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INVESTIGATION OF DIGITAL RETAIL COMPANIES FINANCIAL PERFORMANCE USING MULTIPLE CRITERIA DECISION ANALYSIS

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Abstract. Digital retail (online retail or e-commerce) sector is continuously expanding its stake in the global economy each year. According to the statistics, online retail share of the total global retail sales takes approximately 11.9% in 2018 and is expected to reach 17.5% at the end of 2021. The same pattern of rapid growth was noticed more than 18 years ago when a burst of dot-com bubble crashed many of the internet-based online shopping companies. "Growth over profits" mentality and overestimated perception of the magnitude of online sales resulted in a superficial understanding of the business' financial performance. Because of that, it is highly necessary to analyze and adequately evaluate the financial performance of digital retail companies. Thus, the purpose of this article is to investigate the top 4 digital retail companies' financial performance by applying multiple criteria decision analysis (MCDA) TOPSIS and SAW methods to demonstrate that sales turnover is not the only and the prime measure to evaluate the successful company's financial performance.

Keywords: financial performance, digital retail, digital transformation, online retail, e-commerce, MCDA, TOPSIS method, SAW method.

Introduction

Digitalization or digital transformation is a significant trend in nowadays business world. Digital transformation and transition to digitalization are nearly in all the services of our globalized economy. One of the fields that are affected by digital transformation the most is the retail industry. E-commerce sales have been growing rapidly in the past couple of years. According to the statistics, digital retail sales increased from 1 336 billion USD in 2014 to 2 304 billion USD in 2017 (72% growth) and is expected to grow up to 4 878 billion USD by the end of 2021 (265% growth) (Statista, 2018a, 2018b).

The growing share of this business sector and the potential future impact to the economics emphasises the need for proper investigation and evaluation of the financial performance of this sector players. Sales turnover is a widely used financial indicator of the company's performance and the magnitude of the business. However, this traditional performance determinant might not be the most adequate measurement to evaluate digital company's success due to the vastly increasing digital transformation process and its impact to the business. Thus, identifying

adequate success factors is a crucial matter to evaluate successful business performance.

This scientific article aims to assess the top 4 digital retail companies financial performance using 2 of the multicriteria decision analysis (MCDA) methods – TOPSIS and SAW – in order to demonstrate that sales turnover is not the only and the prime measure to evaluate the successful company's financial performance and to determine which one is the most successful business.

The research conducted in this scientific article is limited to digital (or e-commerce) retail companies. E-commerce company is defined as a company that does most of its business on the Internet. It excludes Internet service providers or other information technology companies.

1. Theoretical background

1.1. Digital transformation effect to the business

Digital transformation (digitalization or digitization) is a trending process of integration of digital technologies into all areas of a business. This transformational process

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and its effect to business have been widely investigated by many authors in their scientific papers. Jürgen Meffert and Anand Swaminathan (2018) agreed that companies that adopt digital technologies in their business would retain their leadership and leverage their strengths. Companies that want to digitalize successfully can either improve their current business model and processes, add new streams of revenue to their business model, or replace their old business models with the new ones. However, since digital transformation is a complicated process, authors C. Matt, T. Hess and A. Benlian in their scientific article *Digital Transformation Strategies* (2015) argue that increasing digitalization of business processes makes it necessary to develop a better understanding of digital business transformation strategies. It is essential to set a clear approach and assign adequate responsibilities for implementation of such conversion change in the business. One of the core elements which helps the company to differentiate itself from the competitive environment and to create additional value, according to S. Mithas, A. Tafti and W. Mitchell (2013), is an investment into general information technologies and IT outsourcing. Moreover, according to a survey which was conducted by MIT Sloan Management Review and Capgemini Consulting to investigate how businesses succeed or fail in using digital technology to improve business performance it was revealed that 78% of respondents admitted that achieving digital transformation will become critical to their organization within next two years. The results of the survey indicated that managers believe that digital technology will bring transformative change to business (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2013).

