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EVALUATION OF THE PERFORMANCE OF TRADING COMPANIES IN SERBIA USING THE FF-WASPAS AND WASPAS METHODS

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Abstract:

The main goal of this research paper is to comprehensively analyze the performance of trading companies in Serbia and propose appropriate measures for future improvement. In the specific case study, DELHAIZE Serbia achieved a return on sales of 2.50%, a return on assets of 3.56% and a return on capital of 6.95% in 2021. On the other hand, LIDL Serbia achieved a return on sales of 5.77%, a return on assets of 6.66% and a return on capital of 12.55% in the same year. Thus, LIDL Serbia performed more successfully than DELHAIZE Serbia. In general, foreign retail chains demonstrate better performance than domestic ones. One reason for this is that they adopt newer business methods and have a higher degree of digitization of the entire business.

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INTRODUCTION

We measure and analyze the performance of trading companies in Serbia using ratio analysis, statistical analysis and the FF-WASPAS-WASPAS method. The FF-WASPAS-WASPAS method provides a more realistic assessment of the financial situation of trading companies in Serbia (Zavadskas *et al.*, 2012; Zardari *et al.*, 2014; Ersoy, 2017; Đalic *et al.*, 2020 ; Kovač *et al.*, 2021; Lalić, *et al.*, 2021; Mikšić *et al.,* 2021; Stankovič *et al.*, 2020; Saaty, 2008; Trunkg, 2021; Senapati & Yager, 2019a,b, Senapati & Yager, 2020 ; Stević & Brković, 2020; Stević *et al.*, 202; Božanic *et al.*, 2022; Pamučar *et al.*, 2021; Puška *et al.,* 2021). Based on that, the subject of research in this paper is the application of FF-WASPAS and WASPAS methods in evaluating the performance of trading companies in Serbia (Keshavarz-Ghorabaee *et al.*, 2020; Urosevic *et al*, 2017; Saha *et al.*, 2023). The primary goal and purpose of this research are to investigate the performance of trading companies in Serbia as comprehensively as possible in order to improve them in the future by applying relevant measures.

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The main research hypothesis in this paper is based on the fact that continuous analysis of critical performance factors of trading companies, in Serbia, using multi-criteria decision-making methods, including FF-WASPAS and WASPAS, is a basic assumption for future improvement by implementing appropriate measures. This is because several critical performance factors of trading companies are simultaneously integrated, which is not the case with classical methods.

LITERATURE REVIEW

There is an increasing body of literature dedicated to measuring and analyzing the performance of trading companies using multi-criteria decision-making methods (Ayçin *et al*., 2021: Popović *et al*., 2022; Ecer & Aycin, 2022; Mishra *et al*., 2022; Nguyen *et al*., 2022; Rani *et al*., 2022; Toslak *et al*., 2022; Shanmugasundar *et al*., 2022; Saticı, 2022; Keshavarz-Ghorabaee *et al*., 2021). This is also the case with literature in Serbia (Lukic & Hadrovic, 2019, 2021, 2022; Lukic $ Kozarevic, 2021; Lukic, 2020, 2021a,b,c,d,e, 2022a,b,c,d,e,f,g,h, 2023; Lukic *et al*., 2020a,b). In this work, it serves as a theoretical, methodological and empirical basis for conducting comprehensive research on performance factors of trading companies in Serbia. Through a review of the literature, it is evident that there are wide possibilities for applying multi-criteria decision-making methods in the field of trade. In his work, Ersoy (2017) theoretically analyzes the application of various methods of multi-criteria decision-making in retail, highlighting their characteristics and significance. This paper can, in our opinion, serve as a solid foundation for choosing a method that will be applied in specific retail and other trade sectors. A particular study focuses on identifying factors that influence the effectiveness of websites in retail based on the application of the Fuzzy DEMATEL method (Gaur *et al*., 2020). Moreover, the importance of using different methods to analyze the efficiency of electronic commerce is multiple. In the literature, extensive attention has been given to analyzing the efficiency and performance of global retail chains using the integrated fuzzy SWARA and fuzzy EATWOS methods (Görçün *et al*., 2022). Another separate study examined the efficiency and marketing growth of retail food companies (Harangi-Rákos & Fenyves, 2021). The subject of research in the literature is the evaluation and selection of suppliers in the context of the green economy (Keshavarz-Ghorabaee *et al*., 2020). Additionally, considerable emphasis has been placed on analyzing logistics efficiency using the multi-criteria decision-making method (LMAW) (Pamučar *et al*., 2021). Another study highlighted the importance of improving the procurement process for retail companies (Maxim, 2021), with multi-criteria decision-making methods playing a significant role in this regard. Furthermore, multi-criteria decision-making methods offer extensive possibilities for analyzing logistics efficiency. They can be utilized to assess efficiency of individual distribution channels. Similarly, by means of multi-criteria decision-making methods, the selection of employees in retail and in supplementary activities, such as for example tourism, can be carried out (Urosevic *et al*., 2017). Overall, there are wide possibilities of applying multi-criteria decision-making methods to enhance the performance and efficiency of trading companies. Consequently, works focusing on the analysis of financial performance and trade efficiency in Serbia have been published in Serbian literature, using various multi-criteria decision-making methods (Fuzzy AHP - TOPSIS, ELECTRE, MABAC, OCRA, WASPAS, ARAS, MARCOS, TRUST) (Lukic *et al.* , 2020; Lukic & Hadrovic Zekovic, 2021, 2022; Lukic, 2021a,b, 2022a,b,c,d, e,f,g,h; Lukic *et al*., 2021), as well as DEA approaches (Lukic, 2022g). Multi-criteria decision-making methods were applied in the performance analysis of trading companies in Serbia because they provide more realistic results compared to classical methods of financial analysis (for example, ratio analysis), as they consider several criteria simultaneously. When analyzing the performance

of trading companies in Serbia using different methods of multi-criteria decision-making, the following criteria were most often used: number of companies, number of employees, assets, capital sales and net profit. These criteria serve as reliable measures of performance and are in line with the nature of the trade. A special study also placed significant focues on the comparative analysis of the information performance of trade between the European Union and Serbia based on the MARCOS method (Lukic, 2022h).

METHODOLOGY

The analysis of the problem in this paper focuses on the application of the FF-VASPAS (Fermatean Fuzzy VASPAS) method and WASPAS method. **FF-WASPAS** method is based on Fermat fuzzy sets. Fermatean fuzzy sets (**Fermatean Fuzzy Sets - FFSs**) are valuable tools for managing uncertain information with maximum accuracy and flexibility (Senapati & Yager, 2020; Sıcakyüz, 2023; Hezam *et al.,* 2023). It can be successfully used in the decision-making process. Three components are used in defining FFSs: the degree of membership (α), the degree of non-membership (β) and the degree of indeterminacy (π).We will discuss some features and operators associated with FFSs.

