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RESEARCH ARTICLE

A Financial Performance Evaluation via Hybrid MCDM methods: A case of Amazon.com Inc.

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Abstract

This study aims to make inferences about company performance by analyzing the financial performance of Amazon.com, Inc. over a period of fifteen years (2005-2019) using selected evaluation criteria in accordance with Multi-Criteria Decision-Making (MCDM) methods. For this purpose, CRiteria Importance Through Intercriteria Correlation (CRITIC) was used for weighting the evaluation criteria, and COmplex PRoportional ASsessment (COPRAS), Additive Ratio ASsessment (ARAS), Simple Additive Weighting (SAW), and BORDA Count and Copeland methods were used to rank financial performance by years. From the results obtained through the CRITIC method, it was found that the most crucial evaluation criterion was the debt-to-equity (DER) ratio, and the least important was the return-on-assets (ROA) ratio. The BORDA Count and Copeland methods were used to obtain an integrative and single ranking series due to varying results of the COPRAS, ARAS, SAW methods by years. According to the scores obtained using BORDA and Copeland methods 2005 was the best year and 2014 was the least successful year in terms of financial performance. During these years, developments experienced in the company were discussed, and an attempt was made to examine the reasons behind the financial performance.

Keywords

MCDM methods, Financial Performance, CRITIC, COPRAS, ARAS

Introduction

With technology-based innovations, many changes have occurred in human life, and every innovation has become a pioneer of new technologies. Remarkably, with the advent of internet technology, access to information has become easy and fast, and transactions have started to be transferred to the electronic environment, bringing many new business models to the agenda (Mahadevan, 2000). In line with these developments, companies have started to see the internet as a tool to create competitive advantage and increase their revenues (Chan & Al-Hawamdeh, 2000). With the proliferation of new technology products such as smart-

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phones, tablets, and the internet, the chance to appeal to larger audiences has been achieved. Businesses that succeeded in integrating this technology into their business at an early stage have gained great advantages in the international competitive environment (Laudon & Traver, 2017).

As e-commerce is increasingly adopted by consumers every year, its use has risen, especially in the retail industry. When looking at global data for retail e-commerce, B2C (Business-to-Consumer) retail e-commerce sales were realized as 1.33 trillion dollars in 2014 increasing to 4.93 trillion dollars in 2021. This increase is gradually continuing and is expected to reach $7.39 trillion in 2025 (Statista, 2022a). Moreover, while retail e-commerce volume in 2015 constituted only 7.4% of the total e-commerce globally, the total share of retail e-commerce reached 17.8% in 2020, and this ratio is estimated to reach 24.5% in 2025 (Statista, 2022b). Considering B2C retail e-commerce sales in the USA, it is possible to say that e-commerce draws a parallel image to the development in the world. While e-commerce sales amounted to almost 441.5 billion dollars in 2017, it is estimated that in 2021, sales increased almost two-fold and reached approximately 870.8 billion dollars (U.S Census Bureau, 2022). Within the framework of these figures, the company with the largest market share is Amazon.com, Inc., which started off as a book selling business in 1994. It is now an e-commerce giant that offers services in many product categories such as music, consumer electronics, clothing, games, as well as media, advertising, web hosting, payment methods, etc. Amazon has an e-commerce market share of 41% in the US as of October 2021, and its closest competitor Walmart.com is in second place after Amazon.com with 6.6% (Statista, 2021). Amazon has also achieved the success of being the most valuable brand in the world, according to the BrandZ report (Kantar BrandZ, 2021).

In order to effectively understand the performance chart drawn by companies, their financial statements can give strong clues about the financial performance of the company. In one study, it was stated that one of the determinants of e-commerce performance is the financial performance of the company according to the data collected from 70 retail companies operating in China (Huang, et al., 2009). Considering that the general purpose of businesses is profitability, financial ratios are one of the basic indicators that provide information about financial performance. Utilizing financial ratios to evaluate the performance of companies is an old but frequently used and quite effective tool for decision-makers, business analysts, and investors (Delen, et al., 2013). In line with the aforementioned information, in order to understand the success status of Amazon.com, Inc. and the factors affecting this success , an examination of the financial statements of Amazon.com, Inc. and an evaluation of their financial ratios might be considered as the first criteria in the evaluation process. In this direction, to obtain a general valuation measure, the preference of this study was to use MCDM methods, in which many financial ratios can be used together. In the literature there are studies in which financial performance evaluations are made for many sectors using MCDM

methods (Kung & Wen, 2007; Tung & Lee, 2010; Lee, et al., 2012; Moghimi & Anwari, 2014; Doumpos, et al., 2018; Shaverdi, et al., 2016; Inani & Gupta, 2017; Gudiel Pineda, et al., 2018; Heidary Dahooie, et al., 2019; Ayçin & Güçlü, 2020). Although various methods are used to prioritize the factors that affect companies' overall success in order to improve their way of doing business (Lin & Fu, 2012; Chiu, et al., 2004; Titiyal, et al., 2019; Kaushik, et al., 2020; Agrawal, et al., 2020) and to measure the performance of the firm with different variables in the studies conducted under the title of e-commerce (Torres, et al., 2014; Yang, et al., 2015; Dhir & Dhir, 2018), there are few studies (Juliá-Igual, et al., 2016; Urbonavičiūtė & Maknickienė, 2019) that measure the financial performance of the firms with MCDM methods based on e-commerce. Obviously, more studies need to be conducted in the context of e-commerce to address this gap in the literature. Examining the financial performance of a large-scale company such as Amazon in the e-commerce sector with various multi-criteria decision-making techniques is momentous, but it is a necessary way of obtaining more empirical results about the company's past financial performance. At the same time, in the light of the results obtained, it is thought that discussing the possible effects of new investments and managerial decisions taken in the future will guide other companies in the growing and competitive e-commerce sector. For this reason, this study was conducted to fill this gap in the literature.

In this study, the financial performance of Amazon.com, Inc. between the years 2005 and 2019 was analyzed using MCDM-related methods such as CRITIC, COPRAS, ARAS, SAW, BORDA Count, and Copeland methods. CRITIC weighting method was preferred because financial ratios related to each other are used, and the data set is processed without seeking expert opinion. Accordingly, CRITIC method was used to calculate the weight of the criteria. COPRAS, ARAS, and SAW methods were then used to obtain the rankings in terms of performance by years. Finally, the Borda Count and Copeland methods, which are methods that integrate the ranking results, were used in order to do the combined ranking. According to the hybrid analysis results, the most successful and unsuccessful years of the company in terms of financial performance were found, and the reasons behind the performance were examined. It is thought that this study will be a pioneering study in the literature as it is the first study that examines and makes inferences about an e-commerce based company in terms of financial performance with hybrid MCDM methods.

Literature Review

Both nationally and internationally there are many comprehensive studies in the literature that empirically investigate the financial performance of firms or sectors with MCDM methods. For example, Wu et al. (2009) analyzed 3 banks with the SAW, Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), VIekriterijumsko KOmpromisno

Rangiranje (VIKOR) and Fuzzy Analytical Hierarchy Process (FAHP) methods. Tung & Lee (2010) analyzed the financial performance of seven Biotechnology Companies operating in the Taiwan Stock Exchange within the scope of the Gray Factor Analysis (GRA) method. Dinçer & Görener (2011) used Analytical Hierarchy Process (AHP) and VIKOR methods to measure three different bank groups' financial performance success. Marjanović & Popović (2020) investigated the performance of 25 banks in Serbia using CRITIC weighting and TOPSIS decision making methods. Ignatius et al. (2012) made the financial performance evaluation for the automotive sector using Preference Ranking Organization Method for Enrichment Evaluation II (PROMETHEE II) as the MCDM method. In another study conducted for the automotive industry, Ömürbek et al. (2016) used an integrated approach with Entropy, Multi-attribute Utility Theory (MAUT), and SAW methods. Their study, which measured the financial performance of 6 companies registered in Borsa Istanbul, concluded that the most important performance criterion is sales revenues. Yalcin et al. (2012) proposed a new model including FAHP, VIKOR, and TOPSIS for the evaluation of the financial performance of manufacturing companies in different sectors in Turkey. Similarly, Esbouei et al. (2014) examined 143 manufacturing companies registered in the Tehran Stock Exchange and made evaluations by obtaining various financial performance measurements for different industries using Fuzzy Analytic Network Process (FANP) and Fuzzy VIKOR methods.