1.2. Online retail or "e-tail" concept

One of the fields that are affected by digital transformation the most is the retail industry. A term online retail or "e-tail" actually covers retailing using a variety of different technologies or media (Chen & Leteney, 2000). According to the World Trade Organization (World Trade Organization, 2018), e-commerce concept is described as "commercial transactions that are digitally-ordered and either digitally or physically delivered." Many retail firms that have traditionally operated solely in the store channel (or offline) have been transforming their business processes to engage with customers in the online channel. This strategic realignment is triggered by the rapid increase in online retail sales that has grown at a faster rate than in-store sales (Ishfaq, Defee, Gibson, & Raja, 2016).

The online channel is an information-wealthy and cost-effective channel for product placement. It provides consumers with detailed product information worldwide (Rapp, Baker, Bachrach, Ogilvie, & Beitelspacher, 2015). Consumers are provided by the availability to reach the online site and search for product information anywhere without being bordered by time and place. The most significant advantage against offline channels is that consumers can more easily compare information between various products on the Internet (Zhu, Goraya, & Cai, 2018). Due to its many distinctive advantages, online retail continues to grow. Darrell Rigby (2011) also agrees that digital retailing will continue to grow fast because of the vast selection of goods, the reasonable prices, the convenience of shopping from home, and the access to product reviews and recommendations. Comfortable shopping, 24/7 convenience, reducing dependence to visit physical stores, travel costs savings, reasonably quick delivery, secure payment, a wide range of products and personalization services, are only a few of many reasons why consumers choose to shop online over traditional retail options.

1.3. Online retail market overview

The online retail market overview is restricted to digital (or e-commerce) retail companies only. E-commerce company is defined as a company that does most of its business on the Internet. It excludes Internet service providers or other information technology companies. According to revenue (total sales turnover), the top 4 online retail companies are Amazon, Inc, JD.com, Inc, Alibaba Group Holding Ltd and eBay, Inc (Table 1).

Table 1. Top 8 digital retail companies[1] in the world according to turnover (in millions US$)[2]

Company	Country	2017	2016	2015	2014
Amazon, Inc	USA	$177 866	$135 987	$107 006	$88 988
JD.com, Inc	China	$55 641	$37 167	$27 880	$18 537
Alibaba Group Holding Ltd.[3]	China	$22 965	$15 686	$12 293	$8 463
eBay, Inc	USA	$9 567	$8 979	$8 592	$8 790
Rakuten, Inc	Japan	$8 407	$7 123	$5 896	$5 690
Zalando SE	Germany	$5 377	$3 834	$3 232	$2 691
ASOS plc	UK	$2 595	$1 777	$1 706	$1 515
B2W Companhia Digital	Brazil	$2 148	$2 641	$2 308	$ 2 964

[1] Compiled by the author according to financial data from the official firms' annual reports.

[2] In cases were financial mkinformation was stated in other currency than US Dollars (USD), the figures were converted using the year-end-date FX exchange rate stated in https://www.oanda.com/currency/converter/

[3] Financial year of Alibaba Group Holding Ltd. ends as of 31st March.

The top 1 place is firmly occupied by e-commerce company Amazon also known as Amazon.com. Founded in 1994 in Seattle by Jeff Bezos, Amazon has become a household name when it comes to online shopping. This internet company today has the most substantial revenue and is considered as the biggest employer of all the internet companies with a workforce of more than 566 thousand employees. Jingdong or JD.com is an e-commerce company operating in Beijing. Jingdong has well over a quarter of a billion registered users as of 2018. It was founded in 1998 and started trading online six years later. Alibaba is the biggest e-commerce company in Asia with headquarters in Hangzhou; China has more than a billion users worldwide. Jack Ma, the founder of Alibaba, was rejected from more than 30 job posts in the early 1990s when he started making websites for companies with his wife and a friend. The business grew exponentially, and in the year 1999, Alibaba Group was founded. Alibaba has two major portals that run under it, Alibaba and AliExpress. eBay is an e-commerce company which was founded in 1995 by a computer programmer named Pierre Omidyar. It was one of the first successful dot-com bubble companies that epitomized online shopping. Its most distinctive feature is the online auction feature, alongside a conventional buy-it-now shopping option. These top 4 digital retail companies will be further assessed in this scientific article.

