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Human Capital or Human Beings? Analysis of Added Value and Employee Efficiency between SME's and Large Companies

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Abstract

The aim of this research is to illustrate the differences in perception of human capital within companies in the sector of commercializing construction materials. The analysis focuses on the differences between SME's and large companies that activate in the same industry and within a similar cultural and geographic context. For the results to be valid, we have analyzed the productivity of human capital within 1.100 companies for a period of eight consecutive years. The companies activate under the same geo-political terms and are evenly distributed within the territory of Romania. In total, we have 8.800 observations collected annually (2010-2018), represented by two variables: number of employees and turnover of the company. Using a density-based spatial clustering of applications with noise algorithm also known as DBSCAN, we have managed to identify five subgroups that are not homogeneous in terms of employee productivity. Our findings suggest that the indicator analyzed could vary by more than 100% and it is size dependable.

Keywords: human capital; productivity; added value of employees, workforce, labour.

JEL Classification: J24.

1. Introduction

Traditional research is based on the analysis of human capital as a factor of production and investment in non-material assets. The problems of training and efficient use of people's productive qualities have been studied within the framework of human capital theory. The approach to human productive capacities as a result of investments, the accumulation of skills capable of bringing income have been reflected in the works of scholars: W. Petty, A. Smith, D. Ricardo, J. Mill, K. Marx, F. List, L. Walras, A. Marshall, etc. In our view, the notion of human capital is conditioned by the emergence and development of interaction between production and consumption, and, moreover, the metric proposed is based on a quantitative

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measure that evaluates the efficiency of human capital. These values are determined by analysing the financial results of a company in close relationship to the size of the company and the efficiency of human capital. The proposed measured human productivity is calculated as total turnover of a company over the number of employees. Using this technique, we have obtained an "average employee turnover" according to company size.

The aim of the paper is the in-depth investigation of the methodological theory of human capital and its role in the process of formation of the commerce economy of Romania. We are trying to demonstrate the importance of human capital in the process of added value and hence the necessity of developing the innovative economy through analysis of human capital efficiency.

In order to achieve the purpose of the research, the following questions were proposed:

a. What is the productive capacity of an individual from a financial perspective in the given sector (commercializing construction materials)?
b. Are there any differences between productive capacity of individuals according to company size?

Our findings suggests that the employee efficiency of companies that activates in the same industry and within similar cultural and geographic context (Romania) could vary by more than 100% and it is dependable in size. Using DBSCAN, we have managed to identify five subgroups that are not homogeneous in terms of employee productivity. This may suggest that according to company size, there could be entry barriers and technological advancements that can be translated into improved employee productivity.

Although many avenues of research opened up by human capital theory is the "capability approach", which is an application of human capital theory, but which is not limited to addressing the problem exclusively through the labour market, but includes the analysis of individuals' access possibilities in other markets, such as the housing and health care markets, the issue with the human capital theory is that it focuses mostly on the inputs included in developing human capital (e.g., The Organization for Economic Cooperation and Development OECD, (1998) defines human capital as "... productive resources concentrated education, skills, competencies, and knowledge" or "... human competences and skills generated by investment in education and health".), but fails to measure the output of an individual. Because a society is composed of large numbers of individuals that activate under the same conditions, the GDP per capita offers a decent metric in regard to economic development of a society, but the result is homogenised over the industries. The metric that we have proposed looks at one industry and analyses differences of human capital in closed relation to company size.

Aggregate human capital at the national level has been used in particular to characterize the level of development of a country or to explain its economic growth (Robu, Anghel, Șerban, 2014). Poverty can lead to the degradation of the quality of human capital, thus the need for development. Some academics (Hackman, 1999) regard human capital as a means of preventing impoverishment

by making education systems more efficient but especially by investing in lifelong learning.

Specialists addressing the issue of economic growth and development agree with the idea of that as soon as a certain level of human capital accumulation is reached, it becomes more productive, correlating positively with growth in employment rates.