In a study conducted by Lee et al. (2012), the financial performance evaluation of four shipping companies operating in Taiwan and Korea was measured with Entropy and GRA methods, and evaluations were made about the performance in different years. Moghimi & Anvari (2014) discussed the financial performance of eight cement companies in Iran using a combined Fuzzy AHP-TOPSIS method. Rezaie et al. (2014) analyzed the financial performance of companies operating in the cement industry in Iran using Fuzzy AHP and VIKOR methods. Shaverdi et al. (2016) applied Fuzzy AHP and FUZZY TOPSIS methods to measure seven companies' financial performance in the Iranian Petrochemical industry. Gudiel Pineda et al. (2018) made inferences about both the financial and operational efficiency of 12 US-based airline companies in their studies using data mining and MCDM methods together. Dong et al. (2018) proposed a cosine similarity-based QUALItative FLEXible multiple criteria method (QUALIFLEX) approach to measure financial performance and accordingly examined three airline companies and tested the model. Urbonavičiūtė & Maknickienė (2019) analyzed the top four digital retail companies using the SAW and TOPSIS methods. Ayçin & Çakın (2019) used Measuring Attractiveness by a Categorical Based Evaluation Technique (MACBETH) and COPRAS methods in their study, and they used the enterprises included in the BIST SME index. Heidary Dahooie et al. (2019) presented a new model that evaluates manufacturing companies' financial performance applying for a loan from the federal bank using data-based (Correlation Coefficient and Standard Deviation) CCSD and integrated Fuzzy C-means (FCM)-ARAS methods. Isik (2019) analyzed deposit banks operating

in the Turkish banking sector using ARAS and Entropy methods. Abdel-Basset et al. (2020) conducted financial performance research for companies in the steel industry using AHP, VIKOR, and TOPSIS methods by proposing an integrated model. The afore-mentioned studies have been scrutinized and summarized in chronological order in Table 1.

Table 1

Literature Review

Authors (Year)	**Sample/Time Range**	**Applied Method(s)**	**Findings**
Wu et al. (2009)	3 banks operating in Taiwan / unspecified	SAW, TOPSIS, VIKOR, and Fuzzy AHP	In the study, it was reported that the bank performance ranking obtained by all three methods was similar.
Tung & Lee (2010)	7 biotechnology firms operating in Taiwan / 2001-2008	GRA	Apex Biotechnology Corp, Yung Shin Pharmaceutical Industrial Co. and Standard Chem. & Pharm. Co., Ltd. are reported to be the best in terms of financial performance.
Dinçer & Görener (2011)	3 bank groups (public, privately and foreign-owned) in Turkey / 2002-2008	AHP, VIKOR	While public banks had a more successful financial outlook between 2004 and 2007, foreign-owned banks stood out in other years.
Ignatius et al. (2012)	8 largest Iranian automotive companies / 2009-2010	PROMETHEE II	Zamyad Co. is the best, and SAIPA Diesel Co. is the worst in regard to financial performance in the automotive sector.
Yalcin et al. (2012)	94 companies in the Turkish manufacturing industry / 2007	FAHP, TOPSIS, and VIKOR	As a result of the study, top-ranking manufacturing companies were determined for food, paper, chemistry, basic metal, metal and machine, non-metallic minerals, and textile sectors.
Lee et al. (2012)	4 shipping companies operating in Taiwan and Korea / 1999-2009	Entropy and GRA	The results of the Entropy method show that cash flow to net income and cash flow adequacy are the most important ratios. As stated by the GRA method, Taiwan-based Evergreen Corp. and Yang Ming Corp. generally outperformed financially Korea-based Hyundai Merchant Marine Co., Ltd. and Hanjin Co., Ltd. between 1999 and 2009, except 2008.
Esbouei et al. (2014)	143 manufacturing companies listed in Tehran Stock Exchange / 2002-2011	Fuzzy ANP and Fuzzy VIKOR	Applying the Fuzzy ANP method, it was found that Market Value, Refined Economic Value Added, and Cash Value Added are the sub-criteria with the highest weight; Return On Assets (ROA), Return On Equity (ROE) and the ratio of market price and earnings (P/E) are the sub-criteria with the lowest weight. According to Fuzzy VIKOR, the most financially successful companies were identified for each of the related industries.
Moghimi & Anvari (2014)	8 cement companies registered in Tehran Stock Exchange	Fuzzy AHP and TOPSIS	Using the Fuzzy AHP method, it was reported that the most important criterion is the liquidity ratio, and according to the financial success scores obtained by the TOPSIS method, Sabhan is the most successful company among the 8 cement companies.

Authors (Year)	Sample/Time Range	Applied Method(s)	Findings
Rezaie et al. (2014)	27 companies operating in the Iranian cement industry / 2008-2009	Fuzzy AHP and VIKOR	On the basis of the fuzzy AHP method, the most effective evaluation criteria are profitability ratios. Also, according to findings from the VIKOR method, the order of succession of the companies varies according to years.
Ömürbek et al. (2016)	6 companies operating in the automotive industry registered in Borsa Istanbul / 2014	Entropy, MAUT, and SAW	The Entropy method highlights that the most important criterion is sales revenues. The financial success scores obtained from MAUT and SAW methods demonstrated that the most successful firm regarding financial performance is the firm with the C code.
Shaverdi et al. (2016)	7 companies operating in the Iranian Petrochemical Industry / 2003-2013	Fuzzy AHP and Fuzzy TOPSIS	The most important criterion is receivable accounting turnover ratio as revealed by the Fuzzy AHP method, and the most successful company in 2003-2013 was Arak Petrochemical according to TOPSIS output.
Beheshtinia ve Omidi (2017)	4 banks in Iran	AHP, Modified Digital Logic, Fuzzy TOPSIS, Fuzzy VIKOR, Copeland	While evaluating the performance of the banks, it was concluded that the most important criteria were return on investment, lower energy consumption, and debt ratio. Finally, banks were ranked by performance.
Gudiel Pineda et al. (2018)	12 US Airlines / 2005-2014	DRSA, DEMATEL, DANP, and VIKOR	In the model developed to improve airline companies' operational and financial performance, the stock price has the highest weight according to DANP, and Delta Airlines was identified as the most successful airline company in this context as a result of the VIKOR method.
Dong et al. (2018)	3 China-based firms operating in air transport industry	QUALIFLEX	According to the proposed approach for MCDM with HFLTSs to measure financial performance, Air China Ltd. is the most financially successful company. In the article, along with the case study and comparative analysis, the approach's applicability and effectiveness were also confirmed.
Urbonavičiūtė &Maknickienė (2019)	The top four digital retail companies in the world	SAW and TOPSIS	Sales turnover is the prime criteria to evaluate financial performance. According to the TOPSIS method, Alibaba Inc. is the most successful company, and according to Saw method eBay Inc. is the most successful company.
Ayçin & Çakın (2019)	Enterprises included in the BIST SME Index	MACBETH and COPRAS	According to the results, the most important criteria is return on asset (ROA), and the best performing enterprise is RTA Inc.
Heidary Dahooie et al. (2019)	58 manufacturing corporations applying to get a loan from a federal bank in Iran / 2016-2018	CCSD, Fuzzy c-means, ARAS	Based on the CCSD, the data-based objective method, the main financial performance metrics are Debt ratio, Return on Assets, and equity-to-asset ratio. Thanks to the hybrid FCM-ARAS method, top companies with the best financial performance were determined, and it was evaluated that these banks would have high priority in getting loans.

Authors (Year)	Sample/Time Range	Applied Method(s)	Findings
Isik (2019)	Turkish deposit banking sector / 2008-2017	ARAS and Entropy	According to the analysis, the most important criteria for the period in question are the short-term debt to assets ratio. Also, the year 2010 was identified as the best financial performance of the sector.
Marjanovic & Popovic (2020)	25 banks running in Serbia / 2012-2017	CRITIC and TOPSIS	Based on the CRITIC method, liquidity and financial soundness indicators have gained more importance over the years in evaluating bank performance. Raiffeisen Bank was ranked first with the highest aggregate value according to TOPSIS, although it is not a specific bank that has always demonstrated superior financial performance for these years.
Abdel-Basset et al. (2020)	10 steel companies operating in Egypt	AHP, VIKOR, and TOPSIS	AHP Method results show that the best indicator that evaluates companies' financial performance is their profitability ratio. The results obtained using VIKOR and TOPSIS methods prove that Misr National Steel is the only company in the top 3 in terms of financial success in both methods.

In the literature, in addition to the use of MCDM methods, various other approaches are also used to measure financial performance. When the literature is examined, some studies show that companies can also be evaluated from a financial perspective with the CAMELS approach consisting of six different components (Capital adequacy, Asset quality, Management efficiency, Earnings, Liquidity, and Sensitivity to the market risk) (Singh & Milan, 2020; Ledhem & Mekidiche, 2020), with panel data analysis (Shabbir & Wisdom, 2020; Mishra, et. Al., 2021), and with balanced scorecard (Malagueño, et. al., 2018). In financial performance evaluations, different approaches such as the ones mentioned can also be used.