Definition 1. *Let X denote the universe of discourse. The Fermatean fuzzy set can be* $\tilde{R}$ *defined as follows*:

$$\tilde{R} = \left\{ \left\langle x, a_R(x), \beta_R \right\rangle : x \in X \right\} \tag{1}$$

wherein $a_R(x): X \to [0,1], \beta_R(x): X \to [0,1]$, *and* $0 \le \left(a_R(x)\right)^3 + \left(\beta_R(x)\right)^3 \le 1$. *In addition, the degree of uncertainty is* $\pi_R(x) = \sqrt[3]{1 - \left(a_R(x)\right)^3 - \left(\beta_R(x)\right)^3}$. *For convenience, we use* $\tilde{R} = \left(a_R, \beta_R\right)$ *to represent FFS (Senapati & Yager, 2019).*

Definition 2. *Assume that* $\tilde{R} = \left(a_R, \beta_R\right)$ *and* $\tilde{S} = \left(a_S, \beta_S\right)$ *are Fermatean fuzzy sets i* λ *positive real number* ($\lambda \le 0$). *The following operators can be defined for FFSs (Senapati & Yager, 2019a).*

$$\tilde{R} \oplus \tilde{S} = \left(\sqrt[3]{a_R^3 + \beta_S^3 - a_R^3 a_S^3}, \beta_R \beta_S \right) \tag{2}$$

$$\tilde{R} \oplus \tilde{S} = \left(a_R a_S \sqrt[3]{\beta_R^3 + \beta_S^3 - \beta_R^3 + \beta_S^3} \right) \tag{3}$$

$$\lambda.\tilde{R} = \left(\sqrt[3]{1 - \left(1 - a_R^3\right)^\lambda}, \beta_R^\lambda \right) \tag{4}$$

$$\tilde{R}^\lambda = \left(a_R^\lambda, \sqrt[3]{1 - \left(1 - \beta_R^3\right)^\lambda} \right) \tag{5}$$

Definition 3. *Let* $\tilde{R} = \left(a_R, \beta_R\right)$*FFS. The score T function and accuracy function A for FFS are defined as (Senapati & Yager, 2019a)*:

$$T = \left(\tilde{R}\right) = a_R^3 - \beta_R^3 \tag{6}$$

$$A = \left(\tilde{R}\right) = a_R^3 + \beta_R^3 \tag{7}$$

These functions are used to compare two FFSs, i.e. $\tilde{R}=(a_R,\beta_R)$ *and* $\tilde{S}=(a_S,\beta_S)$. *They exist when different conditions are met (Senapati & Yager, 2019a)*:

1. *If* $T(\tilde{R})<T(\tilde{S})$, *then* $\tilde{R}<\tilde{S}$;
2. *If* $T(\tilde{R})>T(\tilde{S})$, *then* $\tilde{R}>\tilde{S}$;
3. *If* $T(\tilde{R})=T(\tilde{S})$, *then*
   i. *If* $A(\tilde{R})<A(\tilde{S})$, *then* $\tilde{R}<\tilde{S}$;
   ii. *If* $A(\tilde{R})>A(\tilde{S})$, *then* $\tilde{R}>\tilde{S}$;
   iii. *If* $A(\tilde{R})=A(\tilde{S})$, *then* $\tilde{R}=\tilde{S}$.

Definition 4. *Complement FFS* $\tilde{R}=(a_R,\beta_R)$ *is defined as follows (Senapati & Yager, 2019a):*

$$Com(\tilde{R})=(\beta_R,a_R) \tag{8}$$

Definition 5. *Let be a* $\tilde{R}_i=(a_R,\beta_R)\ (i=1,2,...,n)$*set of n FFSs, and w=(w_1, w_2,…,w_n)*^{T} *the corresponding weight vector for the* $\tilde{R}_i=\sum_i w_i=1$. *Fermatean fuzzy weighted average (FFWA) aggregate operator is defined based on the following equation (Senapati & Yager, 2019b):*

$$FFWA(\tilde{R}_1,\tilde{R}_2,...\tilde{R}_n)=\left(\sum_{i=1}^{n}w_i a_{R_i},\sum_{i=1}^{n}w_i\beta_{R_i}\right) \tag{9}$$

Definition 6. Definition 3 defines the result of the function FFS. *Let* $\tilde{R}=(a_R,\beta_R)$*FFS. The value of T(*$\tilde{R}$*)can vary in the range from -1 to 1. According to this range, the positive score FFS function is defined. It always gives a positive defuzzified value.*

$$T^P(\tilde{X}_{ij})=1+T(\tilde{X}_{ij}) \tag{10}$$

Let us denote the number of alternatives by *n*, the number of criteria by *m* and the number of decision makers by *p*. The extended VASPAS method takes place through several steps (Senapati &Yager, 2019a,b).

Step 1: Determining the group of decision makers.

In this step, experts are chosen to define the problem. They should have enough knowledge about the subject.

Step 2: Defining a set of alternatives.

A group of decision makers should evaluate the problem and list possible and important alternatives for the evaluation process.

Step 3: Defining a set of evaluation criteria.

Alternatives are evaluated according to defined criteria. Decision makers evaluate the criteria. The criteria are defined on the basis of data obtained on alternatives from existing related studies.

Step 4: Determining the weight of the criteria(w_j).

In this step, for example, the SMART (Simple Multi-Attribute Rating Technikue) method (Zardari *et al.*, 2014) can be used to determine the weights of the criteria. The decision maker is asked to assign 10 points to the least important criterion, and to give an increasing number of points (up to 100) for

more important criteria. The sum of points of all criteria is calculated. Criterion weights are determined by normalizing the sum of points.

Step 5: Determination of linguistic terms and corresponding Fermat fuzzy scopes.

In this step, decision makers define linguistic terms such as "very low" and "very high" and their corresponding FFS.

Step 6: Assigning scores of alternatives for each criterion by the decision maker.

In this step, the decision maker evaluates alternatives against each defined criterion. Linguistic terms defined in the previous step on the basis of Fermat's fuzzy sets are used. Evaluation of the *i*-th alternative in relation to the *j*-th criterion by the *k*-th decision-maker symbolized by

$$\tilde{E}_{ijk} = \left(a_{E_{ijk}}, \beta_{E_{ijk}}\right).$$

Step 7: Consolidation of evaluation criteria by decision makers.

The aggregation operator is defined in equation (9). Using this equation and equal weights $\left(w_k = \frac{1}{p}\right)$, the evaluations of the decision makers are aggregated in step 6. The aggregated evaluations or elements of the decision matrix $\left(\tilde{X}_{ij} = \left(a_{X_{ij}}, \beta_{X_{ij}}\right)\right)$ are represented as:

$$\tilde{X}_{ij} = FFWA\left(\tilde{E}_{ij1}, \tilde{E}_{ij2}, ..., \tilde{E}_{ijp}\right) = \left(\frac{1}{p}\sum_{k=1}^{p} a_{E_{ijk}}, \frac{1}{p}\sum_{k=1}^{p} \beta_{E_{ijk}}\right) \tag{11}$$

Step 8: Normalization of the decision matrix.

The linear normalization method is used in the classical WASPAS method to normalize the decision matrix. However, when we use Fermat fuzzy ranges, then we encounter elements that range from 0 to 1. Therefore, the normalization method cannot be used to change the scale of values. In the case when we have cost criteria, we have to make certain modifications. In this study, the FFS supplement concept is used to transform values related to cost criteria. The complement is defined in equation (8). Let BC and NC be the benefit and non-benefit criterion sets, respectively. The elements of the normalized decision matrix can be defined as follows:

$$\tilde{N}_{ij} = \begin{cases} \tilde{X}_{ij} & if \quad j \in BC \\ Com\left(\tilde{X}_{ij}\right) & if \quad \in NC \end{cases} \tag{12}$$

Step 9: Determination of VSM and VPM measures.