The issue of investment in human capital concerns today all countries competing for progress and welfare, but even more so in emerging economies. Human capital emerges as a complementary factor to other factors of economic growth (Mankiw, Romer, Weil, 1992; Romer, 1986). Investment in human capital, i.e., education, training, and health, is aimed firstly at the professional-scientific training of available human resources and, secondly, on adapting to the structural changes in the economy brought by scientific and technical progress, based on efficiency criteria.

Human capital development strategies focus on the size of capital resources and operational needs of the national economy and on ensuring that human resources use these resources efficiently. They will contribute to the formulation of development strategies by determining future human capital requirements and identifying ways of the best use of this capital, whereby available human capital will support the implementation of economic development plans. But it should be stressed that there are certain restrictive limits in the use of human capital, such as shortage of qualified personnel, difficulties of labour force, low labour productivity, flexibility and adaptability of the labour force, and insufficient flexibility and adaptability, or a work climate that discourages cooperation and personal commitment.

2. Context

The concept of human capital was theoretically founded in the 1960s by the American economist Th. Schultz and G. Becker (Nobel Prize winners in economics: the former in 1979, the latter in 1992). They showed that spending to increase an individual's education increases his or her productivity and hence future income - hence the term "human capital".

In the current literature, there are many definitions of this concept. According to the definition in official OECD publications, human capital is "the sum of knowledge, skills, competencies, and individual characteristics that facilitate the creation of personal, social, and economic well-being".

An important application of the concept of human capital is to deepen the analysis of economic growth. Thus, economic growth theory was initially based on a quantitative approach to the role of labour. For example, in economic growth models based on the Cobb-Douglas production function, the factors capital and labour have an elasticity of substitution equal to 1 (to achieve the same volume of output, a 1% reduction in capital must be compensated by a 1% increase in labour). In these models, labour is considered a homogeneous factor of production; it depends on the number of the working population and on people's behaviour (creativity, performance, etc.), but it influences the rate of economic growth only marginally, since workers are mostly unskilled and therefore only have a role as undifferentiated labour.

The use of the Cobb-Douglas function in empirical investigations of economic growth has made it possible to measure the relative action of capital and labour on the volume of total output. However, this tool has proved insufficient to explain the high rate of economic growth in Western countries in the early post-World War II years and continued into the 1950s. As a result, some economists began to point out the limitations of this approach. For example, Solow (1956) (winner of the 1987 Nobel Prize for economics) introduced a third factor into the Cobb-Douglas function, namely the "residual factor", determined by technical progress, scientific knowledge, the creative capacity of people, etc. This is therefore an "endogenous" factor in relation to the economic growth process, but it incorporates a number of "exogenous" elements which are likely to increase the effectiveness of production processes. In this way, a qualitative approach to the labour factor has been prefigured.

Today, this qualitative approach is predominant in the literature because it allows the role of internal conditions of economic growth to be highlighted. Often referred to as "technical progress", the residual factor reflects the importance – in contemporary economies – of scientific knowledge and technical and organizational innovations, which increase the efficiency of using other factors of production, primarily labour productivity. Therefore, theoretical analyses and empirical studies of technical progress have helped to clarify the role of human capital in economic growth.

The idea that education is not an investment to increase human capital, but a means to create positive externalities in society, was put forward by M. Spence, who is one of the main promoters of the application of what is called "signal theory" in the study of education. According to this theory, education is not only to increase the productivity of individuals but primarily to select the most productive individuals. The social usefulness of an education system which, although costly, does not increase labour productivity can therefore be questioned.

The 'capability approach' is a scientific approach primarily in terms of individual benefits. These advantages are manifested in the capacity of human beings to do many things that are considered important for life. Sen's work thus places at the heart of the economic development process the growth of the individual's capabilities: a set of real freedoms that enable him to use his personal endowments and control his life. In doing so, the scholar (winner of the 1998 Nobel Prize in Economics) takes into account, in addition to pecuniary wealth, all possibilities – economic, social and political opportunities offered to individuals by the society in which they live, opportunities that are directly linked to their health, their level of education, their life expectancy, and the possibility of making their voice heard in local and national debates.

