Pelplin 2000, p. 12.

Both terms (knowledge and science) do not only describe economics and place it within the function of scientific cognition but they also become the object of economic considerations, including such issues as economic growth, the role of R&D in the growing wealth of nations or the influence of state on science, higher education and life-long learning from the point of view of the significance of human capital as a crucial element of economic growth. Economic growth is understood as a theoretical and empirical justification of the reasons of changes in GDP (including GDP per capita) in different countries. The issue of economic growth is also related to the disproportions in the development (the increasing wealth) of particular countries. Contemporary research recognizes also the interactions between the dynamics of GDP changes and work efficiency. In this approach, economic growth is perceived not only as the capacity of an economy to develop through the generation of a growing domestic product but also as the capacity to improve the quality of human capital which is responsible for work effectiveness (e.g. in the context of the analysis of value added per working hour)[19].

With regard to the previous experience concerning the assessment of factors that inflence economic growth and the increase in the wealth of nations, one can say that material

[19] S. Gomułka, Mechanizmy i źródła wzrostu gospodarczego na świecie [in:] J.L. Bednarczyk, S.I. Bukowski, W. Przybylska-Kapuścińska (ed.), Mechanizmy i źródła wzrostu gospodarczego. Polityka ekonomiczna a wzrost gospodarczy, CeDeWu.pl, Warszawa 2008, pp. 47-48.

resources used to be the main factor that determined economic growth that was understood – in the classic approach - as the production growth.

With the increase of the significance of high technologies and the implemenation of the R&D results in all sectors the role of material production resources is diminishing and the devekopment of science is becoming an indicator of wealth and the measure of social and economic development. The evolution in this respect can be divided into three levels[20]:

- society, economy and science function completely independently from one another; knowledge, which is transferred in the course of the systematization process, is theoretical and non-institutional in character; education system, higher education including, has no impact on economy growth;
- society, economy, science and scientific research are not connected closely to one another but some scientific discoveries are implemented; technological advance is rather the effect of imitation and the development of science takes place spontaneously although in specialized scientific centres;
- society where knowledge and science integrate significantly; scientific cognition and research take place in specialized research centres and organizations which work directly for the needs of technological progress that supports economic growth; the government and business co-finance scientific research and educational system, particularly higher education; science is becoming one of the main factors of economic growth.

With regard to economics, knowledge and science are closely related to the idea of knowledge-based economy and the economic models (theories of economic growth) that use the notions of knowledge, science and R&D to determine the causes of economic growth. This approach is also visible in the so called neoclassical theory of economic growth which originated from the research and investigations of R.Solow and T.Swan. In the neoclassical models, economic growth is stimulated not only by capital but also by knowledge (which is then identified with technological progress) [21].

Thus, with reference to the thesis of scientific society[22], one can say that both **knowledge** and **science** are becoming the object of interest of economics. The interest is

[20] B. Jałowiecki, *Reguły działania w społeczeństwie i nauce,* Scholar, Warszawa 2002, pp. 192-193.
[21] Ł. Jabłoński, *Kapitał ludzki a konwergencja gospodarcza,* C.H. Beck, Warszawa 2012, p. 35.
[22] Ibidem, p. 35.

focused mainly on the factor approach to economic growth. The factors inquestion are knowledge and science and the acquisition of knowledge is related to the learning process.

Another example that reflects the interest of ecomomics as regards knowledge and science is the so called endogenous economic growth theory. Its basic assumption is that sole physical capital and technological progress cannot justify the differences in the development of particular economies. Thus, in order to analyze economic growth, the notion of human capital was introduced. Moreover, it was taken into consideration that research and scientific sector, including universities and higher education sector is the basic economic growth factor[23]. When one refers the model concepts to the reality, one can see that already at the turn of the 21st century practical examples were identified of the impact and significance of human capital and R&D on economic growth – this was done, among others, by the analysis of the level of investment in fixed assets and the investments in R&D and human capital[24].