Based on addition, multiplier and other FFS operators defined in the previous section (equation (2) to (5)), measures of VSM and VPM are calculated:

$$\tilde{Q}_i^S = \bigoplus_{j=1}^{m}\left(w_j \oplus \tilde{N}_{ij}\right) \tag{13}$$

$$\tilde{Q}_i^P = \bigoplus_{j=1}^{m}\left(\tilde{N}_{ij}^{w_j}\right) \tag{14}$$

Step 10: Determination of the VASPAS measure.

By combining the VSM and VPM measures, the WASPAS measure is calculated. In doing so, it is necessary to define the combined parameter γ and its value. The following formula is used to calculate:

$$\tilde{Q}_i = \gamma \tilde{Q}_i^S \oplus \left(1-\gamma\right)\tilde{Q}_i^P \tag{15}$$

Step 11: Ranking alternatives based on positive values of $\tilde{Q}_i$.

Definition 6 is used to compare $\tilde{Q}_i$ values and rank alternatives.

The **WASPAS** method is used to solve various complex problems in multi-criteria decision-making (for example, production decision-making) (Zavadskas *et al.* 2012;Chakraborty & Zavadskas, 2014; Zavadskas *et al.*, 2013a,b). An advanced fuzzy WASPAS method was developed for solving complex problems under uncertainty.

The procedure of the WASPAS method consists of the following steps (Urosevic *et al.*, 2017):

Step 1. Determining the optimal performance rating for each criterion.

The optimal performance rating is calculated as follows:

$$x_{0j} = \begin{cases} \max\limits_i x_{ij};\ j = \in \Omega_{max} \\ \min\limits_i x_{ij};\ j = \in \Omega_{min} \end{cases}, \tag{16}$$

where: x_{0j} denotes the optimal performance rating of the *i*-th criterion, Ω_{max} denotes the benefit criterion (the higher the value, the better), Ω_{min} denotes the set of cost criteria (the lower the value, the better), *m* denotes the number of alternatives (*i*= 0.1 ,..., *m*), and *n* denotes the number of criteria (*j*= 0,1,..., *n*).

Step 2. Determination of the normalized decision matrix.

The normalized performance rating is calculated as follows:

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{x_{0j}};\ j \in \Omega_{max} \\ \dfrac{x_{0j}}{x_{ij}}; j \in \Omega_{min} \end{cases}, \tag{17}$$

where: r_{ij} denotes the normalized performance rating of the *i*- th alternative in relation to the *j* - th criterion.

Step 3. Calculation of the relative importance of the *i*- th alternative based on the WS method.

The relative importance of the *i*- th alternative, based on the WS method, is calculated as follows:

$$Q_i^{(1)} = \sum_{j=1}^{n} w_j r_{ij}, \tag{18}$$

where: $Q_i^{(1)}$ indicates the relative importance of the *i*- th alternative in relation to the *j* - th criterion, based on the WS method.

Step 4. Calculation of the relative importance of the *i*- th alternative, based on the bzi WP method.

The relative importance of the alternative, based on the WP method, is calculated as follows:

$$Q_i^{(2)} = \prod_{j=1}^{n} r_{ij}^{w_j}, \tag{19}$$

where: $Q_i^{(2)}$ denotes the relative importance of the *i*- th alternative in relation to the *j* - th criterion, based on the WP method.

Step 5. Calculating the overall relative importance for each alternative.

The total relative importance (common generalized criterion of weight aggregations of additive and multiplicative methods) (Zavadskas *et al.*, 2012) is calculated as follows:

$$Q_i = \lambda Q_i^{(1)} + (1-\lambda) Q_i^{(2)} = \lambda \sum_{j=1}^{n} w_j r_{ij} + (1-\lambda) \prod_{j=1}^{n} r_{ij}^{w_j} \tag{20}$$

where: λ is the coefficient and $\lambda \in [0,1]$.

When decision-makers have no preference for the coefficient, the value is 0.5, and equation (5) is expressed as:

$$Q_i = 0.5 Q_i^{(1)} + 0.5 Q_i^{(2)} = 0.5 \sum_{j=1}^{n} w_j r_{ij} + 0.5 \prod_{j=1}^{n} r_{ij}^{w_j} \tag{21}$$

RESULTS AND DISCUSSION

Table 1 and Figure 1 show the criteria, alternatives and relevant initial data (Source: Agency for Economic Registers of the Republic of Serbia). Table 2 shows the descriptive statistics. (All calculations, results and the pictures are made by the authors.)

Table 1. Criteria, alternatives and initial data (in millions of dinars)

	C1 - Business income	C2 - Net result	C3 - Assets	C4 - Capital	C5 - Number of employees
NELT CO.	80291	488	27246	13814	2094
MERCATA VT	71694	945	12132	1061	1005
PHOENIX PHARMA	59160	688	28816	7039	526
KNEZ PETROL	51491	483	10637	2969	1171
OMV SERBIA	42520	1193	18259	10064	47
DELHAIZE SERBIA	118913	2973	83479	42756	11637
MERCATOR-S	81407	-1629	53135	0	8352
LIDL SERBIA	71643	4133	62074	32938	2935
MOL SERBIA	58157	1158	19347	12232	98
LUKOIL SERBIA	37563	1799	8969	4823	148

Figure 1. Criteria, alternatives and initial data

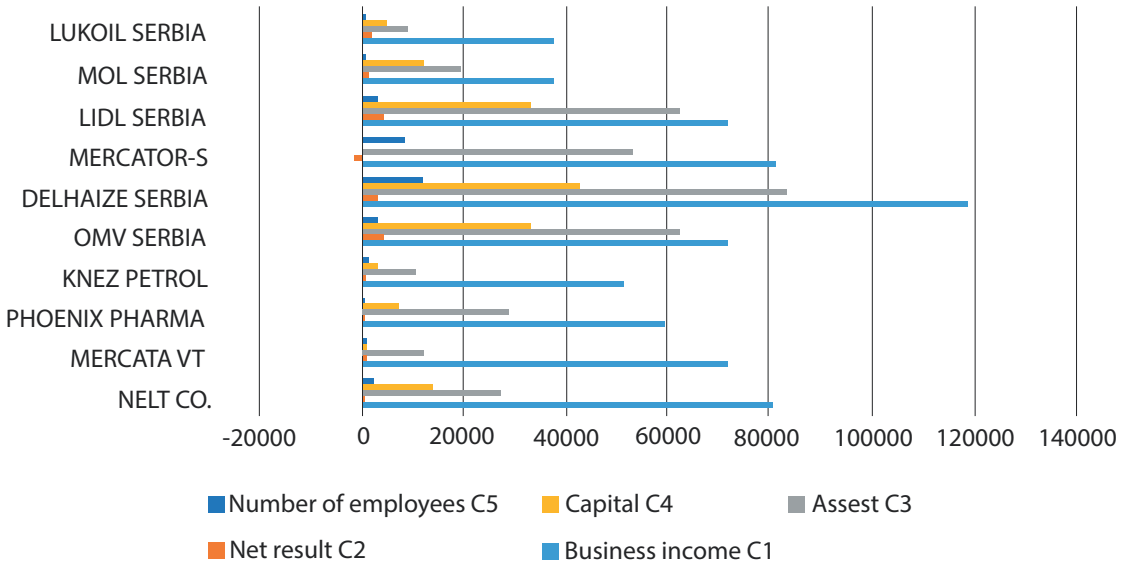


Table 2. Statistics

		Business income	Net result	Assets	Capital	Number of employees
N	Valid	10	10	10	10	10
	Missing	0	0	0	0	0
Mean		67283.9000	1223.1000	32409.4000	12769.6000	2801.3000
Std. Error of Mean		7429.63861	488.22512	8001.90191	4480.62816	1257.83578
Median		65401.5000	1051.5000	23296.5000	8551.5000	1088.0000
Std. Deviation		23494.58020	1543.90338	25304.23565	14168.99034	3977.62598
Minimum		37563.00	-1629.00	8969.00	.00	47.00
Maximum		118913.00	4133.00	83479.00	42756.00	11637.00

