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THE MEASUREMENT OF HUMAN CAPITAL METHODS

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Abstract

Nowadays, knowledge and technology is a key factor supporting socio-economic development. Human capital gained crucial importance for the development, and became a major factor of the success. This paper attempts to expose the nature and components of human capital. The aim of this paper is to present the specificity and components of human capital, and to discuss the methods of measurement and the dilemmas of their practical application. Nowadays, the advantage is achieved thanks to unique and difficult to copy resources. One such resource is human capital, whose identification and measurement becomes a key task for both countries and companies.

Keywords: quotation, methods of measurement, monetary value, human capital

JEL classification: A1, C00, D6, D8, O4

Introduction

The company's abilities to create by its development strategies depend on many factors, e.g. range of offer, used methods of management, organizational structure. However, decisive for the company are the resources which can be used. We can divide them into tangible and intangible assets. At present, non-material resources begin to determine to a greater extent than ever before the success of market enterprises. These sources include: experience, information, brand, knowledge, contacts, organizational culture, and the potential of employees. These resources represent a kind of conditioning, in which the company operates and which affects the creation of its strategy. The resources used by the company should not be treated separately, but the possibility of their complementary or substitutional use should be taken into account.

Nowadays, intangible resources are increasingly important. As part of these resources, we can distinguish structural, relational, and human capital (Bombiak, 2011). Structural capital is defined as the expressible and systematic knowledge, which is reflected as an intellectual property, databases, and technical infrastructure. Relational capital (the client) means relations and market relationships with the outside companies, such as customers, suppliers, power centers, and the knowledge set in inter-organizational relations (Ujwary-Gil, 2009). The intangible resources of the company represented by the human factor include also qualifications and competence. These resources are very important because they allow the company to learn new skills and offer development opportunities, which affect the growth of organizational knowledge and the use of business opportunities.

1. The essence of human capital

Nowadays, knowledge and technology is a key factor supporting socio-economic development. Intellectual capital gained key importance for the development, becoming a major factor of success, and thus affecting the transformation of environment and increasingly stronger competition. The implementation of information technology and having a skilled staff intensifies the activity of companies. An educated person, due to the substantial amount of work needed to carry out the activities requiring extraordinary skills and abilities, can be compared to an expensive machine. The quality of human capital has become of special importance for the economies of developed countries, together with the acceleration of globalization, reduced costs, and increased availability.

The definition of capital is derived from the fields of economics and finance, where it refers to the financial goods (wealth, resources, and assets), especially when they are used to

initiate or continue a business activity. In a broad context, capital is a ‘multiplying itself’ value. Such a definition indicates, firstly, that the capital does not have to be only money and goods, but also technology and other intangibles, and, secondly, that not all values are capital, but only those invested, i.e. the ones the possession of which gives certain benefits to the owner. The capital is the source of current and future income. Therefore, employees are also a form of capital. The human capital is the value which, when used, gives to the owner the income as well as the values having the ability to achieve and multiply income and other benefits. The concept of capital in relation to people forces, from the very beginning, its complete evaluation, and a clear division should be made between the part which is put at the disposal of the organization and the one which is undeveloped (Bratnicki, Strużyna, 2001). In the concept of human capital, the responsibility for using the employee potential is on the both sides – the organization and the employee. Human capital is more than human resources, because human capital is a dynamic and qualitative category, suggesting the possibility of creating new values, while the resource is more a statistical and quantitative category. The variety of definitions, on the one hand, complicates the practical use of the concept of human capital, and, on the other hand, definitely allows for the rediscovery of its complex structure.

Table 1. Definitions of human capital

No.	The author	Definition
1.	Baron, Armstrong (2008)	knowledge, skills, opportunities and potential for development and introducing innovations, shown by the people working in the company
2.	Ulrich (1997)	competence multiplied by commitment
3.	Dross (1999)	knowledge and skills acquired in the education process and professional practice, as well as health resources and vital energy
4.	Bontis (2002)	the human factor of organization means connected to each other: intelligence, skills and specialized knowledge which give the organization its specific character
5.	Sajkiewicz (1999)	people permanently associated with the company and its mission, characterized by cooperation skills, creativity, attitudes and skills. They constitute the motor and the heart of the company, without which the impossible becomes its further development
6.	Grodzicki (2003)	knowledge, skills, and abilities of individuals, having an economic value for the organization
7.	Pocztowski (2003)	general and specific features and characteristics embodied in employees, which have a specific value and are the source of future income for the owner as well as for the organization benefiting from the capital
8.	Gableta (1998)	inextricably linked with the physical, mental, intellectual, as well as moral characteristics of human individuals
9.	Miciuła (2015)	the values inextricably inherent in man which cannot constitute income without their participation, such as: skills (knowledge and skills), social skills, attitudes and behaviors towards the organization (motivation and commitment)
10.	OECD (2012)	knowledge, skills, abilities, and other appropriate entity attributes facilitating the creation of personal, social and economic welfare

Source: own elaboration based on: Król and Ludwiczynski (2006); Baron and Armstrong (2007); OECD (2012).