Methodology

In this section, detailed information about CRITIC weighting, COPRAS, ARAS and, SAW financial performance measurement techniques and Borda Count and Copeland methods used to measure the financial indicators of Amazon.com, Inc. for the years 2005-2019 will be given. Financial indicators for Amazon.com, Inc. were taken from the macrotrends.net platform (Macrotrends 2020).

CRITIC Method

The criteria weights can be determined by various methods, including subjective, objective, and both subjective and objective. The weights of the criteria can be affected by the characteristics of the determined criteria as well as by the subjective judgments of the decision-making mechanisms. Since the mentioned subjective judgments may lead to biased results, some methods that provide objective evaluation have been introduced into the

literature (Kazan & Ozdemir, 2014; Akyüz & Aka, 2017). The CRITIC method is one of the objective weighting methods introduced into the literature by Diakoulaki et al. (1995). The method is based on weighting each criterion objectively based on correlation and standard deviation (Ren, et al., 2020). The process of determining the weight coefficients consists of the following steps (Diakoulaki, et al., 1995; Aytaç Adalı & Tuş Işık, 2017; Wu, et al., 2020; Akbulut, 2020a; Marjanović & Popović, 2020):

Step 1: The decision matrix consisting of n evaluation criteria and m alternatives is formed as shown in Eq. (1).

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}; i = 1, \dots \dots m \text{ ve } j = 1, \dots n \quad (1)$$

Step 2: Each evaluation criterion in the decision matrix is normalized according to its beneficial and non-beneficial or cost properties. Criteria are normalized using Eq. (2) if they have beneficial properties and Eq.(3) if they have non-beneficial or cost properties. x_j^{max} and x_j^{min} values in the equations represent the highest and lowest value of the j criterion, respectively.

$$r_{ij} = \frac{x_{ij} - x_j^{min}}{x_j^{max} - x_j^{min}} \quad (2)$$

$$r_{ij} = \frac{x_j^{max} - x_{ij}}{x_j^{max} - x_j^{min}} \quad (3)$$

Step 3: Correlation coefficients are calculated using Eq. (4) in order to measure the degree of the linear relationship between the criteria pairs.

$$p_{jk} = \frac{\sum_{i=1}^{m}(r_{ij} - \bar{r}_j) \times (r_{ik} - \bar{r}_k)}{\sqrt{\sum_{i=1}^{m}(x_{ij} - \bar{x}_j)^2 \times \sum_{i=1}^{m}(x_{ik} - \bar{x}_k)^2}}; j, k = 1, \dots, n \quad (4)$$

Step 4: C_j value, representing the quantity of information for each evaluation criterion, is obtained using Eq. (5).

$$c_j = \sigma_j \sum_{k=1}^{n}(1 - p_{jk}); \; j = 1, \dots, n \quad (5)$$

The value of σ_j in Eq. (5) represents each evaluation criterion's standard deviation and is obtained by Eq. (6).

$$\sigma_j = \sqrt{\frac{1}{n-1}\sum_{j=1}^{n}(x_{ij} - \bar{x}_j)^2}; i = 1, \dots, m \quad (6)$$

Step 5: The criteria weights are calculated by Eq. (7). The weight of the jth criterion (w_j) is obtained as:

$$w_j = \frac{c_j}{\sum_{j=1}^{n} c_j} ; \; j = 1, \dots, n \tag{7}$$

In this case, the criterion with the highest value is accepted as the best relative significant criterion.

COPRAS Method

COPRAS method is a MCDM method developed by Zavadskas and Kaklauskas (1996) which can evaluate qualitative and quantitative criteria with accuracy and which is used by many scientists today to improve decision-making processes in a wide range of fields from management to engineering (Beheshti, et al., 2016; Amoozad Mahdiraji, et al., 2018). According to this method, the effect of the values to be maximized and minimized is considered separately in the evaluation (Podvezko, 2011). In addition to the afore-mentioned advantages of the method, the COPRAS method differs from other MCDM methods with certain features such as its short and easy calculation period, its use in estimating the utility degrees of alternatives, its ability to calculate how much better or worse alternatives are compared to each other in percentage terms, and its ability to be used in different disciplines such as planning and sustainability (Mulliner, et al., 2013). The COPRAS method consists of 7 stages and these stages are formulated as follows (Kaklauskas, et al., 2007; Chatterjee, et al., 2011; Podvezko, 2011):

Step 1: The decision matrix is created with m alternatives and n criteria and is shown as in Eq. (1).

Step 2: Using Eq. (8) the decision matrix is normalized.

$$x_{ij}^{*} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}}; \forall j = 1,2,3 \dots, n \tag{8}$$

Step 3: The criterion weights obtained using the CRITIC method are included in the COPRAS method, and a weighted normalized decision matrix is formed by Eq. (9).

$$x_{ij}^{*} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}}; \forall j = 1,2,3 \dots, n \tag{9}$$

Step 4: Beneficial and non-beneficial or cost criteria in the decision matrix are grouped among themselves, and it is ensured that the benefit criteria reach the maximum level and the non-beneficial or cost criteria reach the minimum level. For this purpose, benefit criteria are grouped among themselves using Eq. (10) and non-beneficial or cost criteria using Eq. (11).

$$S_i^{+} = \sum_{j=1}^{k} d_{ij} \; ; \; j = 1,2,3, \dots, k \tag{10}$$

$$S_i^{-} = \sum_{j=k+1}^{n} d_{ij} \; ; \; j = k+1, k+2, \dots, n \tag{11}$$

Step 5: The value expressed as the Q_i value is the relative significance value for each al-

ternative included in the study and is obtained through Eq. (12). As a result of the calculation, the alternative with the highest relative significance value is determined as the best decision alternative.

$$Q_i = S_i^+ + \frac{\sum_{i=1}^{m} S_i^-}{S_i^- \times \sum_{i=1}^{m} \frac{1}{S_i^-}} \quad (12)$$

Step 6: Using the Q_i values calculated in the previous step, the alternative with the highest relative significance value is obtained through Eq. (13).

$$Q_{max} = \text{maksimum}\,(Q_i); \forall_i = 1,2,3 \ldots, m \quad (13)$$

Step 7: The performance value index (P_i) for each alternative included in the study is obtained using Eq. (14). According to the calculated values, the alternative with a P_i score of 100 is determined as the best decision alternative, and the performance ranking of each alternative is obtained by ranking the other values in descending order.

$$P_i = \frac{Q_i}{Q_{max}} \times \%100 \quad (14)$$

ARAS Method

In this method, which was introduced to the literature by Zavadskas and Turskis (2010), the utility values of the alternatives are compared with an optimal value determined by the decision-maker (Akbulut, 2020b). The ARAS method consists of the following steps (Zavadskas, et al., 2010; Isik, 2019):

Step 1: As in other MCDM methods, the decision matrix consisting of m evaluations and n alternative criteria is presented in Eq. (15).

$$X = \left[x_{ij}\right]_{mxn} = \begin{bmatrix} x_{01} & x_{02} & \cdots & x_{0n} \\ x_{11} & x_{12} & \cdots & x_{1n} \\ \cdots & \cdots & \cdots & \cdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (15)$$

According to the initial matrix, x_{ij} expresses the performance value of *i* alternative in terms of *j* criterion, and x_{0i} is the optimal value for the j criterion. If the value of x_{0j} is not known for the decision makers, the optimal values of the criteria according to the benefit (maximizing) and cost (minimizing) status are obtained with the help of Eq. (16) and Eq. (17), respectively.

For benefit type criteria; $x_{oj} = \max_i x_{ij}; i = 0,1, \ldots, m \text{ ve } j = 1, \ldots, n$ (16)

For cost type criteria; $x_{oj} = \min_i x_{ij}; i = 0,1, \ldots, m \text{ ve } j = 1, \ldots, n$ (17)

Step 2: Primary inputs are normalized to take values in the range [0-1]. If the criterion is benefit type, normalization is performed using Eq. (18); if it is cost type, using Eq. (19).

$$\overline{x}_{ij} = \frac{x_{ij}}{\sum_{i=0}^{m} x_{ij}} \quad (18)$$

$$\overline{x}_{ij} = \frac{1/x_{ij}}{\sum_{i=0}^{m} 1/x_{ij}} \quad (19)$$

Step 3: The weighting coefficients of the evaluation criteria obtained using the CRITIC method are covered in the ARAS method, and a weighted normalized decision matrix is obtained following Eq. (20).

$$x_{ij} = \overline{x}_{ij} \times w_j \quad (20)$$

Step 4: After obtaining the weighted normalized matrix, optimality values for decision alternatives are calculated using Eq. (21).

$$S_i = \sum_{j=1}^{n} x_{ij} \quad (21)$$

S_i value in the equation explains the optimality value of the i alternative. The alternative with the highest S_i value is defined as the best alternative and the alternative with the lowest S_i value as the worst alternative.