1.4. Factors affecting a firm's financial performance

Successful financial business performance can be described in various ways; it depends on a company's strategy and management goals. However, some widely used performance indicators truly reflect a positive and a leading to success business. The main factors that affect a firm's financial performance and that are going to be analyzed in this paper are:
- The company's stock price growth
- Revenue
- Gross Profit margin
- Net Profit margin
- Return on Assets (ROA)
- Return on Equity (ROE)
- Return on Sales (ROS)
- Cost of investment in digital technologies
- GDP per capita of the country of the headquarters
- Total ESG score

The stock price is one of the main factors of the successful company's financial performance. Fluctuations in a stock price not only brings gain or loss to the investors but also can indicate triggers in business performance. The stock market wholly and quickly incorporates public information into the stock price. Thus, the evaluation of the company's market share price growth can indicate the success of a business in a given market condition.

Ratio analysis is perhaps the most commonly used tool in financial analysis. Financial ratios allow to assess and analyze the strengths and weaknesses of a given company about such measures as liquidity, profitability, performance, and growth and compare them to other companies in the market or an industry standard (Hitchner, 2011). Additionally, profitability ratios are also widely used by the investors of the company since they help to measure and evaluate the ability of a company to generate income (or profit) relative to revenue, assets, operating costs, and shareholders' equity during a specific period. Ratios indicate how well a firm utilizes its assets to produce profit and, thus, create value to shareholders (Corporate Finance Institute, 2018).

Profitability ratios that will be used in this paper to analyze the previously identified research object are:

$$Gross\ Profit\ Margin = \frac{Gross\ Profit}{Revenue}\,x100\%\,; \qquad (1)$$

$$Net\ Profit\ margin = \frac{Net\ Profit}{Revenue}\,x100\%\,; \qquad (2)$$

$$Return\ on\ Sales\,(ROS) = \frac{Operating\ profit}{Revenue}\,; \qquad (3)$$

$$Return\ on\ Assets\,(ROA) = \frac{Net\ Profit}{Total\ Assets}\,; \qquad (4)$$

$$Return\ on\ Equity\,(ROE) = \frac{Net\ Profit}{Owners'Equity}\,. \qquad (5)$$

Gross Profit margin compares gross profit to sales revenue. It shows how much a business is earning, considering the needed costs to produce its goods and services. Net Profit margin is the bottom line and takes everything into account. It provides the final picture of how profitable a company is after all expenses including interest and taxes. Return on Sales (ROS) is an operational efficiency ratio. This measure provides information on how much profit is being generated per dollar of the company's sales. Return on Assets (ROA) expresses a percentage of the company's net revenue in relation to the total assets. ROA ratio shows how much after-tax profit a company generates for 1 dollar of assets it has. Return on equity (ROE) indicates the rate of return of 1 dollar that the company's shareholders have invested in the business.

As revenue is used in the majority of profitability ratios and traditionally is one of the primary measures when evaluating a company's magnitude and selling power, it will also be assessed separately as one of the influencing factors of business financial performance.

Majority of different companies are focusing on digitalization and trying to find a way forward to develop business cases for such technology adoption. Mithas, Tafti, and Mitchell (2013) in their article *How a Firm's Competitive Environment and Digital Strategic Posture Influence Digital Business Strategy* discuss how the competitive industry environment shapes the way that digital strategic posture influences firms realized digital business strategy. According to the authors, increasing digitization of business processes, products, and services makes it imperative to develop a better understanding of digital business strategies. Digital strategies such as investments in general

information technology and IT outsourcing are significant elements of overall business strategy. However, considerable investments in the digital environment and the development of online platforms might lead to high operating expenses. Hence, digital companies might provide lower prices to the customer and significantly increase sales turnover but suffer in operating expenses regarding digital technologies maintenance costs. Because of that, cost of investment in digital technologies is a crucial factor to evaluate successful business performance.

