

## **How does the intangible asset affect company efficiency? Evidence from the listed companies in Serbia's meat industry**

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### **Abstract**

With an intangible asset becoming the most valuable part of nowadays businesses, there is an unanswered question – how much does the human capital as part of the intangible assets affect the efficiency of the meat industry in the Republic of Serbia? By analyzing the top 45 Serbian meat companies during the 5-year period (2013-2017), the authors used the DEA method to measure the efficiency of the representative companies and compare it to the HCVA index. The results indicate that the companies with a greater level of using human capital had higher efficiency indicators. By analyzing the literature, it was shown that there is a lack of research in this field. From the originality point, this is the first paper that examines the impact of human capital on the financial performance of the Serbian meat industry.

**Keywords:** Intangible assets. Human capital. Meat industry. Data envelopment analysis. Republic of Serbia.

### **1. Introduction**

The meat industry globally, but in the Republic of Serbia as well is the relevant agricultural branch. With the growth of the overall population and the growth of meat consumption, the meat industry shows positive trendlines (Ali, 2007; Privredna komora Srbije, 2017). In order to achieve sustainable competitiveness, the companies in this industry, but in other industries as well need to manage the intangible assets properly. There are many studies which have shown a positive correlation between company's business performance and its intangible assets from the different perspectives and industries, including the agriculture (Bontis, 1998; Wang, 2008; Sharabati, Jawad, & Bontis, 2010; Ferraro & Veltri, 2011; Mondal & Ghosh, 2012; Henri, Paavo, Mika, & Aino, 2014; Sardo & Serrasqueiro, 2017).

This paper focusses on Serbia as the representative of the economically developing and emerging (EDE) countries. By having a strong role in the domestic economy, the meat industry represents more than 12% of the total GDP of Serbia (Bogdanov, 2007). Nonetheless, there is a decreasing trend of experts in this field (Privredna komora Srbije, 2017) which impose a question - How important is the human capital for the companies which operate in the meat industry?

Therefore, this research shows interest in the relationship between human capital as the key representative of intangible assets and the efficiency of the meat companies in the Republic of Serbia. The research consists of the systematic approach, comparative analysis of the existing literature, as well as the author's research. By taking the inputs from a sample of the top 45 meat companies in Serbia based on the total sales through the five-year period (2013-2017), the authors have analyzed the financial statements and financial statements notes, as well as the macroeconomics trends in order to show the impact of human capital on the overall successful results. By evaluating the efficiency of the meat companies, the authors used the DEA method. In particular, the authors have used six indicators from the financial statements: *FTE*, *sales*, *capital*, *assets*, *salary costs*, *total costs*. The number of full-time employees, total costs, salary costs and sales are only some of the indicators which could be used to estimate the human capital and its efficiency. The indicators were adopted from the literature on human capital measures (Hermanson, 1964). By using these indicators to calculate *HCVA* as one of the overall accepted human capital indicators, the companies could measure the value of human capital. This is further explained in the paper. Even though the sample used in this research is not big, the focus was only on the top representative companies.

Consequently, the aim of this paper is to obtain the relevance of human capital as the most valuable part of assets, by analyzing the sample of Serbia's top 45 representative companies. Although some researches point out that there is a huge benefit of human capital and its influence on the overall business performance, there is a lack of the existing literature focusing on the meat industry, especially for the EDE countries. Based on this and other related researches, the companies, but the governments and educational systems as well might get an input for the strategic decision making in the agricultural industries.

## **2. Literature Review**

### **2.1. Human capital as the key driver of the intangible assets**

Intangible assets have become the most valuable part of every business, especially in the transition from the industrial to the information revolution. Many authors argue that it represents a vital resource of any organization (Hermanson, 1964; Robinson & Kleiner, 1996; Edvinsson, 1997; Bontis, 1998; Kaplan & Norton, 2004; Damodaran, 2006). The term intangible assets also relates to intellectual capital, brand, patents, recipes, computer software, licenses, franchise, and others (Epstein, Barry J., Mirza, 2006).

Based on the theoretic approach, intangible assets represent the part of the company's assets which is hard to measure and estimate. Intangible assets have nowadays become essential for generating overall business performance. Intangible resources secure future benefits and do not have any physical or financial embodiment. By proper managing the intangible assets, companies can generate better business results, including sales, EBIT, EBITDA and other profitability ratios (Dženopoljac, 2011). Companies need to identify and understand the intangible assets structure in order to manage it. This could apply to other industries as well.

Norton and Kaplan (2004) discussed the importance of intangible assets as well. According to their research, more than 75% of the total assets consist of intangible resources. Therefore, the transition from the physical to the intangible assets is a key determinant for the success of businesses in many industries.

Sveiby (1998) has given a major intangible assets structure by dividing it into the human resources (skills and competences), the internal structure (patents, licenses, recipes, software) and external structure (stakeholders relationships). Besides Sveiby, the other authors have also proposed the structure of the intangible assets. Each of these structures

considered human capital as one of the most important intangible parts of the company's assets. (Edvinsson, 1997; Roos & Roos, 1997; Wingren, 2004).