Step 5: Using the optimal values for the alternatives, the utility degree for each alternative is calculated using the formula in Eq. (22).

$$K_i = \frac{S_i}{S_0} \quad (22)$$

In the equation, S_0 means the optimality function value of the best alternative. The K_i value of each alternative is ranked in descending order. The alternative with the highest K_i value is the most effective.

SAW Method

SAW (Simple Additive Weighting) is a MCDM method which is simple and easy to apply. It is also known as scoring technique and weighted linear combination in the literature. This method was first used by Churchman and Ackoff (1954). According to this method, which is based on the weighted average, the normalized value of each criterion is multiplied by the importance coefficients of the criteria, and evaluation scores are formed. The calculated evaluation scores are then listed, and the decision alternative with the highest score is evaluated as the most effective alternative. The application steps of the SAW method are shown below (Jaberidoost, et al., 2015; Rezaei, et al., 2015; Wang, et al., 2016):

Step 1: The decision matrix, which includes the criteria and alternatives, is formed as in Eq (1).

Step 2: All values in the decision matrix are normalized using Eq. (23) and Eq. (24), taking into account the benefit and cost properties, respectively.

For benefit type criteria; $r_{ij} = \frac{x_{ij}}{\max x_{ij}}$ (23)

For cost type criteria; $r_{ij} = \frac{\min x_{ij}}{x_{ij}}$ (24)

Step 3: The weight coefficients obtained from the CRITIC method are used in applying the SAW method, and the decision matrix weighted by Eq. (25) is obtained.

$$W_j \times r_{ij} \quad (25)$$

Step 4: The decision alternatives' values in the weighted matrix are summed among themselves, and the total ranking scores for the alternatives (S_i) are obtained using Eq. (26).

$$S_i = \sum_{j=1}^{n} W_j \times r_{ij} \quad (26)$$

The decision alternative with a higher S_i value is the best, while the lowest alternative with the S_i value is considered the worst decision alternative.

BORDA Count and Copeland Method

BORDA Count method, proposed by Jean - Charles de Borda in the 18th century, is a method used to assign ranks to decision alternatives in line with the preferences of decision-makers (Gorsevski, et al., 2013). Although the method was first introduced to solve voting problems (Costa 2017), it is applied today to facilitate decision-making processes in different areas. Thanks to the BORDA Count method, it is possible to combine at least two ranked lists into one and to choose the most appropriate decision alternative (Lumini & Nanni, 2006). In the literature, the BORDA Count method is used in many studies involving the integrated MCDM method to obtain a combined ranking list (Görçün, 2020; Ecer, 2021; Poongavanam, et. al., 2021).

In the Borda rank aggregation method, the Borda values are calculated by giving 0 points to the decision alternative with the lowest evaluation score, 1 point to the next alternative, and n-1 point (n = number of alternatives) to the best decision alternative (Wu, 2011). As a result of the process, the total Borda score for each decision alternative is calculated by adding up all the values given to the alternatives. As a result of the obtained scores, the final success scores are obtained by ranking each alternative in descending order (Ludwin, 1978; Lansdowne & Woodward, 1996).

The Copeland method, which was introduced to the literature by Saari and Merlin (1996), is the modified version of the Borda Count Method and is another method used in combining the rankings obtained from different methods in studies which use the MCDM method. In the Copeland method, the scoring of alternatives is based on how many times an alternative is dominant in terms of ranking compared to the others. Accordingly, this method considers not only the wins but also the losses for each alternative. The ranking is determined by the difference between the win and the loss (Dortaj et. al, 2020; Şahin, 2021).

In the first step of the Copeland method, the ranking results of the COPRAS, ARAS, and SAW methods are compared in pairs. In the comparison process, each decision alternative is examined in pairs and handled separately. "1" point is given for the case where the alternative is dominant to the other alternatives, while "0" points are given for the case where it is weak. With this scoring, the winning score of each alternative is calculated. Secondly, the loss score is calculated. The losses score of the alternatives is obtained by subtracting the wins score received for each option from the majority wins score. Lastly, the final scores and ranking are determined. The difference between the wins score and the losses score gives the final result of each alternative, and according to this result, the best option is the one with the highest total score (Bączkiewicz et. al, 2021).

Application and Results

This section begins by outlining the evaluation criteria and their explanations as discussed within the scope of the study. Then the results of the methods used are given in tables, and the year ranking is created by considering the financial performance success. Finally, Spearman's Correlation Coefficient results are shared in order to check the validity of the applicability of the methods.

Evaluation Criteria Used in the Study

This study aims to examine the financial performance of Amazon for the period 2005-2019. Data on financial indicators were obtained from the financial statements that the company regularly publishes. The financial ratios, which are the evaluation criteria used in the study, the calculation methods for these ratios, and the codes and qualitative information regarding the criteria, are presented in Table 2.

Table 2
Evaluation Criteria

Evaluation Criteria (Code)	Calculation Method (%)	Criteria Type	Studies Using the Criterion
Current Ratio (CR)	Current Assets / Current Liabilities	Max	Baležentis, et al., 2012; Moghimi & Anwari, 2014; Farrokh, et al., 2016; Abdel-Basset, et al., 2020
Return on Investment (ROI)	Net Return on Investment / Cost of Investment	Max	Chen, et al., 2011; Baležentis, et al., 2012; Beheshtinia & Omidi, 2017
Return on Assets (ROA)	Net Income / Average Total Assets	Max	Yalcin, et al., 2012; Safaei Ghadikolaei, et al., 2014; Shaverdi, et al., 2014; Bilbao-Terol, et al., 2018
Return on Equity (ROE)	Net Income / Total Equity	Max	Lee, et al., 2012; Dong, et al., 2018; Abdel-Basset, et al., 2020
Accounts Receivables Turnover Rate (ART)	Net Sales / Average Account Receivables	Max	Wang, 2008; Ertuğrul & Karakaşoğlu, 2009; Moghimi & Anvari, 2014; Kazan & Ozdemir, 2014

Evaluation Criteria (Code)	Calculation Method (%)	Criteria Type	Studies Using the Criterion
Inventory Turnover Ratio (ITR)	Cost of Goods Sold / Average Inventory	Max	Moghimi & Anvari, 2014; Visalakshmi, et al., 2015; Aytekin, 2019
Net Profit Margin Ratio (NPM)	Net Profit / Net Sales	Max	Önder, et al., 2014; Abdel-Basset, et al., 2020; Gupta, et al., 2020
Debt-to-equity Ratio (DER)	Total Debt / Total Equity	Min	Rahmani & Keshavarz, 2015; Karimi & Barati, 2018; Tey, et al., 2019; Erdoğan, et al., 2020
Debt Ratio (DR)	Total Debt / Total Assets	Min	Deng, et al., 2020; Rezaie, et al., 2014; Tavana, et al., 2014; Beheshtinia & Omidi, 2017

The evaluation criteria used in the study are variables that are frequently used in the literature to determine the financial performance of companies. Criteria used in the study are listed as follows: "*Current Ratio*" which expresses the ability of the company to pay its short-term debts (Baležentis, et al., 2012; Moghimi & Anwari, 2014; Farrokh, et al., 2016; Abdel-Basset, et al., 2020); "*Return on Investment*" which measures the efficiency of the investments made by companies (Chen, et al., 2011; Baležentis, et al., 2012; Beheshtinia & Omidi, 2017); "*Return on Assets*" showing how effectively the company uses its assets to generate income (Yalcin, et al., 2012; Safaei Ghadikolaei, et al., 2014; Shaverdi, et al., 2014; Bilbao-Terol, et al., 2018); "*Return on Equity*" which describes how much of the equity owned by the company can be converted into profit (Lee, et al., 2012; Dong, et al., 2018; Abdel-Basset, et al., 2020); "*Accounts Receivables Turnover Ratio*" which measures how effective the business is in collecting its receivables (Wang, 2008; Ertuğrul & Karakaşoğlu, 2009; Moghimi & Anvari, 2014; Kazan & Ozdemir, 2014); "*Inventory Turnover Ratio*" which measures how many days the company turns its stocks into sales in a year (Moghimi & Anvari, 2014; Visalakshmi, et al., 2015; Aytekin, 2019); "*Net Profit Margin Ratio*" which measures the level of control of the expenses of the company (Önder, et al., 2014; Abdel-Basset, et al., 2020; Gupta, et al., 2020); "*Debt-to-equity Ratio*" showing how much equity and debt the company uses to finance its assets (Rahmani & Keshavarz, 2015; Karimi & Barati, 2018; Tey, et al., 2019; Erdoğan, et al., 2020); "*Debt Ratio*" expressing how much of the assets of the company is obtained through debt (Deng, et al., 2020; Rezaie, et al., 2014; Tavana, et al., 2014; Beheshtinia & Omidi, 2017).