Można zatem stwierdzić, że zarówno czynnik wiedzy, umiejętności, jak i oddziaływanie B+R ma coraz większe znaczenie dla gospodarki, zatem staje się przedmiotem zintensyfikowanych rozważań na gruncie ekonomii. Dużą rolę w kształtowaniu tych czynników ma kształcenie. Kształcenie jest nieodłącznym elementem procesu pozyskiwania i późniejszego wykorzystania wiedzy.

Thus, one can state that knowledge, skills and R&D are factors that have an increasing significance to economy and consequently they are becoming the object of intensive investigations on the grounds of economics. They are heavily influenced by education which is an indispensable element of knowledge acquisition and implementation.

2. Knowledge acquisition and implementation

Education – as a process – and the implementation of knowledge in social and economic development – as the effect of education – are closely connected with the educational system which is associated with the concept of **school** that is understood as an institutionalized organization whose purpose is to support the process of **knowledge** acquisition. The process of knowledge acquisition is crucial and it determines the capacity of subjects, human individuals

[23] Ibidem, p. 37.

[24] There is a trend in the countries with stable economies that company investment in R&D or human capital account for almost 80% of the total investment expenditure; the trend is accompanied by a decrease in expenditure on fixed assets investments cf. K. Pawłowski, *Społeczeństwo wiedzy. Szansa dla Polski,* Znak, Kraków 2004, p. 21.

including, to gain knowledge[25]. Thus, the acquisition of knowledge itself and the skill to acquire knowledge is one of the main factors that determine the succes not only of an individual but also of the society. The process is conducted through the learning of an individual on primary, postprimary, secondary and higher levels, which results in his/her education. The education constitutes one of the basic factors that form human capital[26], which is becoming a new force influencing positively the economic growth. The segmentation of the educational process and its division into stages was defined already in the 19th century by Winhelm von Humboldt. His concept of the natural division into three stages, which remained basically unchanged despite some evolution, met the demand for the acquisition of knowledge at different levels of specialisation. Primary educaiton should give strong fundamentals that enable the acquisition of comprehensive knowledge, with the assumption that education higher than elementary is also offered (according to Humbold, the lack of schools higher than the elementary ones would spoil any educational system). According to him, a common labourer and a sophisticated university graduate should receive the same education at the beginning [27].

Thus, education is a process that is closely integrated with the notion of school. At various levels of education and knowledge acquisition and implementation it is **school** (primary, secondary and the school of higher education) that provides the access to systematized knowledge. Such access is in line with the philosophy of science and refers to rational thinking, with the consideration of the variability of the cognitive process and with the application of indirect ways of approaching the truth.

It should be emphasized, however, that education, the acquistion of knowledge and skills as well as cognitive processes take place also in families, communities, companies and institutions, which results in the fact that the process of education is comprehensive and holistic in character[28]. According to Humbodlt, the process should also be democratic as the concept of education, university education including, assumes equality in the processes of knowledge acquisition, shaping attitudes and the implementation of the acquired knowledge. This means that the teacher/lecturer/professor does not have the monopoly for scientific truth.

[25] Cf. A. Kukliński, Gospodarka oparta na wiedzy – społeczeństwo oparte na wiedzy – trajektoria regionalna. Artykuł dyskusyjny, „Nauka i Szkolnictwo Wyższe" 2003, No 2; A. Marszałek, Rola uczelni w regionie, Difin, Warszawa 2010, p. 54.

[26] Szerzej: A. Świebocka-Nerkowska (ed.), *Bilans kapitału ludzkiego w Polsce – raport z badania*, PARP, Warszawa 2011.

[27] R. Nowakowska-Siuta, *Uniwersytet w systemie szkolnictwa wyższego Niemiec na europejskim tle porównawczym*, Wydawnictwo Uniwersytetu Warszawskiego, Warszawa 2005, pp. 84-85; W. Humbolt, Gesammelte Schriften: Ausgabe der Preussischen Akademie der Wissenschaften, t. 1903-1936 (XII), Berlin 1936, pp. 278.

