ANALYSIS OF THE POSITIONING OF TRADING COMPANIES IN SERBIA USING THE TODIM METHOD

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Researching the positioning of trading companies globally and in each country, which means in Serbia, is a very challenging issue. In doing so, various methods of multi-criteria decision-making are increasingly being used. This provides a realistic basis for improving the positioning of a specific trading company by applying relevant measures. This study investigates the positioning of trading companies in Serbia using the TODIM method. The results of this study show that the top five trading companies in Serbia include: Delhaize Serbia, Lidl Serbia, Mercator-S, Nelt CO and Phoenix Pharma DOO. In Serbia, Delhaize Serbia ranks first in overall performance. The worst-positioned trading company is DOO Vimeksim SRB Novi Sad. To improve the positioning of trading companies in Serbia, it is necessary to manage business income, profit, assets, capital, and human resources as efficiently as possible. In this direction, it is important to adapt as adequately as possible to dynamic business changes. The function of this is the digitization of the entire business.

Keywords

Positioning, trading companies, Serbia, TODIM method

JEL classification

L81, M31, M41, O32

1.Introduction

Researching the positioning of trading companies globally and in each country, which also applies to Serbia, is very challenging, complex, and significant. Recently, to obtain the most accurate results, various methods of multi-criteria decision-making are being applied more and more in the analysis of the positioning of trading companies. Based on this, this study investigates the positioning of trading companies in Serbia using the TODIM method. The aim of this is to determine as realistically as possible the positioning of the analyzed trading companies in the function of improvement in the future by applying relevant measures.

Recently, as it is known, the richer literature is dedicated to the analysis of the efficiency of companies from different economic sectors based on the TODIM method (Tosun, 2014). Unlike the application of AHP and TOPSIS methods, there are very few, however, works of this kind from the trade sector (Velasquez, 2013; Cagri, 2013; Ersoy, 2017; Gaur, 2020; Lukic, 2019, 2020a, b, s; Sarsour, 2020). As far as we know, there is not a single complete work in the literature in Serbia dedicated to the analysis of the efficiency of trade companies in Serbia based on the TODIM method. In this sense, this judge somewhat fills that gap.

2.Materials and methods

The problem analyzed in this study is based on original empirical data collected from the Agency for Economic Registers of the Republic of Serbia. The data was created by the relevant international standards. This enables an international comparison of the obtained results without any restrictions. The method used in the analysis of the treated problem in this study is TODIM. The basic characteristics of this method are presented below.

TODIM (an acronym in Portuguese for Interactive and Multicriteria Decision Making - a shortcut in Portuguese for interactive and multicriteria decision making) method was proposed by Gomes and Lima (Gomes, 1992). It is based on the concept of Prospect Theory. The basic idea of the TODIM method is to measure the degree of dominance of each alternative over the others using the prospect value function. The partial and total degree of dominance of each alternative over the others is calculated and, finally, the global ranking of alternatives is performed (Gomes, 2009a, b). It also makes it possible to estimate values based on a verbal scale, using fuzzy values and understanding the interdependence between alternatives (2024). The basic procedural steps of the TODIM method are as follows (Gomes, 2009a, b; Uysal, 2014; Shankar, 2018; Blagojević, 2019):

Step 1: Formulate a decision matrix, with *n* alternatives and *m* evaluation criteria, as follows:

$$X = [x_{ic}]_{n\,x\,m} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix} \quad (i = 1,2,\dots,n; c = 1,2,\dots,m) \qquad (1)$$

Where x_{ic} denotes the performance of the *i* -th alternative about the *c*- th criterion.

Step 2: In order for the decision matrix to become a dimensionless matrix and all its elements to be comparable, normalization is performed, so that a normalized decision matrix is obtained.

The following equation can be used for benefit criteria that require higher values:

$$P_{ic} = \frac{x_{ic}}{\sum_{i=1}^{n} x_{ic}}, \qquad (2)$$

And for non-benefit (cost) criteria that prefer lower values of equations:

$$P_{ic} = \frac{1/x_{ic}}{\sum_{i=1}^{n} 1/x_{ic}}, \qquad (3)$$

Where: P_{ic} is the normalized value of x_{ic}.

Step 3: Using AHP or Shannon's entropy method (Lotfi, 2010), the weight priorities (relative importance) of all observed criteria are determined. The relative weight (w_{cr}) of the criterion C_c (c = 1,2, ..., m) about the reference criterion C_r is determined using the following equation:

$$w_{cr} = w_c / w_r \qquad (4)$$

Where: w_r is the weight of the reference criterion.

The reference criterion is the one that has the maximum value. Using w_{cr} enables the translation of all pairs of differences between performance measurements into the same dimension as the reference criterion.