Another influencing factor of the company's financial performance on the level of economic development measured as Gross Domestic Product per capita (GDP per capita). Tim Jackson (2009) in a book *Prosperity Without Growth. Economics for a Finite Planet* discuss the GDP per capita and its value to economic growth. According to the author: "The GDP is broadly speaking a measure of "economic activity" in a nation or region. The GDP counts the economic value of goods and services exchanged on the market. If we're spending our money on more and more commodities, it's because we value them. We wouldn't value them if they weren't at the same time improving our lives. Hence a continually increasing per capita GDP is a reasonable proxy for rising prosperity". GDP per capita identifies a citizen ability to consume more, and higher incomes mean increased choices, more prosperous lives, improved quality of life for those who benefit from them. Thus, a successful business adds its part to a better GDP per capita measure and vice versa – high GDP per capita can also influence a better performance of a company in the country that it operates in.

The last criteria that could be analyzed as one of the indicators of a successful company's performance is the environmental, social and governance (ESG) rating. Being a sustainable business, which also shows a social responsibility is necessary in the business world. ESG ratings measure how well companies proactively manage the environmental, social and governance issues that are the most material to their business and provide an assessment of companies' ability to mitigate ESG risks. The ESG rating is a quantitative score on a scale of 1–100 and is categorized across five risk levels: negligible, low, medium, high and severe. Most international and domestic public (and many private) companies are being evaluated and rated on their ESG performance. Institutional investors, asset managers, financial institutions and other stakeholders are increasingly relying on these reports and ratings to assess and measure company ESG performance over time and as compared to peers. Hence, ESG rating is also one of the factors that could influence a company's success (Sustainanalytics, 2018).

The criteria mentioned above will be further used for application of multiple criteria decision analysis methods to assess which one of the selected top 4 digital retail companies' is operating the most successfully.

2. Multiple criteria decision analysis (MCDA) methodology

To assess the criteria and their effect on a project (or alternative) multiple criteria decision analysis (MCDA) methods (or multicriteria methods) are widely used. TOPSIS and SAW methods will be further analyzed and applied in this article to evaluate the financial performance of the top 4 digital retail companies.

2.1. TOPSIS method

TOPSIS (technique for order preference by similarity to ideal solution) method is a popular approach to multiple criteria decision analysis (MCDA) developed by Hwang and Yoon. TOPSIS has been widely used to rank the preference order of alternatives and determine the optimal choice (T. Y. Chen & Tsao, 2008). The positive ideal solution is a solution that maximizes the benefit criteria and minimizes the cost criteria, whereas the negative ideal solution maximizes the cost criteria and minimizes the benefit criteria. The best alternative is the one with a value which is closest to the positive ideal solution and has the farthest distance from the negative ideal solution (Wang & Elhag, 2006).

The TOPSIS method can be applied using several calculation steps: the first step is gathering the performance values of the alternatives according to the criteria set. The second step is performance values normalization. Then, normalized values need to be weighted (multiplied by the weights of the criteria), and the distances to the positive ideal and negative ideal solutions are calculated. Lastly, the relative closeness to the positive ideal solution is indicated, and ranking of the alternatives is performed (Ishizaka & Nemery, 2013).

These steps are detailed explained below:

1. Construct the decision matrix and determine the weight of criteria:

$$x = \left(x_{ij} \right). \tag{6}$$

2. Normalize the decision matrix:

$$n_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}. \tag{7}$$

3. Calculate the weighted normalized decision matrix:

$$v_{ij} = w_j n_{ij} \tag{8}$$

for $i = 1, \ldots, m; j = 1, \ldots, n$.

w_j – the weight of the j – th criterion.

4. Determine the positive ideal and negative ideal solutions:

$$V^+ = \left(v_1^+, v_2^+, \ldots, v_n^+ \right) = \left(\left(\max_i v_{ij} \middle| j \in I \right), \left(\min_i v_{ij} \middle| j \in J \right) \right);$$

$$\tag{9}$$

$$V^- = \left(v_1^-,\, v_2^-, ...,\, v_n^-\right) = \left(\left(\min_i v_{ij}\,\middle|\,j \in I\right), \left(\max_i v_{ij}\,\middle|\,j \in J\right)\right),$$ (10)

where I is associated with benefit criteria and J with the cost criteria, $i = 1, ..., m$; $j = 1, ..., n$;