The importance of human capital was also highlighted in studies by Hermanson (1964) and Wang & Chang (2005). Hermanson, (1964) has researched the value of human capital by analyzing the efficiency of using the workforce. These authors have also agreed on using several indicators such as the productivity and efficiency of the workforce, seniority rate (number of experts with the specific and specialized knowledge in the industry), learning and development costs, knowledge and skills of employees and rate of fluctuation (Sveiby, 1998). Considering the meat industry in Serbia, there is a lack of experts in meat production, maintenance and serving. Therefore, the government and the companies have organized a special education for all students specializing in this area (The Chamber of Commerce of Serbia, 2017). With the lack of experts in this field, skills and knowledge are becoming an important part of human capital.

Speaking of the meat industry in general, intangible assets with all of its elements is crucial for the success of the businesses in this domain. Food safety, animal welfare and the environment through licenses and certifications represent the intangible part of meat industry assets (Perez, de Castro, & Font i Furnols, 2009). In order for the meat manufacturer to have a competitive price which according to Perez et al. represents a tangible attribute, the manufacturer has to have proper management and know-how to provide the optimal supply chain.

The efficiency of using intangible resources might affect the overall business of the company according to several authors (Edvinsson, 1997; Sveiby, 1998; Chareonsuk & Chuej, 2008; Marrocu, Paci, & Pontis, 2012). Some authors point out that foreign investments affect company efficiency as well. The study performed in Turkey has shown that the companies with foreign capitalization have higher efficiency ratios than the companies with the domestic capital (Basti & Bayyurt, 2008). In a study performed in Brazil, it was presented that there is a great importance of managing the costs in the meat industry, especially in inventory management (Silva & Scarpin, 2010). On the revenue side, price management also plays an essential role. Furthermore, higher volatility in the meat industry is destructive for the meat producers (Yıldırım, Türkten, & Boz, 2016).

All in all, the company's performance measurement usually relies on efficiency and profitability indicators. Specifically, efficiency represents the relation between the outputs (mostly presented as the economic results) and the inputs (resources). It affects the

sustainability and success of every business (Martić, 1999). Thus, it is necessary to have positive efficiency indicators.

Throughout this paper, the focus will be on the efficiency indicators, which show the success level of utilizing the resources (human capital, physical assets, etc.).

## 2.2. Business case of the meat industry in the Republic of Serbia

Globally, the meat industry has a positive growth. It could be said that the overall growth of the population is in a correlation with increased meat consumption. However, the researches have shown that the meat consumption per person has increased on average, as well. In 1961, the daily meat consumption per person was 60g of meat in average on a global scale, while in 2011. it reached 80g of meat (Sans & Combris, 2015).

The meat industry in the Republic of Serbia has pretty much the same positive trend of consumption. Considering Serbia's GDP, GDP per capita and meat consumption, it could be said that there is a positive correlation (Privredna komora Srbije, 2017).

By looking at the GDP and GDP per capita, there could be seen a similar trend as the trend of meat consumption (RZS, 2018).

**Table 1: Correlation between GDP of the Republic of Serbia and meat consumption**

	<i>Total meat consumption</i>	<i>GDP per capita</i>	<i>GDP</i>
Total meat consumption	1		
GDP per capita	.842441815	1	
GDP *in billions	.854765918	.99810542	1

Source: The authors' calculations

Besides the strong correlation between the GDP, GDP per capita and meat consumption in the Republic of Serbia, there are other factors that could lead to a more successful meat industry, such as the standard of living, national average salary, inflation rate and other.

Even though there is an increased consumption of meat in the Republic of Serbia, followed by an increased meat production, there is a deficit of the workforce, especially the butchers and meat experts. Therefore, the Government of the Republic of Serbia has proposed new programs of education – *dual education system* which specializes the students in specific fields such as meat production (Privredna komora Srbije, 2017). Considering the fact that the

meat industry seeks experts in this field with the specific knowledge and set of skills, human resources are one of the most important intangible attributes of this industry. By analyzing the Serbian meat industry Mijić *et al.*, (2014) have shown that the business performance of the meat processing companies is greater than the livestock companies within the meat industry. This study was performed for the 2010-2012 period.

### **2.3. Human capital as the key determinant**

By analyzing the number of employees in the meat industry companies as a resource in deficit (Privredna komora Srbije, 2017), the authors tested the overall efficiency of using human capital. The financial statements as the source of information in this research have provided the financial aspect of efficiency. The efficiency and productivity ratios could easily be calculated through indicators such as: sales per employee, net profit per employee, assets per employee, etc. The investment into employees through the R&D costs is proven to have positive impact on the profitability ratios (Morbey & Reithner, 1990). However, it is hard to estimate the effect of human capital on efficiency. From the perspective of the globally accepted accounting standards (IFRS and GAAP), the official valuation method for intangible assets doesn't exist. Therefore, the value of human capital is hard to estimate. Investment into employees and organizational learning can improve the overall performance of the companies. Hernaus, T., Skerlavaj, M. & Dimovski (2008) have shown a positive correlation between organizational learning and performance of the Croatian companies, which might have the similar results in Serbian companies as well, considering the same region and similar market.