In order to analyze the financial performance of Amazon.com, Inc. with different MCDM methods, the required data of Amazon.com, Inc. were examined. First, the importance weights of the evaluation criteria were determined using the CRITIC method. Then, the weight coefficients obtained from the CRITIC method were included with the COPRAS, ARAS and SAW methods respectively and the financial performance rankings for each method were identified. Finally, an overall assessment was made by combining all methods with the Borda Count and Copeland methods.

CRITIC Method Findings

In this part of the study, the weight coefficients (significance weights) of the evaluation criteria were determined using the CRITIC method. Created in line with Step (1), the decision matrix that includes firm-level data of Amazon.com, Inc. for the years 2005-2019 is included in Table 3.

Table 3

Decision Matrix

	Max	Max	Max	Max	Max	Max	Max	Min	Min
	CR	**ROI**	**ROA**	**ROE**	**ART**	**ITR**	**NPM**	**DER**	**DR**
2019	1.097	13.557	5.145	18.672	1.245	8.076	4.131	0.377	0.724
2018	1.098	15.025	6.193	23.130	1.432	8.103	4.325	0.540	0.732
2017	1.040	5.782	2.310	10.946	1.355	6.975	1.705	0.893	0.789
2016	1.045	8.788	2.843	12.295	1.631	7.701	1.744	0.399	0.769
2015	1.054	2.758	0.921	4.453	1.653	6.995	0.557	0.615	0.793
2014	1.115	-1.268	-0.442	-2.244	1.633	7.561	-0.271	0.770	0.803
2013	1.072	2.118	0.682	2.811	1.854	7.311	0.368	0.327	0.757
2012	1.121	-0.346	-0.120	-0.476	1.877	7.623	-0.064	0.377	0.748
2011	1.174	7.876	2.496	8.135	1.902	7.470	1.313	0.033	0.693
2010	1.325	13.674	6.129	16.783	1.820	8.295	3.368	0.227	0.635
2009	1.330	17.158	6.530	17.158	1.774	8.742	3.680	0.533	0.619
2008	1.297	20.935	7.758	24.139	2.305	10.648	3.365	0.153	0.656
2007	1.390	19.201	7.340	39.766	2.288	9.568	3.209	1.085	0.815
2006	1.332	11.323	4.355	44.084	2.455	9.413	1.774	2.893	0.901
2005	1.542	19.293	9.010	135.366	2.297	11.398	4.229	6.016	0.933

The initial decision matrix was normalized by considering the benefits as well as the non-beneficial or cost properties of each criterion. To put it more clearly, Eq. (2) was used for the utility criteria, Eq. (3) was used for the cost criteria, and the normalized decision matrix was created as shown in Table 4.

Table 4

Normalized Decision Matrix

	CR	**ROI**	**ROA**	**ROE**	**ART**	**ITR**	**NPM**	**DER**	**DR**
2019	0.113	0.668	0.591	0.152	0.000	0.249	0.958	0.942	0.666
2018	0.116	0.734	0.702	0.184	0.154	0.255	1.000	0.915	0.640
2017	0.000	0.318	0.291	0.096	0.090	0.000	0.430	0.856	0.459
2016	0.010	0.453	0.348	0.106	0.318	0.164	0.438	0.939	0.522
2015	0.027	0.181	0.144	0.049	0.337	0.004	0.180	0.903	0.446
2014	0.150	0.000	0.000	0.000	0.320	0.133	0.000	0.877	0.414
2013	0.063	0.153	0.119	0.037	0.503	0.076	0.139	0.951	0.561
2012	0.161	0.042	0.034	0.013	0.522	0.146	0.045	0.943	0.589
2011	0.267	0.412	0.311	0.075	0.543	0.112	0.344	1.000	0.764
2010	0.568	0.673	0.695	0.138	0.475	0.298	0.792	0.967	0.949
2009	0.578	0.830	0.738	0.141	0.437	0.399	0.860	0.916	1.000
2008	0.512	1.000	0.868	0.192	0.876	0.830	0.791	0.980	0.882
2007	0.697	0.922	0.823	0.305	0.862	0.586	0.757	0.824	0.376

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
2006	0.581	0.567	0.508	0.337	1.000	0.551	0.445	0.522	0.102
2005	1.000	0.926	1.000	1.000	0.869	1.000	0.979	0.000	0.000

In Table 5, correlation coefficients calculated with the help of Eq. (4) are presented to determine the relationships between the evaluation criteria used in the study.

Table 5
Correlation Coefficients Between Evaluation Criteria

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
CR	1	0.714	0.766	0.777	0.764	0.882	0.540	-0.659	-0.205
ROI	0.714	1	0.986	0.595	0.393	0.795	0.920	-0.315	0.123
ROA	0.766	0.986	1	0.683	0.396	0.825	0.933	-0.419	0.054
ROE	0.777	0.595	0.683	1	0.521	0.811	0.548	-0.933	-0.580
ART	0.764	0.393	0.396	0.521	1	0.737	0.062	-0.494	-0.331
ITR	0.882	0.795	0.825	0.811	0.737	1	0.615	-0.659	-0.257
NPM	0.540	0.920	0.933	0.548	0.062	0.615	1	-0.277	0.171
DER	-0.659	-0.315	-0.419	-0.933	-0.494	-0.659	-0.277	1	0.769
DR	-0.205	0.123	0.054	-0.580	-0.331	-0.257	0.171	0.769	1

At this stage of the method, (C_j) values representing the amount of information contained in each evaluation criterion regarding the years within the scope of the study were calculated with Eq. (5). Also, the standard deviation values of the evaluation criteria were calculated with Eq. (6), and finally, the weighting values of the evaluation criteria for all years (W_j) were calculated using Eq. (7). The findings obtained are presented in Table 6.

Table 6
Calculated C_j and W_j Values

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
C_j	1.363	1.262	1.222	1.364	1.808	1.274	1.587	2.829	2.327
W_j	0.091	0.084	**0.081**	0.090	0.120	0.085	0.106	**0.188**	0.155

According to the findings in Table 6, it is seen that the importance weights of the financial performance criteria of Amazon.com, Inc. vary between 0.081 and 0.188. In other words, the most important performance criterion for Amazon.com, Inc. is the debt-to-equity ratio (DER). The findings also show that the return on assets (ROA) criterion is the lowest performance criterion.

The significance levels of the performance criteria of the variables included in the study for the years 2005-2019 are debt-to-equity ratio (DER), debt ratio (DR), accounts receivables turnover rate (ART), net profit margin ratio (NPM), current ratio (CR), return on equity ratio (ROE), inventory turnover rate (IRT), return on investments ratio (ROI), and return on assets ratio (ROA), respectively.

COPRAS Method Findings

In the first stage of the COPRAS Method, the decision matrix was created according to Eq. (1) and presented in Table 3. Then, in the second stage, with the help of Eq. (8), each value in the decision matrix presented in Table 3 was normalized by dividing it by the total column in which it was found. The decision matrix that was normalized is presented in Table 7.

Table 7

Normalized Decision Matrix

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
2019	0.061	0.087	0.084	0.053	0.045	0.064	0.124	0.025	0.064
2018	0.061	0.096	0.101	0.065	0.052	0.064	0.129	0.035	0.064
2017	0.058	0.037	0.038	0.031	0.049	0.055	0.051	0.059	0.069
2016	0.058	0.056	0.046	0.035	0.059	0.061	0.052	0.026	0.068
2015	0.058	0.018	0.015	0.013	0.060	0.056	0.017	0.040	0.070
2014	0.062	-0.008	-0.007	-0.006	0.059	0.060	-0.008	0.050	0.071
2013	0.059	0.014	0.011	0.008	0.067	0.058	0.011	0.021	0.067
2012	0.062	-0.002	-0.002	-0.001	0.068	0.061	-0.002	0.025	0.066
2011	0.065	0.051	0.041	0.023	0.069	0.059	0.039	0.002	0.061
2010	0.073	0.088	0.100	0.047	0.066	0.066	0.101	0.015	0.056
2009	0.074	0.110	0.107	0.048	0.064	0.069	0.110	0.035	0.054
2008	0.072	0.134	0.127	0.068	0.084	0.085	0.101	0.010	0.058
2007	0.077	0.123	0.120	0.112	0.083	0.076	0.096	0.071	0.072
2006	0.074	0.073	0.071	0.124	0.089	0.075	0.053	0.190	0.079
2005	0.086	0.124	0.147	0.381	0.083	0.091	0.126	0.395	0.082

In the third stage of the method, the importance coefficients of the evaluation criteria obtained from the CRITIC method were included in the COPRAS method and a weighted normalized matrix was created within the scope of Eq. (9). The results are presented in Table 8.