5. Calculate the separation measures from the positive ideal solution and the negative ideal solution:

$$S_i^+ = \sqrt{\sum_{j=1}^n \left(v_{ij} - v_i^+\right)^2},\quad i = 1, ..., m;$$ (11)

$$S_i^- = \sqrt{\sum_{j=1}^n \left(v_{ij} - v_i^-\right)^2},\quad i = 1, 2, ..., m.$$ (12)

6. Calculate the relative closeness to the positive ideal solution:

$$P_i = \frac{S_i^-}{S_i^- + S_i^+}.$$ (13)

7. Rank the alternatives according to the relative closeness to the ideal solution. The bigger the Pi, the better the alternative. The best alternative is the one with the highest relative closeness to the ideal solution.

TOPSIS is considered as a very understandable and straightforward method. However, the drawback of this method is that the extreme value of the criteria might be preferred more than the compromise one and it might provide illogical results. Thus, another MCDA method is being used to assess and rank the top 4 digital retail companies financial performance results.

2.2. SAW method

Simple Additive Weighting (SAW) method is often also known as weighted summing method. The basic concept of SAW method is to find the weighted sum of performance ratings on each alternative on all attributes. The SAW method requires the process of normalizing the decision matrix (X_{ij}) to a scale comparable to all existing alternative ratings (Anggraeni, Huda, Maseleno, Safar, & Jasmi, 2018).

1. The sum S_j of the weighted normalized values of all the criteria is calculated for the j-th object. The alternatives are then ranked according to the calculated values S_j from the largest value to the lowest one. The largest value of the sum S_j reflects the best alternative:

$$S_j = \sum_{i=1}^m w_i \overline{r}_{ij},$$ (14)

w_i – weight of the i – th criterion
$\overline{r}_{ij}$ – normalized i – th criterion's value for j – th object;
$i = 1, ..., m$; $j = 1, ..., n$
m – the number of the criteria used
n – the number of the criteria used (alternatives) compared

2. One of the limitations of the SAW method is that it can only be used when all the criteria are maximizing. Thus, if the criteria are minimizing, this can be implemented by converting the criteria to maximizing ones using the below the formula. In this way, the minimal criteria value $r_{ij} = \min_j r_{ij}$ acquires the largest value equal to unity:

$$\overline{r}_{ij} = \frac{\min_j r_{ij}}{r_{ij}},$$ (15)

r_{ij} – i – th criterion's value for j – th alternative,
$\min_j r_{ij}$ – the smallest i – th criterion's value for all the alternatives compared,
$\overline{r}_{ij}$ – detonates the converted values.

3. Normalization of the initial data is performed in order to the largest maximizing value of the criteria value would get the largest value equal to unity. The formula used for maximizing criteria is below:

$$\overline{r}_{ij} = \frac{r_{ij}}{\max_j r_{ij}},$$ (16)

$\max_j r_{ij}$ – the largest i – th criterion's value of the alternatives compared.

4. Another drawback of the SAW method is that all criteria values r_{ij} should be positive. In cases when there are negative values of the criteria used, these values are transformed into positive ones using the formula below (Podvezko, 2011):

$$\overline{r}_{ij} = r_{ij} + \left|\min_j r_{ij}\right| + 1.$$ (17)

SAW method is a very easy-to-apply method and is very commonly used in alternatives ranking. However, due to its drawbacks mentioned above and usage of transformational steps might distort the ranking results.

3. Investigation of top 4 digital retail companies' financial performance

3.1. Criteria

Ten criteria determined as factors influencing a company's financial performance will be further used in applying the selected methods (Table 2).

Criterion C8 will be set as a cost criterion because investment in digital technologies, product and content development, and online platforms requires a lot of expenses. Even though it brings efficiency to a company's processes and more qualitative services, however, the company should be focused on how to reduce such expenses since it affects the profitability of a business. The remaining nine success factors will be set as benefit criteria because usually a firm would concentrate on the maximization of these determinants and the higher the result of the factor, the better performance of a company. Factor C10 was measured according to the ranking of ESG ratings, applying for the position number according to five

risk levels: 1 – negligible, 2 – low, 3 – medium, 4 – high and 5 – severe (Sustainanalytics, 2018).