Schultz proposes a way of measuring human capital that takes into account variables likely to improve those attributes of individuals that are likely to lead to higher wages in the labour market: infrastructure and health services, which influence the life expectancy and vitality of individuals; vocational training (including on-the-job apprenticeships) organized by enterprises; the education

system (from primary schools to universities); adult education and training programs organized outside enterprises; migration of individuals and families to find work.

Schultz (1959) concluded that this scarce resource, human capital, must be developed by appropriate means. This confirms Acemoglu (2012) and Acemoglu, Robinson (2019) perspective that countries emerge from poverty if and only if they have adequate economic institutions.

An important contribution of Becker (1964) is the distinction he makes between general human capital and firm-specific capital. General training, which is carried out in the public education system, determines the level of productivity of individuals in all the firms in which they will work, because it is closely linked to the individual worker and can be exploited by him or her in the whole labour market (domestic or international).

Businesses are therefore little interested in bearing the costs involved in an individual's general training, as the individual may well use his or her knowledge in another business, which is prepared to pay better. The firm in question may be interested in financing such specialist training because its managers believe that they have a reasonable chance of getting a return on their investment: the wages they will pay the worker after the end of his training period will be higher than the wages of workers in other firms, which gives the worker an incentive to stay with the firm that trained him. However, this wage will still be lower than the amount of the production bonus obtained by the company as a result of the worker's increased skills. The difference between the value of the additional production achieved by the worker and the wage paid to him represents the return on the investment made by the undertaking in his training.

An important feature of advanced economies is the self-sustaining nature of economic growth. This puzzling phenomenon can be better understood using the conceptual and analytical apparatus provided by human capital theory, which, as we have shown, allows technical progress to be treated as an endogenous factor of economic growth. Indeed, technical progress and innovations (as measured by overall factor productivity) are the creations of scientists, researchers, engineers, etc., trained through investment in human capital.

3. Research Methods / Questions

The approach we have used aims to illustrate the differences in perception of human capital within companies in the sector of commercializing construction materials.

The analysis focuses on the differences between SME's and large companies that activates in the same industry and within similar cultural and geographic context.

For the results to be valid, using the software termene.ro, we have analysed the productivity of human capital within 1.100 companies for a period of eight consecutive years (2010-2018). The companies activate under the same geo-political terms and are evenly distributed within the territory of Romania. In total we have 8.800 observations collected annually, represented by two variables: the number of employees and turnover of the company. We have used a density-based spatial

clustering of applications with a noise algorithm, also known as DBSCAN, with the help of Python.

The DBSCAN algorithm can identify clusters in large spatial data sets by looking at the local density of database elements, suggesting one core parameter. The DBSCAN can also determine what information should be classified as noise or outliers. By using the density distribution of nodes in the database, DBSCAN can categorize these nodes into separate clusters that define the different classes. Compared to other clustering algorithms, DBSCAN can find clusters of arbitrary shape, as can be seen in Figure 1.