One of the aspects of intangible resource utilization is efficiency and productivity ratios. To achieve a higher level of efficiency means that the company produces and sells more meat with the current workforce. By comparing the current workforce with the profitability indicators such as sales, net profit and return on assets, the companies could define the efficiency level of using their human capital. The efficiency is important because it defines the value of the human capital (Hermanson, 1964). There are some indicators that are presented in the research by Bontis & Fitz-enz (2002) where the total cost of the human capital is defined as the sum of the gross salary costs, bonuses, trainings and learning costs, as well as fluctuation and absenteeism costs. HCVA (*Human Capital Value Added*) is one of the indicators which shows the ability of employees to generate additional value. It could be presented with the following formula:

$$\sum_{i=1}^n \mu_i = \frac{\alpha_i - (\Omega_i - \lambda_i)}{\varepsilon_i} \quad (1)$$

a.c.

$$\alpha_i > 0; \varepsilon_i > 0 \quad (2)$$

Where:

$i=1, \dots, n$ ;

$\mu$  - HCVA;

$\alpha$  - Sales;

$\Omega$  - Total costs

$\lambda$  - Gross salary costs;

$\varepsilon$  - FTE (Full-time employees);

Besides HCVA, the efficiency of using human capital could be calculated through HCROI (*Human Capital Return on Investment*). The higher this ratio is, the higher efficiency of using human capital is (Fitz-Enz, 2000).

$$\sum_{i=1}^n \Delta_i = \frac{\alpha_i - (\Omega_i - \lambda_i)}{\lambda_i} \quad (3)$$

a.c.

$$\alpha_i > 0 \quad (4)$$

Where:

$i=1, \dots, n$ ;  $\Delta$  - HCROI

For achieving the greater level of efficiency, the companies which operate in the meat industry should be focusing on tracking the right key performance indicators, finding the proper ways to manage the human capital, as well as gaining the quality certificates and building a good reputation (Knežević & Fabris, 2010). By using the tools specialized in measuring the organizational performance, companies could see their performance through

efficiency. Nonetheless, it's important to compare the HCVA indicator with the overall efficiency indicators, which will be calculated by using the data envelopment analysis.

## 2.4. The use of non-parametric DEA method

Data envelopment analysis (DEA) is one of the widely used tools for measuring efficiency (Charnes, Cooper, & Rhodes, 1978). There has been a continuous and rapid growth in the field of Data Envelopment Analysis (DEA) related studies, since the original work of *Charnes, Cooper, and Rhodes (1978)*. The study of *Charnes, Cooper, and Rhodes (1978)* is the most complete source of references on DEA theory and its applications in measuring the efficiency, productivity, or performance of decision-making units (Charnes, Cooper, & Rhodes, 1978; Emrouznejad & Yang, 2017). According to Sherman & Zhu (2006) Data Envelopment Analysis (DEA) is a very powerful service management and benchmarking technique to evaluate the performance. Seiford and Thrall (1990) researched the mathematical programming approach to frontier estimation known as Data Envelopment Analysis (DEA), and examine the effect of model orientation on the efficient frontier and the effect of convexity requirements on returns to scale.

According to Knežević & Marković, 2014, Decision Making Unit (DMU) is the standard name for the business units that are included in the efficiency analysis of units on the basis of selected input and output values. Also, DEA gives the results on DMU in terms of efficiency and inefficiency, as well as how much is necessary to reduce a certain input and/or increase a certain output to make a particular DMU efficient (Knežević & Marković, 2014).

Considering the number of inputs and outputs, throughout this paper the authors will focus on using the non-parametric linear programming tools, by using multiple inputs and outputs in measuring the level of efficiency of the selected companies.

The authors used *The Constant Returns to Scale Model (CRS)*, where the main condition is:

$$\sum_{j=1}^n \lambda_j = 1, \quad (5)$$

$\lambda$  – coefficient

There are several non-parametric DEA methods which could be used for the efficiency analysis:

*Method 1.*

Where,  $x_{ij}$  represents the value of  $i$ -type inputs for the DMU $_j$  ( $x_{ij} > 0$ ,  $i = 1, 2, \dots, m$ ,  $j = 1, 2, \dots, n$ ), and  $y_{rj}$  – the value of the  $r$ -type output for the DMU $_j$  ( $y_{rj} > 0$ ,  $r = 1, 2, \dots, s$ ,  $j = 1, 2, \dots, n$ ).

The optimization model proposed by Charnes, Cooper and Rhodes could be set as:

$$\max h_k(u, v) = \frac{\sum_{r=1}^s u_r y_{rk}}{\sum_{i=1}^m v_i x_{ik}}, \quad (6)$$

where the conditions are:

$h_k$  - relative efficiency  $k$ -type for DMU;

$n$  - number of DMU;

$m$  - number of inputs;

$s$  - number of outputs;

$u_r$  – the coefficient for the output  $r$ ;

$v_i$  - the coefficient for the input  $i$ ;

$$0 \leq h \leq 1$$

*Method 2.*

Method 1 could be transformed to the linear method as follows:

$$\max z = \sum_{r=1}^s u_r y_{rk}, \quad (7)$$

where the conditions are:

$$\sum_{i=1}^m v_i x_{ik} = 1, u_r \geq 0, v_i \geq 0, \sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ik} \leq 0, j = 1, 2, \dots, n \quad (8)$$

$$u_r \geq \varepsilon, v_i \geq \varepsilon, \text{ and } \varepsilon > 0, r = 1, 2, \dots, s, j = 1, 2, \dots, m,$$

Method 2 maximizes the output under the condition that the virtual input is set as 1.