3.2. Application of the TOPSIS method

First, the decision matrix was constructed of the selected alternatives (top 4 digital retail companies: Amazon. com, JD.com, Alibaba.com, and eBay.com) and 10 factors (or criteria) identified in the previous section. Moreover, weights of the criteria were calculated. In order to

have a fair and not subjective view, the weights to the criteria were equally set to 0,1 summing up to a total of 1 (Table 3).

Secondly, a normalized decision matrix was computed (Table 4). Normalization was performed by dividing each criteria value by the square root of the squared sum of the total criteria values.

Then the weighted normalized decision matrix was calculated (Table 5) by multiplying identified weights by each value of the normalized decision matrix cell.

Table 2. Data of the top 4 digital retail companies[4] (source: Alibaba Group Holding Ltd., 2019; Amazon, Inc., 2019; eBay, Inc., 2019; JD.com, Inc., 2019; The World Bank, 2019; Yahoo Finance, 2018)

	AMAZON	JD	ALIBABA	EBAY
The company's stock price growth in 2017 (%)	55%	60%	95%	27%
Revenue (millions $)	177 866	55 641	22 965	9 567
Gross Profit margin (%)	37%	14%	62%	77%
Net Profit margin (%)	2%	0%	28%	−11%
Return on Assets (ROA) (%)	2%	0%	30%	24%
Return on Equity (ROE) (%)	2%	0%	9%	−4%
Return on Sales (ROS) (%)	11%	0%	16%	−13%
Investment in digital technologies & product development (millions $)	22 620	1 022	2 479	1 224
GDP per capita in country of the headquarters in 2017 ($)	59 928	8 827	8 827	59 928
Total ESG score	45 (2)	43 (2)	49 (3)	64 (4)

Table 3. Weights of the criteria and performances of the alternatives

	Benefit	Benefit	Benefit	Benefit	Benefit	Benefit	Benefit	Cost	Benefit	Benefit
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Weights	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Amazon	55%	177 866	37%	2%	2%	2%	11%	22 620	59 928	2
JD	60%	55 641	14%	0%	0%	0%	0%	1 022	8 827	2
Alibaba	95%	22 965	62%	28%	30%	9%	16%	2 479	8 827	3
eBay	27%	9 567	77%	−11%	24%	−4%	−13%	1 224	59 928	4

Table 4. Normalized decision matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Amazon	0.431	0.946	0.347	0.066	0.052	0.199	0.471	0.992	0.700	0.348
JD	0.472	0.296	0.131	0.000	0.000	0.000	0.000	0.045	0.103	0.348
Alibaba	0.739	0.122	0.582	0.929	0.780	0.896	0.685	0.109	0.103	0.522
eBay	0.212	0.051	0.723	−0.365	0.624	−0.398	−0.556	0.054	0.700	0.696

Table 5. Weighted normalized decision matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Amazon	0.043	0.095	0.035	0.007	0.005	0.020	0.047	0.099	0.070	0.035
JD	0.047	0.030	0.013	0.000	0.000	0.000	0.000	0.004	0.010	0.035
Alibaba	0.074	0.012	0.058	0.093	0.078	0.090	0.068	0.011	0.010	0.052
eBay	0.021	0.005	0.072	−0.036	0.062	−0.040	−0.056	0.005	0.070	0.070

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[4] The most recent publicly available data was used for the criteria measures.

Table 6. Positive ideal and negative ideal solutions

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
V^+	0.074	0.095	0.072	0.093	0.078	0.090	0.068	0.004	0.070	0.070
V^-	0.021	0.005	0.013	−0.036	0.000	−0.040	−0.056	0.099	0.010	0.035

Later, the positive ideal V^+ and negative ideal V^- solutions were determined (Table 6) by maximizing or minimizing benefit and cost criteria. All the criteria were maximized (except for C8 – it was minimized).

The distances of each alternative from the positive ideal solution S_i^+ and the negative ideal solution S_i^- were calculated (Table 7). After that, a relative closeness P_i of each alternative to the positive ideal solution was also identified (Table 8).