Figure 1. Comparing 10 clustering algorithms on *dummy* datasets

Source: https://scikit-learn.org/.
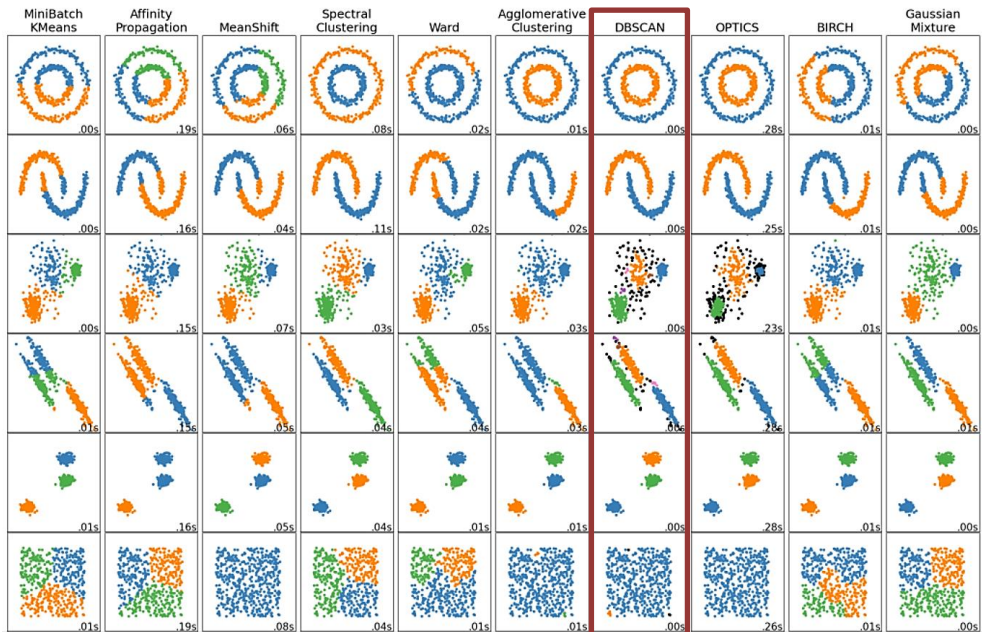
Its computing process is composed on six rules or definitions, creating two lemmas:

Definition 1: (*The Eps-neighborhood of a point*) For a point to belong to a cluster it needs to have at least one other point that lies closer to it than the distance Eps.

$N_{Eps}(p) = \{q \in D | dist(p,q) < Eps\}$

Definition 2: (*Directly density-reachable*) There are two kinds of points belonging to a cluster; there are border points and core points.

Definition 3: (*Density-reachable*) A point p is density-reachable from a point q with respect to *Eps* and *MinPts* if there is a chain of points $p_1…,p_n$, $p_1=q$, $p_n=p$ such that p_i+1 is directly density-reachable from p_i.

Definition 4: (*Density-connected*) A point p is density-connected to a point q with respect to *Eps* and *MinPts* if there is a point o such that both, p and q are density-reachable from o with respect to *Eps* and *MinPts.*

Definition 5: (*Cluster*) If point *p* is a part of a cluster *C* and point *q* is density-reachable from point *p* with respect to a given distance and a minimum number of points within that distance, then *q* is also a part of cluster *C*.

Definition 6: (*Noise*) Noise is the set of points, in the database, that don't belong to any of the clusters.

Lemma 1: A cluster can be formed from any of its core points and will always have the same shape.

Lemma 2: Let *p* be a core point in cluster *C* with a given minimum distance (*Eps*) and a minimum number of points within that distance (*MinPts*). If the set *O* is density-reachable from *p* with respect to the same *Eps* and *MinPts*, then *C* is equal to the set *O*.

Inputs: T*urnover* for a period of one year; average *number of employees* for one year.

Outputs: Employee productivity (employee turnover) compared to company size (number of employees).

4. Analysis of Employee Productivity

In the graph below, we have illustrated a scatter plot for companies that have between 50 and 3050 employees. On the X axis is represented the average number of employees and on the Y axis is represented the average employee productivity obtained by dividing the yearly turnover to average number of employees for each company, for a period of eight consecutive years (2010-2018). Using this method, we can have a holistic image of the variation of employee productivity in relation to company size.