For the Method 2, there is a dual problem of linear programming which could be set as:

$$\theta^* = \min \theta, \quad (8)$$

where the conditions are:

$$\sum_{j=1}^n \lambda_j x_{ij} \leq \theta x_{ik}, \quad i=1,2,\dots,m, \quad \sum_{j=1}^n \lambda_j y_{rj} \geq y_{rk} \quad (9)$$
$$r=1,2,\dots,s, \quad \lambda_j \geq 0, \quad j=1,2,\dots,n$$

The authors have used method 2 in the research, where there is the definition of strong and weak efficiency.

**Strong DEA efficiency:** The DMU<sub>k</sub> performance is fully efficient (100%) if and only if,  $\theta^* = 1$ , and all  $s_i^* = 0$ ,  $s_r^* = 0$ .

**Weak DEA efficiency:** The DMU<sub>k</sub> performance has the weak efficiency, if and only if,  $\theta^* = 1$ , and all  $s_i^* \neq 0$ ,  $s_r^* \neq 0$  for  $i$  and  $r$  in the optimal value.

DEA is a widely used method that operates over the homogenous units formed from the DMU, which in this paper represents the selected companies in the Serbian meat industry. Considering that the homogenous groups were formed based on the total sales criteria, this could be the limitation of DEA for extreme values.

The identification of the inputs and outputs is another possible limitation for using the DEA. Setting the inputs and outputs is one of the main issues when checking the efficiency of the meat industry. The focus of this paper is to measure the efficiency of DMU in the meat industry of the Republic of Serbia. The existing literature shows a similar performance of using the DEA for measuring the efficiency of companies in other agricultural industries on foreign markets (Sellers-Rubio, Alampi Sottini, & Menghini, 2016). By analyzing the wine industry using DEA methodology, the authors have tracked the efficiency of the wine industry in Spain and Italy. Throughout that research, the authors have shown a strong correlation between the size of the companies and their profitability. By focusing more on the meat industry, Ali (2007) has used the principles of DEA for measuring the efficiency of this industry on the Indian market. One of the key conclusions relates to treating labor and human capital as input for tracking the efficiency of the meat processing units. In order to track the efficiency and rank the companies based on the efficiency ratios, Andersen and Peterson (1993) suggest using the modified DEA model. Therefore, DEA is widely used through

different industries and shows the potential for analyzing the meat industry as one of the key industries in Serbia.

### **3. Research Methodology**

The study was performed on the data collected through the business registry for the entities registered in the Republic of Serbia. More specifically, the data was collected from the financial statements from the top 45 representative companies in the meat industry during the 5-year period (2013-2017).

By using the DEA methodology as a non-parametric method, the authors calculated the level of efficiency of the representative companies in the meat industry. The first step in this research was related to the selection of the representative companies based on the public data reported in the financial statements. Based on the total sales, the authors took the top 45 companies throughout the period from 2013<sup>th</sup> to 2017<sup>th</sup> with the total sales above the industry standard. By reducing the sample based on the companies which have been fully active in the period 2013-2017 and have submitted their financial statements, the further selection has been done and reduced the sample to 22 companies.

The second step was related to the calculation of HCVA index as the parameter for showing the success the human capital utilization. This indicator was also calculated by using the data collected through the financial statements for the period 2013-2017.

The third point of this research referred to the use of DEA method to calculate the efficiency indicators for each company, based on the variables shown in the following subtitle. Two DEA models have been recognized as important for tracking the efficiency level throughout the determined period.

By comparing the efficiency ratios and the HCVA indicators, the authors tested how does the human capital affects the efficiency of selected companies.

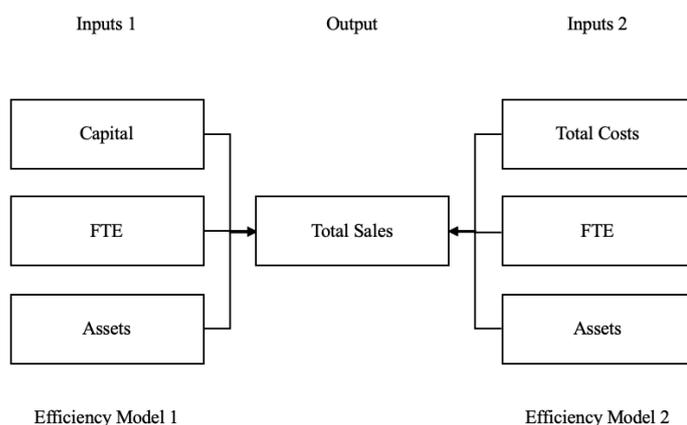
#### **3.1. Measures and variables**

Measurement of the company efficiency based on human capital as part of the intangible assets is a non-standardized task and hard to achieve. However, the effect of the human capital on efficiency could be analyzed through the regularities of the selected companies.

The selection of the companies was done based on the total sales as a profitability indicator and as the output used for the DEA method. By analyzing the financial statements and the notes to the financial statements for the period 2013-2017, the authors used several key measures as inputs and outputs used in the DEA method:

- FTE (number of full-time employees);
- Total costs;
- Salary costs;
- Total Sales;
- Capital and
- Assets.