[28] J. Kużma, O szkołę naukową, humanistyczną, otwartą na świat przyrody i społeczeństwo [in:] H. Moroz (ed.), Problemy doskonalenia systemu edukacyjnego w Polsce, Impuls, Kraków 2008, pp. 118-119.

Consequently, education should be perceived as unselfish sharing of knowledge and the assistance in the endevours to find the scientific truth that are based on three pillars[29]:

- the acquistion of specalist knowledge,
- the habit to use the methods of scientific research
- the insight into the general theory of science through the study of philosophical sciences as well as the development of criticism to the investigation results.

While it is the area of primary and secondary education (the stage of early/primary education and of shaping the attitudes) to provide the fundamentals of knowledge and its implementation, it is higher education (the stage of shaping personality features and knowledge and skill acquistion) that – in line with the assumptions of contemorary economics which treats knowledge/information as a resource – is the main factor of knowledge acquisiton (the knowledge institution). Schools of higher education are the final element that is involved in the development of human capital which is indispensable to the creation of a stable economic growth.

Consequently, „higher education should be a process that provides university graduates with current knowledge" [30]. However, one should disagree with the opinion that knowledge that is shared in the educational process should be correlated with the present demand of the labour market.

Such requirement is not justified when one considers the time necessary to provide a potential graduate with knowledge. Considering the pace of changes on current labour market, the adjustment of the educational path to the needs of employers is impossible. Consequently, higher education should focus on the quality of knowledge that it transfers, improve the tools of access to knowledge and - in line with Humboldt's ideas – incorporate students into the processs of practical application of knowledge, with the emphasis on the practical character of education. With such assumptions, education should both result in the acquisition of knowledge and its practical application. The process is presented in figure 3.

Such understanding of education is identical to the approach of economies whose attributes are knowledge and information which is created, shared and processed.

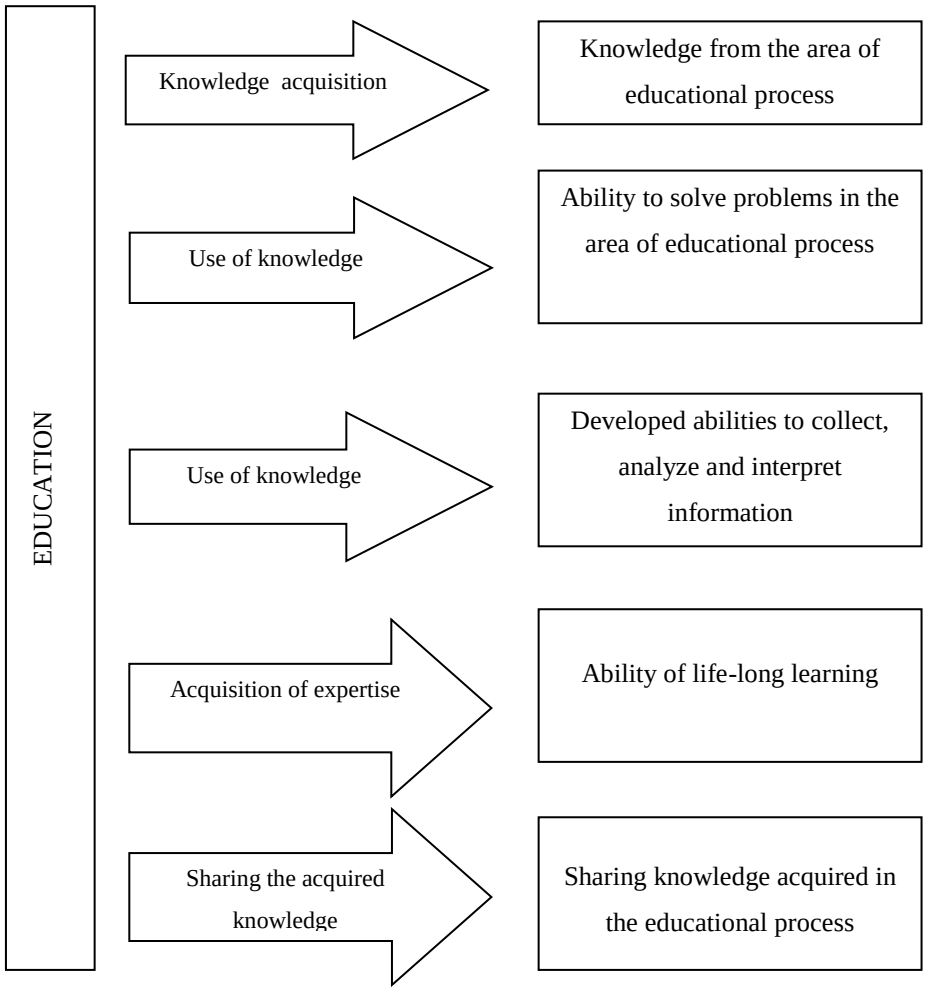
[29] I. Zakowicz, Idea uniwersytetu Wilhelma von Humboldta, Kontynuacja czy zmierzch?, „Ogrody Nauk i Sztuk" 2012, No. 2.

