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**THE INTEGRATED APPROACH INVOLVING
THE AHP AND TOPSIS METHODS IN ASSESSING
FINANCIAL CONDITION OF THE COMPANIES
OF THE TELECOMMUNICATIONS SECTOR**

**ZINTEGROWANE PODEJŚCIE OBEJMUJĄCE
METODĘ AHP I TOPSIS W OCENIE KONDYCJI
FINANSOWEJ PRZEDSIĘBIORSTW
SEKTORA TELEKOMUNIKACYJNEGO**

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Abstract: The aim of the paper is to make a synthetic evaluation of the financial condition of telecommunications sector companies listed on the NewConnect market in the years 2012-2015. Integrated approach, which includes the use of the AHP and TOPSIS methods, is presented and applied. The paper is both theoretical and empirical: the first part describes the process of developing a synthetic measure and the second contains the analysis and assessment, on the basis of the presented synthetic measure. Next, the studied companies are ranked and grouped by assigning the companies to four typological groups. The conducted calculations show that, the analysed companies had a varying financial condition. Most often it could be described as average and good. A positive sign is that, in the analysed time period, financial condition improved in 70% of the studied companies.

Keywords: financial condition, telecommunications sector, AHP method, TOPSIS method, synthetic measure.

Streszczenie: Celem artykułu jest syntetyczna ocena kondycji finansowej przedsiębiorstw sektora telekomunikacyjnego notowanych na rynku NewConnect w latach 2012-2015. W artykule przedstawiono i zastosowano zintegrowane podejście, które obejmuje zastosowanie metody AHP i TOPSIS. Artykuł ma charakter teoretyczno-empiryczny: w części pierwszej przedstawiono procedurę tworzenia miary syntetycznej, w drugiej zaś przeprowadzono analizę i ocenę w oparciu o przedstawioną miarę. Ponadto sporządzono ranking przedsiębiorstw oraz przeprowadzono procedurę grupowania, czyli przyporządkowania przedsiębiorstw do czterech grup typologicznych. Z przeprowadzonych obliczeń wynika, że badane przedsiębiorstwa charakteryzują się zróżnicowaną kondycją finansową. Najczęściej można ją określić jako średnią. Pozytywnym sygnałem jest to, że w analizowanym okresie w 70% badanych firm kondycja ta poprawiła się.

Słowa kluczowe: kondycja finansowa, przedsiębiorstwa sektora telekomunikacyjnego, metoda AHP, metoda TOPSIS, miernik syntetyczny.

1. Introduction

The analysis of the financial condition of a company is an important element in the assessment of its business activity. It provides important information, especially for its executives (from the standpoint of management), financial institutions such as banks (from the standpoint of creditworthiness assessment) or partners either cooperating or willing to cooperate with the company. In addition, if the company is listed on the capital market, its ratings are of interest to potential investors who decide whether or not they should invest in such a company.

In order to determine the financial condition of a given company, its financial statements are analysed, which include, among other things, the balance sheet, profit and loss account, and cash flow statement. Nevertheless, assessment of financial condition remains complex and multidimensional. It should consider various aspects of the business activity, especially the profitability, liquidity, operational efficiency and debt. Of course, many financial indicators that measure these values can be developed. Individual indicators, however, can give conflicting signals, i.e. some may point to a very good financial situation, while others indicate trouble at the same time. Therefore, when conducting research concerned with financial condition of a company, it is helpful to use multivariate statistical methods that allow for the determination of a synthetic measure, thus replacing the large group of various financial indicators with one aggregate variable.

The concept of developing a synthetic measure came about nearly 50 years ago thanks to Hellwig [1968]. It became a source of inspiration for future generations of statisticians and econometricians, who would go on to make numerous modification attempts and come up with further proposals for methods of linear ordering [Wysocki 2010]. Currently, there is a large group of methods to select, organize and classify objects that are assessed in terms of many criteria. These include: AHP, MACBETH, SMART, the ELECTRE family of methods, PROMETHEE, BIPOLAR and others.