Considering the nature of the DEA method, net result as an indicator was excluded from the analysis due to the possible negative values. The model used in this study has perceived three inputs and one output as the representation of the non-parametric model. The first model considered capital as the key determinant. The other two inputs – assets and the number of full-time employees (FTE) were set for both models. On the other hand, the second model used total costs instead of the capital. The total costs were perceived as an important factor for analyzing the efficiency and profitability of the companies. Therefore, the use of these two models could provide a better overview of the efficiency and later on show a correlation with the human capital index (HCVA).



**Figure 1: DEA efficiency models**

*Source:* The authors' diagram

In this paper, the authors used the *Human Capital Value Added* (HCVA) indicator, originally proposed by Hermanson (1964). By comparing HCVA and the efficiency

indicators, the authors tracked the influence of the intangible assets (with the special accent on the human capital). To be more precise, the authors used the modified version of the DEA evaluation model. In order to rank the business units based on their efficiency, this model shows the *super-efficiency score* by being able to compare the overall efficiency between the companies (Andersen & Petersen, 1993).

### 3.2. Efficiency Models

The profitability and competitiveness of any company are highly related to the efficiency of using the resources. Therefore, the authors propose using two models of DEA efficiency in this paper. Both models have three inputs and include FTE and assets as common inputs. However, the first model recognizes the capital as the third input. According to Pulić,'s VAIC method (1998) for tracking the efficiency of the intellectual capital, it is necessary to calculate the capital employed as one of the segments as well. On the other hand, the total cost of ownership shows CAPEX as the important cost part, which could be analyzed through the efficiency of using capital. Nonetheless, the other parts of cost structured such as OPEX remain unanalyzed. For that reason, the authors have created the second model which uses the total costs as integration for all resources. The overview of the models could be seen in Figure 1.

Each of these models uses the second DEA model paraphrased in the explanation of DEA. By using this model, the authors searched for the maximum sales used as an output in this model, with the fixed inputs. By using the 5-year period of efficiency, the authors have found the regularities which show how important are the analyzed resources in achieving the maximum sales. The contribution level of FTE and assets to the total efficiency score is the same in both efficiency models.

The authors have also analyzed the HCVA index as another level of measuring efficiency which shows the value-added per each employee. Calculating the efficiency of using the workforce which is crucial in the meat industry, the authors emphasize the importance of the value generated per each employee.

### 3.3. The structure of the sample

Based on the sample taken in this research, the authors have selected the top 45 companies in the meat industry based on their total sales in 2017<sup>th</sup>. The period taken for the analysis of these companies was set for the 5-year period (2013-2017).

Out of 45 companies, 22 have had a total sales of more than 450 million RSD (3.8 million euros) and have been operative throughout the whole analyzed period. The selection of 22 companies have further been analyzed and compared by using the DEA and HCVA index (the list of the filtered companies is presented in Table 3).

## 4. Results

The results of this study show the trendline of the efficiency of selected companies and the correlation with the HCVA index as the measure for human capital utilization score. In other words, the effects of the human capital have been analyzed throughout the 5-year period for the representative companies. Thus, it is essential to test multiple efficiency models.

### 4.1. Pre-analysis

Out of the top 45 companies taken for the analysis, 48% (22) of them have fulfilled the conditions such as:

- Companies with revenue of more than 450 million RSD;
- Companies fully active throughout the period 2013-2017.

Revenue of 450 million RSD was taken as number slightly above the industry average in the Republic of Serbia (400 million RSD). Based on the public information from the Business Registry, the industry averages for the inputs used in calculating the efficiency are presented in Table 2.

**Table 2: Industry average for the inputs and outputs used in DEA**

Input/output	Category	2013	2014	2015	2016	2017
Input - both models	Asset	288,898	378,031	458,457	490,847	388,947

<b>Input - model 1</b>	Capital	137,665	211,612	270,054	300,046	205,534
<b>Input - both models</b>	FTE	34	52	56	54	48
<b>Input - model 2</b>	Total costs	294,382	452,706	464,570	485,874	481,857
<b>Output - both models</b>	Sales	291,375	482,557	491,335	511,353	497,682

\* 000 RSD

Source: Author's Calculation

Each of the 22 selected companies has the inputs and outputs indicators greater than the industry average. For analyzing the human capital, it is important to have the representative and successful companies. Therefore, the ratios above the industry average have been taken as a critical factor for the sample selection.

The second step after the data collection and selection of representative companies was to calculate the HCVA indicator as to the measurement for human capital efficiency. HCVA shows how is the workforce used as a resource and how does the workforce uses the other resources (presented through OPEX) to generate the business results. Companies that have shown a negative HCVA didn't use efficiently the human capital as the intangible resource. On the other hand, companies with a high HCVA indicator have shown a significant efficiency in using human capital. Based on the analysis of 22 selected companies, HCVA ratios are as in Table 3.