Table 7. Distance from the positive ideal solution and the negative ideal solution

	S_i^+	S_i^-
Amazon	0.175	0.169
JD	0.202	0.127
Alibaba	0.104	0.261
eBay	0.245	0.145

Table 8. Relative closeness calculation

	P_i
Amazon	0.491
JD	0.387
Alibaba	0.714
eBay	0.372

Finally, the ranking of the alternatives was performed based on the greater result of the relative closeness to the ideal solution (Table 9).

Table 9. Ranking of the alternatives

	Rank
Amazon	2
JD	3
Alibaba	1
eBay	4

According to the TOPSIS method, it turns out that the most successful digital retail company is Alibaba. Even though the highest revenue is generated by Amazon, it only takes a second place. Surprisingly, the second-place winner (according to the sales revenue) JD is almost the least successful company out of the top 4 e-commerce companies analyzed using this method and wins over the eBay, which takes the 4th place, by only a 2nd decimal point. However, TOPSIS method is being criticized because it sometimes gives not logical results and a compromise alternative is usually never ranked as a first choice.

3.3. Application of the SAW method

The first step of the SAW method implementation is the preparation of the decision matrix. The same decision matrix (Table 3) used in the TOPSIS method will be used applying the SAW method. Since C4, C6 and C7 criterions used in the model have a negative value, normalization requires an a-priori transformation of negative values to positive ones. Using the formula explained in the second paragraph of this paper (17), the three criteria are being converted to positive values in Table 10:

The second step is normalization for each criterion. Normalization is done by dividing the alternative score of each criterion then divided by the largest score of the score of each alternative. Additional transformation of minimizing values into maximizing ones is also performed. Values are divided by a maximum value of the alternatives and minimizing values are converted by the inverse formula – minimum value of the alternative is divided by the value of criteria (Table 11).

The third step is to multiply the normalized criteria to the weights assigned (Table 12). As previously mentioned, the weights are set to be equal to see a fair and adequate view.

The final step is to sum up all the values of the alternatives and rank the alternatives (Table 13).

The SAW method suggests a bit different result in comparison with the TOPSIS method. The first-place winner and the best alternative is eBay. However, since the SAW method only uses positive values and transformation of negative values needed to be performed, such conversion introduces distortions, so the results highly depend on the magnitude of the shift of the set of values of criteria. Nevertheless, the second-ranked company is Alibaba, the third place is taken by Amazon, and the last one – by JD.

TOPSIS and SAW methods provided slightly different ranking results mainly because of the specific drawbacks of the methods indicated in the previous paragraphs. Another reason for the difference in the results is the equal weights of the criteria applied. The distinction of the weights might have a stronger impact on the particular criteria and might also affect the results. However, due to the objective view and avoidance of judgment involved in the criteria significance, the weights have been set equally. Nevertheless, the main finding after applying both of the methods is that Amazon is not ranked the first. According to the TOPSIS method it takes the second place out of 4 digital retail companies and the SAW method ranks it only as third alternative. Thus, it means that sales revenue is indeed not the only and the prime measure to evaluate the successful company's financial performance.

Table 10. Transformation of negative values

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Amazon	55%	177 866	37%	113%	2%	106%	124%	22 620	59 928	2
JD	60%	55 641	14%	111%	0%	104%	113%	1 022	8 827	2
Alibaba	95%	22 965	62%	139%	30%	113%	129%	2 479	8 827	3
eBay	27%	9 567	77%	100%	24%	100%	100%	1 224	59 928	4

Table 11. Normalized decision matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Amazon	0.583	1.000	0.481	0.813	0.067	0.938	0.961	0.045	1.000	0.500
JD	0.639	0.313	0.182	0.799	0.000	0.920	0.876	1.000	0.147	0.500
Alibaba	1.000	0.129	0.805	1.000	1.000	1.000	1.000	0.412	0.147	0.750
eBay	0.287	0.054	1.000	0.719	0.800	0.885	0.775	0.835	1.000	1.000