The aim of this article is to make a synthetic evaluation of the financial condition of the telecommunications sector companies listed on the NewConnect market in the years 2012-2015. To achieve this goal, the integrated approach to determining a synthetic measure of the financial condition of the companies, which includes the use of the AHP and TOPSIS methods, was presented and applied.

The paper is both theoretical and empirical, and consists of two parts. The first part describes the process of developing a synthetic measure of the financial condition of companies using the AHP (Analytic Hierarchy Process) and TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) methods. The other part, meanwhile, is made up of an analysis and assessment of the financial condition of the companies of the telecommunications sector that are listed on the NewConnect market, on the basis of the synthetic measure calculated according to

the concepts presented in the first part of the article. Furthermore, the studied companies were ranked and the grouping process – i.e. assigning the companies to four typological groups – was implemented.

2. Research methodology – an integrated approach to the determination of the synthetic measure of the financial condition of companies involving the use of the AHP and TOPSIS methods

While defining or trying to solve problems in different fields of science, multi-criteria decision problems and methods to solve them are often encountered. The TOPSIS method, which is one of the primary methods of linear ordering of multi-criteria objects, is most commonly used to assess the economic efficiency of companies or financial condition of companies [Malinowski 2016; Yadav et al. 2016; Kazan, Ozdemir 2014; Bulgurcu 2012]. However, in this article an approach that combines the AHP and TOPSIS methods, i.e. a combination of a flexible TOPSIS algorithm and a universal mechanism for the selection of the weighting vector originating from the AHP method was applied.

The AHP (Analytic Hierarchy Process) uses expert opinions to establish weight coefficients determining the significance of partial variables (e.g. financial ratios). These coefficients are then used to develop the synthetic measure with the help of the TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution), which is a statistical process leading to linear ordering of objects (companies) described by multiple variables.

In the process of developing the synthetic measure of the financial condition of companies, based on the methods: TOPSIS [Hwang, Yoon 1981; Lai et al. 1994; Wysocki 2010] and AHP [see Saaty 1980; Golden et al. 1989; Saaty 1990; Saaty, Kearns 1991; Saaty 2001; Saaty, Vargas 2001; Saaty 2008], the following stages can be distinguished:

Stage 1: Developing a hierarchical structure of the multi-criteria problem of objects' (companies) assessment;

Stage 2: Determining the significance of the secondary criteria (areas of the financial standing, e.g. financial liquidity, profitability, efficiency, debt) and partial variables (financial ratios) by assigning to them weighting coefficients obtained from the analytic hierarchical process (AHP);

Stage 3: Determination of the synthetic measure S_i (synthetic measure of financial condition) using the TOPSIS method;

Stage 4: Linear ordering and typological classification of objects according to the synthetic measure.

Stage 1. A hierarchical structure of the multi-criteria problem of objects' (companies) assessment is developed through a decomposition of the problem

under consideration into the following components: the main criterion (financial condition), secondary criteria (areas of the financial standing, e.g. financial liquidity, profitability, efficiency, debt), partial variables (financial ratios) and objects (companies) assessed [see Saaty 1980; Saaty 1990; Saaty 2008].

The main criterion, secondary criteria and partial variables describing the researched objects (companies) are all interrelated. The selection of criteria and variables should be based on substantive and formal, as well as statistical, grounds. In the process of selecting secondary criteria and partial variables, one should pay attention, above all, to their significance from the perspective of the main assessment criterion and the scope of the information available.

Then, the proposed partial variables can be verified using statistical criteria. One can examine whether these variables really characterize and differentiate the assessed objects (companies) in terms of the main criterion (financial condition). To do this, their variation (where weak variation represents small analytical value) and the degree of correlation (strongly correlated variables carry similar information) can be tested.