**Table 3: HCVA index (2013-2017) in 000 RSD**

#	Company name	2013	2014	2015	2016	2017	$\bar{x}$
1	Biftek	1,076	913	710	12,345	13,883	1,076
2	Big Bull d.o.o.	1,442	268	-575	-4,268	947	268
3	Big Trade	685	699	450	384	633	633
4	Braća Đokić d.o.o.	2,274	1,466	1,481	1,872	994	1,481
5	Carnex d.o.o.	1,864	2,326	1,568	1,922	1,875	1,875
6	Dakom d.o.o.	1,832	805	525	355	527	527
7	Industrija mesa Bačka Topola	930	1,107	573	726	1,030	930
8	Kotlenik-Promet	671	716	410	264	571	571

9	Makinternacional	621	587	558	533	559	559
10	Matijević d.o.o.	1,849	1,823	1,787	1,529	1,465	1,787
11	Mesokombinat - Promet d.o.o.	889	1,159	829	660	782	829
12	Mesopromet Company d.o.o.	698	699	701	686	727	699
13	Mesopromet d.o.o.	923	1,642	783	820	1,403	923
14	Mustang d.o.o.	822	845	937	1,114	1,063	937
15	Neoplanta	1,573	1,878	1,543	1,224	2,035	1,573
16	Nid d.o.o.	459	616	734	701	581	616
17	Pro-mes d.o.o.	454	478	492	504	549	492
18	Strand d.o.o.	621	621	810	613	821	621
19	SZTR Đurđević Milenko	1,105	1,167	614	918	1,075	1,075
20	Vindija d.o.o.	1,320	1,396	756	700	811	811
21	Yuxor-Export a.d.	1,345	1,524	711	5	697	711
22	Zlatiborac	1,195	1,769	1,325	1,165	1,994	1,325

Source: Author's Calculation

In the last column, the authors calculated the median, considering the extreme values in 2016 and 2017 for the companies *Biftek* and *Big Bull d.o.o.* The extreme values of these companies are explained by the high sales and an extremely low number of full-time employees. *Biftek* has had a meat retail network and has hired the employees as a contractors. Therefore, the extreme HCVA values in 2016 and 2017 could be explained with the outsourcing within these companies. By analyzing the average salary per employee in the selected companies it could be seen that there is a strong positive correlation between the HCVA index and average salary ( $r = 0.49$ ), meaning that the increase in salaries might result in a positive efficiency of the companies. The average gross salaries per employee are presented in Table 4.

**Table 4: Average gross salaries (2013-2017) in 000 RSD**

#	Company name	2013	2014	2015	2016	2017	$\bar{x}$
1	Biftek	453	471	398	8,038*	10,648*	471*
2	Big Bull d.o.o.	1,040	954	753	922	910	916
3	Big Trade	363	353	349	372	459	379
4	Braća Đokić d.o.o.	577	533	447	474	533	513
5	Carnex d.o.o.	1,187	1,175	1,227	1,057	1,059	1,141
6	Dakom d.o.o.	532	500	387	496	501	483
7	Industrija mesa Bačka	765	812	802	884	902	833

	Topola						
8	<b>Kotlenik-Promet</b>	473	487	502	510	496	494
9	<b>Makinternacional</b>	467	468	414	509	520	476
10	<b>Matijević d.o.o.</b>	739	732	710	787	820	757
11	<b>Mesokombinat</b>	454	496	489	528	562	506
12	<b>Mesopromet</b>	601	595	658	692	677	645
13	<b>Mesopromet d.o.o.</b>	767	769	769	589	741	727
14	<b>Mustang d.o.o.</b>	566	610	603	736	789	661
15	<b>Neoplanta</b>	979	1,074	975	1,108	1,287	1,085
16	<b>Nid d.o.o.</b>	386	486	473	509	504	472
17	<b>Pro-mes d.o.o.</b>	400	428	428	458	494	441
18	<b>Strand d.o.o.</b>	487	584	604	554	557	557
19	<b>SZTR Đurđević</b>	542	592	630	650	690	621
20	<b>Vindija d.o.o.</b>	675	694	674	764	798	721
21	<b>Yuxor-Export a.d.</b>	1,038	1,044	994	1,038	1,037	1,030
22	<b>Zlatiborac</b>	750	793	805	889	1,121	872

Source: Author's Calculation

Considering the sales of the companies and their market share, it could be acknowledged that the companies such as *Matijević d.o.o.*, *Carnex d.o.o* and *Neoplanta* have the highest sales throughout the period 2013-2017 and the highest HCVA indicator. From that perspective, HCVA could be further analyzed and compared with the profitability of the meat companies as well.

## 4.2. Main analysis

In this study, the efficiency was calculated for each of the 5-year. The relationship between assets, capital and FTE as inputs with the total sales as output was used in determining the efficiency by using the DEA non-parametric method. Each of the inputs contributes to the overall efficiency ratio of the company. The overall efficiency could reach a 1.0 efficiency only if the inputs have reached a contribution of 1.0.

Capital as one of the three inputs used in model 1 had the highest contribution to the sales through the 5-year period, followed by FTE and assets retrospectively. The results were analyzed by using DEA and the Parson's R correlation to show how strong is the contribution of each of these inputs.

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**Table 5: Parson's R Correlation (Contribution level of inputs - model 1)**

	2013	2014	2015	2016	2017
Asset	.8483	.6923	.8776	.9174	.8625
Capital	.8978	.9213	.8863	.9736	.9626
FTE	.8055	.8101	.8101	.9516	.9590

Source: Author's Calculation

Companies such as *Matijević d.o.o.* and *Mesopromet d.o.o.* have reached a maximum efficiency based on Model 1 throughout the 5 years period. Their sales have reached an optimal level with the existing resources (assets, capital, FTE). On the other hand, companies with 0.3 efficiency or less have shown to have a poor efficiency ratio, meaning that their utilization of the resources is low. Table 6 reflects the efficiency levels based on using Model 1.