[30] J. Ejdys., Kształcenie na rzecz gospodarki opartej na wiedzy w polskich uczelniach technicznych, [in:] B. Poskrobko (ed.), Gospodarka…, op. cit., p. 208.

Consequently, the development of economies is correlated with production, i.e. gaining knowledge, with distribution, i.e. sharing knowledge and with implementation, i.e. using knowledge in practice.

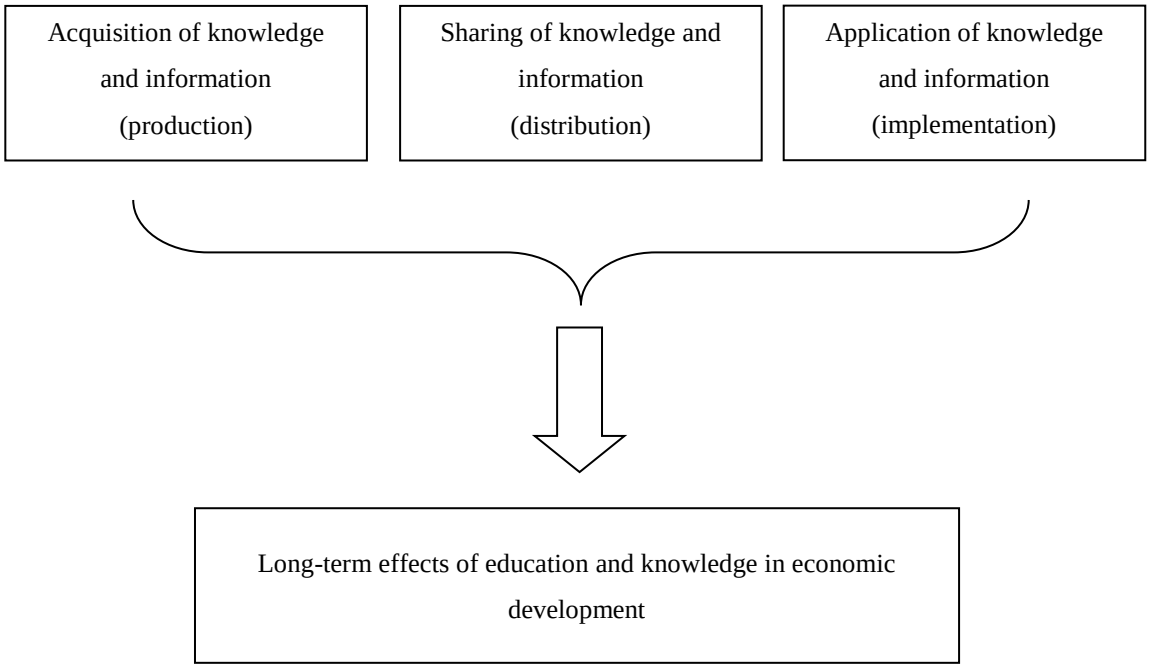
All the stages take place via the educational process; even the use of knowledge in practice must be supported by an adequate theoretical preparation. The phases of the evolution of knowledge in the context of education and its impact on economy are presented in figure 4.