Table 8

Weighted Normalized Decision Matrix

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
2019	0.006	0.007	0.007	0.005	0.005	0.005	0.013	0.005	0.010
2018	0.006	0.008	0.008	0.006	0.006	0.005	0.014	0.007	0.010
2017	0.005	0.003	0.003	0.003	0.006	0.005	0.005	0.011	0.011
2016	0.005	0.005	0.004	0.003	0.007	0.005	0.006	0.005	0.010
2015	0.005	0.001	0.001	0.001	0.007	0.005	0.002	0.008	0.011
2014	0.006	-0.001	-0.001	-0.001	0.007	0.005	-0.001	0.010	0.011
2013	0.005	0.001	0.001	0.001	0.008	0.005	0.001	0.004	0.010
2012	0.006	0.000	0.000	0.000	0.008	0.005	0.000	0.005	0.010
2011	0.006	0.004	0.003	0.002	0.008	0.005	0.004	0.000	0.009
2010	0.007	0.007	0.008	0.004	0.008	0.006	0.011	0.003	0.009
2009	0.007	0.009	0.009	0.004	0.008	0.006	0.012	0.007	0.008
2008	0.007	0.011	0.010	0.006	0.010	0.007	0.011	0.002	0.009
2007	0.007	0.010	0.010	0.010	0.010	0.006	0.010	0.013	0.011
2006	0.007	0.006	0.006	0.011	0.011	0.006	0.006	0.036	0.012
2005	0.086	0.124	0.147	0.381	0.083	0.091	0.126	0.395	0.082

Beneficial and non-beneficial or cost criteria were determined with the help of Eq. (10) and Eq. (11) and reported in table 9.

Table 9

Beneficial (S_i^+) and non-beneficial or cost (S_i^-) Criterion Values

	S_i^+	S_i^-	$1/S_i^-$
2019	0.048	0.015	68.894
2018	0.053	0.017	60.144
2017	0.030	0.022	45.940
2016	0.035	0.015	64.954
2015	0.023	0.018	54.390
2014	0.015	0.020	48.940
2013	0.022	0.014	69.695
2012	0.018	0.015	67.422
2011	0.033	0.010	101.619
2010	0.051	0.011	87.317
2009	0.054	0.015	66.624
2008	0.062	0.011	92.412
2007	0.064	0.024	40.826
2006	0.053	0.048	20.838
2005	0.096	0.087	11.496
Sum (∑)		0.343	901.511

At this stage, the Q_i values expressed as relative importance value for each decision alternative were calculated using Eq. (12), and then the Q_{max} value with the highest Q_i value was calculated using Eq. (13). In the last part, the values for each alternative included in the study, expressed as P_i and representing the performance index value, were calculated with the help of Eq. (14), and all the findings obtained are presented in Table 10.

Table 10

Relative Importance Value (Q_i), Performance Index (P_i), and Rankings by Years

	Q_i	c	Ranking by COPRAS
2019	0.075	74.440	7
2018	0.076	75.885	6
2017	0.048	47.611	12
2016	0.059	59.337	10
2015	0.044	43.456	14
2014	0.034	33.697	**15**
2013	0.049	48.775	11
2012	0.044	43.877	13
2011	0.072	71.569	8
2010	0.084	83.719	3
2009	0.080	79.473	4
2008	0.097	97.149	2
2007	0.079	79.227	5
2006	0.060	60.350	9
2005	0.100	100.000	**1**
	$Q_{imax=0.100}$		

According to the findings obtained from the COPRAS method, it was concluded that the year 2005 was the most successful financially for Amazon.com, Inc. between the years 2005 and 2019, and that 2014 was the year in which the company was financially the most unsuccessful in the same period.

ARAS Method Findings

In the first stage of the ARAS method, the decision matrix was created according to Eq. (15). Then, the optimal values (OPT) for the evaluation criteria were calculated using Eq. (16) and Eq. (17) according to the benefit and cost characteristics. The findings are presented in Table 11.

Table 11

Decision Matrix

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
OPT	1.542	20.935	9.010	135.366	2.455	11.398	4.325	0.033	0.619
2019	1.097	13.557	5.145	18.672	1.245	8.076	4.131	0.377	0.724
2018	1.098	15.025	6.193	23.130	1.432	8.103	4.325	0.540	0.732
2017	1.040	5.782	2.310	10.946	1.355	6.975	1.705	0.893	0.789
2016	1.045	8.788	2.843	12.295	1.631	7.701	1.744	0.399	0.769
2015	1.054	2.758	0.921	4.453	1.653	6.995	0.557	0.615	0.793
2014	1.115	-1.268	-0.442	-2.244	1.633	7.561	-0.271	0.770	0.803
2013	1.072	2.118	0.682	2.811	1.854	7.311	0.368	0.327	0.757
2012	1.121	-0.346	-0.120	-0.476	1.877	7.623	-0.064	0.377	0.748
2011	1.174	7.876	2.496	8.135	1.902	7.470	1.313	0.033	0.693
2010	1.325	13.674	6.129	16.783	1.820	8.295	3.368	0.227	0.635
2009	1.330	17.158	6.530	17.158	1.774	8.742	3.680	0.533	0.619
2008	1.297	20.935	7.758	24.139	2.305	10.648	3.365	0.153	0.656
2007	1.390	19.201	7.340	39.766	2.288	9.568	3.209	1.085	0.815
2006	1.332	11.323	4.355	44.084	2.455	9.413	1.774	2.893	0.901
2005	1.542	19.293	9.010	135.366	2.297	11.398	4.229	6.016	0.933

Considering the cost and benefit types of the criteria, each value in the decision matrix in line with Eq. (18) and Eq. (19) is normalized and presented in Table 12.

Table 12

Normalized Decision Matrix

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
OPT.	0.086	0.134	0.147	0.381	0.089	0.091	0.129	0.331	0.075
2019	0.061	0.087	0.084	0.053	0.045	0.064	0.124	0.029	0.064
2018	0.061	0.096	0.101	0.065	0.052	0.064	0.129	0.020	0.063
2017	0.058	0.037	0.038	0.031	0.049	0.055	0.051	0.012	0.059
2016	0.058	0.056	0.046	0.035	0.059	0.061	0.052	0.027	0.060
2015	0.058	0.018	0.015	0.013	0.060	0.056	0.017	0.018	0.058
2014	0.062	-0.008	-0.007	-0.006	0.059	0.060	-0.008	0.014	0.057
2013	0.059	0.014	0.011	0.008	0.067	0.058	0.011	0.033	0.061

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
2012	0.062	-0.002	-0.002	-0.001	0.068	0.061	-0.002	0.029	0.062
2011	0.065	0.051	0.041	0.023	0.069	0.059	0.039	0.331	0.067
2010	0.073	0.088	0.100	0.047	0.066	0.066	0.101	0.048	0.073
2009	0.074	0.110	0.107	0.048	0.064	0.069	0.110	0.020	0.075
2008	0.072	0.134	0.127	0.068	0.084	0.085	0.101	0.071	0.070
2007	0.077	0.123	0.120	0.112	0.083	0.076	0.096	0.010	0.057
2006	0.074	0.073	0.071	0.124	0.089	0.075	0.053	0.004	0.051
2005	0.086	0.124	0.147	0.381	0.083	0.091	0.126	0.002	0.049

The importance weights of the evaluation criteria obtained using the CRITIC method are included in the ARAS method and the decision matrix weighted in line with Eq. (20) is obtained and presented in Table 13.