Table 12. Weighted normalized decision matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Amazon	0.058	0.100	0.048	0.081	0.007	0.094	0.096	0.005	0.100	0.050
JD	0.064	0.031	0.018	0.080	0.000	0.092	0.088	0.100	0.015	0.050
Alibaba	0.100	0.013	0.081	0.100	0.100	0.100	0.100	0.041	0.015	0.075
eBay	0.029	0.005	0.100	0.072	0.080	0.088	0.078	0.083	0.100	0.100

Table 13. Ranking of the alternatives

	Sum	Rank
Amazon	0.639	3
JD	0.538	4
Alibaba	0.724	2
eBay	0.735	1

Conclusions

According to the investigation of the top 4 online retail companies, it turned out that the highest sales turnover does not lead to the best performance and financial results overall. Results of the TOPSIS method revealed that the most successful company is Alibaba followed by Amazon, JD, and eBay taking the last place. Contrary, the SAW method presented a little bit different results of eBay taking the first place, Alibaba at the second place and Amazon and JD being third and forth respectfully. Even though Amazon has significantly higher sales turnover then other competitors, the company is not ranked the first when applying both MCDA methods. It is a reliable indicator that the company's success needs to be evaluated and investigated more deeply rather than make a prejudice from the sales turnover.

Individual application and perception of digital transformation and various financial and non-financial measures can result in the different outcome of the company's well-being. However, to avoid historical examples such as dot-com bubble burst, detailed evaluation of a digital retail company's financial performance needs to be implemented because traditionally used sales turnover measure does not indicate the most accurate view.

Limitations and drawbacks of the TOPSIS and SAW methods led to different ranking results of the alternatives compared. TOPSIS method results might have been affected by the extreme values of the criteria used whereas transformation of the negative criteria values in the SAW method might have also distorted the final listing. Moreover, the distinction of the weights used in both methods might have influenced the significance of the criteria and the ranking of the alternatives. Hence, due to the particular limitations and drawbacks of the TOPSIS and SAW methods, it would be beneficial and recommended to use the third method to evaluate the top 4 digital retail companies financial performance. Nevertheless, the primary results of the research performed demonstrate that regular evaluation of the company's financial performance by its sales turnover can be misleading and does not show the accurate picture of the business success.

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SKAITMENINĖS MAŽMENINĖS PREKYBOS ĮMONIŲ FINANSINĖS VEIKLOS TYRIMAS TAIKANT DAUGIAKRITERIUS SPRENDIMŲ ANALIZĖS METODUS

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Santrauka

Skaitmeninės mažmeninės prekybos (mažmeninė prekyba internetu arba elektroninė prekyba) vaidmuo pasaulio ekonomikoje kasmet didėja. Statistikos duomenimis, skaitmeninės mažmeninės prekybos dalis pasaulio mažmeninės prekybos sektoriuje 2018 m. siekė apie 11,9 %, o 2021 m. pabaigoje tikimasi, kad ji pasieks 17,5 %. Toks spartus augimas buvo pastebėtas ir daugiau nei prieš 18 metų, kai „dot-com" burbulo sprogimas sužlugdė daugelį elektroninės prekybos įmonių. „Augimo per pelną" mentalitetas ir pervertinta internetinės prekybos apimtis privedė prie paviršutiniško verslo finansinių rezultatų suvokimo. Būtent dėl šios priežasties yra itin svarbu tinkamai analizuoti bei įvertinti skaitmeninės mažmeninės prekybos įmonių finansinius rezultatus. Taigi šio straipsnio tikslas – ištirti 4 didžiausių skaitmeninės mažmeninės prekybos bendrovių finansinius rezultatus, taikant daugiakriterius sprendimų analizės (DSMA) TOPSIS ir SAW metodus, tam, kad būtų galima įrodyti, jog pardavimų apyvarta nėra vienintelis ir svarbiausias matas siekiant įvertinti sėkmingą įmonės finansinę veiklą.

Reikšminiai žodžiai: finansiniai rezultatai, skaitmeninė mažmeninė prekyba, skaitmeninė transformacija, mažmeninė prekyba internetu, elektroninė prekyba, DSMA, TOPSIS metodas, SAW metodas.