Figure 2. Average employee productivity for large companies
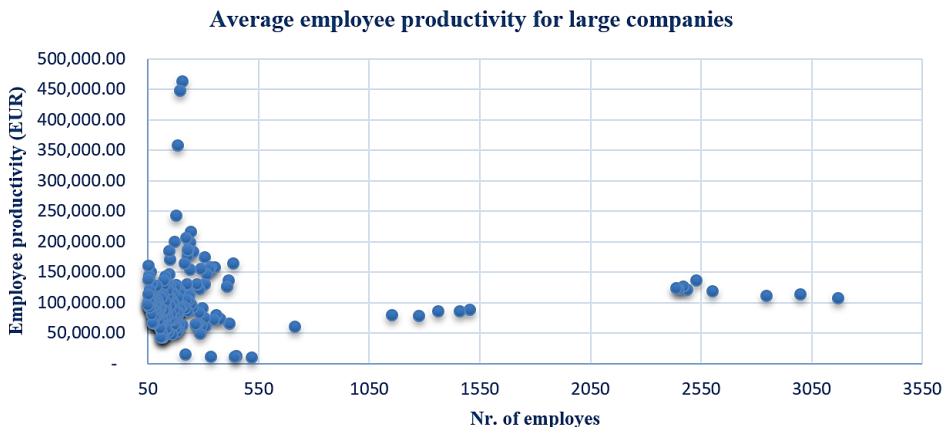
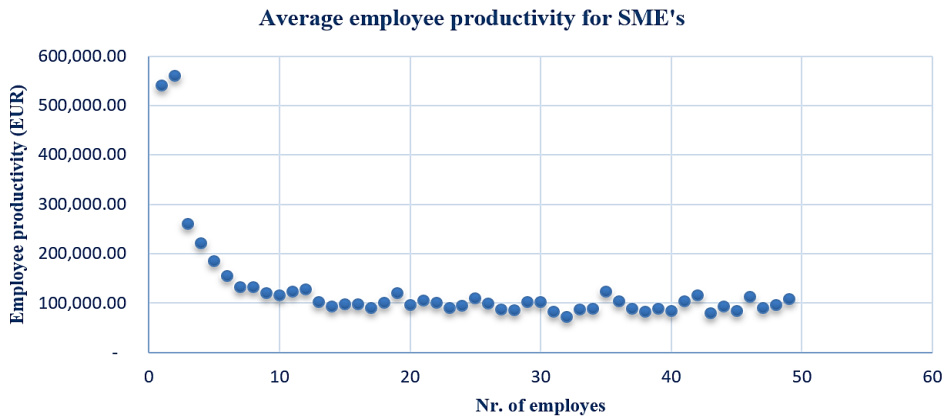*Source:* Personal research and analysis.

For the companies that have between 50 and 3050 employees we can distinguish three groups using DBSCAN.

The first cluster, which is represented by the majority, is composed of companies that have between 50 and 500 employees. Within this cluster, the median value of employee productivity is 91k EUR/year.

The second cluster is represented by companies that have between 500 and 1500 employees. Within this group, the median employee productivity is 78k EUR/year; however, due to a reduced number of companies that meet the criteria of the above-mentioned cluster, our findings suggest that there could be a penetration barrier that requires a different business approach. The third cluster is represented by the companies that have between 1500 and 3000 employees. Within this cluster, the median value of employee productivity is 118k EUR/year.

In the graph below is illustrated a scatter plot for companies that have between 0 and 50 employees. On the X axis is represented the average number of employees and on the Y axis is represented the average employee productivity obtained by dividing the yearly turnover to average number of employees for each company, for a period of eight consecutive years (2010-2018). Using this method, we can have a holistic image of the variation of employee productivity in relation to company size.

Figure 3. Average employee productivity for SME's

Source: Personal research and analysis.