Table 13

Weighted Normalized Decision Matrix

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
OPT.	0.008	0.011	0.012	0.035	0.011	0.008	0.014	0.062	0.012
2019	0.006	0.007	0.007	0.005	0.005	0.005	0.013	0.005	0.010
2018	0.006	0.008	0.008	0.006	0.006	0.005	0.014	0.004	0.010
2017	0.005	0.003	0.003	0.003	0.006	0.005	0.005	0.002	0.009
2016	0.005	0.005	0.004	0.003	0.007	0.005	0.006	0.005	0.009
2015	0.005	0.001	0.001	0.001	0.007	0.005	0.002	0.003	0.009
2014	0.006	-0.001	-0.001	-0.001	0.007	0.005	-0.001	0.003	0.009
2013	0.005	0.001	0.001	0.001	0.008	0.005	0.001	0.006	0.009
2012	0.006	0	0	0	0.008	0.005	0	0.005	0.010
2011	0.006	0.004	0.003	0.002	0.008	0.005	0.004	0.062	0.010
2010	0.007	0.007	0.008	0.004	0.008	0.006	0.011	0.009	0.011
2009	0.007	0.009	0.009	0.004	0.008	0.006	0.012	0.004	0.012
2008	0.007	0.011	0.010	0.006	0.010	0.007	0.011	0.013	0.011
2007	0.007	0.010	0.010	0.010	0.010	0.006	0.01	0.002	0.009
2006	0.007	0.006	0.006	0.011	0.011	0.006	0.006	0.001	0.008
2005	0.008	0.010	0.012	0.035	0.010	0.008	0.013	0	0.008

After weighting the values in the normalized decision matrix, the S_i value expressing the optimality function value for each decision alternative and the K_i values expressing the utility degree of each decision alternative were determined using Eq. (21) and Eq. (22) respectively. The results obtained are reported in Table 14.

Table 14

Optimal Values and Performance Ranking of ARAS Method

	S_i	K_i	Rank
OPT.	0.171		
2019	0.064	0.371	8
2018	0.067	0.389	7
2017	0.042	0.242	11
2016	0.049	0.287	10

	S_i	K_i	Rank
2015	0.035	0.205	13
2014	0.027	0.156	**15**
2013	0.038	0.222	12
2012	0.033	0.194	14
2011	0.106	0.616	**1**
2010	0.071	0.413	5
2009	0.070	0.406	6
2008	0.086	0.504	3
2007	0.074	0.434	4
2006	0.061	0.357	9
2005	0.104	0.605	2

Considering the values of S_i, which expresses the optimality function for each decision alternative, and K_i values expressing the utility degrees in Table 14, a financial performance ranking was made according to the ARAS method for each year included in the study and is presented in the last column of Table 14. According to the results reported in the table, it was concluded that between the years 2005 and 2019 the financial performance of Amazon.com, Inc. was the highest in 2011 according to the ARAS method. However, the year in which the firm in question was the worst in terms of financial performance within the same period was 2014, as in the COPRAS method.

SAW Method Findings

In the first stage of the SAW method, the decision matrix was created in line with Eq. (1) and presented in Table 3. Then, in the second stage, the benefit and cost types of each value in the decision matrix were normalized within the scope of Eq. (23) and Eq. (24), and the results reached are given in Table 15.

Table 15

Normalized Decision Matrix

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR
2019	0.711	0.648	0.571	0.138	0.507	0.709	0.955	0.087	0.855
2018	0.712	0.718	0.687	0.171	0.583	0.711	1.000	0.061	0.846
2017	0.674	0.276	0.256	0.081	0.552	0.612	0.394	0.037	0.785
2016	0.677	0.420	0.316	0.091	0.664	0.676	0.403	0.082	0.805
2015	0.683	0.132	0.102	0.033	0.673	0.614	0.129	0.054	0.781
2014	0.723	-0.061	-0.049	-0.017	0.665	0.663	-0.063	0.043	0.771
2013	0.695	0.101	0.076	0.021	0.755	0.641	0.085	0.100	0.818
2012	0.727	-0.017	-0.013	-0.004	0.764	0.669	-0.015	0.087	0.828
2011	0.761	0.376	0.277	0.060	0.775	0.655	0.303	1.000	0.893
2010	0.859	0.653	0.680	0.124	0.741	0.728	0.779	0.145	0.975
2009	0.863	0.820	0.725	0.127	0.723	0.767	0.851	0.062	1.000
2008	0.841	1.000	0.861	0.178	0.939	0.934	0.778	0.215	0.944
2007	0.901	0.917	0.815	0.294	0.932	0.840	0.742	0.030	0.760
2006	0.864	0.541	0.483	0.326	1.000	0.826	0.410	0.011	0.687
2005	1.000	0.922	1.000	1.000	0.936	1.000	0.978	0.005	0.663

At this stage of the method, criteria weights obtained from the CRITIC method were included in the SAW method and the criteria were weighted with the help of Eq. (25). Then, using Eq. (26), the preference score, called S_i value, was determined for each decision alternative, and success ranking was made for each alternative. All findings achieved are reported in Table 16.

Table 16

Weighted Normalized Decision Matrix and SAW Method Rankings

	CR	ROI	ROA	ROE	ART	ITR	NPM	DER	DR	S_i	Rank
2019	0.064	0.054	0.046	0.013	0.061	0.060	0.101	0.016	0.132	0.548	8
2018	0.065	0.060	0.056	0.016	0.070	0.060	0.106	0.011	0.131	0.574	7
2017	0.061	0.023	0.021	0.007	0.066	0.052	0.042	0.007	0.121	0.401	11
2016	0.061	0.035	0.026	0.008	0.080	0.057	0.043	0.016	0.125	0.450	10
2015	0.062	0.011	0.008	0.003	0.081	0.052	0.014	0.010	0.121	0.362	13
2014	0.066	-0.005	-0.004	-0.002	0.080	0.056	-0.007	0.008	0.119	0.312	**15**
2013	0.063	0.008	0.006	0.002	0.091	0.054	0.009	0.019	0.127	0.379	12
2012	0.066	-0.001	-0.001	0.000	0.092	0.057	-0.002	0.016	0.128	0.355	14
2011	0.069	0.032	0.023	0.005	0.093	0.056	0.032	0.188	0.138	0.636	4
2010	0.078	0.055	0.055	0.011	0.089	0.062	0.082	0.027	0.151	0.610	6
2009	0.078	0.069	0.059	0.012	0.087	0.065	0.090	0.012	0.155	0.625	5
2008	0.076	0.084	0.070	0.016	0.113	0.079	0.082	0.040	0.146	0.707	2
2007	0.082	0.077	0.066	0.027	0.112	0.071	0.078	0.006	0.118	0.636	3
2006	0.078	0.045	0.039	0.030	0.120	0.070	0.043	0.002	0.106	0.534	9
2005	0.091	0.077	0.081	0.091	0.113	0.085	0.103	0.001	0.103	0.744	**1**

According to the findings in Table 16 which were obtained from the SAW method, it was found that, in terms of finance, the most successful year of Amazon.com, Inc. within the 2005-2019 time period was 2005, just like the COPRAS method. In addition, it was concluded that the firm in question was the most financially unsuccessful in the year 2014, as also seen in the COPRAS and ARAS methods within the same period.

In order to see the results obtained from the study more clearly, the financial performance success rankings obtained from the COPRAS, ARAS and SAW methods used in the study are presented collectively in Table 17.

Table 17

Rankings Comparison of COPRAS, ARAS, and SAW Methods

Years	Ranking by COPRAS Method	Ranking by ARAS Method	Ranking by SAW Method
2019	7	8	8
2018	6	7	7
2017	12	11	11
2016	10	10	10
2015	14	13	13
2014	**15**	**15**	**15**
2013	11	12	12

Years	Ranking by COPRAS Method	Ranking by ARAS Method	Ranking by SAW Method
2012	13	14	14
2011	8	**1**	4
2010	3	5	6
2009	4	6	5
2008	2	3	2
2007	5	4	3
2006	9	9	9
2005	**1**	2	**1**

BORDA Count and Copeland Method Findings

Due to the difference of some values obtained within the same time period from the three MCDM methods, Borda Count and Copeland Method were included in the study so that a single financial performance ranking could be obtained by combining the sequence series.

In the Borda Count Method, values between 0 and 15 were given to sequence series previously created with COPRAS, ARAS, and SAW methods. Scoring was made for each alternative and the Borda values were calculated by assigning a value of 0 to the decision alternative that ranked last in the series, and a value of 15 to the first decision alternative. Borda score for each alternative was created by summing the Borda values obtained by the alternatives according to all three methods, and the alternatives were reordered as a result of the scores. The decision alternative with the highest Borda score was evaluated as the most successful alternative financially. The Borda values obtained by Amazon.com, Inc. from the COPRAS, ARAS, and SAW methods, the Borda scores calculated based on these values, and the success rankings are shown in Table 18.

In the Copeland Method, which is a modified version of the Borda Count method and another ranking method used in the study, the ranking results obtained from the COPRAS, ARAS, and SAW methods were compared with each other and then the wins and losses of alternatives were determined. In the final step of the Copeland method, the final ranking was formed by taking the difference between the wins and losses score of alternatives.