Step 4: Calculate the degree of dominance of alternative *A* over alternative A_j using the following equation:

$$\delta(A_i, A_j) = \sum_{c=1}^{m} \emptyset_c(A_i, A_j) \quad \forall(i,j) \qquad (5)$$

In the above equation, the degree of dominance of alternative *A* and over alternative *A* $_j$, ie $\emptyset_c(A_i, A_j)$ of the observed criterion *C* $_c$ is estimated using the following equation:

$$\emptyset_c(A_i, A_j) = \begin{cases} \sqrt{\dfrac{w_{cr}(P_{ic} - P_{jc})}{\sum_{c=1}^{m} w_{cr}}} & if \quad (P_{ic} - P_{jc}) > 0 \\ 0 & if \quad (P_{ic} - P_{jc}) = 0 \\ \dfrac{-1}{\theta}\sqrt{\dfrac{(\sum_{c=1}^{m} w_{cr})(P_{ic} - P_{jc})}{w_{cr}}} & if \quad (P_{ic} - P_{jc}) < 0 \end{cases} \qquad (6)$$

Where P_{ic} and P_{jc} are respectively, the performance of alternative A_i A_j about c, and θ represents the loss factor.

The expression $\emptyset_c(A_i, A_j)$ denotes the contribution of criterion *c* to the function $\delta(A_i, A_j)$ when we compare alternatives *Ai* and *Aj*.

The terms represent:

$(P_{ic} - P_{jc}) > 0$, function gain $\delta(A_i, A_j)$;

$(P_{ic} - P_{jc}) = 0$, and a value of 0 is assigned $\emptyset_c(A_i, A_j)$; and

$(P_{ic} - P_{jc}) < 0$, the loss of the *i*-th alternative about the *j*-th alternative.

The expression $\emptyset_c(A_i, A_j)$ allows the value of the data to be adjusted to the function of the Prospectus Theory, thus explaining the aversion and risk appetite.

The Prospect Theory function has an " *S* " shape. Above the horizontal axis, the concave curve represents the gain. Below the horizontal axis, the convex curve symbolizes loss.

Different values θ can lead to different forms of the Prospect Theory function in the negative square (Gomes, 2009b; Chakraborty, 2018).

Step 5: Determining the global degree of dominance of alternative *A* and (ζ_i) using the following expression:

$$\zeta_i = \frac{\sum_{j=1}^{n} \delta(A_i, A_j) - min \sum_{j=1}^{n} \delta(A_i, A_j)}{max \sum_{j=1}^{n} \delta(A_i, A_j) - min \sum_{j=1}^{n} \delta(A_i, A_j)} \; . \qquad (7)$$

Step 6: Ranking alternatives based on declining values of their dominance ratings. The alternative with the highest rating of dominance is the most desirable, ie chosen.

The use of numerical values in estimating alternatives may have limitations in terms of uncertainty. For these reasons, the TODIM method for solving the MDCM problem with uncertain information was upgraded (Blagojević, 2019; Li, 2015).

3.Results and discussion

This study examines the positioning of trading companies in Serbia based on the TODIM method. The following criteria are used: C1 - Business revenues, C2 - Net result, C3 - Business assets, C4 - Capital and C5 - Number of employees. These criteria fully correspond to the nature of the business operations of trading companies. Alternatives were analyzed for ten trading companies

with the highest business revenues in Serbia in 2023. Table 1 shows the criteria, alternatives, and original empirical data.

Table 1 Trading companies in Serbia with the highest operating income in 2023
Amounts in millions of dinars, Number of employees used as a whole number

		Business revenues	Net result	Business assets	Capital	Number of employees
		C1	C2	C3	C4	C5
A1	Nelt CO. DOO Belgrade	95781	60	33354	8241	2384
A2	Merkata VT DOO Novi Sad	86256	1345	16138	1701	1039
A3	Phoenix Pharma DOO Belgrade	68848	669	35225	8786	585
A4	Knez Petrol DOO Zemun	60677	589	11612	3147	1229
A5	DOO Vimeksim SRB Novi Sad	59789	245	7016	850	14
A6	Delhaize Serbia DOO Belgrade	155477	7738	103220	48640	12399
A7	Lidl Serbia KD Nova Pazova	103471	1799	76508	36779	3415
A8	Mercator-S DOO Belgrade	102038	1658	53425	1282	7372
A9	MOL Serbia DOO Belgrade	67837	1496	22751	14560	100
A10	Lukoil Serbia DOO Belgrade	46514	936	11047	6224	150

Source: Agency for Economic Registers of the Republic of Serbia

Table 2 shows the descriptive statistics of the criteria.