In studying variation, the variation coefficient can be used. It is generally assumed that from the set of possible variables eliminated should be those whose variation coefficient is smaller than the arbitrarily predetermined, critical threshold value of this coefficient, namely 10%. To study the degree of correlation, the analysis of the matrix of Pearson's correlation coefficients can be conducted [Zeliaś 2000]. In the case of a high-value coefficient (where the threshold level is usually assumed to be $r^* = 0.7$), one of the variables should be eliminated. The removal of a variable should be decided upon substantive criteria.

Statistical data regarding partial variables selected for further research can be presented as a data matrix $X [m \times p_j]$, where the rows represent the studied objects (companies) and columns represent partial variables (financial ratios) within individual criteria w_j ($j = 1, \dots, n; p_1 + p_2 + \dots + p_n = P$) and x_{ik} is the value of k -partial variable on the i -object).

Stage 2. The vector of weights for the secondary criteria (areas of the financial standing, e.g. financial liquidity, profitability, efficiency, debt) $W = (w_1, w_2, \dots, w_n)$ and partial variables (financial ratios) $W_j = (w_{j1}, w_{j2}, \dots, w_{jp_j})$ ($j = 1, 2, \dots, n; k = 1, 2, \dots, p_j$) can be obtained through the Analytic Hierarchy Process [Saaty, Kearns 1991; Saaty 2001; Saaty 2008]. This method comprises the following steps:

Step 1. Pairwise comparison of the secondary criteria (areas of the financial standing, e.g. financial liquidity, profitability, efficiency, debt) in relation to the main assessment criterion (financial condition of the company).

Comparisons are made in pairs, in terms of the significance of the secondary criteria related to a given main criterion using e.g. Saaty's nine-point scale. The results of comparisons are presented in the form of the so-called square matrix of pairwise comparisons ($n \times n$) $A = [a_{ij}]$. It contains the assessment indicating the

impact of the elements on the left side of the matrix on the elements located on top of it. Within this matrix, $n(n - 1)/2$ pairwise comparisons are made:

$$A = [a_{ji}] = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & \dots & 1 \end{bmatrix}.$$

Step 2. Calculating weight coefficients for the secondary criteria.

One needs to multiply the elements in each row of the comparisons matrix and calculate the root whose degree is equal to the number of the elements in the row. The obtained numbers are then standardized to units by dividing each of them by their sum. The resulting values represent the vector of the weights of the secondary criteria.

Step 3. Pairwise comparison of partial variables (financial ratios) in relation to the secondary criterion (areas of the financial standing, e.g. financial liquidity, profitability, efficiency, debt).

Proceeds as described in Step 1.

Step 4. Calculating local weighting coefficients for partial variables (financial ratios).

Local weights determine the relative importance of the variables within a given secondary criterion. The sum of the local weights within each secondary criterion is 1. The structuring of the local weights for partial variables proceeds as described in Step 2.

Step 5. Calculating global values of weighting coefficients for partial variables (financial ratios).

Global weights of partial variables represent the importance of the characteristics in relation to the main criterion. The sum of all global weights for partial variables is 1. They are calculated by multiplying the local weighting coefficients for the variables by the weighting coefficients for the partial variables. As a result, the w_{jk} values are assumed to be the weights for the partial variables and they are presented the vector $W_j = (w_{j1}, w_{j2}, \dots, w_{jp_j})$ ($j = 1, 2, \dots, n; k = 1, 2, \dots, p_j$).

Stage 3. Determination of the synthetic measure S_i (synthetic measure of financial condition) using the TOPSIS method [Hwang, Yoon 1981; Lai et al. 1994; Wysocki 2010].

The calculation process proceeds according to the following steps:

Step 1. Identification of the nature of the partial variables (financial ratios).