**Table 6: Efficiency levels - model 1**

Name of the company	2013	2014	2015	2016	2017	geom. $\bar{x}$
Biftek	.64	.61	.93	<b>1.00</b>	<b>1.00</b>	.81
Big Bull d.o.o.	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	.32	.41	.67
Big Trade	.21	.18	.28	.18	.29	.22
Braća Đokić d.o.o.	.56	.43	.54	.37	.38	.45
Carnex d.o.o.	.32	.41	.42	.57	.26	.38
Dakom d.o.o.	.27	.25	.23	.15	.27	.23
Industrija mesa Bačka Topola	.24	.43	.60	.26	.24	.33
Kotlenik-Promet	.28	.36	.54	.26	.22	.32
Makinternacional	.30	.39	.44	.19	.25	.30
Matijević d.o.o.	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>
Mesokombinat - Promet d.o.o.	.39	.51	.44	.22	.20	.33
Mesopromet Company d.o.o.	.54	.60	.45	.14	.27	.35
Mesopromet d.o.o.	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>
Mustang d.o.o.	.29	.30	.35	.18	.30	.28
Neoplanta	.54	.69	.73	.52	.19	.48
Nid d.o.o.	.62	.48	.40	.26	.40	.41
Pro-mes d.o.o.	.30	.37	.40	.24	.26	.31
Strand d.o.o.	.34	.46	<b>1.00</b>	.24	.25	.39
SZTR Đurđević Milenko	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	.45	.40	.71
Vindija d.o.o.	.22	.27	.30	.16	.14	.21
Yuxor-Export a.d.	.46	.54	.46	.19	.17	.32
Zlatiborac	.27	.35	.36	.17	.15	.24

Source: Author's Calculation

Considering the results, the authors tested the second efficiency model by exchanging the capital as the highest influencing element in the first model with the total costs. There are the scenarios in which the efficiency levels could go above 1.0, where the level of contribution of total costs might also go above 1.0. In those scenarios, the ratio of efficiency indicates that the company could increase the total costs without reducing the overall efficiency. In the combination of inputs with the total costs as the replacement for the capital, there were no regularities in the terms of most contributing input from the period 2013-2017. However, FTE has shown a significant contribution in 2013<sup>th</sup>, 2014<sup>th</sup> and 2016<sup>th</sup>. In the second model, the efficiency levels have stayed the same for *Matijević d.o.o.* as the market

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leader in the Serbian meat industry. *SZTR Đurđević Milenko* also reached a similar efficiency level as in Model 1. The coefficient of variation between these two models is 21% which is caused by the higher efficiency levels based on the total costs used in Model 2. The biggest difference has been seen at the companies such as *Yuhor*, *Vindija*, *Mesokombinat – Promet d.o.o.*, *Dakom d.o.o.*, *Makinternacional*, *Carnex*, but *Zlatiborac* and *Mustang* as well.

**Table 7: Efficiency levels - model 2**

Name of the company	2013	2014	2015	2016	2017	geom. $\bar{x}$
Biftek	.76	.70	.42	<b>1.00</b>	.43	.63
Big Bull d.o.o.	.89	.84	.45	.48	.80	.66
Big Trade	.51	.47	.44	.44	.63	.50
Braća Đokić d.o.o.	.85	.72	.54	.67	.52	.65
Carnex d.o.o.	.58	.67	.69	.77	.59	.66
Dakom d.o.o.	.62	.56	.65	.44	.56	.56
Industrija mesa Bačka Topola	.52	.61	.49	.49	<b>1.00</b>	.60
Kotlenik-Promet	.56	.59	.49	.49	.54	.53
Makinternacional	.56	.61	.67	.47	.67	.59
Matijević d.o.o.	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>
Mesokombinat - Promet d.o.o.	.64	.70	<b>1.00</b>	.51	.62	.68
Mesopromet Company d.o.o.	.57	.61	.26	.42	.75	.49
Mesopromet d.o.o.	<b>1.00</b>	<b>1.00</b>	.46	<b>1.00</b>	.53	.75
Mustang d.o.o.	.61	.63	.44	.50	.92	.60
Neoplanta	.72	.83	.77	.69	.51	.69
Nid d.o.o.	.66	.73	.52	.52	.45	.57
Pro-mes d.o.o.	.56	.61	<b>1.00</b>	.46	.45	.59
Strand d.o.o.	.61	.67	.51	.54	.68	.60
SZTR Đurđević Milenko	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	.69	.68	.86
Vindija d.o.o.	.55	.56	.66	.45	.52	.54
Yuhor-Export a.d.	.66	.71	.69	.42	<b>1.00</b>	.67
Zlatiborac	.57	.62	.46	.46	.56	.53

Source: Author's Calculation

The variation was higher in model 1 than in model 2. Throughout the years, the variation was the lowest in 2014<sup>th</sup> (25.73%) and the highest in 2016<sup>th</sup> (28.26%). On the other hand, in model 2, the variation fluctuated from 14.76% in 2014<sup>th</sup> to 19.37% in 2016<sup>th</sup>.