Descriptive statistics show that, for example, the net result of the largest trading companies in Serbia ranged from -1629.00 (MERCATOR-S) to 4133.00 (LIDL Serbia). The situation is the same with respect to the range and with other statistical variables (business income from 37563.00 (LUKOIL SERBIA) to 118913.00 (DELHAIZE SERBIA), business assets from 8969.00 (LUKOIL SERBIA) to 83479.00 (DELHAIZE SERBIA), capital from .00 (MERCATOR-S) to 42756.00 (DELHAIZE SERBIA) and Number of employees from 47.00 (OMV SERBIA) to 11637.00 (DELHAIZE SERBIA). According to the descriptive statistics of the analyzed indicators, the company achieves the best performance DELHAIZE SERBIA. Table 3 shows the correlation matrix of the initial data.

Table 3. Correlations

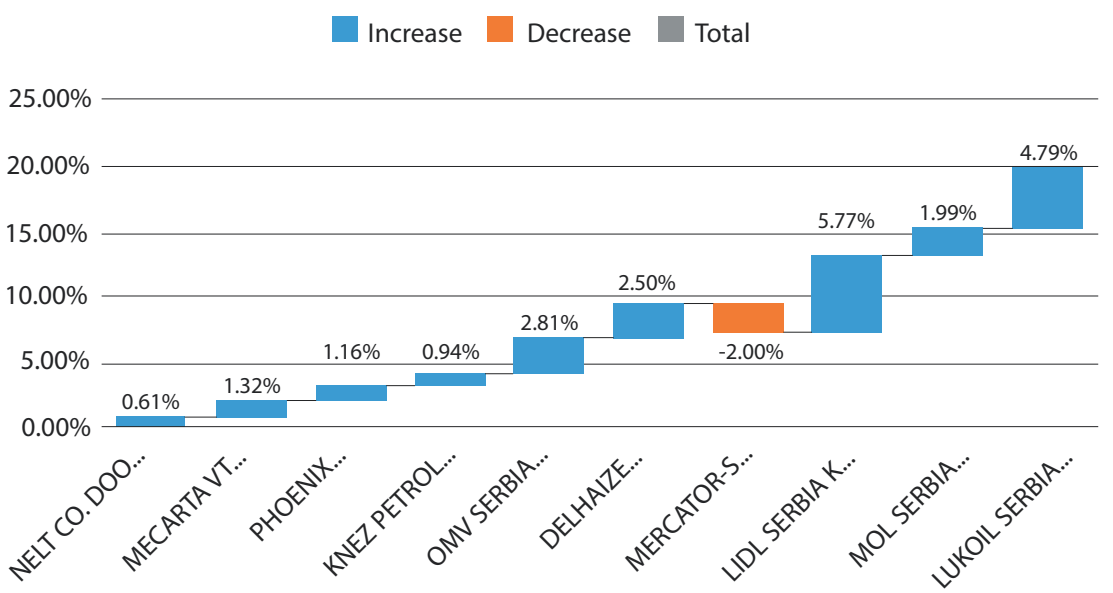
		1	2	3	4	5
1 Business income	Pearson Correlation	1	.160	.830**	.643*	.873**
	Sig. (2-tailed)		.659	.003	.045	.001
	N	10	10	10	10	10
2 Net result	Pearson Correlation	.160	1	.375	.792**	.040
	Sig. (2-tailed)	.659		.286	.006	.913
	N	10	10	10	10	10
3 Assets	Pearson Correlation	.830**	.375	1	.794**	.873**
	Sig. (2-tailed)	.003	.286		.006	.001
	N	10	10	10	10	10
4 Capital	Pearson Correlation	.643*	.792**	.794**	1	.544
	Sig. (2-tailed)	.045	.006	.006		.104
	N	10	10	10	10	10
5 Number of employees	Pearson Correlation	.873**	.040	.873**	.544	1
	Sig. (2-tailed)	.001	.913	.001	.104	
	N	10	10	10	10	10
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

There is a strong correlation between the number of employees and business income and business assets, capital and business income, net result and business assets. Significant correlation is between the net result and the number of employees. Table 4 and Figure 2 show a ratio analysis.

Table 4. Ratio analysis

	Net result/ Business income	Business income/ Assets	Assets/ Capital	Net result/ Business assets	Net result/ Capital	Net result per employee in thousands
NELT CO.	0.61%	2.946891	1.972347	1.79%	3.53%	233.0468
MERCATA VT	1.32%	5.909496	11.4345	7.79%	89.07%	940.2985
PHOENIX PHARMA	1.16%	2.053026	4.093763	2.39%	9.77%	1307.985
KNEZ PETROL	0.94%	4.840745	3.582688	4.54%	16.27%	412.468
OMV SERBIA	2.81%	2.328715	1.814289	6.53%	11.85%	25382.98
DELHAIZE SERBIA	2.50%	1.424466	1.952451	3.56%	6.95%	255.4782
MERCATOR-S	-2.00%	1.532079	0	-3.07%	0	-195.043
LIDL SERBIA	5.77%	1.154155	1.884571	6.66%	12.55%	1408.177
MOL SERBIA	1.99%	3.005996	1.581671	5.99%	9.47%	11816.33
LUKOIL SERBIA	4.79%	4.188092	1.859631	20.06%	37.30%	12155.41