For the companies that have up to 10 employees, the average productivity has a descending trend ranging from 560k EUR to 116k EUR with a median value of 184k EUR/year. This is an overall 84% increase in employee productivity in comparison to the companies that have between 10 and 50 employees. In other words, our findings suggest that there could be an exogenous effort led by the owner of the company that is translated in increased overall employee productivity. However, as the company size exceeds 10 employees, the overall productivity ranges from 72k EUR to 128k EUR with a median value of 100k EUR/year. In this scenario, we can observe that the effort input of the owner is homogenized due to the increased number of employees. For this reason, we can consider this indicator a representative one for SME's activating in this industry.
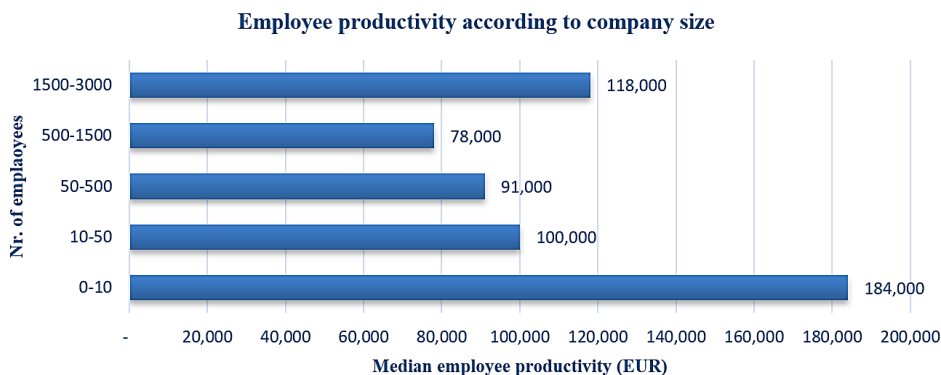
5. Findings

In order to fulfil the purpose of the research, we have answered the following questions that have been proposed:

a. What is the productive capacity of an individual from a financial perspective in the given sector (commercializing construction materials)?

b. Are there any differences between productive capacity of individuals according to company size?

Our findings suggest that there is a large disequilibrium within a homogeneous industry according to employee productivity. Due to exogenous factors, the discrepancy within the same context measured by quantitative indicators varies by more than 100%. Within the first group (0-10 employees), the median employee productivity is 56% larger compared to the fifth group (1500-3000 employees). This result was unexpected, but could be translated in a surplus of effort led mostly by the owner, or some type of embezzlement for unreported employment. This could be a common practice for small companies that activate in an emerging economy.

The second group (10-50 employees) has a median employee productivity of 100k EUR/year. Within this group, the overall productivity of employees is 9% larger than the third group (50-100 employees), and 28% larger than the fourth group (500-1500 employees). However, when we compare it to the fifth group (1500-3000 employees) the representative value for SME's is 18% lower than the employee productivity of large companies.

Figure 4. Employee productivity according to company size

Source: Personal research and analysis.

Our findings suggests that the indicator analysed of companies that activate in the same industry and within similar cultural and geographic context could vary by more than 100% and it is size dependable. Using DBSCAN, we have managed to identify five subgroups that are not homogeneous in terms of employee productivity. This may suggest that according to company size, there could be entry barriers and technological advancements that can be translated into improved employee productivity.

6. Conclusions

The conclusion that emerges from this research is that within the same industry, within similar cultural and geographic context, the human capital is exploited differently, contrary to previous beliefs. Thus, analysing an industry as a homogenous group could result in misleading indicators. Our findings suggest that small companies (< 10 employees) tend to have better metrics, in our case, the median employee productivity is 56% larger compared to the fifth group (1500-3000 employees). This result was unexpected, but could be translated in a surplus of effort led mostly by the owner, or some type of embezzlement for unreported employment. This could be a common practice for small companies that activates in an emerging economy.

For this reason, when an industry analysis is performed, our recommendation for further studies is to pay adequate consideration at the number of employees of that specific group of companies and see if they illustrate aberrant values in comparison to the other groups.

"Through this prism, education is not just a means to other ends (income, pleasure, prestige, etc.), but an end in itself, whose multiple ethical and social dimensions stem from the fact that it enables human beings to be free, to grow and evolve as a species."

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