Fig.3. Education and knowledge acquisition and implementation



Source" Author's research.

Fig.4. Education as a factor of economic development



Source: Based on H. Klepacz, E. Żółtowska, *Uwagi o standardach kształcenia w Polsce w świetle wymogów gospodarki opartej na wiedzy* [in:] B. Poskrobko (ed.), *Gospodarka oparta na wiedzy. Materiały do studiowania,* WSE w Białymstoku, Białystok 2011, p. 226.

3. Human capital as the effect of education

Human capital (HC) remains an underestimated concept and it is frequently erroneously defined. However, it is considered as one of the factors of economic growth, i.e. variables that can be treated on sound theoretical basis as the sources or reasons for economic growth[31].

HC is commonly identified with operations that are related to the redistribution of EU funds. The analysis of HC is frequently approached in an inadequate way. This results in an improper use of public help which should have an impact on the improvement of this crucial factor of economic growth whereas HC as the product of education influences substantially economic growth in two dimensions that were mentioned before: it is the growth of GDP and the increase in work effectiveness which is related to the better quality of the workforce available on the market.

[31] A. Jakimowicz, *Modele i prognozy w ekonomii i finansach,* Wydawnictwo Naukowe PWN, Warszawa 2012, p. 81.

The notion of HC appeared in the literature on widely understood economics already at the beginning of the 20th century. However, the theoretical foundations of HC appeared in the works of G.S. Becker, who published the theory of human capital in 1975[32].

Human capital – as a the object of interest of macroeconomics – emerged in the works on economic growth in the 20th century when it was realized that the opportunities for the development of economy and the economic growth factors do not depend only on material "wealth". Due to the technological progress an increasing significance is attached to people, their education, knowledge and skills, i.e. the effects of "life-long learning"; in other words, to everything that is inseparably related to an employee, is not physical in character and that facilitates the increase in work effectiveness and consequently results in the growing pace of economic growth[33].

From the point of view of macroeconomics, the literature on the subject defines HC in two ways. There is a narrow approach which relates HC to knowledge, educational level and competencies (including the social ones) of the labour force that is available on the market. All HC components enable employees to meet production and social targets[34]. In the broad approach, the concept of HC can be extended by issues related to health, fitness and vitality that characterize the society[35]. The two ways of defining HC do not exhaust the debate on the features of this factor of economic growth. This is due to the fact that HC, as an economic and social notion, is subject to continual evolution and extension because it is still being redefined as well as increased by investing in people. Thus, four levels (components) can be distinguished that characterize human capital (Table 1):

- general skills,
- specialist skills,
- technical and scientific knowledge,
- health.

[32] G. S. Becker, Human capital: a theoretical and empirical analysis with special reference to education, The University of Chicago Press, Chicago 1993.
[33] L. Balcerowicz, A. Rzońca, Wzrost gospodarczy: znaczenie, zróżnicowanie, metody badania [i:] L. Balcerowicz, A. Rzońca (ed.), Zagadki wzrostu gospodarczego. Siły napędowe i kryzysy – analiza porównawcza, C.H. Beck, Warszawa 2010, p. 19.
[34] Ł. Jabłoński, *Kapitał ludzki …,* op. cit., p. 103.
[35] Ibidem, p. 103.

Table 1. HC components

No.	Specification	Description	HC source
1.	General skills	Skills to read, write, process information and apply it in the development of science (R&D)	Primary school, family education
2.	Specialist skills	Skills to operate specialist technology, to manage manufacturing processes, etc. There are various levels of complexity.	Secondary vocational schools in the field of basic technologies; higher vocational education in the area of advanced technologies and R&D
3.	Technical and scientific knowledge	Related usually to scientific organizations (e.g. research centers, universities, etc.); the capacity to possess and process organized knowledge and operate analytical techniques that may be used in industry	Second- and third-cycle education, lifelong learning (postgraduate studies), specialist courses and training conducted by university staff and scientific institutes (e.g. Polish Academy of Sciences)
4.	Health (health level)	It determines HC effectiveness; health has an impact on the productivity of both knowledge and workers; the health of people may be a crucial condition for achieving an effective level of knowledge management in a company – every company manages its resources in a rational way and aims at the maximization of economic benefits.	The access to health care by every citizen; the quality of health service; the quality and reliability of the fiscal aspects of health service; the waiting time for health services; employee health care systems – employee regular medical checks