In the context of the mentioned definitions, human capital is the driving force of development.

Figure 1. Components of human capital

Source: own elaboration.

As a result of the analysis of the previous achievements in the field of this subject, another attempt was made to separate the components of the universal human capital, which in this classification constitute: skills, social skills, and attitudes and behaviours towards the organization. Qualifications include mainly knowledge and practical skills, which manifest themselves in education and experience. Social competences, called soft skills, which arise from personality traits, include such elements as: the ability to build positive relationships, the ability to cooperation, communication, and mediation, adapting to new conditions, innovation, teamwork, and the so-called position skills, e.g. the leadership. The third important element constitute the attitudes and behaviors towards the activities of the organization (including motivation, identification with the company, goal orientation, etc.).

2. The Measurement of Human Capital Methods

Measurement (estimation) of human capital causes many problems, and the methods of measuring its values arise today. The availability of statistical data and the development of mathematical methods have had a significant impact on the way of estimating the human capital over the centuries. From the beginning of their history, the methods of measuring human capital can be divided into two basic approaches to the problem (Lanjouw, Schankerman, 2004):

- cost – calculating the values of all the expenses which are an investment in human (Schultz, 1976),
- profitable – the current count value of an income stream.

Unfortunately, the high labour intensity and ambiguity, or the lack of appropriate data and little practical value made it necessary to look for other methods. This led to the development of an approach based on the parameters of education (statistics on the level of literacy, scholarisation, average study time, etc.). Other developed methods were based on the indexes which were constructed on the basis of educational, demographic measurements and other details of the labor market. Another approach included using the skills verification tests (benchmarks) gained in education. However, the tests were useful in the nation-wide scale, and allowed for comparative analyses between countries, as well as the analysis of trends in the science in each country. The current stage includes the development of methods useful for the measurement of human capital in companies, based on the mixed approaches which accurately reflect the state of the market.

Table 2. Measurement of human capital methods

No.	Methods	The essence an approach based on
1.	Retrospective	the cost of manufacturing
2.	Prospective	the cost of manufacturing
3.	Related to retrospective	the education parameters
4.	Aggregate many variables	indexes
5.	Benchmarks	competence tests such as PISA, IALS
6.	Synthetic measures	a mix of approaches to develop a synthetic indicator

Source: own elaboration.

The analysis of human capital indicators describing or having an impact on its development, due to their nature, can be divided into four groups:

- the quantitative-qualitative dimension,
- expensive,
- profitable,
- market.

To the first group should include a whole range of the indicators describing the population, related to the variables such as education, health, or the labor market. The next two groups of indicators refer to the economic determinants of human capital. Cost indicators explore the necessary costs associated with the maintenance and development of human capital, whereas income indicators explore the size of the salaries received in relation to the type of qualification.

The last group of indicators refers to the measurement of the market value of human capital in the production process at a time in specific economic conditions. Human capital can be considered in three stages of the life cycle: creation, maintenance, and use. Building human capital is most widely studied through the analysis of indicators, such as the reproductive ability of a society, an access to healthcare, pre-school, and formal education. Maintaining is primarily associated with ensuring an access to healthcare, lifelong learning, and cultural goods. The use of human capital includes mostly an economic activity, employment, reported patents, or utility models.

The precursor of the approach based on production costs was Engel (1883). In this approach, all the expenses related to the maintenance and education of a person since the moment of the birth to the age of 25 should be considered as ‘production cost’. Engel suggested the formula:

$$C_{xi} = C_{0i} + x C_{0i} + \sum k_i C_{0i} = C_{0i} \left(1 + x + \frac{k_i \times x \times (x+1)}{2} \right) \quad (1)$$

where:

- i – social class ($i = 1, 2, 3$ respectively for a lower, mid-, and upper class),
- X – the age, where $x < 26$,
- C_{0i} – costs in the moment of birth,
- $C_{0i} + k_i C_{0i}$ – the yearly cost of living.

From the point of view of the theory of investment, the weak point of the formula was ignoring the variable value of money in time, and from the point of view of economy, it did not include the non-financial expenditures, which are essential for the ultimate value of human capital. The described approach has some significant disadvantages (Czajkowski, 2012):

- the manufacturing cost of capital does not have to be reflected in the quality,
- capital value is determined by consumer demand and not by the cost of production,
- knowledge and skills become outdated with the progress of technology,
- there is a loss of competence over time as a result of forgetting,
- cost elements and their prices are not clearly defined and reliable within the meaning of the gear ratio of expenditure on the results.