Due to their impact on the main criterion (financial condition), partial variables (financial ratios) should be divided into stimulants, destimulants and nominants. Stimulants are the variables whose increase in value means a positive situation for the phenomenon. Destimulants are the variables showing the opposite effect, i.e., their increase in value means a negative state. Nominants are the variables

characterized by a certain optimum level, from which any deviation – increase or decrease – is a negative state. If there are destimulants and nominants in a set of variables, they have to be converted into stimulants. It is from the many transformations proposed in the literature [Kolenda 2006; Walesiak 2006] that the following ones will be applied in this study:

- for destimulants:

$$x_{ik}^S = -x_{ik}, \quad (1)$$

where: x_{ik}^S – the value of the k -partial variable (financial ratio) in the i -object (company) converted into a stimulant,

x_{ik} – the value of the k -partial variable (financial ratio) in the i -object (company),

$k = 1, 2, 3, \dots, p_j$ – the number of ratios,

$i = 1, 2, 3, \dots, m$ – the number of the ratio observations (number of companies).

- for nominants:

$$\begin{aligned} x_{ik}^S &= 0 && \text{when } x_{k,nom,D} \leq x_{ik} \leq x_{k,nom,G} \\ x_{ik}^S &= x_{k,nom,G} - x_{ik} && \text{when } x_{ik} > x_{k,nom,G} \\ x_{ik}^S &= x_{ik} - x_{k,nom,D} && \text{when } x_{ik} < x_{k,nom,D} \end{aligned} \quad (2)$$

where: $x_{k,nom,D}$ – lower value of the nominal range of the k -partial variable (financial ratio),

$x_{k,nom,G}$ – upper value of the nominal range of the k -partial variable (financial ratio).

Step 2. Developing a standardized data matrix.

The partial variables, which are aggregated to a synthetic variable must be mutually comparable. In general, variables are expressed in different units (e.g. PLN, %), which prevents from their direct aggregation. Therefore, the next step is the process of standardization.

In the literature, different standardization processes are described (e.g. standardization, quotient mapping). In this study one of the most frequently used methods of unitarization was applied, using the following formula [Strahl 1998]:

$$z_{ik} = \frac{(x_{ik} - \min x_i)}{(\max x_i - \min x_i)}, \quad (3)$$

where: z_{ik} – the standardized values of the k -partial variable (financial ratio) in the i -object (company),

x_{ik} – the empirical value of the k -partial variable (financial ratio) in the i -object (company),

$\min x_i$ – the minimum value of the k -partial variable (financial ratio),

$\max x_i$ – the maximum value of the k -partial variable (financial ratio).

Step 3. Accounting for the weights assigned to individual variables.

$$v_{ik} = w_{jk} \times z_{ik} \quad (I = 1, \dots, n; k = 1, \dots, p_j). \quad (4)$$

Step 4. Determining the vector of an ideal (A+) and anti-ideal (A-) solution

$$A^+ = [v_1^+, v_2^+, \dots, v_n^+], (v_j^+ = \max_i v_{ik}) \quad A^- = [v_1^-, v_2^-, \dots, v_n^-], (v_j^- = \min_i v_{ik}). \quad (5)$$

Step 5. Calculating Euclidean distances of the studied objects from the ideal and anti-ideal solution.

$$d_i^+ = \sqrt{\sum_{k=1}^P (v_{ik} - v_k^+)^2}, \quad d_i^- = \sqrt{\sum_{k=1}^P (v_{ik} - v_k^-)^2}. \quad (6)$$

Step 6. Developing the ranking coefficient that determines the similarity of objects to the ideal solution.

$$S_i = \frac{d_i^-}{d_i^+ + d_i^-} \quad i = 1, \dots, m. \quad (7)$$

A company that obtains the highest S_i value is considered to be the best within the given decision-making problem.

Stage 4. Linear ordering and typological classification of companies according to the synthetic measure, following the rules described below [see: Wysocki 2010]:

- Group I (very good financial condition): $S_i \geq \bar{S}_i + S_{S_i}$;
- Group II (good financial condition): $\bar{S}_i + S_{S_i} > S_i \geq \bar{S}_i$;
- Group III (average financial condition): $\bar{S}_i > S_i \geq \bar{S}_i - S_{S_i}$;
- Group IV (weak financial condition): $S_i < \bar{S}_i - S_{S_i}$,

where \bar{S}_i is the arithmetic average of the value of the synthetic variable S_{S_i} and is standard deviation.