Source: based on A. de la Fuente, A. Ciccione, *Human capital in global and knowledge-based economy. Final report*, Instituto de Analisis Economico, Universitat Pampeu 2002; J. Fitz-enz, *Rentowność inwestycji w kapitał ludzki*, Dom Wydawniczy ABC, Kraków 2001, p. 16.

As it can be concluded from Table 1, HC is an inseparable pro-growth element in the theory of economic growth, both in the macro and micro (development of companies) scale. All elements listed in Table 1 lead to the increase in work efficiency, which also means a potential possibility of the increase in company productivity (the growth in the maximization of economic benefits resulting from an increased work efficiency and effectiveness). These elements are also the result of high quality HC that exists in an economy. The quality is measured by the investigation of adequate relations, e.g. the ratio of the total work force in economy to the number of professionally active persons, life expectancy in a given economy, the desire to improve qualifications (life-long learning), etc.

HC is the effect of education whose final result from the point of view of a knowledge-based economy is tertiary education. The first three elements in Table 1 refer directly to the products of education that shape HC, while the fourth element is also a quality component of HC.

Before starting the considerations on HC as the economic growth factor (multiplier), one should discuss the issue of HC sources and the factors of HC development.

The HC components that concern education, i.e.:

- general skills,
- specialist skills,
- technical and scientific knowledge

are inseparably related to human individuals and are developed in the course of the educational process, including tertiary education (which is a priority for knowledge-based economies). It is the educational system as the agent in the transfer of systematized knowledge that influences the development of HC and its quality. This is so because every key element of HC is the result of attitudes obtained during the acquisition of knowledge, and knowledge – when supported by inspiration – is beneficial in the practical use of the skills possessed. Thus, a relation is visible between HC and its quality and the economy's growth opportunities. One can see already at the stage of defining HC that the identification of HC with a level of education is connected with the availability of qualified work force that is a necessary element for present-day companies to function properly.

One can find in the literature on the subject an opinion that HC should be identified particularly with the knowledge and skills of employees; such approach would legitimize even more the opinion that HC is the effect or even the product of education[36]. The higher the quality of HC, the more powerful the effect[37]. This is due to the fact that in the theory of HC itself, education is considered to be one of the most crucial elements that develop skills of individuals and it is perceived in a broad sense and is not restricted only to formal education (the primary, secondary and tertiary levels). With regard to the employee and the employer, knowledge will be developed in life-long learning.

In contemporary literature on the subject, the understanding of HC as the effect of education and the factor that influences the wealth of nations is commonly accepted and hardly anybody questions the role of education and investment in people as pro-growth factors (i.e. factors that reinforce economic growth).

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[36] J.J. Sztaudynger, *Wzrost gospodarczy a kapitał społeczny, prywatyzacja i inflacja,* Wydawnictwo Naukowe PWN, Warszawa 2005, p. 24.

[37] In the neoclassical concept of economic growth, HC is assessed by real wages in economy; Investigations in 1990s showed a positive relation between the level of education and the salary – employees with secondary education earn approx. 20% more than the ones with primary education; the salaries in the population with higher education is approx. 75% higher than in the population with primary education; Ibidem, p. 24.

Such approach appears also in the microscale – in economic units that attach an increasing importance to the training of their employees since they are treated as a unique company asset. Company development is based on the intellectual capital of employees; consequently it is a common practice to measure the profitability of investing in HC, i.e. the return of investment in HC as the product of education, which legitimizes the thesis that HC is the effect of education[38].