Figure 2. Profit from the sale of trading companies in Serbia

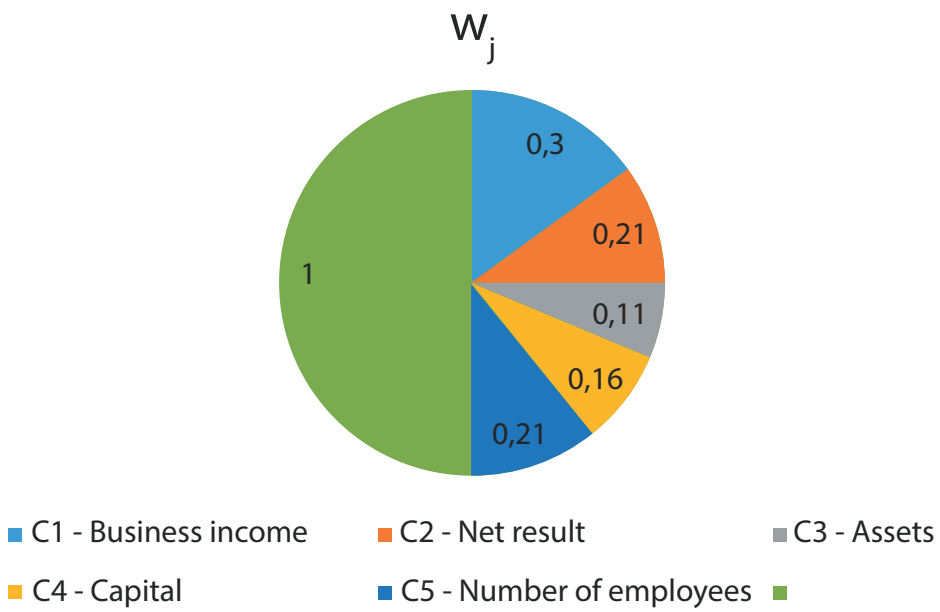


In the specific case, the trading company DELHAIZE Serbia in 2021 achieved a return on sales on 2.50%, a return on assets of 3.56% and a return on capital of 6.95%. In the same year, the trading company LIDL Serbia achieved a return on sales of 5.77%, a return on assets of 6.66% and a return on capital of 12.55%. So, trading company LIDL Serbia performed more successfully than trading company DELHAIZE Serbia. Generally speaking, foreign retail chains achieve better performance than domestic ones. One of the reasons for this is that they apply newer business methods and a greater degree of digitization of the entire business. Table 5 and Figure 3 show weight coefficients of criteria.

Table 5. Weight coefficients of the criteria

Kind	Criteria	DM1	DM2	DM3	SUM	Wj
1	C1 - Business income	100	100	100	300	0.30
1	C2 - Net result	70	80	60	210	0.21
1	C3 - Assets	50	20	40	110	0.11
1	C4 - Capital	60	50	50	160	0.16
1	C5 - Number of employees	60	70	80	210	0.21
				Total Sum	990	1

Figure 3. Weight coefficients of criteria



The most important criterion in this case is C1. Next: C2, C5, C4 and C3.

The calculation and results of the FF-WASPAS method are shown in Tables 6 – 12 and Figure 4.

Table 6. Initial Aggregated Matrix

	0.30	0.30	0.21	0.21	0.11	0.11	0.16	0.16	0.21	0.21
	1	1	1	1	1	1	1	1	1	1
	C1 - Business income		**C2** - Net result		**C3** - Assets		**C4** - Capital		**C5** - Number of employees	
A1 - NELT CO	0.83	0.10	0.80	0.10	0.70	0.20	0.70	0.20	0.70	0.20
A2 - MERCATA VT	0.63	0.27	0.38	0.50	0.53	0.37	0.47	0.43	0.50	0.40
A3 - PHOENIX PHARMA	0.80	0.10	0.10	0.85	0.10	0.80	0.10	0.80	0.15	0.75
A4 - KNEZ PETROL	0.83	0.13	0.10	0.85	0.10	0.75	0.30	0.58	0.33	0.53
A5 - OMV SERBIA	0.63	0.27	0.50	0.40	0.47	0.43	0.43	0.47	0.43	0.47
A6 - DELHAIZE SERBIA	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10
A7 - MERCATOR-S	0.25	0.62	0.87	0.10	0.53	0.37	0.80	0.10	0.70	0.20
A8 - LIDL SERBIA	0.83	0.10	0.80	0.10	0.80	0.10	0.80	0.10	0.80	0.10
A9 - MOL SERBIA	0.10	0.85	0.73	0.17	0.83	0.13	0.73	0.17	0.80	0.10
A10 - LUKOIL SERBIA	0.53	0.37	0.30	0.57	0.33	0.53	0.35	0.53	0.70	0.20

Table 7. Normalized Matrix

	0.30	0.30	0.21	0.21	0.11	0.11	0.16	0.16	0.21	0.21
	1	1	1	1	1	1	1	1	1	1
	C1 - Business income		**C2** - Net result		**C3** - Assets		**C4** - Capital		**C5** - Number of employees	
A1 - NELT CO	0.83	0.10	0.80	0.10	0.70	0.20	0.70	0.20	0.70	0.20
A2 - MERCATA VT	0.63	0.27	0.38	0.50	0.53	0.37	0.47	0.43	0.50	0.40
A3 - PHOENIX PHARMA	0.80	0.10	0.10	0.85	0.10	0.80	0.10	0.80	0.15	0.75
A4 - KNEZ PETROL	0.83	0.13	0.10	0.85	0.10	0.75	0.30	0.58	0.33	0.53
A5 - OMV SERBIA	0.63	0.27	0.50	0.40	0.47	0.43	0.43	0.47	0.43	0.47
A6 - DELHAIZE SERBIA	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10
A7 - MERCATOR-S	0.25	0.62	0.87	0.10	0.53	0.37	0.80	0.10	0.70	0.20
A8 - LIDL SERBIA	0.83	0.10	0.80	0.10	0.80	0.10	0.80	0.10	0.80	0.10
A9 - MOL SERBIA	0.10	0.85	0.73	0.17	0.83	0.13	0.73	0.17	0.80	0.10
A10 - LUKOIL SERBIA	0.53	0.37	0.30	0.57	0.33	0.53	0.35	0.53	0.70	0.20

Table 8. Weighted Normalized Matrix for WSM

	1	1	2	2	3	3	4	4	5	5
	C1 - Business income		**C2** - Net result		**C3** - Assets		**C4** - Capital		**C5** - Number of employees	
A1 - NELT CO	0.61	0.50	0.52	0.61	0.36	0.84	0.40	0.77	0.44	0.71
A2 - MERCATA VT	0.44	0.67	0.23	0.86	0.26	0.89	0.26	0.87	0.30	0.82
A3 - PHOENIX PHARMA	0.58	0.50	0.06	0.97	0.05	0.98	0.05	0.96	0.09	0.94
A4 - KNEZ PETROL	0.61	0.54	0.06	0.97	0.05	0.97	0.16	0.92	0.20	0.88
A5 - OMV SERBIA	0.44	0.67	0.30	0.82	0.23	0.91	0.24	0.88	0.26	0.85
A6 - DELHAIZE SERBIA	0.69	0.50	0.62	0.61	0.51	0.77	0.58	0.69	0.62	0.61
A7 - MERCATOR-S	0.17	0.86	0.58	0.61	0.26	0.89	0.48	0.69	0.44	0.71
A8 - LIDL SERBIA	0.61	0.50	0.52	0.61	0.42	0.77	0.48	0.69	0.52	0.61
A9 - MOL SERBIA	0.07	0.95	0.47	0.68	0.45	0.80	0.43	0.75	0.52	0.61
A10 - LUKOIL SERBIA	0.37	0.74	0.18	0.89	0.16	0.93	0.19	0.90	0.44	0.71