Table 18

Ranking of the COPRAS, ARAS, and SAW Methods Rankings with Borda and Copeland Scores

	COPRAS Rank	Borda Rank	ARAS Rank	Borda Rank	SAW Rank	Borda Rank	Overall Borda Rank	Borda Integrated Rank	Copeland Integrated Rank
2019	7	8	8	7	8	7	22	8	8
2018	6	9	7	8	7	8	25	7	7
2017	12	3	11	4	11	4	11	11	11
2016	10	5	10	5	10	5	15	10	10
2015	14	1	13	2	13	2	5	13	13
2014	15	0	15	0	15	0	0	**15**	**15**

	COPRAS Rank	Borda Rank	ARAS Rank	Borda Rank	SAW Rank	Borda Rank	Overall Borda Rank	Borda Integrated Rank	Copeland Integrated Rank
2013	11	4	12	3	12	3	10	12	12
2012	13	2	14	1	14	1	4	14	14
2011	8	7	1	14	4	11	32	4	4
2010	3	12	5	10	6	9	31	5	5
2009	4	11	6	9	5	10	30	6	6
2008	2	13	3	12	2	13	38	2	2
2007	5	10	4	11	3	12	33	3	3
2006	9	6	9	6	9	6	18	9	9
2005	1	14	2	13	1	14	41	**1**	**1**

The success scores obtained as a result of Borda Count scores and Copeland Method scores are included in the last column of Table 18. According to the results obtained from the Borda Count method and Copeland method, it was determined that 2005 was the most successful year for Amazon in terms of financial performance as in the COPRAS and SAW method, and the most unsuccessful year was 2014 as in the COPRAS, ARAS and SAW methods. In line with these outcomes, it can be stated that the results obtained from combined ranking methods are consistent with each other.

Spearman's Correlation Coefficient

Spearman's Correlation Coefficient was used to check the similarities in the rankings obtained from the methods. The correlation values between the methods are given in Table 19.

Table 19

Correlation values between applied MCDM methods

	COPRAS	ARAS	SAW
COPRAS	1.000	0.882	0.936
ARAS	0.882	1.000	0.975
SAW	0.936	0.975	1.000

As seen in Table 19, it can be said that there is a strong correlation between the COPRAS-ARAS, COPRAS-SAW, and ARAS-SAW methods, with a high correlation of 0.882, 0.936, and 0.975, respectively. Accordingly, it can be stated that the results of the method approaches are stable.

Conclusion and Discussion

With globalization, new technologies, and ease of access to the internet, many businesses have started to carry out their activities more frequently over the internet. As the scope and quality of service provided over the Internet has increased in recent years, e-commerce has reached new heights as one of the fastest-growing channels. Worldwide e-commerce sales

increased from $23.8 trillion in 2017 to $25.6 trillion in 2018, an 8% increase led by B2C sales, which corresponds to roughly 30% of the global GDP (UNCTAD, 2020). With the continuation of the upward trend of e-commerce, companies that want to survive in an increasingly competitive environment should quickly adapt to the dynamic structure experienced on a national and international scale. Additionally, in response to various performance evaluations and sector analyses, companies should take all necessary action without wasting time in order to get ahead of their competitors. In this direction, it is vital that companies operating in the e-commerce sector, which has started to take an essential place in the economy , are evaluated regularly in accordance with the results obtained by measuring their performance.

The purpose of this study was to examine the financial performance of the biggest e-commerce retailer Amazon.com, Inc. for the period 2005-2019. For this purpose, nine evaluation criteria and five MCDM methods were used in the study. In the first stage of the analysis, the importance weights of the evaluation criteria included in the study were determined within the scope of the CRITIC method. According to the findings obtained from the CRITIC method, it was concluded that the most important evaluation criterion affecting the performance of Amazon.com, Inc. in the 2005-2019 period was the debt-to-equity (DER) ratio. However, the most ineffective evaluation criterion on performance was the return on assets (ROA) ratio. In the second stage of the analysis, the weight values obtained from the CRITIC method which expressed the importance level of the evaluation criteria were included in the COPRAS, ARAS, and SAW methods respectively, and the performance scores were determined within the scope of each method. According to the performance scores obtained, the year in which Amazon.com, Inc. was most financially successful varied depending on the periods, while 2014 was determined to be the most financially unsuccessful year for the company according to all methods. In the last stage of the study, a single success score was obtained by combining different performance rankings obtained from COPRAS, ARAS and SAW methods with Borda Count and Copeland methods. According to the financial performance rankings made as a result of the scores obtained from Borda and Copeland methods, it was determined that the company was the most financially successful in 2005 and that 2014 was the worst year between the years 2005 and 2019.

There are several reasons why Amazon.com, Inc. had its most successful year in terms of financial performance in 2005. These reasons can be explained by the company's high market value in the international arena, the global spread of internet access in the 2000s, and the company's technological and customer-value based investments. Examples of these investments include Amazon Prime and Amazon Mechanical Turk (MTurk), which were established in 2005. Amazon Prime, which gives customers a variety of special privileges for a certain annual fee, has more than 150 million subscribers today. Amazon Prime nowadays offers its subscribers a variety of benefits in various areas such as shopping, games, and TV series. It offers special discounts, early shopping, and fast shipping (Euromonitor, 2020; Ke-

yes, 2020). MTurk, on the other hand, is the platform "online labor marketplace", which is presented by bringing together what machines find difficult to do, what is easier to be done by humans, and what can be done digitally (Paolacci, et al., 2010). New business models such as Amazon Prime membership and MTurk provided data about customers to improve their services to Amazon, contributing to its growth rate and leading to the development of new services suitable for its customers. In addition, the success in 2005 can be explained by the company's responsible investments in human resources fields, increasing process efficiency, reducing costs, and increasing product variety. Finally, it can be explained by the firm's steady increase in active assets compared to previous years (About Amazon, 2020).

There are several factors that contribute to Amazon.com, Inc.'s worst financial year in 2014. During this period called "Investment Mode," the company invested $100 million in online video programming and $970 million for the acquisition of the game related live-streaming company Twitch. It then launched its new products (Mac, 2014). The most notable driver of the failure in 2014 can be assumed to be the "Amazon Fire Phone" product. The Fire Phone, announced on June 18, 2014, was manufactured by Foxconn, and had various technological features. Fire Phone, which attracted people's attention especially with its X-ray feature and Dynamic Perspective feature, also received serious criticism and this investment did not achieve the desired result. The sales of the Fire Phone, which was discontinued in August 2015, were stopped shortly after, and Amazon.com, Inc. lost 170 million dollars from this investment (Kokalitcheva, 2015). During 2014, these heavy investments of Amazon may have concluded with long-term success, but they harmed the financial performance of the company in that year. At the same time , Amazon had a dispute with Hachette due to Amazon's desire to maintain price control over electronic books, and Hachette, one of the major book publishers, did not allow this pricing control. The reaction of many authors and publishers to this conflict affected Amazon badly (Ellis-Petersen, 2014). In addition, Amazon.com, Inc. experienced a serious decrease in its revenues despite increasing the amount of sales made in 2014 and they had to pay high principal and interest as a result of the increase in long-term debt structure compared to previous years. These factors can be considered together as being instrumental in the poor financial performance of the company (About Amazon, 2020).

Although different MCDM methods can give different results alone, this study uses more than one method together and is evaluated in a broader perspective thus having a better analysis power. Moreover, it is believed that decision-makers can make more accurate managerial and operational decisions by examining the results in line with financial performance evaluation with integrated methods. In this way, the investments made and the developments occurring on a global scale will be understood better.

This study also has some limitations. The first limitation of this study is to evaluate the company included in the analysis around only nine evaluation criteria. Another limitation of

the study is the short period (2005-2019) that the data selected for analysis were used. In addition, the use of COPRAS, ARAS, SAW, Borda Count, and Copeland methods based on the CRITIC method can be considered as a limitation for performance comparison. Different results could be obtained using more evaluation criteria and different MCDM methods in future studies on the financial performance of companies. Moreover, methods such as the CAMELS approach, balanced scorecard, and panel data analysis could also be used in financial performance evaluations. Another limitation is that the study is limited to only the Amazon firm. Therefore, it is impossible to compare companies operating in the e-commerce sector and other sectors with Amazon.com Inc. in terms of financial performance. Lastly, since there were extraordinary changes in e-commerce due to the pandemic in 2020, the year 2020 was not included in the analysis in order for an objective evaluation to be made. In future studies, comparisons can be made by analyzing companies' financial data in both the same and different sectors' firms. In company reviews for Amazon.com, not only relying on financial data but also analyzing data obtained from different areas such as supply chain, marketing, sales, customer service, research and development, and determining and analyzing other criteria that affect company performance may also be the subject of future studies.

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