3. The application of the AHP and TOPSIS methods in the study of the financial condition of the companies of the telecommunications sector

As proposed in this paper, the integrated approach to the determination of the synthetic measure of the financial condition of enterprises, which includes the use of the methods AHP and TOPSIS, was used to assess the financial condition of the companies of the telecommunications sector.

The research included all the companies of the telecommunications sector whose shares were listed on the NewConnect market at the beginning of July 2016. This group comprised 10 entities¹. The research time period were the years 2012-2015.

NewConnect has been present in Poland since 2007. It is a market organized and managed by the Stock Exchange in Warsaw outside the regulated market. NewConnect is a financing and marketing platform for the small and medium-sized enterprises. It is a market for companies with a short history of development – often niche, modern, with high-growth potential, seeking to raise capital for investments in new technologies.

The financial condition of the companies of the telecommunications sector				Main assessment criterion
Financial liquidity	Profitability	Efficiency	Debt	Secondary criteria (areas of the financial standing)
Current ratio (CR)	Return on sales (ROS)	Total assets turnover ratio (TATR)	Debt ratio (DR)	Partial variables (financial ratios)
Quick ratio (QR)	Return on assets (ROA)	Current assets turnover ratio (CATR)	Debt structure ratio (DSR)	
	Return on equity (ROE)	Inventory turnover ratio (ITR)	Long-term debt ratio (LDR)	
		Trade receivables turnover ratio (TRTR)		
		Trade payables turnover ratio (TPTR)		
		Cash conversion cycle (CCC)		
AIT ECL ERS IUS KOR MAR OPE TLG SFN TLS				Objects (companies)

Fig. 1. The hierarchical structure of the problem of financial condition assessment for the companies studied

Source: own study.

¹ Aiton Caldwell (AIT), easyCALL.pl (ECL), Eurosystem (ERS), Internet Union (IUS), Korbank (KOR), Marsoft (MAR), Open-Net (OPE), Telegam (TLG), SferaNet (SFN), Telestrada (TLS).

At the first stage, the hierarchical structure of the problem of assessing the financial condition of the researched companies was developed. Based on substantive reasons, 4 secondary criteria (areas of the financial standing) and 14 partial variables (financial ratios)² were determined for assessing the financial condition of the enterprises (see: [Sierpińska, Jachna 2011]; [Wędzki 2015] (Fig. 1)).

Table 1 shows how the partial variables (financial ratios) were calculated.

Table 1. Partial variables (financial ratios)

The area of the financial liquidity	<u>Current ratio (CR)</u>	current assets / current liabilities
	<u>Quick ratio (QR)</u>	(current assets – stocks – short-term inter-period settlements) / current liabilities
The area of profitability	<u>Return on sales (ROS)</u>	(net profit (loss) / sales revenue) × 100%
	<u>Return on assets (ROA)</u>	(net profit (loss) / <u>average</u> total assets) × 100%
	<u>Return on equity (ROE)</u>	(net profit (loss) / <u>average</u> equity capital) × 100%
The area of efficiency	<u>Total assets turnover ratio (TATR)</u>	total revenue / <u>average</u> total assets
	<u>Current assets turnover ratio (CATR)</u>	total revenue / <u>average</u> current assets
	<u>Inventory turnover ratio (ITR)</u>	(<u>average</u> stocks / sales revenue) × 365
	<u>Trade receivables turnover ratio (TRTR)</u>	(<u>average</u> receivables from deliveries and services / sales revenue) × 365
	<u>Trade payables turnover ratio (TPTR)</u>	(<u>average</u> liabilities from deliveries and services / sales revenue) × 365
	<u>Cash conversion cycle (CCC)</u>	((<u>average</u> stocks + <u>average</u> receivables from deliveries and services – <u>average</u> liabilities from deliveries and services) / sales revenue) × 365
The area of debt	<u>Debt ratio (DR)</u>	total liabilities / total assets
	<u>Debt structure ratio (DSR)</u>	long-term liabilities / total liabilities
	<u>Long-term debt ratio (LDR)</u>	long-term liabilities / equity capitals

Source: own study based on [Sierpińska, Jachna 2011; Wędzki 2015].