Table 9. Calculation for WSM

	1	1	2	2	3	3	4	4	5	5				
	1-(μ*μ*μ)	ν	1-(μ*μ*μ)	ν	1-(μ*μ*μ)	ν	1-(μ*μ*μ)	ν	1-(μ*μ*μ)	ν	ϒ	0.5		
	C1 - Business income		**C2** - Net result		**C3** - Assets		**C4** - Capital		**C5** - Number of employees		**QiS**		**ϒQiS**	
A1 - NELT CO	0.83	0.10	0.80	0.10	0.70	0.20	0.70	0.20	0.70	0.20	0.77	0.14	0.64	0.37
A2 - MERCATA VT	0.63	0.27	0.38	0.50	0.53	0.37	0.47	0.43	0.50	0.40	0.53	0.37	0.43	0.61
A3 - PHOENIX PHARMA	0.80	0.10	0.10	0.85	0.10	0.80	0.10	0.80	0.15	0.75	0.58	0.43	0.47	0.65
A4 - KNEZ PETROL	0.83	0.13	0.10	0.85	0.10	0.75	0.30	0.58	0.33	0.53	0.62	0.41	0.50	0.64
A5 - OMV SERBIA	0.63	0.27	0.50	0.40	0.47	0.43	0.43	0.47	0.43	0.47	0.53	0.38	0.43	0.61
A6 - DELHAIZE SERBIA	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10	0.90	0.10	0.78	0.32
A7 - MERCATOR-S	0.25	0.62	0.87	0.10	0.53	0.37	0.80	0.10	0.70	0.20	0.71	0.23	0.59	0.48
A8 - LIDL SERBIA	0.83	0.10	0.80	0.10	0.80	0.10	0.80	0.10	0.80	0.10	0.81	0.10	0.68	0.32
A9 - MOL SERBIA	0.10	0.85	0.73	0.17	0.83	0.13	0.73	0.17	0.80	0.10	0.71	0.24	0.58	0.49
A10 - LUKOIL SERBIA	0.53	0.37	0.30	0.57	0.33	0.53	0.35	0.53	0.70	0.20	0.52	0.39	0.42	0.63

Table 10. Normalized weighted matrix for WPM

	1	1	2	2	3	3	4	4	5	5
	C1 - Business income		**C2** - Net result		**C3** - Assets		**C4** - Capital		**C5** - Number of employees	
A1 - NELT CO	0.95	0.07	0.95	0.06	0.96	0.10	0.94	0.11	0.93	0.12
A2 - MERCATA VT	0.87	0.18	0.82	0.30	0.93	0.18	0.88	0.24	0.86	0.24
A3 - PHOENIX PHARMA	0.93	0.07	0.61	0.57	0.77	0.42	0.69	0.48	0.67	0.48
A4 - KNEZ PETROL	0.95	0.09	0.61	0.57	0.77	0.39	0.82	0.33	0.79	0.32
A5 - OMV SERBIA	0.87	0.18	0.86	0.24	0.92	0.21	0.87	0.26	0.84	0.28
A6 - DELHAIZE SERBIA	0.97	0.07	0.98	0.06	0.99	0.05	0.98	0.05	0.98	0.06
A7 - MERCATOR-S	0.66	0.43	0.97	0.06	0.93	0.18	0.96	0.05	0.93	0.12
A8 - LIDL SERBIA	0.95	0.07	0.95	0.06	0.98	0.05	0.96	0.05	0.95	0.06
A9 - MOL SERBIA	0.50	0.63	0.94	0.10	0.98	0.06	0.95	0.09	0.95	0.06
A10 - LUKOIL SERBIA	0.83	0.25	0.77	0.35	0.89	0.26	0.84	0.30	0.93	0.12

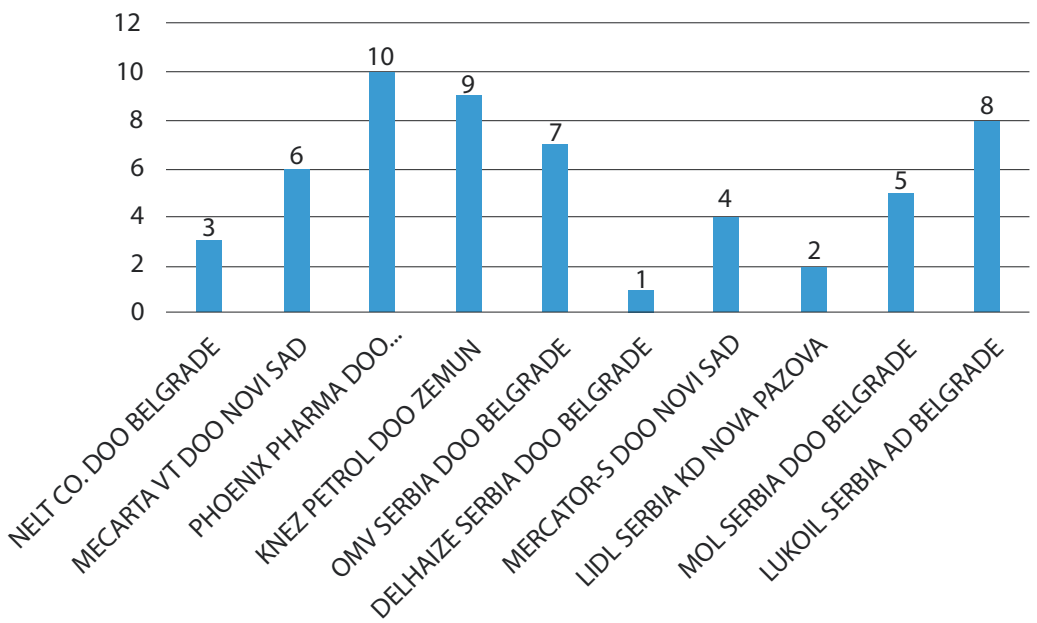
Table 11. Calculation for WPM

	1	1	2	2	3	3	4	4	5	5				
	μ	1-(v*v*v)	μ	1-(v*v*v)	μ	1-(v*v*v)	μ	1-(v*v*v)	μ	1-(v*v*v)	(1-Y)	0.5		
	C1 - Business income		**C2** - Net result		**C3** - Assets		**C4** - Capital		**C5** - Number of employees		**QiP**		**(1-Y)QiP**	
A1 - NELT CO	0.95	1.00	0.95	1.00	0.96	1.00	0.94	1.00	0.93	1.00	0.76	0.16	0.63	0.40
A2 - MERCATA VT	0.87	0.99	0.82	0.97	0.93	0.99	0.88	0.99	0.86	0.99	0.51	0.40	0.41	0.63
A3 - PHOENIX PHARMA	0.93	1.00	0.61	0.82	0.77	0.92	0.69	0.89	0.67	0.89	0.20	0.74	0.16	0.86
A4 - KNEZ PETROL	0.95	1.00	0.61	0.82	0.77	0.94	0.82	0.96	0.79	0.97	0.29	0.66	0.23	0.81
A5 - OMV SERBIA	0.87	0.99	0.86	0.99	0.92	0.99	0.87	0.98	0.84	0.98	0.51	0.41	0.41	0.64
A6 - DELHAIZE SERBIA	0.97	1.00	0.98	1.00	0.99	1.00	0.98	1.00	0.98	1.00	0.90	0.10	0.78	0.32
A7 - MERCATOR-S	0.66	0.92	0.97	1.00	0.93	0.99	0.96	1.00	0.93	1.00	0.53	0.44	0.43	0.66
A8 - LIDL SERBIA	0.95	1.00	0.95	1.00	0.98	1.00	0.96	1.00	0.95	1.00	0.81	0.10	0.68	0.32
A9 - MOL SERBIA	0.50	0.75	0.94	1.00	0.98	1.00	0.95	1.00	0.95	1.00	0.41	0.63	0.33	0.79
A10 - LUKOIL SERBIA	0.83	0.98	0.77	0.96	0.89	0.98	0.84	0.97	0.93	1.00	0.44	0.46	0.35	0.68