The manufacturing approach to the costs of human capital is important for management at the level of the nation, while the enterprise market is of little importance.

The precursor of the approach based on production costs was Kiker (1966). He suggested the estimation of the human capital of a person by estimating the present value of future earnings reduced by living expenses and corrected according to the life table. This concept was developed in the publication of Dublin and Lotka (1977). The authors took into account the

correction on the employment rate (Farr's (1853) model assumed full employment). According to their formula, human capital at the time of the birth can be written in the model:

$$V_0 = \sum_{x=0}^{\infty} P_{0,x} (E_x Y_x - C_x) / (1+i)^x \quad (2)$$

where:

- i – interest rate,
- $P_{0,x}$ – probability (at the birth) years of experience x ,
- E_x – employment rate for people aged x ,
- Y_x – individual annual revenue from age x to $x + 1$,
- C_x – the annual cost of living.

The model can be converted in order to obtain the formula for the human capital in age a :

$$V_a = P_0 / P_a \sum P_x (E_x \times Y_x - C_x) / (1 + i)^{x-a} \quad (3)$$

Prospective approach is characterised by the following properties:

- the valuation of human capital is expressed in market prices,
- the valuation takes into account the current economic conditions in a given time,
- the data necessary to estimate human capital include the life expectancy tables, salaries, unemployment rate, education structure, and the element requiring estimation – term structure of interest rates (e.g. based on government bond yields) used to discount income streams.

On the other hand, the main disadvantage of this approach is the assumption that the differences in salaries significantly reflect the differences in productivity and the quality of human capital, which is the basis of these methods. The factors affecting the salaries disturbances are many and include, among others, development of a country or region, unemployment, which deteriorates the negotiating position of workers, monopolies on the labor market, and the phenomenon of redistribution of the value added, generated by the employees at lower levels to the higher levels of employees. In addition, the measure of salaries is very susceptible to changes, discounting factors, and other elements of the economic system. On the other hand, it can be concluded that the results show the effects of investment in human capital by raising the level of education. This means the direct relationship between the level of education and the amount of gross salary. This relationship becomes more noticeable with the increase in the level of formal education.

The concept of index was proposed by Mulligan and Sala-i-Martin (1995). It consisted of the approximation of human capital using an index created by dividing an average salary in the economy by an average unskilled worker's salary. The authors proposed a method to reduce the impact of unskilled labor on human capital index according to the formula (Bochniarz, Gugala, 2005):

$$h_i(t) = \int w_i(t, s) \times \eta_i(t, s) / w_i(t, 0) \quad (4)$$

where:

- $w_i(t, s)$ – salary of employee, who educating s -th years in i – this country,
- $\eta_i(t, s)$ – percentage of people educating from s years in i – this country,
- $w_i(t, 0)$ – salary of employee no having education in i – this country.

In practice, discrete forms of the above formula are used depending on the available time series, for example (Florczak, 2007):

$$h_i = \sum w_{i,e} \times L_{i,e} / w_{i,0} \quad (5)$$

where:

- $w_{i,e}$ – salary in i – this country of an educated worker having e – level of education,
- $w_{i,0}$ – an average employee's salary with a minimum basic education (or no education) occurring in this country,
- $L_{i,e}$ – percentage of the labour force members who are the holders of education on e – level in i – this country.

The approach proposed by the authors has some deficiencies (Wachtel, 1997):

- using the salary of an unskilled worker as the denominator is sufficient to obtain a comparable indicator on international scale. In addition, the same period of study in different countries is not reflected in the equal increments of the quality of human capital,
- the structure of salaries does not have to follow the structure of the value added generated,
- the method ignores the impact of factors other than formal education (including vocational courses, training, etc.) on the formation of human capital.

Also, it does not take into account informal education, or the differences between the different directions of education. On the other hand, this is undoubtedly the next step in the improvement of prospective methods, and the imperfections result from the complexity of the

problem and an exploration stage of searching for optimal solutions, which is a natural step in the development of a new field of knowledge.

Another method of measuring human capital values are based on quantitative and qualitative indicators. The approach based on the parameters of education is a method similar to the retrospective method (cost) because it uses some indicators estimating educational investments. An important difference is shifting away from the expression of human capital in monetary terms. In the studies belonging to the described mainstream, the following variables are used in order to estimate human capital (Strużyna, 2007):

- literacy,
- education, the percentage of learners calculated in relation to the population in a certain age range,
- the percentage of people not completing education at a given level,
- the average duration of education, etc.