The at least dual character of HC is the basic dilemma and the barrier as regards its measurement. As a result, the measurement of HC is a complex operation. The empirical research on the level and quality of HC applies most frequently the indicator approach (the measures of HC). Chapter I.1 presents the most common definition of HC which, as it was indicated above, assumes that apart from the sphere of education, skills and experience that is inseparably related to employees, a behavioral area can be distinguished, which results in problems regarding the quantification of HC.

There are several groups of the measures of HC[39]:

- measures of HC structure in economy,
- synthetic measures,
- quality measures,
- "educational" measures,
- human economic value added,
- cost approach to HC measurement – human capital cost index.

A detailed characteristics of the measures of HC is given in Table 2. The measures refer directly or indirectly to the concept of HC as the effect of educational process. They treat HC as the product of education and aim at a synthetic presentation of HC and its possible impact on economic growth.

One of the measures describing the condition of HC is the Human Development Index HDI, which is calculated by the UN and was presented in 1990 by Mahbub ul Haq; it evaluates countries in three areas: knowledge, the quality and the standard of life[40]. Numerous

[38] This is particularly visible in highly developed countries where knowledge as the component of entities that create HC is the major production factor of goods and services whose market value is the highest – c.f. K. Porwit, *Cechy gospodarki opartej na wiedzy (G.O.W.), ich współczesne znaczenie i warunki skuteczności* [in:] A. Kukliński (ed.), *Gospodarka oparta na wiedzy. Wyzwanie dla Polski XXI wieku*, Komitet Badań Naukowych, Warszawa 2001.

[39] M. Niklewicz-Pilaczyńska, M. Wachowska, *Wiedza…,* op. cit., p. 55; J. Fitz-enz, *Rentowność…,* op. cit., pp. 37-44.

[40] www.un.org (access: 5 January 2015)

economists consider it as the indicator of human capital or life quality standard. However, it has some drawbacks – first of all it is not an absolute measure. On the other hand, it reflects the development level of a particular country with the use of values other than income itself.

Table2. Measures of human capital

No.	Groups	Description	Measure
1.	Structural measures	This is a group of indexes that refer to the broadly defined HC. The indexes are helpful in the assessment of the quality of HC in economy. They inform potential businesspeople about the available work force resources that can be used to obtain economic benefits and to expand their activities.	Scholarization indexes; the length of education process, the education costs, the structure of education by levels; life expectancy; expenditures on health care; infant mortality.
2.	Synthetic measures	The measures allow for a quantitative analysis of HC from the point of view of the assessment of its share to e.g. GDP or the application of HC in industry development.	The share of education in GDP; the increase of HC during the education process; the component approach to HC.
3.	Education-related measures	The measures are used in the qualitative assessment/analysis of HC from the point of view of the educational process on all levels.	The percentage of literates; the ratio of teachers to the population in the economy; the length of school year; the ratio of the number of teachers to school children/students; the percentage of students in technical studies.
4.	Human economic value added (EVA_K)	The assignment of EVA to a unit of work; the analysis concerns actual work and not the number of workers – the assumption is that full time jobs are analyzed	The index is the ratio of the net profit after tax less cost capital to the number of employees (full-time jobs)
5.	Human capital cost	An attempt of a synthetic evaluation of the impact on HC of the cost of work and additional benefits (for full time jobs), the cost of the remuneration of casual staff and the costs of staff absenteeism and turnover.	The assessment of costs that influence HC (e.g. in a company)

Source: Ł. Jabłoński, *Kapitał ludzki a konwergencja gospodarcza,* C.H. Beck, Warszawa 2012, pp. 110-114; R.E. Lucas Jr., *Wykłady z teorii wzrostu gospodarczego,* C.H. Beck, Warszawa 2010, chapter 1.4; M. Niklewicz-Pilaczyńska, M. Wachowska, *Wiedza – Kapitał ludzki – Innowacje,* Uniwersytet Wrocławski, Wrocław 2012, pp. 55-56.

A detailed characteristics of HC measurement is given in Table 3.