Table 12. Results of FF-WASPAS

	QiS		YQiS		QiP		(1-Y)QiP		Qi		Positive Score Function		Ranking
A1 - NELT CO	0.77	0.14	0.64	0.37	0.76	0.16	0.63	0.40	0.77	0.15	**1.4459**	**1.4459**	**3**
A2 - MERCATA VT	0.53	0.37	0.43	0.61	0.51	0.40	0.41	0.63	0.52	0.39	**1.0828**	**1.0828**	**6**
A3 - PHOENIX PHARMA	0.58	0.43	0.47	0.65	0.20	0.74	0.16	0.86	0.48	0.56	**0.9313**	**0.9313**	**10**
A4 - KNEZ PETROL	0.62	0.41	0.50	0.64	0.29	0.66	0.23	0.81	0.52	0.52	**1.0007**	**1.0007**	**9**
A5 - OMV SERBIA	0.53	0.38	0.43	0.61	0.51	0.41	0.41	0.64	0.52	0.39	**1.0786**	**1.0786**	**7**
A6 - DELHAIZE SERBIA	0.90	0.10	0.78	0.32	0.90	0.10	0.78	0.32	0.90	0.10	**1.7280**	**1.7280**	**1**
A7 - MERCATOR-S	0.71	0.23	0.59	0.48	0.53	0.44	0.43	0.66	0.64	0.32	**1.2318**	**1.2318**	**4**
A8 - LIDL SERBIA	0.81	0.10	0.68	0.32	0.81	0.10	0.68	0.32	0.81	0.10	**1.5313**	**1.5313**	**2**
A9 - MOL SERBIA	0.71	0.24	0.58	0.49	0.41	0.63	0.33	0.79	0.61	0.39	**1.1663**	**1.1663**	**5**
A10 - LUKOIL SERBIA	0.52	0.39	0.42	0.63	0.44	0.46	0.35	0.68	0.49	0.43	**1.0391**	**1.0391**	**8**

Figure 4. Ranking of trading companies



The most important trading companies in Serbia are: DELHAIZE SERBIA, LIDL SERBIA, NELT CO., MERCATOR-S and MOL SERBIA. Trading company PHOENIX PHARMA DOO BELGRADE is on the lower ranking ladder. Tables 13 - 17 and Figure 5 show the calculations and results of the WASPAS method.

Table 13. Initial Matrix

weights of criteria	0.3	0.21	0.11	0.16	0.21
kind of criteria	1	1	1	1	1
	C1 - Business income	**C2** - Net result	**C3** - Assets	**C4** - Capital	**C5** - Number of employees
A1 - NELT CO	80291	488	27246	13814	2094
A2 - MERCATA VT	71694	945	12132	1061	1005
A3 - PHOENIX PHARMA	59160	688	28816	7039	526
A4 - KNEZ PETROL	51491	483	10637	2969	1171
A5 - OMV SERBIA	42520	1193	18259	10064	47
A6 - DELHAIZE SERBIA	118913	2973	83479	42756	11637
A7 - MERCATOR-S	81407	-1629	53135	0	8352
A8 - LIDL SERBIA	71643	4133	62074	32938	2935
A9 - MOL SERBIA	58157	1158	19347	12232	98
A10 - LUKOIL SERBIA	37563	1799	8969	4823	148
MAX	118913	4133	83479	42756	11637
MIN	37563	-1629	8969	0	47

Table 14. Normalized Matrix

weights of criteria	0.3	0.21	0.11	0.16	0.21
kind of criteria	1	1	1	1	1
	C1 - Business income	**C2** - Net result	**C3** - Assets	**C4** - Capital	**C5** - Number of employees
A1 - NELT CO	0.6752	0.1181	0.3264	0.3231	0.1799
A2 - MERCATA VT	0.6029	0.2286	0.1453	0.0248	0.0864
A3 - PHOENIX PHARMA	0.4975	0.1665	0.3452	0.1646	0.0452
A4 - KNEZ PETROL	0.4330	0.1169	0.1274	0.0694	0.1006
A5 - OMV SERBIA	0.3576	0.2887	0.2187	0.2354	0.0040
A6 - DELHAIZE SERBIA	1.0000	0.7193	1.0000	1.0000	1.0000
A7 - MERCATOR-S	0.6846	0.0000	0.6365	0.0000	0.7177
A8 - LIDL SERBIA	0.6025	1.0000	0.7436	0.7704	0.2522
A9 - MOL SERBIA	0.4891	0.2802	0.2318	0.2861	0.0084
A10 - LUKOIL SERBIA	0.3159	0.4353	0.1074	0.1128	0.0127

Table 15. Normalized weighted matrix

	C1 - Business income	**C2** - Net result	**C3** - Assets	**C4** - Capital	**C5** - Number of employees	**Qi1**
A1 - NELT CO	0.2026	0.0248	0.0359	0.0517	0.0378	0.3527
A2 - MERCATA VT	0.1809	0.0480	0.0160	0.0040	0.0181	0.2670
A3 - PHOENIX PHARMA	0.1493	0.0350	0.0380	0.0263	0.0095	0.2580
A4 - KNEZ PETROL	0.1299	0.0245	0.0140	0.0111	0.0211	0.2007
A5 - OMV SERBIA	0.1073	0.0606	0.0241	0.0377	0.0008	0.2305
A6 - DELHAIZE SERBIA	0.3000	0.1511	0.1100	0.1600	0.2100	0.9311
A7 - MERCATOR-S	0.2054	0.0000	0.0700	0.0000	0.1507	0.4261
A8 - LIDL SERBIA	0.1807	0.2100	0.0818	0.1233	0.0530	0.6488
A9 - MOL SERBIA	0.1467	0.0588	0.0255	0.0458	0.0018	0.2786
A10 - LUKOIL SERBIA	0.0948	0.0914	0.0118	0.0180	0.0027	0.2187