The natural process of the development of these methods was the appearance of qualitative research in the form of competence tests (e.g. PISA), the results of which are used to determine the quality of education at a given level, and to compare the relationships between countries. The above indicators are indirect measures of educational investments that are considered to be the main element of the formation of human capital.

The aggregating methods of many variables (the approach based on indexes) have developed from a desire to embrace the comprehensive complex issue of human capital, and this group of basic values (indicators) include, among others, such elements as (Anger, 2007):

- demography – population, partition, age, etc.,
- health – health condition, access to healthcare, average lifespan,
- education – the level and quality of education,
- labour market – salaries, unemployment status,
- modern qualifications – technology and innovation, i.e. skills of using new technologies.

An example based on the index of modern qualification is a method based on the so-called hidden factor of Messin and Ahmed (2009). The proposed method is a pioneering approach in the area of human capital measurement, modelled on the concept developed for the purpose of measuring the quality of patents, so that to bring together in a single indicator both the level of technological advancement as well as their economic value (Messinis, Ahmed, 2009). The authors intend to include in the proposed index both the quality of education and the market valuation skills. For the construction of the index for the hidden variable, they use the analysis

of the common factors (a saving for a single common factor, the character developed on the basis of the authors' own elaboration and tests) (Baron, Armstrong, 2008):

$$I_{k,jt} = \mu_k + \lambda_k \times h_{jt}^s + e_{k,jt} \quad (6)$$

where:

- $I_{k,jt}$ – a natural logarithm of k – this indicator for j – this country in year t ,
- μ_k – an average value k – this indicator,
- λ_k – the load of a common factor for k – this indicator,
- h_{jt}^s – a common factor,
- $e_{k,jt}$ – an idiosyncratic error.

The common factor is an unobserved variable describing the human capital of the country. For the calculation, the indicators are used describing: the value of machinery and the equipment for the human unit, books and scientific publications, and patents. The results obtained by the authors indicate the relationship of these indicators with the dynamics and the level of GDP in the country. Other indexes and indicators are calculated according to specific formulas on the basis of the available statistical data. However, due to the properties described above, the index approach is often not able to identify how in reality a socio-economic parameter changes. Despite the problems which occur in all the methods, there are also arguments for using the indexes. These include the following considerations:

- variability in income resulting from education,
- predispositions not associated with knowledge,
- desactualization of skills,
- mismatching of skills and education to the profession.

The next step in the development of measurement methods of the value of human capital was the process of merging the values (indicators) in order to achieve an aggregate description of the phenomenon as a whole. Depending on the degree of aggregation, there may be synthetic measures, particulars, and symptomatic. These measures complement each other in the description of human capital development. Using one of them depends on the availability and quality of information, the status of the development, and the work reliability of statistical reporting services in the country. Synthetic measures are characterized by a mix of approaches used to develop a comprehensive coverage of the problem defined by the indicator. However, despite their prevalence and recognition as the best so far, they do not reflect all the phenomena related to human capital, among others, due to the loss of some information in the process of

determining and a too general measurement method of the described phenomena. An example of a synthetic measure is “The Lisbon Council Human Capital Index” (Fraumeni, 2011).

Conclusions

The measurement of human capital, despite the availability of suitable theoretical models is a serious problem, due to the lack of the sufficient detailed data, unreported by the state statistical institutes in the areas of economic activity, or the imperfection of the measurement methods. The complexity of the problem has forced researchers to use indirect measures, with a different theoretical and statistical quality. Works are being conducted to standardize the national accounts of human capital based on a set of indicators, with titers and economic interpretation. The analysis of all the aspects of human capital cannot be based on one measure. Therefore, the current development of the measurement methods of human capital seems to be the right direction for determining the appropriate test methods and drawing conclusions. A set of measurements must be used which will create synthetic measures depending on the purpose of the study, because the choice of the appropriate method of measuring human capital depends mainly on the purpose for which the results are used. The historical development of the measures of human capital is linked to the national economy, which was shown in the article in the description of the development of measuring methods. However, nowadays, indexes are used and new concepts are created for the development of the measures of human capital for the enterprises operating in the knowledge economy, for which this capital began to play a key role (Urbanek, 2011). An example is the indicator of intellectual value added (VAIC), which calculates the efficient use of human capital based on the cost of employees (Beyer, 2013). According to the classification presented in the article, the estimation based on cost was the oldest concept at the national level. Therefore, we can determine the prospects for the development of human capital measures at the enterprise level, because the current results are of little practical value and do not show the importance of human capital for the company. Undoubtedly, the measuring components of human capital is a complex issue, which is confirmed by numerous scientific studies, waiting for applicable solutions.

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