Table 3. Barriers in HC measurement

No.	Specification	Barrier description
1.	Ambiguity of the notion of HC	HC is heterogeneous category, which means that both science and practice have not developed a clear definition of the term (multidimensional character of HC). It is extremely difficult to measure (and particularly to compare) such features of HC as: knowledge, level of skills, personality features and physical features of individuals. Consequently, it is difficult (although not impossible) to conduct a quantitative analysis of HC.
2.	Lack of the explicitness in HC value measurement	This barrier is the effect of item 1 in the table; a varied character of HC components makes it difficult to formulate a synthetic measure that would describe the level of HC and its value, which would make it possible to place the phenomena under investigation both in time and space. The emerging attempts to measure HC still arise controversies.
3.	Lack of an aggregated measure	Basically, the description of HC involves the sum of knowledge, skills and practical experience of an individual. However, in the opinion of numerous researchers, the aggregated value of HC in the economy exceeds the sum of its particular components as the process of synergy occurs in the microscale. Thus, the total level of HC in the economy is higher than the total of its components.
4.	Poor (incomplete) resource of statistical data	Statistical data concerning HC (its development) describe mainly the effects of education or the investment in the educational system in particular economies; they also present the financial data of the investment in R&D, in health care system and the data concerning the products of the educational system (both the qualitative and structural ones). However, very rarely or hardly ever a qualitative assessment is conducted of particular areas that influence HC (e.g. the quality of tertiary education, the quality of the healthcare system or the effectiveness of the investments in R&D – e.g. the number of patents, etc.)

Source: Author's research based on: Ł. Jabłoński, *Kapitał ludzki a konwergencja gospodarcza,* C.H. Beck, Warszawa 2012, p. 108-109; R.E. Lucas Jr., *Wykłady z teorii wzrostu gospodarczego,* C.H. Beck, Warszawa 2010, chapter 1.4.; M. Niklewicz-Pijaczyńska, M. Wachowska, *Wiedza – Kapitał ludzki – Innowacje,* Uniwersytet Wrocławski, Wrocław 2012, pp. 50-55.

The following four groups of the reasons for the difficulties in HC measurement can be concluded from Table 3[41]:

- difficulty with defining HC – it is a category that is not clearly defined in social sciences, economics including;

[41] J. Czekaj, M. Jabłoński, Metodyczne aspekty pomiaru kapitału intelektualnego organizacji, „Przegląd Organizacji" 2004, nr 10; G. Łukaszewicz, Metody pomiaru kapitału ludzkiego [in:] M. G. Woźniak (ed.), Nierówności społeczne a wzrost gospodarczy. Kapitał ludzki i intelektualny, Uniwersytet Rzeszowski, Rzeszów 2005; Ł. Jabłoński, Kapitał…, op. cit., pp. 108-109; K. Pawłowski, Społeczeństwo wiedzy. Szansa dla Polski, Wydawnictwo ZNAK, Kraków 2004.

- difficulty with the selection of units of measurement of HC; in the case of HC there is no clear measure that would make it possible to quantify its quality and/or level in economy;
- a limitation in the assessment of the aggregated value of HC; despite several investigations on the significance of HC in economy, it is difficult to find an aggregated unambiguous formula to measure HC value;
- difficulties with the collection of statistical data – this problem derives from the previously listed issues; HC can be measured in many ways and this leads to problems with the comparison of the results of investigations on the role of HC in economy.

In spite of dilemmas and controversies regarding the measurement of HC, the theory of economics and practical experience of companies and industry resulted in the development of several areas where attempts are made to create HC measures.

Currently, it is assumed that HC is a recognized factor of economic growth, i.e. it is a variable that has strong theoretical and empirical grounds which testify to the fact that HC exerts an impact on GDP. Present investigations in the fields of the theory of economic growth and the modelling of economic growth assume more and more frequently that HC has its place in the modelling of growth processes and, consequently, it becomes increasingly more often a component in the models of economic growth. The idea of the measure is an important aspect of the further research on HC as only the quantitative approach to this factor makes it possible to apply it in economic growth modelling and, particularly, to decompose the rate of DGP growth.

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Abstract

The main purpose of the article is to present knowledge and human capital as a crucial economic growth factor i.e. a recognized variable that substantially influences the GDP growth rate.