**Table 8: Descriptive statistics - Efficiency models**

	2013	2014	2015	2016	2017	geom. $\bar{x}$
<b>M1 - Geom. <math>\bar{x}</math></b>	.42	.47	.52	.29	.30	.39
<b>M1 - Std. Deviation</b>	.27	.25	.27	.28	.26	
<b>M1 - Min</b>	.21	.18	.23	.14	.14	.21
<b>M2 - Geom. <math>\bar{x}</math></b>	.66	.68	.58	.56	.63	.62
<b>M2 - Std. Deviation</b>	.16	.14	.21	.19	.18	
<b>M2 - Min</b>	.51	.47	.26	.42	.43	.41

Source: Author's Calculation

By comparing these two models, the companies have reached an average efficiency of 62.47% based on model 2. On the other hand, the efficiency of the companies based on the first model through the 5-year period was 39.56%.

In order to compare HCVA and Efficiency levels, the authors have used Pearson's Correlation Coefficient. It was shown that there is a strong positive correlation between HCVA ( $r = .518^*$ ) and efficiency calculated by using model 2. On the other hand, the correlation between HCVA and model 1 was determined as positive, but not significant ( $r = .329$ ).

**Table 9: Pearson Correlation Coefficient (HCVA, Efficiency models: 2013-2017)**

		HCVA	G. Mean 1	G. Mean 2
<b>HCVA</b>	Pearson Correlation	1	.329	.518*
	Sig. (2-tailed)		.135	.014
<b>G. Mean 1</b>	Pearson Correlation	.329	1	.781**
	Sig. (2-tailed)	.135		.000
<b>G. Mean 2</b>	Pearson Correlation	.518*	.781**	1
	Sig. (2-tailed)	.014	.000	

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Source: Author's Calculation

Considering the strong relationship between the HCVA index of the companies in the meat industry as the determinant and the efficiency scores (based on model 1 and model 2), this study has shown the effect of the HCVA on the efficiency with the focus on the total

costs. By analyzing the results of the multiple regression, the data has shown that 28.3% of dependent variables predict the variance of efficiency.

The authors have also used the Durbin-Watson test to analyze the linear autocorrelation. With the Durbin-Watson indicator of  $d = 1.957$ , where the value's index is between the critical values ( $1.5 < d < 2.5$ ), there was no first-order linear autocorrelation (Dufour & Dagenais, 1985).

## 5. Discussion and Conclusion

The main question of this study was how much the utilization of human capital affects the efficiency of the representative companies in the meat industry. The Serbian market was taken for this research, as the representative of the emerging and developing countries. With the lack of resources in this industry in Serbia and Balkan region in general, the authors highlighted the importance of using the human capital efficiently in order to boost the overall business performance. The authors used DEA as the method for testing the efficiency of the companies in the meat industry, based on the data subtracted from the financial statements during the 5-year period (2013-2017).

In the pre-analysis, the authors have used the industry average as the limitation for selecting the representative companies based on the total sales. On the other hand, the second condition made was related to the activeness of the companies during the whole period from 2013<sup>th</sup> to 2017<sup>th</sup>. Based on those conditions, 22 companies have been selected.

In order to analyze the efficiency of the companies, the authors used two DEA models – the capital-oriented and the total cost-oriented model. Both models have used assets and the number of full-time employees as inputs. Furthermore, it was shown that the human capital has a stronger and more significant correlation with the total costs in calculating efficiency than with the first model focused on the capital. Capital as the input could be affected by the investments and debt management which is highly influenced by the management decisions. However, the other *non-management* employees mostly don't have a direct impact on capital. From that perspective, the authors tested the second model as well, even though there are similarities between the efficiency scores calculated in these two models.

Human capital value added (HCVA) as the metrics used for measuring the utilization of human capital has shown that companies with a higher efficiency ratio are better in using the human capital. and vice versa. The absolute leader based on both efficiency ratios and HCVA index was the company *Matijević d.o.o.*, followed by *Mesopromet d.o.o.* and *SZTR*

*Durđević Milenko* retrospectively. The optimal balance was reached between their assets, FTE, capital (in model 1), total costs (in model 2) and the total sales through the period 2013-2017. On the other hand, there are companies with high sales, but lower efficiency as a consequence of the disbalance between the determinants. Furthermore, the authors propose testing the relationship between the HCVA index and profitability, since profitability ratios are crucial for business sustainability as well.

There is not an accounting or financial standard which is officially recognized as the method for measuring intangible assets. Therefore, this paper gives a guideline on how can the human capital be valued and put into a correlation with the efficiency of the companies. The DEA method with its limitations might not give the same results in other countries and industries. Nonetheless, the authors call out for another research in the developed countries, but the other emerging and developing countries, where meat industry is recognized as a highly developed or has a high potential.

All in all, this study raises awareness among the companies within the meat industry in understanding the measures for human capital utilization as well as the relationship between the human capital and efficiency of the companies. Considering human capital in the meat industry as the rare and valuable resource in this region, especially in Serbia, it is essential to utilize these intangibles properly. By analyzing the current literature, there is a lack of researches in this field and industry, so the authors recognized the importance of giving both a social and theoretic contribution.

In conclusion, the intangible resources with a special focus on the human aspect have become the factor of improving sustainable competitiveness. Therefore, the positive relationship between the human capital and efficiency has given a decision-making input, not just for the meat industry, but for the other industries as well.

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