Then, using statistical criteria, the 14 partial variables (financial ratios) were verified. In order to so, variation coefficients were calculated and the matrix of Pearson's correlation coefficients was analysed. Next, by doing the appropriate calculations, it was found that:

- all the partial variables show sufficient variability (variation coefficients reach values greater than the arbitrarily set $\varepsilon = 0.1$),
- the following variables are strongly correlated with each other: CR and QR, ROE and ROA, ROE and ROS.

So QR and ROE were eliminated from the set of variables. The studied set was thus limited to 12 partial variables.

The next, namely second, stage was to determine the significance of the partial variables by assigning to them weighting coefficients (or simply weights). In many

² The selection criteria were the significance of the ratios and the scope of the available statistical data.

studies, authors propose to recognize all partial variables as equally significant and assign them the same weight. One may also come across an approach according to which the vector of the partial variables' weights is determined subjectively. In the present study, however, it was assumed that a better solution would be to varyate the significance of individual variables by assigning them different weights determined using the AHP method based on Saaty's suggestion. Experts played an important role at this stage – a bank employee with many years of experience in assessing the creditworthiness of companies, the chief accountant of the company belonging to the SME sector and a financial analyst. Together they made a pairwise assessment – first identifying secondary criteria (areas of the financial standing) and then – the partial variables (financial ratios) contained within each of them.

The resulting vector of the weight coefficients for partial variables was used in the process of determining the synthetic measure with the use of the TOPSIS method (Stage 3).

The third stage is where the nature of the partial variables – 6 stimulants (ROS, ROA, TATR, CATR, TPTR, DSR), 3 nominants (CR, DR, LDR) and 3 destimulants (ITR, TRTR, CCC) – was determined. Using the formulas (1) and (2), the nominants (the value recommended in the literature as optimal: CR 1,2-2,0, DR 0,57-0,67, LDR 0,5-1,0) and destimulants were converted into stimulants, and then using formula (3) they were standardized. The standardized partial variables were then multiplied by the weights according to formula (4). Based on this, standard and anti-standard values were established according to formula (5) and the distance of the studied companies from these values was calculated with formula (6). The calculated distances were used to determine the value of the synthetic variable according to formula (7).

Table 2 shows the linear ordering of the studied companies by the decreasing value of the synthetic measure (Step 4).

Table 2. The ranking of the companies of the telecommunications sector as listed on the NewConnect market

	2012		2013		2014		2015		2012-2015	
	S_i	Position in the ranking	S_i	Position in the ranking	S_i	Position in the ranking	S_i	Position in the ranking	\bar{S}_i	Position in the ranking
AIT	0.421	8	0.447	8	0.582	4	0.582	7	0.508	8
ECL	0.580	5	0.493	5	0.506	7	0.513	8	0.523	7
ERS	0.669	3	0.482	6	0.430	10	0.114	10	0.423	10
IUS	0.573	6	0.616	2	0.737	1	0.786	2	0.678	2
KOR	0.701	2	0.624	1	0.703	3	0.746	3	0.694	1
MAR	0.627	4	0.385	9	0.474	8	0.694	4	0.545	4
OPE	0.358	10	0.574	3	0.720	2	0.457	9	0.527	6
TLG	0.411	9	0.479	7	0.465	9	0.584	6	0.485	9
SFN	0.804	1	0.545	4	0.567	6	0.629	5	0.636	3
TLS	0.505	7	0.255	10	0.579	5	0.811	1	0.538	5

Source: own study.