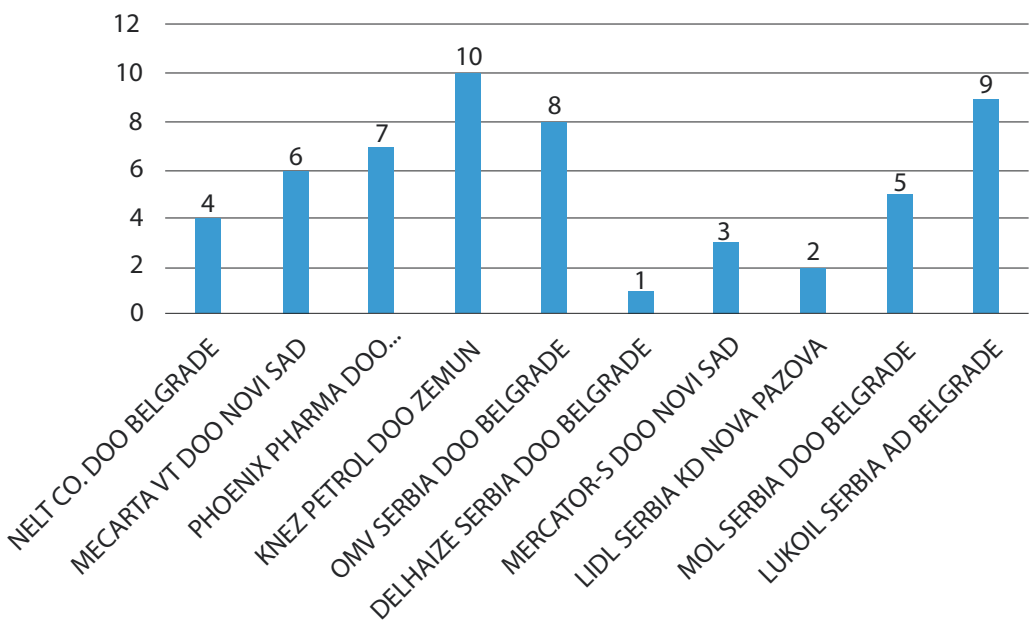
Table 16. Exponentially Weighted Matrix

	C1 - Business income	**C2** - Net result	**C3** - Assets	**C4** - Capital	**C5** - Number of employees	**Qi2**
A1 - NELT CO	0.8889	0.6385	0.8841	0.8346	0.6976	0.8889
A2 - MERCATA VT	0.8592	0.7335	0.8088	0.5535	0.5979	0.8592
A3 - PHOENIX PHARMA	0.8110	0.6862	0.8896	0.7493	0.5219	0.8110
A4 - KNEZ PETROL	0.7779	0.6371	0.7972	0.6526	0.6174	0.7779
A5 - OMV SERBIA	0.7345	0.7703	0.8460	0.7934	0.3143	0.7345
A6 - DELHAIZE SERBIA	1.0000	0.9332	1.0000	1.0000	1.0000	1.0000
A7 - MERCATOR-S	0.8925	0.0000	0.9515	0.0000	0.9327	0.8925
A8 - LIDL SERBIA	0.8590	1.0000	0.9679	0.9591	0.7488	0.8590
A9 - MOL SERBIA	0.8069	0.7655	0.8514	0.8185	0.3667	0.8069
A10 - LUKOIL SERBIA	0.7077	0.8397	0.7824	0.7053	0.3999	0.7077

Table 17. Ranking

				λ 0.5	
	Qi1	**Qi2**	**Qi**	**Qi**	**Ranking**
A1 - NELT CO	0.3527	0.3527	0.3527	0.3527	**4**
A2 - MERCATA VT	0.2670	0.2670	0.2670	0.2670	**6**
A3 - PHOENIX PHARMA	0.2580	0.2580	0.2580	0.2580	**7**
A4 - KNEZ PETROL	0.2007	0.2007	0.2007	0.2007	**10**
A5 - OMV SERBIA	0.2305	0.2305	0.2305	0.2305	**8**
A6 - DELHAIZE SERBIA	0.9311	0.9311	0.9311	0.9311	**1**
A7 - MERCATOR-S	0.4261	0.4261	0.4261	0.4261	**3**
A8 - LIDL SERBIA	0.6488	0.6488	0.6488	0.6488	**2**
A9 - MOL SERBIA	0.2786	0.2786	0.2786	0.2786	**5**
A10 - LUKOIL SERBIA	0.2187	0.2187	0.2187	0.2187	**9**

Figure 5. Ranking of trading companies according to the WASPAS method



Significant trading companies in Serbia include: DELHAIZE SERBIA , LIDL SERBIA, MERCATOR-S, NELT CO. and MOL SERBIA. KNEZ PETROL ranked the lowest among them. The performance of trading companies in Serbia is influenced by various factors, such as the global political and economic climate, interest rate, inflation, employment, exchange rate, living standards of the population, multi-channel sales – both in-store and electronic, sale of organic products, private brands, implementation of new concepts of cost, sales and profit management, customer management strategies, product categories, sustainable development, application of Japanese business philosophy, energy crisis, transportation and logistics costs and digitization of business processes.

The utilization of multi-criteria decision-making methods (Fuzzy AHP - TOPSIS, ELECTRE, MABAC, OCRA, ARAS, MARCOS, TRUST, FF-WEASPAS, WASPAS, etc.), as well as financial and statistical data, provides a more realistic overview of the financial situation of trading companies in Serbia. Therefore, these methods are highly recommended. It is also suggested to carry out similar research in other countries, as it allows for international comparisons to be made.

CONCLUSION

In trading companies in Serbia, there is a significant correlation between the net result and the number of employees.Specifically, there is a strong correlation between the number of employees and business income and business assets at the level of statistical significance. Additionally, there is a significant correlation between capital and business income, net result and business assets. Furthermore, there is a significant correlation between the net result and the number of employees. Labor productivity is a significant factor in the performance of trading companies in Serbia. In the specific case of DELHAIZE Serbia in 2021, they achieved a return on sales of 2.50%, a return on assets of 3.56% and a return on capital of 6.95%. On the other hand, the trading company LIDL Serbia achieved a return on sales of 5.77%, a return on assets of 6.66% and a return on capital of 12.55% in the same year. Therefore, LIDL Serbia outperformed DELHAIZE Serbia. Generally speaking, foreign retail chains achieve better performance than domestic ones. One of the reasons for this is that they adopt newer business methods and have a higher degree of digitization throughout their operations. There are significant differences in statistical variables among trading companies in Serbia. For instance, business income ranges from 37563.00 (LUKOIL Serbia) to 118913.00 (DELHIZE Serbia), net result ranges from 1629.00 (MERCATOR-S) to 4133.00 (LIDL Serbia), business assets range from 8969.00 (LUKOIL Serbia) to 83479.00 (DELHAIZE Serbia), the capital ranges from 0 (MERCATOR-S) to 42756.00 (DELHAIZE Serbia) and the number of employees ranges from 47.00 (OMV Serbia) to 11637.00 (DELHAIZE Serbia). Foreign retail chains have greater financial and non-financial resources at their disposal. Based on the research in this paper, the most important trading companies are DELHAIZE Serbia, LIDL Serbia, MERCATOR-S, NELT CO. and MOL Serbia. These companies primarily dominate and influence the business conditions in the retail market in Serbia.

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EVALUACIJA PERFORMANSI TRGOVINSKIH PREDUZEĆA U SRBIJI NA BAZI FF-WASPAS I WASPAS METODA

Rezime:

Glavni cilj ovog istraživačkog rada je sveobuhvatna analiza učinka trgovačkih kompanija u Srbiji i predlaganje odgovarajućih mera za buduće poboljšanje. U konkretnoj studiji slučaja, DELHAIZE Srbija ostvarila je povrat od prodaje od 2,50%, povrat na imovinu od 3,56% i povrat na kapital od 6,95% u 2021. godini. Sa druge strane, LIDL Srbija je ostvarila povrat od prodaje od 5,77%, povrat na imovinu od 6,66% i povrat na kapital od 12,55% iste godine. Prema tome, LIDL Srbija je ostvarila veći uspeh od DELHAIZE Srbija. Uopšteno govoreći, strani maloprodajni lanci pokazuju bolji učinak od domaćih. Jedan od razloga za to je što usvajaju nove poslovne metode i imaju veći stepen digitalizacije celokupnog poslovanja.

Ključne reči:
učinak,
efikasnost,
faktori,
FF-WASPAS i WASPAS metoda,
trgovina u Srbiji.

JEL klasifikacija:
L66, L81, L91.