Table 2 Descriptive statistics

Statistics						
		C1	C2	C3	C4	C5
N	Valid	10	10	10	10	10
	Missing	0	0	0	0	0
Mean		84668.8000	1653.5000	37029.6000	13021.0000	2868.7000
Median		77552.0000	1140.5000	28052.5000	7232.5000	1134.0000
Std. Deviation		31585.89716	2218.67404	31776.28802	16445.47462	4029.03010

Minimum	46514.00	60.00	7016.00	850.00	14.00
Maximum	155477.00	7738.00	103220.00	48640.00	12399.00

Note: Author's calculation using the SPSS software program

According to descriptive statistics, the largest business income in Serbia in 2023 was achieved by the trading company Delhaize Serbia. The largest net result was achieved by the trading company Delhaize Serbia. The trading company Dehaize Serbia has the largest business assets. The largest available capital is with the trading company Delhaize Serbia. The largest number of employees is in the trading company Delhaize Serbia. This in itself indicates that the trading company Delhaize Serbia significantly affects the market situation and the overall performance of trade in Serbia.

The correlation matrix of the criteria is shown in Table 3.

Table 3 Correlation matrix

Correlations						
		C1	C2	C3	C4	C5
C1	Pearson Correlation	1	.827 **	.914 **	.756 *	.918 **
	Sig. (2-tailed)		.003	.000	.011	.000
	N	10	10	10	10	10
C2	Pearson Correlation	.827 **	1	.808 **	.815 **	.868 **
	Sig. (2-tailed)	.003		.005	.004	.001
	N	10	10	10	10	10
C3	Pearson Correlation	.914 **	.808 **	1	.879 **	.875 **
	Sig. (2-tailed)	.000	.005		.001	.001
	N	10	10	10	10	10
C4	Pearson Correlation	.756 *	.815 **	.879 **	1	.666 *
	Sig. (2-tailed)	.011	.004	.001		.035
	N	10	10	10	10	10
C5	Pearson Correlation	.918 **	.868 **	.875 **	.666 *	1
	Sig. (2-tailed)	.000	.001	.001	.035	
	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).						

Note: Author's calculation using the SPSS software program

There is a strong correlation between the analyzed criteria at the level of statistical significance.

Table 4 shows the priorities (weighting coefficients) of the criteria calculated using the AHP (Analytical Hierarchy Process) method (Saaty, 2008).

Table 4 Criteria weighting coefficients

Resulting Priorities. Priorities

These are the resulting weights for the criteria based on your pairwise comparisons:

Chat		**Priority**	**Rank**	**(+)**	**(-)**
1	C1	41.1%	1	11.2%	11.2%
2	C2	26.1%	2	8.9%	8.9%
3	C3	13.6%	4	3.3%	3.3%
4	C4	14.3%	3	5.6%	5.6%
5	C5	5.0%	5	2.1%	2.1%

Decision Matrix

The resulting weights are based on the principal eigenvector of the decision matrix:

	1	2	3	4	5
1	1	2.00	4.00	3.00	5.00
2	0.50	1	2.00	3.00	4.00
3	0.25	0.50	1	1.00	4.00
4	0.33	0.33	1.00	1	5.00
5	0.20	0.25	0.25	0.20	1

Number of comparisons = 10

Consistency Ratio CR = 5.3%

Main value = 5.237

Average solution: 6 iterations, delta = 1.6E-9

Note: Author's calculation using AHP Online Calculator

According to the results of the AHP method, the most important criterion is C1. Next: C2, C4, C3. and C5. The analyzed trading companies can achieve the target business income with efficient sales. In this direction, it is important to effectively manage the other criteria as well.

The calculation procedure and the results of applying the TODIM method are presented in the tables (5-8) below.

In Table 5 the initial decision matrix is shown.

Table 5 Initial Matrix

Initial Matrix						SUM	MAX
weights of criteria	0.411	0.261	0.136	0.143	0.05	1.001	0.411
kind of criteria	1	1	1	1	1		
	C1	**C2**	**C3**	**C4**	**C5**		
A1	95781	60	33354	8241	2384		
A2	86256	1345	16138	1701	1039		
A3	68848	669	35225	8786	585		
A4	60677	589	11612	3147	1229		
A5	59789	245	7016	850	14		
A6	155477	7738	103220	48640	12399		
A7	103471	1799	76508	36779	3415		
A8	102038	1658	53425	1282	7372		
A9	67837	1496	22751	14560	100		
A10	46514	936	11047	6224	150		
SUM	846688	16535	370296	130210	28687		

In Table 6 the normalized decision matrix is shown.