The study shows that in each year of the indicated time period, the financial condition of the studied companies changed, as reflected by the synthetic measure and the position of the companies in the ranking. No company in the ranking held the same position in all the years analysed. It can be considered that for three of the companies (ECL, KOR, TLG), the change in the ranking positions was not particularly substantial (i.e. by 1-3 places). Five companies (AIT, IUS, MAR, SFN, TLS), however, changed their position significantly – by 4-6 places, whereas in the case of two companies a change of up to 8 spots was observed (ERS, OPE).

In the analysed period, KOR and IUS had the best financial condition, while ERS and TLG had the worst. In seven enterprises, financial condition improved (synthetic measure increased), while in three cases it got worse (synthetic measure decreased). The biggest positive changes in financial condition were reported for TLS – in 2013, the company had the synthetic measure value of barely 0.255 (10th position in the ranking), only to achieve 0.579 (5th position) in 2014 and then up to 0.811 (1st position) in 2015. The biggest negative changes in the financial condition, on the other hand, were observed for ERS (0.555 drop in synthetic measure value – down from 3rd to the 10th position).

The results of the linear ordering subsequently formed the basis for dividing the studied companies into uniform and differing groups from the standpoint of their respective financial condition (Table 3).

Table 3. Classification of the studied companies into groups based on their financial condition

Group	Financial condition	2012	2013	2014	2015	2013-2015
1	Very good	SFN	IUS, KOR	IUS, KOR, OPE	TLS	IUS, KOR
2	Good	ECL, ERS, IUS, KOR, MAR	ECL, OPE, SFN	AIT, TLS	IUS, KOR, MAR, SFN	OPE, SFN
3	Average	AIT, TLS	AIT, ERS, MAR, TLG	ECL, MAR, TLG, SFN	AIT, ECL, OPE, TLG	AIT, ECL, MAR, TLG, TLS
4	Weak	OPE, TLG	TLS	ERS	ERS	ERS

Source: own study.

In 2012, the most popular group was Group 2 (good financial condition), in 2013-2014 – Group 3 (average financial condition), in 2015 – Group 2 and 3. The least popular group, in 2012 was Group 1 (very good financial condition), in 2013-2014 – Group 4 (weak financial condition), in 2015 – Group 1 and 4.

An interesting case is TLS who, in 2013, was in the group characterized by weak financial condition, moving up to the group of good financial condition in 2014, and achieving very good financial condition in 2015.

4. Conclusion

The synthetic measure enables the measurement of a multidimensional phenomenon such as financial condition and group-ordering of the studied companies according to the level of their financial strength. This paper presents an integrated approach to the determination of a synthetic measure of the financial condition of companies, which includes the use of the AHP and TOPSIS methods.

The AHP was used to establish the weight coefficients determining the significance of partial variables. Then, these coefficients were used to develop the synthetic measure using the TOPSIS method. The presented process of developing a synthetic measure was applied to assess the financial condition of the companies of the telecommunications sector as listed on the NewConnect market. Using the criterion of the decreasing synthetic measure value, a ranking of the companies studied in the years 2012-2015 was developed, with these enterprises being divided into four typological groups, based on the level of their financial condition.

The conducted calculations show that:

1. In the years 2013-2015 financial condition of the studied companies was subject to change (either positive or negative). In most cases, these changes were positive – the financial condition of seven companies improved (increase in synthetic measure value) and got worse in three companies (a decrease in synthetic measure value).

2. In the following years of the indicated time period, the ranking of the studied companies changed in terms of their respective financial condition. In the case of 30% of the studied companies, these changes in position were not particularly substantial (i.e. 1-3 places). 50% of the companies noted a fairly substantial change in their ranking position, while in the case of two companies this change was very substantial.

3. In the analysed time period, the most popular group was Group 3 (average financial condition). The least popular group, meanwhile was Group 4 (weak financial condition).

To conclude, the companies of the telecommunications sector listed on the NewConnect market had a varying financial condition. Most often it could be described as average and good. A positive sign is that, in the analysed time period, financial condition improved in 70% of the studied companies.

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