Table 6 Normalized Matrix

Normalized Matrix					
	C1	**C2**	**C3**	**C4**	**C5**
A1	0.1131	0.0036	0.0901	0.0633	0.0831
A2	0.1019	0.0813	0.0436	0.0131	0.0362
A3	0.0813	0.0405	0.0951	0.0675	0.0204
A4	0.0717	0.0356	0.0314	0.0242	0.0428
A5	0.0706	0.0148	0.0189	0.0065	0.0005
A6	0.1836	0.4680	0.2787	0.3736	0.4322
A7	0.1222	0.1088	0.2066	0.2825	0.1190
A8	0.1205	0.1003	0.1443	0.0098	0.2570
A9	0.0801	0.0905	0.0614	0.1118	0.0035
A10	0.0549	0.0566	0.0298	0.0478	0.0052

						SUM
recalculated weights	1.0000	0.6350	0.3309	0.3479	0.1217	

You can see single-criterion dominances in another sheet.
Table 7 shows the Sum of single criterion dominances [δ(ai,ak)]

Table 7 Sum of single criterion dominances [δ(ai,ak)]

Som of single criterion dominances [δ(ai,ak)]	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	SUM
A1	0.0000	-0.2654	-0.5696	-0.0109	0.1776	-7.0448	-3.7968	-3.1530	-0.9181	-0.0963	-15.6773
A2	-2.1699	0.0000	-1.0099	-0.3816	0.3756	-7.3838	-4.3034	-3.4243	-1.2462	-0.1914	-19.7348
A3	-1.2502	-1.0108	0.0000	-0.4002	0.3746	-7.2773	-4.3655	-3.4750	-0.8763	0.0299	-18.2507
A4	-2.3049	-0.9319	-1.4917	0.0000	0.2317	-7.5152	-4.5961	-3.7798	-1.8117	-0.5498	-22.7495
A5	-2.9077	-2.2665	-2.5083	-1.9075	0.0000	-7.7686	-5.0605	-4.3000	-2.3536	-1.4487	-30.5214
A6	1.0208	1.0470	1.0493	1.0964	1.1229	0.0000	0.8030	0.9273	1.0314	1.1030	9.2011
A7	0.5718	0.5853	0.6316	0.6903	0.7373	-5.5916	0.0000	-1.2989	0.5731	0.6963	-2.4048
A8	-0.2188	0.2296	-0.1930	0.1821	0.5579	-6.0431	-2.2208	0.0000	-0.4469	-0.0078	-8.1609
A9	-1.7714	-0.8229	-0.9399	-0.5333	0.4138	-7.2533	-4.2329	-3.4204	0.0000	0.1700	-18.3902
A10	-2.5027	-1.6814	-1.8039	-1.0435	0.0396	-7.6033	-4.7840	-3.8980	-1.7505	0.0000	-25.0278

Table 8 shows the global dominance of G (ai), the relative global value of V (ai), and the ranking of alternatives.

Table 8 Global dominance, relative global value, and ranking of alternatives

	Alternatives	Global Dominance G (ai)	Relative Overall Value V (ai)		Ranking
Nelt CO. DOO Belgrade	**A1**	-15.6773	0.3737	0.3737	4
Merkata VT DOO Novi Sad	**A2**	-19.7348	0.2715	0.2715	7
Phoenix Pharma DOO Belgrade	**A3**	-18.2507	0.3089	0.3089	5
Knez Petrol DOO Zemun	**A4**	-22.7495	0.1957	0.1957	8
DOO Vimeksim SRB Novi Sad	**A5**	-30.5214	0.0000	0.0000	10

Delhaize Serbia DOO Belgrade	**A6**	9.2011	1.0000	1.0000	1
Lidl Serbia KD Nova Pazova	**A7**	-2.4048	0.7078	0.7078	2
Mercator-S DOO Belgrade	**A8**	-8.1609	0.5629	0.5629	3
MOL Serbia DOO Belgrade	**A8**	-18.3902	0.3054	0.3054	6
Lukoil Serbia DOO Belgrade	**A9**	-25.0278	0.1383	0.1383	9
Nelt CO. DOO Belgrade	**A10**	-15.6773	0.3737	0.3737	4
	MIN	-30.5214			
	MAX	9.2011			

The results of this study show that the top five trading companies in Serbia include: Delhaize Serbia, Lidl Serbia, Mercator-S, Nelt CO and Phoenix Pharma DOO. In terms of overall performance, Delhaize Serbia is in first place in Serbia. The worst-positioned trading company is DOO Vimeksim SRB Novi Sad. To improve the positioning of trading companies in Serbia, it is necessary to manage business income, profit, assets, capital, and human resources as efficiently as possible. In this direction, it is important to adapt as adequately as possible to dynamic business changes. The function of this is the digitization of the entire business.

4.Conclusion

Based on the results of this study, the following can be concluded: the top five trading companies in Serbia include Delhaize Serbia, Lidl Serbia, Mercator-S, Nelt CO, and Phoenix Pharma DOO. In Serbia, Delhaize Serbia is in first place in terms of overall performance. The worst-positioned trading company is DOO Vimeksim SRB Novi Sad. Adequate management of business income, profit, business assets, capital, and human resources is aimed at improving the positioning of trading companies in Serbia. Adequate adaptation to dynamic business changes and digitalization of the entire business plays a significant role in this.

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